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CWL TRAVERSAL PROGRAM
PHASE [illegible] - "[illegible]"

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Norman Reich
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CWL Technical Memorandum 33-19
Status Report
CWL Teuversal Program
Phase B - "Pick-Up"

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ABSTRACT

(C) Object.

The object of this phase of the Traversal Program is to estimate the quantity of V-agent that can be picked up on the clothing of troops traversing contaminated areas.

(C) Results.

"Creep and crawl" trials simulating a straight-line traversal of open terrain under fire were conducted at Army Chemical Center, Maryland, on test sites where the moderately dense vegetation (80 to 90% coverage) was maintained at a height of 3 to 6 in. The quantity of simulant picked up on the U.S. Army fatigue uniforms of test subjects crawling across the area within an hour after the dispersion of simulant averaged approximately 1% of the contamination density per unit length of the traversal path (ie, P' = 0.01 CL; where P' is the pick-up of simulant, g; C is the contamination density, g/sq m; and L is the distance traversed, m). This relationship appeared to be independent of the particle size of the dispersed simulant, although evidence exists to show that particle size does have some effect on the transferability of simulant and agent.

A comparison of the transferability of agent to that of simulant indicated that the relative transferability of agent decreased with increasing contamination. This relationship may be expressed as R = exp-(0.06 C), where R is the ratio of agent to simulant picked up on the cloth-covered roller. The constant of this equation is an approximation based on limited data and requires substantiation by further testing.

From the foregoing it was assumed that, if V-agent were used instead of simulant in the "creep and crawl" trials, the average quantity of agent that would have been picked up could be represented by the equation P = 0.01 CL exp -(0.06 C).

The quantity of agent picked up on the cloth-covered roller traversing contaminated areas one day after the dispersion of V-agent averaged approximately 4% of that picked up when the traversal was effected within one hour after the dispersion. This reflects the apparently rapid decline in agent available for pick-up, a fact which was corroborated in CWL Technical Memorandum 33-19, dated 9 February 1959, covering Phase A (Persistence) of the CWL Traversal Program. (Note: The results presented are specific for a particular field activity and for essentially one type of terrain condition. Additional testing is required to provide information relative to other field activities performed on other and other types of terrain.)

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INTERIM REPORT
CWL TRAVERSAL PROGRAM
PHASE B - "PICK-UP"

I. (C) OBJECT.

The object of this phase of the Traversal Program is to estimate the quantity of V-agent that can be picked up on the clothing of troops traversing contaminated areas.

II. (U) AUTHORITY.

This study was authorized in the Chemical Warfare Laboratories Traversal Program, dated 25 March 1957.

III. (C) INTRODUCTORY REMARKS.

To study and assess the traversal and occupational hazards of dispersed V-agent, the CWL Traversal Program was implemented by direction of the Deputy Commander for Scientific Activities, U.S. Army Chemical Warfare Laboratories. This program is divided into three related phases: Phase A - Persistence and Decontamination - determining the persistence of V-agent and factors governing this persistence; Phase B - "Pick-Up" - determining the quantity of agent transferred to personnel traversing or occupying contaminated areas; and Phase C - Casualty Production - estimating the effectiveness of "pick-up" in producing casualties. These phases are detailed in a CWL document, subject: The Casualty Producing Capability of V-agent when Dispersed as Terrain Contaminant (C), dated 25 March 1957.

This report is concerned primarily with the results of the areal traversal trials conducted under Phase B of the Traversal Program. These trials were designed to provide information relative to the transferability of V-agent to the uniforms of troops crawling across contaminated terrain (ie, simulating the traversal of open areas under fire at night). No tests employing the direct measurement of V-agent pick-up on the clothing of test subjects were considered because of the hazard to participating personnel. Therefore, the objectives of this phase of the program had to be satisfied by estimating the pick-up of V-agent from the results of Field Test No. 1324 and Test Plan No. 29 which were prepared and executed by Test Division. Field Test No. 1324 provided for the conduct of a series of "creep and crawl" trials to determine the quantity of simulant picked up on the uniforms of test subjects crawling across terrain on which simulant was disseminated in specified ranges of contamination densities and particle sizes. Test Plan No. 29 provided for a series of trials to establish (1) the relative transferability of simulant from the ground to both man and a cloth-covered roller, and (2) the relative transferability of agent and simulant from the ground to the roller. The resulting man-to-roller and agent-to-simulant data provided the basis for estimating the quantities of agent that would have been picked up by test subjects had V-agent instead of simulant been used in the "creep and crawl" trials.

The pick-up due to other activities in the field is yet to be studied. However, as a result of a series of field trials conducted at Army Chemical Center in March 1954, a considerable quantity of such data is available. This information is reported in CRLR 500, subject: Liquid Agent Picked Up by Troops Traversing Areas Contaminated with CW Agents, dated 7 December 1955. It is planned to study the extent to which this large body of information is applicable to the present problem.

All data relative to "pick-up" accumulated since the inception of this phase of the program in July 1957 are incorporated in this report. These results and the inferences drawn therefrom are regarded as interim in character, and as such are issued for temporary or limited use only. They may be superseded when additional data are received and evaluated.

IV. (C) EXPERIMENTAL.

A. "Creep and Crawl" Trials.

1. Procedure.

The "creep and crawl" trials, as prescribed in the test directive for Field Test No. 1924, were conducted on "J" Field, Army Chemical Center, on a site selected for the uniformity of vegetation which covered about [illegible] to [illegible]% of the terrain surface. This area was divided into test strips [illegible] wide by [illegible] long. To insure similar terrain conditions for each trial, the grass on these strips was maintained at [illegible] to [illegible] in. In each trial, five or six test strips were contaminated with simulant (dibuty) phthalate dyed with [illegible] (Red) disseminated uniformly by means of a mechanical device. The spinning-tip apparatus (figure 1, appendix C) was employed for the distribution of small particles, whereas the multijet disperser (figure 2, appendix C) was employed for large particles. The uniformity of the contamination and the particle size distribution were determined from sampling pans and [illegible] paper placed strategically along each test strip. As soon as practicable ([illegible] to [illegible] min) after the dissemination of simulant, each test strip was traversed by two test subjects*, each crawling as if he were advancing under fire along an assigned path one a wide. For this reversal, the dress consisted of U.S. Army fatigue uniforms over cotton drawers and long-sleeved undershirts; the test subjects also wore cotton gloves and helmet liners, and carried simulated (wooden) rifles. As soon as the [illegible]-meter traversal was effected, all clothing was removed, and traces of simulant on the rifles, helmet liners and skin were swabbed with solvent. The clothing and all swabs were forwarded for analysis at the close of the trial. Items of clothing were photographed and sectioned prior to being analyzed for the quantities of simulant picked up on the various parts of the uniform.

*In the last four trials, a cloth-covered roller (figure 4, appendix C), was substituted for the second test subject traversing 3 of the 6 test strips. (cf, par B 1).

2. Results.

During the period of July 1957 through May 1958, a total of eleven "creep and crawl" trials were conducted. In these trials simulant was disseminated in densities ranging from 0.3 to 13.6 g/sq m with particle size distributions having mass median diameters of about [illegible]0 to 3,100 microns. The data derived from these trials, representing a total of 103 individual traversals, are presented in tables 1 through 11, appendix A. Photographs of the representative distributions of simulant on clothing are included as figures 5 through 7, appendix C.

The quantity of simulant picked up on the uniforms of test subjects was found to be directly proportional to the density of the disseminated agent. The average pick-up was equal to 1% of the contamination density per unit length of the traversal path, or as alternately phrased, equal to 0.01 times the contamination density times the distance traversed (viz, for the 50-meter traversal during these "creep and crawl" trials, the average pick-up was numerically equal to one-half the contamination density). This relationship, which appeared to hold equally well over the entire range of densities employed, appeared to be independent of the particle size of the dispersed agent.

In general the simulant on the uniforms was located, in descending order of contamination, on the gloves, lower abdomen, elbows, knees, forearms, upper abdomen, thighs, shins, chest, and upper arms. This distribution of simulant is presented graphically in figures 1 and 2, appendix B, and is summarized in the table below. Variations in pick-up and distribution of the simulant on uniforms were attributed to differences in the manner in which individuals crawled; these could not be ascribed to the physical characteristics (ie, height and weight) of the subjects nor to the traversal time.

DISTRIBUTION OF SIMULANT ON CONTAMINATED UNIFORMS

Location	Average Percentage of Total Pick-Up
Jacket	
Chest, left	3.0
Chest, right	1.9
Upper Abdomen, left	6.5
Upper Abdomen, right	3.8
Upper Arm, left	1.3
Upper Arm, right	0.8
Elbow, left	7.6
Elbow, right	5.1
Forearm, left	6.0
Forearm, right	4.4
Trousers	
Lower Abdomen, left	8.1
Lower Abdomen, right	6.4
Thigh, left	5.7
Thigh, right	4.5
Knee, left	6.1
Knee, right	4.7
Lower Leg, left	3.4
Lower Leg, right	2.6
Gloves	
Left	8.0
Right	9.9

In three of the eleven trials, the pick-up deviated significantly from characteristic results. In trials 5 and 7 roughly half the anticipated quantity of simulant was picked up. This reduced pick-up was attributed to the frozen terrain during trial 5, and to the dead and very dry vegetation covering the area during trial 7. In trial 11 the use of a different dye in preparing the simulant was assumed responsible for the pick-up which was apparently twice the anticipated quantity.

B. "Man-Vs-Roller" Trials.

1. Procedure.

In accordance with Test Plan No. 29, as amended, the test site on Graces Quarters was divided into 20 adjacent test strips, 2 meters by 25 meters, which were numbered consecutively. To eliminate grass height as a variable in these trials, the grass was mowed to 3 in. on days of test. On the ten

odd-numbered strips simulant (dibutyl phthalate dyed red) was disseminated uniformly in a specified range of densities in both large and small particle sizes. Large droplet sizes (about 3,000 microns) were generated by the multijet disperser (figure 2, appendix C); small particle sizes (about 500 microns), by the same device equipped with air-operated spray nozzles (figure 3, appendix C). As soon as practicable after the dissemination of simulant (ie, about 15 min, the time to collect the contents of sampling pans used to check the uniformity of dispersion), each test strip was traversed as in the "creep and crawl" trials described in par A, 1, above, however, with the cloth-covered roller substituting for the second test subject. The quantities of simulant picked up on both clothing and cloth of the roller were determined. (Note: One test subject was employed throughout these trials. His selection for these trials was based on a cursory review of "creep and crawl" data which indicated that his manner of crawling resulted in pick-up most representative of the average of all test subjects.)

2. Results.

The results of these ten trials conducted in June 1958 to establish the relative transferability of simulant from terrain to the uniform of a crawling test subject and to the cloth-covered roller are presented in tables 12 and 13, appendix A. These tables also include supplementary data derived from "creep and crawl" trials (see footnote p b).

The average quantity of simulant picked up on the uniform of the test subject was somewhat in excess of 1% of the contamination density per unit length of the traversal path. This pick-up was not significantly different from the results derived from "creep and crawl" trials conducted on "M" Field (cf par A, 2, above).

A good correlation was obtained between the comparative quantities of simulant picked up by man and the cloth-covered roller; ie, ratio of simulant picked up by the roller to that picked up by man appeared to be essentially constant and independent of particle size. The same relationship was found in the supplementary trials conducted in conjunction with "creep and crawl" tests on "M" Field.

Figure 3, appendix B, indicates that smaller particles are somewhat more transferable from the terrain to cloth than are the larger particles. This relationship between particle size and pick-up was not detectable from "creep and crawl" data because of the overshadowing effects of minor differences in crawling techniques of individual test subjects, and differences in terrain characteristics during the 10-mo test period.

C. "Agent-Vs-Simulant" Trials.

1. Procedure.

As prescribed in Test Plan No. 29, the trials described in par B, 1, above, were rerun on the even-numbered test strips with VX substituted for

simulant and with the traversal of the strips by test subjects eliminated. As soon as practicable after the dispersion of toxic agent, the roller, covered with two layers of cotton sateen cloth, was rolled along the left side of the strip. In a like manner, the right side of the strip was traversed by the roller on the following day. In both cases, as soon as the traversal was effected, each layer of cloth was removed from the roller and analyzed for agent picked-up. The procedure of analysis used was the DB3 method.

2. Results.

The results of 10 trials conducted in July and August 1958 to determine the quantity of V-agent picked up from contaminated terrain by the cloth-covered roller are included as table 14, appendix A.

When the quantity of agent picked up on the roller traversing the test strip within an hour after contamination was compared with the quantity of simulant picked up under similar conditions in trials described in par B, above, it was found that the relative transferability of agent decreased with increasing contamination. This relationship is graphically depicted in figure 4, appendix B, where the ratio of agent to simulant pick-up is plotted against contamination density on semi-logarithmic paper to produce a straight line whose equation is $R = \exp -(0.06\ C)$; where R is the ratio of agent to simulant pick-up; and C, the contamination density in g/sq m. This line was based on limited data, and the equation, therefore, requires substantiation by further testing.

As was the case with simulant, agent disseminated in smaller particles was picked up somewhat more efficiently by the roller on the first traversal than was agent disseminated in the larger droplets. Whereas the pick-up of simulant was found to be directly proportional to the contamination density (within test limits), the pick-up of agent leveled off or became less efficient with increasing ground contamination.

The penetration of agent from the top layer of cloth to the under layer was not significant during the first traversal, amounting to an average of about 2%. However, on the second traversals of trials 6 through 10 performed on wet terrain, the increased percentage of agent on the undercloth indicated the aid to penetration provided by moisture.

The quantity of agent picked up on the roller traversing the contaminated area one day after the dispersion of V-agent was found to average approximately 4% of that picked up on a roller traversing the area within an hour after contamination is effected. This indicates the rapid decline in agent available for transfer to troops traversing the area.

V. (C) DISCUSSION.

The over-all objective of the Traversal Program is the estimation of the casualty producing capabilities of V-agent dispersed as a ground contaminant. The performance of the trials covered in this report provided agent pick-up data which, when coupled with information relative to the percutaneous toxicity of the agent and its penetration through treated and untreated fabrics, permit an estimation of

APPENDIX A

TABULATED DATA

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TABLE 1

CREEP AND CRAWL TRIAL NO. 1

Date: 15 July 1957

Test Subject	A	B	C	D	E	F	G	H	I	J
Height (in.)	71	69	75	67	70	71	67	69	65	69
Weight (lb.)	165	155	195	165	180	210	135	175	150	185
Uniform No.	12	16	14	15	14	54	5	55	15	15
Contamination Density (g./sq.m.)	0.330	0.330	0.345	0.345	0.325	0.325	0.305	0.305	0.295	0.295
Particle Size (μ, MMD)	560	560	505	505	455	455	415	416	290	280
Traversal Time (min. - sec.)	3-52	3-52	3-52	3-52	2-45	2-45	2-45	2-45	4-18	4-1
Location of Pick-Up	Simulant Picked up (mg.) on Various Sections of Uniforms									
Jacket										
Chest, left	3	7	2	10	2	2	7	0	2	6
Chest, right	4	3	2	7	0	0	5	0	0	6
Upper Abdomen, left	7	10	5	9	4	6	8	17	3	6
Upper Abdomen, right	10	4	5	7	2	3	8	14	0	5
Upper Arm, left	0	0	0	0	0	0	0	0	0	0
Upper Arm, right	0	0	0	0	0	0	0	0	0	0
Elbow, left	6	6	7	7	6	5	18	11	15	8
Elbow, right	3	5	5	4	4	1	7	3	2	4
Forearm, left	7	7	12	9	2	4	11	8	5	13
Forearm, right	2	6	9	5	2	1	7	4	7	9
Trousers										
Lower Abdomen, left	11	8	16	6	12	9	9	17	8	6
Lower Abdomen, right	12	1	9	11	12	7	15	14	[illegible]	10
Thigh, left	9	6	16	6	9	10	13	15	11	7
Thigh, right	9	3	10	5	7	7	8	15	6	7
Knee, left	6	7	5	4	2	7	9	8	8	[illegible]
Knee, right	6	3	5	6	6	6	7	8	8	6
Lower Leg, left	0	4	1	0	0	5	0	5	3	0
Lower Leg, right	0	2	0	6	0	0	1	5	1	0
Gloves										
Left	16	19	9	15	11	14	26	13	13	12
Right	16	15	6	11	8	13	26	19	11	16
Miscellaneous										
Rifle	3.2	3.4	0.5	2.3	2.4	0.4	1.8	2.9	1.1	0.9
Underwear										
Cuff, left	0.7					0.4	3.8	2.9	0.5	
Cuff, right	0.6			0.8	1.8	1.4	3.4		4.8	1.0
TOTAL*	127	116	124	130	90	100	185	186	108	129
Pick-Up Factor**	0.770	0.703	0.719	0.754	0.554	0.615	1.214	1.220	0.732	0.875

REMARKS:

*Total quantity of simulant picked up on jacket, trousers, and gloves.
**Pick-up factor equals percent of the ground contamination picked up on the uniform per meter of traversal.

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TABLE 1

CREEP AND CRAWL TRIAL NO. 1

Date: 15 July 1957

Test Subject	A	B	C	D	E	F	G	H	I	J
Height (in.)	71	69	75	67	70	71	67	69	65	69
Weight (lb.)	165	155	195	165	190	210	135	175	150	185
Uniform No.	38	36	44	42	38	40	38	38	42	38
Contamination Density (g./sq.m.)	0.330	0.330	0.345	0.345	0.345	0.325	0.305	0.305	0.295	0.295
Particle Size (μ, MMD)	560	560	505	505	455	455	415	415	290	280
Traversal Time (min. - sec.)	3-52	2-52	3-52	3-52	2-45	2-45	2-45	2-45	4-16	4-1
Location of Pick-Up	Simulant Picked up (mg.) on Various Sections of Uniforms									
Jacket										
Chest, left	3	7	2	10	2	2	7	0	2	6
Chest, right	4	3	2	7	0	0	5	0	0	6
Upper Abdomen, left	7	10	5	9	4	6	8	17	3	6
Upper Abdomen, right	10	4	5	7	2	3	8	14	0	5
Upper Arm, left	0	0	0	0	0	0	0	0	0	0
Upper Arm, right	0	0	0	0	0	0	0	0	0	0
Elbow, left	6	2	2	7	6	5	18	11	15	8
Elbow, right	2	6	7	4	4	1	7	3	2	4
Forearm, left	7	5	5	4	2	4	11	8	5	13
Forearm, right	2	7	12	9	5	1	7	4	7	9
Trousers										
Lower Abdomen, left	11	2	16	6	12	9	9	17	8	6
Lower Abdomen, right	12	1	9	11	12	7	15	14	5	10
Thigh, left	9	6	16	6	9	10	13	16	15	2
Thigh, right	9	3	10	5	7	7	9	18	6	7
Knee, left	6	7	5	4	3	7	2	8	8	8
Knee, right	6	3	5	6	6	6	7	8	8	6
Lower Leg, left	0	4	1	0	0	5	0	5	3	0
Lower Leg, right	0	2	0	6	0	0	1	5	1	0
Gloves										
Left	16	12	2	15	11	14	26	13	13	12
Right	16	15	6	11	8	13	26	12	11	16
Miscellaneous										
Rifle	3.2	3.4	0.5	2.3	2.4	0.4	1.8	2.9	1.1	0.9
Underwear										
Cuff, left	0.7					0.4	3.8	2.9	0.5	
Cuff, right	0.6			0.8	1.8	1.4	3.4		4.8	1.0
TOTAL*	127	116	124	130	90	100	185	186	108	109
Pick-Up Factor**	0.775	0.703	0.719	0.754	0.554	0.615	1.214	1.220	0.732	0.875

Remarks:

*Total quantity of simulant picked up on jacket, trousers, and gloves.
**Pick-up factor equals percent of the ground contamination picked up on the uniform per meter of traversal.

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TABLE 2

CRAWL AND CRAWL TRIAL NO. 2

16 July 1957

Test Subject	C	A	J	D	G	L	F	H	B	I
Height (in.)	75	71	69	67	67	70	71	69	69	65
Weight (lb.)	195	165	185	165	135	180	210	175	155	150
Uniform No.	10	44	11	56	2	59	47	48	15	51
Contamination Density (g./sq.m.)	1.64	1.64	2.24	2.24	1.95	1.95	1.71	1.71	5.55	5.55
Particle Size (μ, MMD)	505	505	505	505	415	415	350	350	420	420
Traversal Time (min. - sec.)	2-51	2-24	3-56	3-46	3-12	3-22	3-54	3-52	2-15	4-48
Location of Pick-Up	Simulant Picked up (mg.) on Various Sections of Uniform									
Jacket										
Chest, left	6	17	101	99	50	64	56	25	105	59
Chest, right	7	18	62	39	31	36	62	52	30	25
Upper Abdomen, left	20	35	69	67	61	75	84	174	177	67
Upper Abdomen, right	20	16	32	33	40	42	96	70	60	92
Upper Arm, left	8	2	26	27	11	3	12	9	77	69
Upper Arm, right	2	3	12	17	13	4	11	10	24	27
Elbow, left	26	14	62	76	50	37	71	51	187	241
Elbow, right	27	21	46	47	19	73	31	59	77	107
Forearm, left	66	45	142	172	115	100	96	107	419	315
Forearm, right	58	30	157	63	30	85	55	54	99	131
Trousers										
Lower abdomen, left	62	49	83	78	72	112	104	84	236	118
Lower Abdomen, right	42	68	52	55	90	92	112	92	98	263
Thigh, left	80	34	70	56	91	48	119	50	129	259
Thigh, right	52	37	45	32	36	45	77	48	83	119
Knee, left	77	30	41	32	62	37	35	33	74	145
Knee, right	30	27	36	33	28	31	17	32	55	117
Lower Leg, left	34	71	41	24	79	31	40	61	149	137
Lower Leg, right	30	29	45	22	23	26	24	40	62	81
Gloves										
Left	55	68	52	77	85	110	233	75	294	209
Right	57	59	58	67	138	102	93	102	118	202
Miscellaneous										
Rifle	5	9	6	11	10	7	12	12	17	32
Underwear										
Cuff, left	2.6	0.3	0.4	0.0	0.1	0.3	8.3	0.2		0.4
Cuff, right	0.6	1.8	0.5	3.0		11.3	8.4	8.2		14.3
Skin		0.1	0.8	1.9	0.6	1.4	1.9	0.1	0.7	1.0
TOTAL*	767	673	1197	1072	1037	1210	1422	1150	2553	2848
Pick-Up Factor**	0.936	0.522	1.069	0.957	1.064	1.241	1.663	1.316	0.919	1.025

REMARKS:

*Total quantity of simulant picked up on jacket, trousers, and gloves.
**Pick-up factor equals percent of the ground contamination picked up on the uniform per meter of traversal.

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TABLE 2

CREEP AND CRAWL TRIAL NO. 2

16 July 1957

Test Subject	C	A	J	D	G	E	F	H	B	I
Height (in.)	75	71	69	67	67	70	71	69	69	65
Weight (lb.)	195	165	185	165	135	180	210	175	155	150
Uniform No.	10	44	11	56	2	50	47	48	15	51
Contamination Density (g./sq.m.)	1.64	1.64	2.24	2.24	1.95	1.95	1.71	1.71	5.55	5.55
Particle Size (μ, MMD)	505	505	505	505	415	415	350	350	420	420
Traversal Time (min. - sec.)	2-51	2-24	3-56	3-46	3-12	3-22	3-54	3-52	2-15	4-48
Location of Pick-Up	**Simulant Picked up (mg.) on Various Sections of Uniform**									
Jacket										
Chest, left	6	17	104	99	50	64	56	25	105	59
Chest, right	7	15	62	39	31	36	62	52	30	25
Upper Abdomen, left	20	35	69	67	61	75	84	104	177	67
Upper Abdomen, right	20	46	32	33	40	42	96	70	60	92
Upper Arm, left	8	2	26	27	11	3	12	9	77	69
Upper Arm, right	2	3	12	12	13	4	11	10	24	27
Elbow, left	26	34	62	76	50	27	71	51	187	241
Elbow, right	27	21	48	47	19	73	31	58	77	107
Forearm, left	66	45	142	122	105	100	86	107	419	315
Forearm, right	58	30	107	63	30	85	55	54	99	131
Trousers										
Lower abdomen, left	62	49	83	70	72	11	104	64	236	118
Lower Abdomen, right	42	68	52	52	90	32	112	82	98	263
Thigh, left	80	34	70	56	81	43	119	50	129	259
Thigh, right	52	27	45	32	36	45	77	48	83	119
Knee, left	77	30	41	32	62	37	35	33	74	145
Knee, right	38	27	36	32	28	31	17	32	55	112
Lower Leg, left	34	21	41	24	79	31	40	61	149	137
Lower Leg, right	30	29	45	32	28	28	24	40	62	81
Gloves										
Left	55	68	59	77	85	110	233	75	294	269
Right	57	59	58	67	138	102	93	102	118	202
Miscellaneous										
Rifle	5	9	6	11	10	7	12	12	17	32
Underwear										
Cuff, left	2.6	0.3	0.4	0.0	0.1	0.3	8.3	0.2		0.4
Cuff, right	0.6	1.8	0.5	3.0		11.3	8.4	8.2		14.3
Skin	.	0.1	0.8	1.9	0.6	1.4	1.9	0.1	0.7	1.0
TOTALS	767	673	1197	1072	1037	1210	1122	1150	2553	2848
Pick-Up Factor**	0.936	0.822	1.069	0.957	1.064	1.241	1.663	1.346	0.919	1.025

REMARKS:

*Total quantity of simulant picked up on jacket, trousers, and gloves.
**Pick-up factor equals percent of the ground contamination picked up on the uniform per meter of traversal.

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TABLE 3

CRAWL AND CRAWL TRIAL NO. 3

18 July 1957

Test Subject	H	I	C	E	F	B	D	G	A	J
Height (in.)	69	65	75	70	71	69	67	67	71	69
Weight (lb.)	175	150	195	180	210	155	165	135	165	185
Uniform No.	69	65	43	68	66	45	70	6	41	17
Contamination Density (g./sq.m.)	9.33	9.33	11.5	11.2	11.4	11.4	9.76	9.76	12.2	12.2
Particle Size (μ, MMD)	365	365	325	325	365	325	325	325	390	390
Traversal Time (min. - sec.)	6-12	7-19	5-49	5-28	3-9	3-11	3-23	2-13	3-40	5-0
Location of Pick-Up	Simulant Picked up (mg.) on Various Sections of Uniforms									
Jacket										
Chest, left	212	36	85	326	261	236	330	168	335	296
Chest, right	75	24	116	173	109	119	419	203	314	396
Upper Abdomen, left	484	52	234	248	614	243	484	215	618	545
Upper Abdomen, right	220	34	160	314	387	130	236	284	517	288
Upper Arm, left	275	50	62	61	230	164	109	82	185	314
Upper Arm, right	25	9	43	55	37	81	62	60	65	229
Elbow, left	484	232	249	291	358	126	249	163	363	415
Elbow, right	160	65	148	130	190	220	207	111	141	329
Forearm, left	297	209	495	329	623	235	383	239	493	700
Forearm, right	151	207	159	243	253	91	353	136	189	758
Trousers										
Lower Abdomen, left	143	146	759	417	726	219	326	185	746	382
Lower Abdomen, right	179	154	[illegible]	636	567	298	388	425	605	156
Thigh, left	306	157	512	260	642	84	134	136	393	61
Thigh, right	114	86	255	234	233	130	118	169	278	282
Knee, left	146	72	242	242	148	35	306	101	383	199
Knee, right	89	89	196	156	164	86	209	131	229	196
Lower Leg, left	219	14	117	154	295	62	189	103	461	119
Lower Leg, right	111	94	161	171	140	149	134	192	240	146
Gloves										
Left	315	306	[illegible]	410	360	506	752	600	867	526
Right	126	267	317	140	730	580	366	856	954	1044
Miscellaneous										
Rifle	25		37	94	34		40	76	59	82
Underwear										
Cuff, left	0.8		41.4	26.0	0.8		5.0	3.6		1.9
Cuff, right	51.6	73	1.1	129.0	0.4			52.6	2.0	13.6
Skin	0.1	1.4	1.1	2.4	4.2	0.5	7.7	2.7	5.1	0.8
TOTALS	4741	2333	5199	5050	7331	3844	6214	4561	8218	7450
Pick-Up Factor**	1.015	0.499	0.904	0.879	1.291	0.673	1.274	0.935	1.359	1.222

REMARKS:

*Total quantity of simulant picked up on jacket, trousers, and gloves.
**Pickup factor equals percent of the ground contamination picked up on the uniform per meter of traversal.

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TABLE 3

CREEP AND CRAWL TRIAL NO. 3

18 July 1957

Test Subject	H	I	C	E	F	B	D	G	A	J
Height (in.)	69	65	75	70	71	69	67	67	71	69
Weight (lb.)	175	150	195	180	210	155	165	135	165	135
Uniform No.	69	65	43	68	66	44	70	6	41	17
Contamination Density (g./sq.m.)	9.33	9.33	11.5	11.[illegible]	11.[illegible]	11.4	9.76	9.76	12.2	12.2
Particle Size (μ, MMD)	365	365	325	325	365	325	325	325	390	390
Traversal Time (min. - sec.)	6-12	7-19	5-49	5-28	3-9	3-11	3-23	2-48	3-40	5-0
Location of Pick-Up	Simulant Picked up (mg.) on Various Sections of Uniforms									
Jacket										
Chest, left	213	36	85	326	261	236	930	188	335	296
Chest, right	75	24	115	173	109	119	419	203	314	396
Upper Abdomen, left	484	52	234	248	644	243	484	215	618	545
Upper Abdomen, right	220	34	160	214	387	130	236	284	517	288
Upper Arm, left	275	50	62	61	230	164	109	82	195	314
Upper Arm, right	25	9	43	55	37	81	62	60	65	229
Elbow, left	484	232	249	291	352	126	249	163	363	415
Elbow, right	160	65	149	130	190	220	207	111	141	399
Forearm, left	297	209	495	329	523	235	383	239	493	700
Forearm, right	151	203	157	243	253	91	353	136	189	758
Trousers										
Lower Abdomen, left	443	148	352	417	726	219	326	185	746	382
Lower Abdomen, right	179	154	[illegible]	636	567	298	388	425	605	456
Thigh, left	300	157	91[illegible]	260	642	84	194	136	393	61
Thigh, right	114	86	255	234	233	130	118	169	278	282
Knee, left	146	72	244	242	448	35	306	101	383	199
Knee, right	89	53	196	156	164	86	209	131	229	196
Lower Leg, left	219	44	117	154	295	62	189	103	461	119
Lower Leg, right	111	94	161	121	140	149	134	182	240	146
Gloves										
Left	315	306	56[illegible]	410	360	506	752	600	869	526
Right	426	267	217	440	730	550	366	856	854	1044
Miscellaneous										
Rifle	25		37	24	34		40	76	59	82
Underwear										
Cuff, left	0.8		44.4	26.0	0.8		5.0	9.6		1.9
Cuff, right	51.6	73	1.1	129.0	6.4			52.6	2.0	49.6
Skin	0.1	1.4	1.1	2.4	4.2	0.5	7.7	2.7	5.1	0.8
TOTAL*	4741	2333	5199	5050	7381	3844	6214	4561	8218	7450
Pick-Up Factor**	1.015	0.499	0.904	0.879	1.291	0.673	1.274	0.936	1.358	1.222

REMARKS:

*Total quantity of simulant picked up on jacket, trousers, and gloves.
**Pick-up factor equals percent of the ground contamination picked up on the uniform per meter of traversal.

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TABLE 4

[illegible] TRIAL NO. [illegible]

[illegible] October 1957

[illegible]	B	[illegible]	C	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	69	69	75	63	67	71	70	[illegible]	60	71
[illegible]	175	186	[illegible]	155	165	[illegible]	[illegible]	200	160	165
[illegible]	84	[illegible]	21	24	27	81	85	83	25	28
Contamination Density (g/sq.cm)	[illegible]	2.67	[illegible]	0.91	1.2[illegible]	1.28	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	595	595	605	605	590	590	660	660	700	700
[illegible]	[illegible]	2-10	[illegible]	3-35	2-20	[illegible]	2-20	[illegible]	2-30	[illegible]
Location of Pick-up	[illegible]									
[illegible]										
[illegible]	55	114	[illegible]	21	43	21	[illegible]	35	49	21
[illegible]	28	65	12	24	22	22	71	[illegible]	41	[illegible]
[illegible]	[illegible]	[illegible]	11	[illegible]	[illegible]	[illegible]	71	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	75	13	13	13	[illegible]	[illegible]	[illegible]	36	[illegible]
[illegible]	[illegible]	0	0	0	0	0	0	0	5	0
[illegible]	0	0	0	0	0	0	0	0	0	0
[illegible]	12[illegible]	[illegible]	15	25	46	[illegible]	47	74	42	13
[illegible]	22	[illegible]	[illegible]	7	11	25	63	[illegible]	33	[illegible]
[illegible]	[illegible]	[illegible]	20	[illegible]	[illegible]	[illegible]	136	[illegible]	[illegible]	41
[illegible]	30	51	13	12	15	13	[illegible]	36	37	37
[illegible]										
[illegible]	104	[illegible]	[illegible]	39	45	80	155	[illegible]	72	[illegible]
[illegible]	113	125	33	25	17	37	125	63	62	65
[illegible]	94	65	26	21	29	15	94	86	79	34
[illegible]	84	[illegible]	29	14	12	37	67	[illegible]	81	52
[illegible]	102	69	31	25	52	11	113	111	77	75
[illegible]	96	[illegible]	32	13	15	34	66	96	65	55
[illegible]	59	[illegible]	16	15	[illegible]	15	55	[illegible]	[illegible]	43
[illegible]	24	59	12	13	15	[illegible]	32	40	32	11
[illegible]										
[illegible]	77	101	[illegible]	25	33	34	57	71	[illegible]	[illegible]
[illegible]	77	82	33	14	16	15	45	[illegible]	75	75
[illegible]										
[illegible]	9	4	1	1	2	3	4	2	2	2
[illegible]										
[illegible]	1.8	5.3	[illegible]	0.7	1.5	0.4	4.1	1.6	2.4	1.8
[illegible]	2.9	2.0	[illegible]	0.4	0.6	1.9	1.1	2.1	2.0	3.1
TOTAL*	1477	1712	394	368	493	432	1342	1402	1045	844
Pick-up Factor**	1.106	1.282	0.338	0.283	0.770	0.675	0.879	0.917	1.035	0.832

REMARKS:

*Total quantity of simulant picked up on jacket, trousers, and gloves.
**Pick-up factor equals percent of the ground contamination picked up on the uniform per meter of traversal.

TABLE 4

CREEP AND CRAWL TRIAL NO. 4

29 October 1957

Test Subject	H	[illegible]	C	B	D	F	E	K	L	A
Height (in.)	69	[illegible]	75	69	67	[illegible]	70	62	60	71
Weight (lb.)	175	185	195	155	165	[illegible]	190	200	160	165
Uniform No.	84	82	21	24	27	61	95	83	25	28
Contamination Density (g./sq.m.)	2.67	2.67	0.94	0.94	1.28	1.28	3.06	[illegible]	2.02	[illegible]
Particle Size (μ, MMD)	595	595	605	605	590	590	660	660	[illegible]	[illegible]
Traversal Time (min. - sec.)	[illegible]	9-10	4-25	3-35	2-20	2-45	2-20	3-10	2-30	3-0
Location of Pick-Up	Simulant Picked up (mg.) on Various Sections of Uniforms									
Jacket										
Chest, left	55	114	16	21	43	21	42	35	48	21
Chest, right	28	65	17	24	22	22	71	44	41	[illegible]
Upper Arm, left	181	112	14	21	[illegible]	19	71	150	[illegible]	37
Upper Arm, right	70	75	13	19	13	25	[illegible]	50	36	[illegible]
Upper Arm, left	0	0	0	0	6	0	0	0	5	0
Upper Arm, right	0	0	0	0	0	0	0	0	0	0
Elbow, left	129	[illegible]	15	25	46	[illegible]	47	74	42	42
Elbow, right	22	125	[illegible]	7	11	25	63	64	33	[illegible]
Forearm, left	49	[illegible]	20	17	[illegible]	[illegible]	136	114	96	61
Forearm, right	30	51	19	12	15	19	62	36	37	37
Trousers										
Lower Abdomen, left	104	108	32	38	45	20	155	[illegible]	72	[illegible]
Lower Abdomen, right	113	128	33	25	17	37	108	63	62	65
Thigh, left	94	65	26	21	29	15	94	56	79	34
Thigh, right	84	[illegible]	29	14	12	37	67	[illegible]	41	52
Knee, left	192	69	31	25	52	11	119	111	77	75
Knee, right	96	94	32	13	15	34	66	96	65	55
Lower Leg, left	52	[illegible]	16	15	15	15	58	42	37	43
Lower Leg, right	24	58	12	13	15	18	32	40	32	44
Gloves										
Left	77	101	[illegible]	25	22	34	57	71	103	38
Right	77	82	33	14	16	45	45	85	75	75
Underwear										
Rifle	2	4	1	1	2	3	4	2	2	2
Underwear										
Coff, left	1.8	5.3	2.[illegible]	0.7	1.5	0.4	4.1	1.6	2.4	1.8
Coff, right	2.9	2.0	2.[illegible]	0.4	0.6	1.9	1.1	2.1	2.0	3.1
TOTAL*	1477	1712	394	368	493	432	1342	1402	1045	844
Pick-Up Factor**	1.106	1.282	0.[illegible]38	0.283	0.770	0.675	0.878	0.917	1.035	0.832

REMARKS:

*Total quantity of simulant picked up on jacket, trousers, and gloves.
**Pick-up factor equals percent of the ground contamination picked up on the uniform per meter of traversal.

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TABLE 5

CREEP AND CRAWL TRIAL NO. 5

10 February 1953

Test Subject	B	M	G	C	N	K	P	E
Height (in.)	69	72	67	75	67	69	72	70
Weight (lb.)	155	200	135	195	135	200	190	180
Uniform No.	8	77	7	57	78	63	87	86
Contamination Density (g./sq.m.)	5.66	5.66	6.29	6.29	6.59	6.59	7.09	7.09
Particle Size (μ, MMD)	1550	1500	1400	1400	1100	1100	1300	1300
Traversal Time (min. - sec.)	3-12	4-22	3-18	3-30	5-10	5-40	4-13	4-18
Location of Pick-Up	Simulant Picked up (mg.) on Various Sections of Uniforms							
Jacket								
Chest, left	8	5	39	4	5	91	9	15
Chest, right	9	3	31	3	8	43	6	18
Upper Abdomen, left	41	21	105	24	11	206	36	31
Upper Abdomen, right	23	14	135	2[illegible]	25	101	12	45
Upper Arm, left	8	4	6	5	1	32	10	35
Upper Arm, right	15	5	55	13	4	9	6	4
Elbow, left	26	22	105	49	49	302	100	92
Elbow, right	26	27	49	45	70	79	51	97
Forearm, left	45	24	55	77	95	129	61	70
Forearm, right	55	29	106	98	179	54	49	109
Trousers								
Lower Abdomen, left	100	119	110	191	98	380	226	185
Lower Abdomen, right	83	100	210	216	103	79	50	83
Thigh, left	40	89	59	86	100	309	138	116
Thigh, right	42	117	58	112	38	117	51	130
Knee, left	18	51	67	61	101	284	79	87
Knee, right	27	86	90	67	119	103	66	69
Lower Leg, left	11	25	45	86	22	54	55	88
Lower Leg, right	11	27	45	95	22	31	23	29
Gloves								
Left	64	13	123	137	61	162	64	60
Right	67	89	106	128	92	135	89	37
Miscellaneous								
Rifle	6	3	7	5	4	10	3	6
Underwear								
Cuff, left					1	2	1	1
Cuff, right					10	1	8	1
Elbow					126	85	7	
Skin			0.4		0.2	0.3		0.4
TOTAL*	719	882	1582	1523	1202	2700	1175	1350
Pick-Up Factor**	0.254	0.311	0.503	0.484	0.364	0.818	0.331	0.381

REMARKS:

NOTE: Trial performed on frozen terrain at ground temperature 0°F.

*Total quantity of simulant picked up on jacket, trousers, and gloves.
**Pick-up factor equals percent of the ground contamination picked up on the uniform per meter of traversal.

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TABLE 5

CREEP AND CRAWL TRIAL NO. 5

10 February 1958

Test Subject	B	H	G	C	N	K	O	E
Height (in.)	69	72	67	75	67	69	72	70
Weight (lb.)	155	200	135	195	135	200	190	180
Uniform No.	8	77	7	57	78	63	87	86
Contamination Density (g./sq.m.)	5.66	5.66	6.29	6.29	6.59	6.59	7.09	7.09
Particle Size (μ, MMD)	1550	1500	1400	1400	1100	1100	1300	1300
Traversal Time (min. - sec.)	3-12	4-22	3-18	3-30	5-10	5-40	4-18	4-18
Location of Pick-Up	Simulant Picked up (mg.) on Various Sections of Uniforms							
Jacket								
Chest, left	8	5	39	4	5	91	9	15
Chest, right	9	3	31	3	8	43	6	18
Upper Abdomen, left	41	21	105	24	11	206	36	31
Upper Abdomen, right	23	14	175	26	25	101	12	45
Upper Arm, left	8	4	6	5	1	32	10	35
Upper Arm, right	15	5	55	13	4	9	6	4
Elbow, left	26	22	105	42	49	302	100	92
Elbow, right	26	27	49	45	70	79	51	97
Forearm, left	45	24	55	77	95	129	61	70
Forearm, right	55	23	106	98	179	54	49	109
Trousers								
Lower Abdomen, left	100	119	110	191	98	380	276	185
Lower Abdomen, right	83	100	210	216	103	79	50	83
Thigh, left	40	89	52	86	100	309	134	116
Thigh, right	42	117	58	112	38	117	51	130
Knee, left	18	51	67	61	101	284	73	87
Knee, right	27	88	90	67	119	103	66	69
Lower Leg, left	11	25	45	86	22	54	55	88
Lower Leg, right	11	27	45	95	22	31	23	29
Gloves								
Left	64	13	123	137	61	162	64	60
Right	67	59	106	128	92	135	89	37
Miscellaneous								
Rifle	6	3	7	5	4	10	3	6
Underwear								
Cuff, left					1	2	1	1
Cuff, right					10	1	8	1
Elbow					126	85	7	
Skin			0.4		0.2	0.3		0.4
TOTAL*	719	882	1582	1523	1202	2700	1175	1350
Pick-Up Factor**	0.254	0.311	0.503	0.484	0.364	0.818	0.331	0.381

REMARKS:

NOTE: Trial performed on frozen terrain at ground temperature 0°F.

*Total quantity of simulant picked up on jacket, trousers, and gloves.
**Pick-up factor equals percent of the ground contamination picked up on the uniform per meter of traversal.

TABLE 5

CREEP AND CRAWL TRIAL NO. 5

10 February 1958

Test Subject	B	M	G	C	N	K	O	L
Height (in.)	69	72	67	75	67	69	72	70
Weight (lb.)	155	200	135	195	135	200	190	180
Uniform No.	8	77	7	57	78	63	87	86
Contamination Density (g./sq.yd.)	5.66	5.66	6.29	6.29	6.59	6.59	7.09	7.09
Particle Size (μ, MMD)	1550	1500	1100	1100	1100	1100	1300	1300
Traversal Time (min. - sec.)	3-12	4-22	3-18	3-30	5-10	5-40	4-18	4-18
Location of Pick-Up	Simulant Picked up (mg.) on Various Sections of Uniforms							
Jacket								
Chest, left	8	5	39	4	5	91	9	15
Chest, right	9	3	31	3	8	43	6	18
Upper Abdomen, left	11	21	105	24	11	206	36	31
Upper Abdomen, right	23	14	175	26	25	101	12	45
Upper Arm, left	8	4	6	5	1	32	10	35
Upper Arm, right	15	5	55	13	4	9	6	4
Elbow, left	26	32	105	[illegible]	49	302	100	92
Elbow, right	26	27	49	45	70	79	51	97
Forearm, left	45	24	55	77	95	129	61	70
Forearm, right	55	29	106	98	179	54	49	109
Trousers								
Lower Abdomen, left	100	119	110	141	98	380	226	185
Lower Abdomen, right	83	100	210	216	103	79	50	83
Thigh, left	40	89	52	86	100	309	138	116
Thigh, right	43	117	58	112	38	117	51	130
Knee, left	18	51	67	61	101	284	79	87
Knee, right	27	86	50	67	118	103	66	69
Lower Leg, left	11	25	45	86	22	54	55	88
Lower Leg, right	11	27	45	95	22	31	23	29
Gloves								
Left	54	13	123	137	61	162	64	60
Right	67	89	106	128	92	135	89	37
Miscellaneous								
Rifle	6	3	7	5	4	10	3	6
Underwear								
Cuff, left					1	2	1	1
Cuff, right					10	1	8	1
Elbow					126	85	7	
Skin			0.4		0.2	0.3		0.4
TOTALS	719	882	1582	1523	1202	2700	1175	1350
Pick-Up Factors**	0.254	0.311	0.503	0.484	0.364	0.818	0.331	0.381

REMARKS:

NOTE: Trial performed on frozen terrain at ground temperature 0°F.

*Total quantity of simulant picked up on jacket, trousers, and gloves.
**Pick-up factor equals percent of the ground contamination picked up on the uniform per meter of traversal.

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TABLE 6

CREEP AND CRAWL TRIAL NO. 6

11 February 1958

Test Subject	D	G	H	I	O	K	E	B	J	F
Height (in.)	67	75	67	65	72	69	70	69	62	68
Weight (lb.)	165	195	135	150	190	200	180	155	185	195
Uniform No.	64	89	1	79	80	71	61	9	74	58
Contamination Density (g./sq.m.)	6.00	6.00	5.53	5.53	3.94	3.94	4.86	4.86	5.12	5.12
Particle Size (μ, MMD)	1300	1300	1300	1300	1100	1100	1300	1300	1300	1300
Traversal Time (min. - sec.)	3-0	4-23	6-0	7-43	4-35	5-55	4-10	2-28	6-25	6-25
Location of Pick-up	Simulant Picked-up (mg.) on Various Sections of Uniforms									
Jacket										
Chest, left	101	4	51	25	10	50	64	31	188	14
Chest, right	37	2	23	11	8	15	20	33	49	7
Upper Abdomen, left	159	32	104	210	167	198	323	248	296	338
Upper Abdomen, right	53	29	70	40	24	70	149	169	127	72
Upper Arm, left	39	0	29	55	2	18	65	28	44	77
Upper Arm, right	18	4	170	3	4	0	27	55	32	3
Elbow, left	173	125	62	192	79	44	91	76	58	113
Elbow, right	106	109	72	53	62	15	24	40	78	35
Forearm, left	107	26	108	323	85	275	154	116	203	211
Forearm, right	62	76	176	94	46	55	76	62	179	139
Trousers										
Lower Abdomen, left	233	122	226	60	331	271	89	188	200	475
Lower Abdomen, right	107	137	371	39	125	182	112	43	271	43
Thigh, left	54	88	85	137	204	159	142	150	128	438
Thigh, right	35	119	127	59	103	11	147	52	30	119
Knee, left	89	104	127	253	181	88	135	134	51	357
Knee, right	83	72	251	72	94	82	125	91	109	100
Lower Leg, left	55	33	57	116	28	148	101	92	48	224
Lower Leg, right	29	67	116	29	27	55	128	22	55	131
Gloves										
Left	137	104	202	217	10	256	99	140	170	108
Right	154	67	302	168	107	122	82	212	251	194
Miscellaneous										
Rifle	7	6	9	9	38	40	49	7	25	169
Underwear										
Cuff, left	13				12	2			1	
Cuff, right	1				3	1	4.0		26	
Skin	2.1		0.2	3.5	1.3	6.9	0.1	2.5	1.4	
TOTAL*	1841	1330	2729	2224	1697	2174	2143	1982	2567	3143
Pick-up Factor**	0.613	0.443	0.988	0.805	0.862	1.104	0.882	0.817	1.000	1.229

REMARKS:

*Total quantity of simulant picked up on jacket, trousers, and gloves.
**Pick-up factor equals percent of the ground contamination picked up on the uniform per meter of traversal.

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TABLE 6

CREEP AND CRAWL TRIAL NO. 6

11 February 1953

Test Subject	D	C	G	I	O	K	E	B	J	F
Height (in.)	67	75	67	65	72	69	70	69	69	68
Weight (lb.)	165	155	135	150	190	200	180	155	185	195
Uniform No.	64	89	1	79	80	71	61	9	74	58
Contamination Density (g./sq.m.)	6.00	6.00	5.53	5.53	3.94	3.94	4.86	4.86	5.12	5.12
Particle Size (μ, MMD)	1300	1300	1300	1300	1100	1100	1300	1300	1300	1300
Traversal Time (min. - sec.)	3-0	4-23	6-0	7-43	4-35	5-55	4-10	2-28	6-25	6-25
Location of Pick-Up	Simulant Picked-up (mg.) on Various Sections of Uniforms									
Jacket										
Chest, left	101	4	51	25	10	50	64	31	188	14
Chest, right	37	2	23	11	8	15	20	33	49	7
Upper Abdomen, left	159	32	104	210	167	198	323	248	296	332
Upper Abdomen, right	53	29	70	40	24	70	149	169	127	72
Upper Arm, left	39	0	29	55	2	18	65	28	44	77
Upper Arm, right	18	4	170	3	4	0	27	55	32	3
Elbow, left	173	125	62	192	79	44	91	76	58	148
Elbow, right	106	109	72	53	62	15	24	40	78	35
Forearm, left	107	26	108	323	85	275	154	116	203	211
Forearm, right	62	76	176	94	46	55	76	62	179	139
Trousers										
Lower Abdomen, left	233	122	226	60	331	271	89	188	200	475
Lower Abdomen, right	107	137	371	38	125	182	112	43	211	43
Thigh, left	54	88	85	197	204	159	142	150	128	434
Thigh, right	35	119	127	59	193	11	147	52	30	119
Knee, left	89	104	127	253	181	88	135	134	51	357
Knee, right	83	72	251	72	94	82	125	91	109	100
Lower Leg, left	55	33	57	116	28	148	101	92	43	224
Lower Leg, right	29	67	116	29	27	55	118	22	55	131
Gloves										
Left	137	104	202	217	10	256	99	140	170	108
Right	164	67	302	168	107	182	82	212	251	194
Miscellaneous										
Rifle	7	6	9	9	38	40	49	7	25	169
Underwear										
Cuff, left	13				12	2			1	
Cuff, right	1				3	1	4.0		26	
Skin	2.1		0.2	2.5	1.3	6.9	0.1	2.5	1.4	
TOTAL*	1841	1330	2729	2224	1697	2174	2143	1982	2567	3143
Pick-Up Factor**	0.613	0.443	0.988	0.805	0.862	1.104	0.882	0.817	1.000	1.229

NOTES:

*Total quantity of simulant picked up on jacket, trousers, and gloves.
**Pick-up factor equals percent of the ground contamination picked up on the uniform per meter of traversal.

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TABLE 7

CREEP AND CRAWL TRIAL NO. 7

17 March 1958

Test Subject	H	P	C	H	P	I	E	F	G
Height (in.)	69	68	75	69	68	65	70	67	70
Weight (lb.)	175	195	195	155	195	150	180	165	160
Uniform No.	31	62	19	75	67	72	88	60	73
Contamination Density (g./sq.m.)	6.18	1.58	5.89	5.89	6.18	5.53	5.53	4.45	4.45
Particle Size (μ, MMD)	1180	1180	1275	1275	900	1350	1350	1200	1200
Traversal Time (min. - sec.)	4-0	4-0	4-0	4-0	4-0	5-0	5-20	3-0	4-48
Location of Pick-Up	Simulant Picked up (mg.) on Various Sections of Uniforms								
Jacket									
Chest, left	42	13	3	7	7	11	52	72	70
Chest, right	71	0	1	0	5	4	64	25	7
Upper Abdomen, left	277	388	125	151	94	34	33	220	141
Upper Abdomen, right	116	34	42	73	18	16	40	143	70
Upper Arm, left	11	33	30	2	0	7	4	10	6
Upper Arm, right	8	5	3	10	1	0	2	11	80
Elbow, left	218	278	208	191	29	106	194	95	90
Elbow, right	106	151	154	176	42	87	120	105	38
Forearm, left	115	62	90	8	14	0	111	38	14
Forearm, right	32	106	94	52	36	0	60	49	
Trousers									
Lower Abdomen, left	125	248	230	71	32	0	137	34	119
Lower Abdomen, right	107	32	100	35	16	0	143	59	90
Thigh, left	104	143	4	25	31	0	54	52	50
Thigh, right	79	33	74	54	13	0	67	58	65
Knee, left	354	270	259	54	18	38	86	67	62
Knee, right	119	118	72	128	16	45	28	53	100
Lower Leg, left	86	43	143	40	0	5	40	14	25
Lower Leg, right	65	16	37	17	1	11	16	17	20
Gloves									
Left	107	112	95	136	29	148	72	64	72
Right	169	200	107	128	27	148	79	115	108
Miscellaneous									
Rifle		10	9	15	5	9	11	9	13
Underwear									
Cuff, left	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Cuff, right	[illegible]	[illegible]	[illegible]	[illegible]	27	[illegible]	[illegible]	[illegible]	[illegible]
Skin	0.7	10.0		0.6	1.0	0.4	0.9	1.2	
TOTAL*	2311	2285	1871	1378	478	660	1402	1301	1234
Pick-Up Factor**	0.749	0.740	0.636	0.469	0.605	0.239	0.508	0.584	0.554

REMARKS:

NOTE: Terrain covering consisted of dead, dry, matted grass.

*Total quantity of simulant picked up on jacket, trousers, and gloves.
**Pick-up factor equals percent of the ground contamination picked up on the uniform per meter of traversal.

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CREEP AND CRAWL TRIAL NO. 7

17 March 1958

Test Subject	H	P	C	B	F	I	E	F	G
Height (in.)	69	68	75	69	68	65	70	67	70
Weight (lb.)	175	195	195	155	195	150	180	165	160
Uniform No.	31	62	12	75	67	72	88	60	73
Contamination Density (g./sq.m.)	6.18	1.58	5.89	5.89	6.18	5.53	5.53	4.45	4.45
Particle Size (μ, MMD)	1180	1180	1275	1275	900	1350	1350	1200	1200
Traversal Time (min. - sec.)	4-0	4-0	4-0	4-0	4-0	5-0	5-20	3-0	4-48
Location of Pick-Up	Simulant Picked up (mg.) on Various Sections of Uniforms								
Jacket									
Chest, left	42	13	3	7	7	11	52	78	70
Chest, right	71	0	1	0	5	4	64	25	7
Upper Abdomen, left	277	383	125	151	94	34	33	220	141
Upper Abdomen, right	116	34	42	73	18	16	40	143	70
Upper Arm, left	11	33	30	2	0	7	4	10	6
Upper Arm, right	8	5	3	10	1	0	2	11	89
Elbow, left	218	238	208	191	29	106	144	95	98
Elbow, right	106	151	154	178	42	87	120	105	38
Forearm, left	115	62	90	8	14	0	111	38	14
Forearm, right	32	106	94	52	36	0	60	49	
Trousers									
Lower Abdomen, left	125	283	230	71	32	0	137	34	119
Lower Abdomen, right	107	32	120	35	16	0	143	59	90
Thigh, left	104	143	4	25	31	0	54	52	50
Thigh, right	79	33	74	54	13	0	67	58	65
Knee, left	354	270	259	54	18	38	86	67	62
Knee, right	119	118	79	128	16	45	28	53	100
Lower Leg, left	86	43	143	40	0	5	40	14	25
Lower Leg, right	65	16	37	17	1	11	16	17	20
Gloves									
Left	197	112	95	136	29	148	72	64	72
Right	169	200	107	128	27	148	79	115	108
Miscellaneous									
Rifle		30	2	15	5	9	11	9	13
Underwear									
Cuff, left	414	[illegible]	[illegible]	136	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Cuff, right	[illegible]	[illegible]	[illegible]	[illegible]	97	[illegible]	[illegible]	[illegible]	[illegible]
Skin	0.7	10.0		0.6	1.0	0.4	0.9	1.2	
TOTAL*	2311	2285	1871	1378	478	660	1402	1301	1234
Pick-Up Factor**	0.749	0.740	0.636	0.469	0.605	0.239	0.508	0.584	0.554

REMARKS:

NOTE: Terrain covering consisted of dead, dry, matted grass.

*Total quantity of simulant picked up on jacket, trousers, and gloves.
**Pick-up factor equals percent of the ground contamination picked up on the uniform per meter of traversal.

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TABLE 8

CREEP AND CRAWL TRIAL NO. 8

14 April 1958

Test Subject	P	C	E	B	D	A	R	I	Q
Height (in.)	68	75	70	69	67	71	67	65	70
Weight (lb.)	195	195	180	159	165	165	130	150	160
Uniform No.	40	39	59	4	34	36	33	37	22
Contamination Density (g./sq.m.)	2.38	2.38	2.13	2.59	2.59	2.43	2.03	2.03	2.08
Particle Size (μ, MMD)	940	940	1100	940	940	960	830	830	880
Traversal Time (min. - sec.)	4-40	4-10	2-15	2-30	2-20	3-42	2-30	5-45	5-45
Location of Pick-up	Simulant Picked up (mg.) on Various Sections of Uniforms								
Jacket									
Chest, left	20	15	23	16	49	16	35	13	14
Chest, right	6	0	20	1	8	6	9	4	12
Upper Abdomen, left	87	53	132	46	110	130	76	30	160
Upper Abdomen, right	295	38	66	19	28	92	51	9	60
Upper Arm, left	53	16	25	6	23	16	10	56	8
Upper Arm, right	11	12	13	19	12	14	8	6	11
Elbow, left	130	92	140	62	93	158	89	79	105
Elbow, right	76	78	110	117	53	111	85	70	45
Forearm, left	67	40	43	21	55	61	83	61	70
Forearm, right	79	49	106	42	32	71	67	83	43
Trousers									
Lower abdomen, left	286	113	101	100	184	148	77	20	246
Lower Abdomen, right	50	139	59	90	81	146	93	13	11
Thigh, left	125	66	71	27	47	125	100	17	93
Thigh, right	88	44	50	67	21	98	62	22	46
Knee, left	131	97	173	64	64	231	106	63	118
Knee, right	62	59	54	104	39	128	65	71	43
Lower Leg, left	110	103	137	35	55	88	70	24	106
Lower Leg, right	222	40	46	31	41	43	35	16	74
Gloves									
Left	79	50	34	63	107	69	62	70	54
Right	158	27	117	144	94	230	94	69	145
Miscellaneous									
Rifle	17	15	11	13	24	25	14		28
Underwear									
Cuff, left		38				0.2	0.7		
Cuff, right	0.0	3.2		2.2	1.0	8.9	17.0	2.2	10.8
Elbows	0.3	2.6	0.4			0.7	1.6	3.1	5.2
Neck								1.2	
Thighs	0.5		0.2		0.6				
Skin	0.4	3.8	0.2	1.4	0.1	0.3	0.1	0.2	0.2
TOTAL*	2198	1219	1470	1074	1236	1971	1277	796	1464
Pick-up Factor**	1.846	1.024	1.380	0.829	0.939	1.622	1.258	0.784	1.408

*Total quantity of simulant picked up on jacket, trousers, and gloves.

**Pick-up factor equals percent of the ground contamination picked up on the uniform per meter of traversal.

TABLE 8

CREEP AND CRAWL TRIAL NO. 3

14 April 1958

Test Subject	F	C	E	B	D	A	H	I	Q
Height (in.)	68	75	70	69	67	71	67	65	70
Weight (lb.)	195	195	180	155	165	165	130	150	160
Uniform No.	40	39	59	4	34	36	33	37	22
Contamination Density (g./sq.m.)	2.38	2.39	2.13	2.59	2.59	2.43	2.03	2.03	2.08
Particle Size (μ, MMD)	940	940	1100	940	940	960	830	830	830
Traversal Time (min. - sec.)	4-40	4-10	2-15	2-30	2-20	3-42	2-30	5-45	5-45
Location of Pick-Up	Simulant Picked up (mg.) on Various Sections of Uniforms								
Jacket									
Chest, left	20	10	23	16	49	16	35	13	14
Chest, right	6	0	20	1	8	6	9	4	12
Upper Abdomen, left	87	53	122	46	110	130	76	30	150
Upper Abdomen, right	295	38	66	19	28	92	51	9	60
Upper Arm, left	53	14	25	6	23	16	10	56	8
Upper Arm, right	11	12	13	19	12	14	8	6	11
Elbow, left	130	92	140	62	93	158	89	79	105
Elbow, right	76	79	110	117	53	111	85	70	45
Forearm, left	67	40	43	21	55	61	83	61	70
Forearm, right	79	49	106	42	30	71	67	82	43
Trousers									
Lower Abdomen, left	286	113	101	100	184	148	77	20	246
Lower Abdomen, right	50	139	59	30	81	146	93	13	11
Thigh, left	125	66	71	27	47	125	100	17	93
Thigh, right	88	44	50	67	21	88	62	22	46
Knee, left	131	97	123	61	64	231	106	63	118
Knee, right	62	59	51	124	32	128	65	71	43
Lower Leg, left	110	103	127	31	55	86	70	24	106
Lower Leg, right	222	40	47	31	61	43	35	16	74
Gloves									
Left	72	52	34	62	127	59	62	70	54
Right	125	57	117	144	94	230	94	69	145
Miscellaneous									
Rifle	17	15	11	13	24	25	14		20
Underwear									
Cuff, left		38				0.2	0.7		
Cuff, right	2.0	3.2		7.2	1.0	4.9	17.0	2.2	10.8
Elbows	0.3		0.4			0.7	1.0	3.1	5.2
Neck								1.2	
Thighs	0.5		0.2		0.6				
Skin	0.4	3.5	0.2	1.0	0.1	0.3	0.1	0.2	0.2
TOTAL*	2178	1212	1470	1074	1216	1371	1277	796	2164
Pick-up Factor**	1.846	1.024	1.250	0.829	0.939	1.622	1.258	0.784	1.405

Remarks:

*Total quantity of simulant picked up on jacket, trousers, and gloves.
**Pick-up factor equals percent of the ground contamination picked up on the uniform per meter of traversal.

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TABLE 9

GRAVEL AND GRAVEL TRIAL NO. 9

17 April 1958

Test Subject	B	C	D	F	A	I	J	G	K
Height (in.)	69	75	67	68	71	65	67	70	67
Weight (lb.)	155	195	165	195	165	150	165	160	130
Uniform No.	3	18	20	26	23	42	119	32	76
Contamination Density (c./sq.m.)	13.6	13.6	12.1	10.5	10.5	9.85	10.7	10.7	8.0
Particle Size (μ, ADP)	2510	2510	2510	2510	2510	2510	2510	2510	2510
Traversal Time (min. - secs)	1-35	3-35	3-0	3-55	3-55	4-22	5-0	5-0	1-50
Location of Pick-Up	Simulant Picked up (mg.) on Various Sections of Uniforms								
Jacket									
Chest, left	28	27	76	42	14	30	413	95	77
Chest, right	28	38	193	29	28	5	96	46	30
Upper Abdomen, left	234	153	378	414	109	23	228	290	650
Upper Abdomen, right	13	108	267	201	33	9	115	172	169
Upper Arm, left	35	31	56	46	57	30	129	34	21
Upper Arm, right	24	17	23	45	26	25	66	12	25
Elbow, left	420	453	937	564	521	580	182	402	276
Elbow, right	332	307	331	373	131	123	479	200	116
Forearm, left	13	283	525	266	290	94	166	281	180
Forearm, right	12	321	198	137	103	127	261	122	137
Trousers									
Lower Abdomen, left	319	320	661	353	344	216	405	487	128
Lower Abdomen, right	94	324	150	102	292	104	340	281	281
Thigh, left	65	130	166	244	247	361	429	111	273
Thigh, right	102	117	68	106	330	216	132	113	67
Knee, left	50	446	260	197	275	320	162	159	325
Knee, right	154	138	79	151	232	251	190	198	124
Lower Leg, left	71	135	140	225	275	269	174	82	252
Lower Leg, right	70	128	73	86	235	117	185	124	56
Gloves									
Left	396	192	373	205	236	229	414	320	79
Right	421	332	328	596	700	289	297	578	171
Miscellaneous									
Rifle	25	3	24	34	26		16	14	9.4
Underwear									
Cuff, left		8	1.1		0.5	68.0	4.1		4.1
Cuff, right		8.8	3.0	9.4	12.5	4.6	29.4	12	0.4
Elbows	2.4	9.2	3.6	2.1	2.6	8.3	2.6	123	4.7
Abdomen	1.7	1.6	2.8	0.3	0.1		6.3	0.8	2.1
Neck							0.6		
Thighs							0.4	2.8	
Skin		8.9	1.6	7.1	1.4	1.9	1.7	0.3	1.8
TOTAL*	2881	3950	5062	4884	4388	3428	4933	4127	3361
Pick-Up Factor**	0.424	0.581	0.837	0.930	0.836	0.696	0.922	0.771	0.840

REMARKS:

*Total quantity of simulant picked up on jacket, trousers, and gloves.
**Pickup factor equals percent of the ground contamination picked up on the uniform per meter of traversal.

TABLE 9

CREEP AND CRAWL TRIAL NO. 9

17 April 1958

Test Subject	B	C	D	F	A	I	D	G	K
Height (in.)	69	75	67	68	71	65	67	70	67
Weight (lb.)	135	195	165	195	165	150	165	160	130
Uniform No.	3	18	20	26	23	42	119	32	76
Contamination Density (gm./sq.ft.)	13.6	13.6	12.1	10.5	10.5	9.85	10.7	10.7	8.0
Particle Size (μ, MMD)	2510	2510	2510	2510	2510	2510	2510	2510	2510
Traversal Time (min. - sec.)	1-35	3-35	3-0	3-55	3-55	4-22	5-0	5-0	1-50
Location of Pick-Up	Simulant Picked up (mg.) on Various Sections of Uniforms								
Jacket									
Chest, left	28	27	76	42	14	30	413	95	77
Chest, right	28	38	193	29	28	5	96	46	39
Upper Abdomen, left	234	153	378	414	109	23	228	249	650
Upper Abdomen, right	13	108	267	201	31	9	115	172	169
Upper Arm, left	35	31	56	46	57	30	129	34	21
Upper Arm, right	24	17	23	15	26	25	66	12	25
Elbow, left	420	453	937	564	521	580	182	402	276
Elbow, right	332	307	331	373	131	123	479	200	116
Forearm, left	13	253	525	266	270	94	166	281	180
Forearm, right	12	321	198	137	103	127	261	122	137
Trousers									
Lower Abdomen, left	319	320	461	353	344	216	405	487	128
Lower Abdomen, right	94	324	150	102	292	104	340	281	281
Thigh, left	65	130	166	244	247	341	429	111	273
Thigh, right	102	117	69	146	310	266	192	113	67
Knee, left	50	446	240	197	275	320	182	159	315
Knee, right	154	138	79	151	232	251	190	198	134
Lower Leg, left	71	135	140	225	275	269	174	82	252
Lower Leg, right	70	128	73	86	235	117	185	144	56
Gloves									
Left	396	192	373	205	236	289	414	320	79
Right	421	339	323	526	700	289	297	578	171
Miscellaneous									
Rifle	25	3	24	34	26		16	14	9.4
Underwear									
Cuff, left		8	1.1		0.5	68.0	4.1		4.1
Cuff, right		8.8	3.9	9.4	17.5	4.6	29.4	12	0.4
Elbows	2.4	9.2	3.6	2.4	2.6	8.3	2.6	149	4.9
Abdomen	1.7	1.6	2.8	0.4	0.1		6.3	0.8	2.1
Back							0.6		
Thighs							0.4	2.8	
Skin		8.9	1.6	7.1	1.4	1.9	1.7	0.3	1.8
TOTAL*	2831	3650	5062	4884	4388	3428	4933	4127	3361
Pick-Up Factor**	0.424	0.581	0.837	0.930	0.836	0.696	0.922	0.773	0.840

REMARKS:

*Total quantity of simulant picked up on jacket, trousers, and gloves.
**Pick-up factor equals percent of the ground contamination picked up on the uniform per meter of traversal.

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TABLE 10

CREEP AND CRAWL TRIAL NO. 10

15 May 1958

Test Subject	H	J	D	F	C	G	D	B	E
Height (in.)	69	69	67	68	75	67	67	69	70
Weight (lb.)	175	145	165	195	195	135	165	155	180
Uniform No.	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Contamination Density (g./sq.m.)	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Particle Size (μ, MMD)	3120	3120	3120	3120	3120	3120	3120	3120	3120
Traversal Time (min. - sec.)	3-30	7-0	7-0	5-30	5-30	3-15	7-0	1-45	3-0
Location of Pick-Up	Simulant Picked up (mg.) on Various Sections of Uniforms								
Jacket									
Chest, left	38	112	118	19	0	38	118	4	4
Chest, right	26	35	35	17	0	13	35	0	0
Upper Abdomen, left	73	98	101	87	32	35	101	39	104
Upper Abdomen, right	62	26	38	[illegible]	15	14	38	6	43
Upper Arm, left	10	47	26	12	8	0	26	3	5
Upper Arm, right	3	24	35	8	6	12	35	16	6
Elbow, left	88	212	66	115	96	29	66	64	129
Elbow, right	11	57	96	52	92	49	96	72	62
Forearm, left	54	148	41	66	26	33	41	4	68
Forearm, right	22	44	57	[illegible]	[illegible]	47	57	6	42
Trousers									
Lower Abdomen, left	38	93	62	94	133	18	62	41	48
Lower Abdomen, right	32	48	75	91	92	51	75	38	16
Thigh, left	28	52	36	86	69	13	36	39	59
Thigh, right	38	45	45	86	40	24	45	58	65
Knee, left	63	66	29	73	52	11	29	24	46
Knee, right	122	15	37	63	36	15	37	70	37
Lower Leg, left	59	30	44	25	11	12	44	7	68
Lower Leg, right	0	26	34	17	12	38	34	11	40
Gloves									
Left	71	127	26	29	48	71	26	89	68
Right	115	139	165	127	86	53	165	123	69
Miscellaneous									
Rifle	6	5	4	4		5	4	7	6
Underwear									
Cuff, left			1.7			3.3	1.7		
Cuff, right	5.4		19.3	16.9			19.3		3.7
Elbow									0.3
Skin				0.2	0.3			0.2	0.1
TOTAL*	853	1104	[redacted]	[redacted]	922	572	[redacted]	705	[redacted]
Pick-Up Factor**	1.176	1.377	1.476	1.837	1.475	1.413	1.047	0.893	1.245

REMARKS:

NOTE: Trial was performed on damp terrain.

*Total quantity of simulant picked up on jacket, trousers, and gloves.
**Pick-up factor equals percent of the ground contamination picked up on the uniform per meter of traversal.

TABLE 10

CREEP AND CRAWL TRIAL NO. 10

15 May 1958

Test Subject	H	J	D	F	C	G	D	B	S
Height (in.)	69	69	67	68	75	67	67	69	70
Weight (lb.)	175	185	165	195	195	135	165	155	180
Uniform No.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Contamination Density (g./sq.m.)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Particle Size (μ, MMD)	3120	3120	3120	3120	3120	3120	3120	3120	3120
Traversal Time (min. - sec.)	3-30	7-0	7-0	5-30	5-30	3-15	7-0	1-45	3-0
Location of Pick-Up	Simulant Picked up (mg.) on Various Sections of Uniforms								
Jacket									
Chest, left	38	112	118	19	0	38	118	4	4
Chest, right	26	35	35	17	0	13	35	0	0
Upper Abdomen, left	73	98	101	87	32	35	101	39	104
Upper Abdomen, right	62	26	38	18	18	14	38	6	43
Upper Arm, left	10	47	26	12	8	0	26	3	5
Upper Arm, right	3	24	35	8	6	12	35	16	6
Elbow, left	88	212	66	115	96	29	66	64	129
Elbow, right	11	57	96	52	92	19	96	72	62
Forearm, left	54	108	41	68	26	33	41	4	68
Forearm, right	22	44	57	23	65	47	57	6	42
Trousers									
Lower Abdomen, left	38	93	62	94	133	18	62	41	48
Lower Abdomen, right	32	48	75	91	92	51	75	38	46
Thigh, left	28	52	36	86	69	13	36	30	59
Thigh, right	38	45	45	86	40	24	45	58	65
Knee, left	62	66	29	73	52	11	29	24	46
Knee, right	122	15	37	63	36	11	37	70	37
Lower Leg, left	59	30	44	25	11	12	44	7	68
Lower Leg, right	0	26	34	17	12	38	34	11	40
Gloves									
Left	71	127	26	29	48	71	26	89	68
Right	115	139	165	127	86	53	165	123	69
Miscellaneous									
Rifle	6	5	4	4		5	4	7	6
Underwear									
Cuff, left			1.7			3.3	1.7		3.7
Cuff, right	5.4		19.3	16.9			19.3		0.3
Elbow				0.2	0.3			0.2	0.1
Skin									
TOTAL*	853	1.04	[illegible]	[illegible]	922	572	[illegible]	705	[illegible]
Pick-Up Factor**	1.176	1.177	1.476	1.837	1.475	1.413	1.047	0.893	[illegible]

REMARKS:

NOTE: Trial was performed on damp terrain.

*Total quantity of simulant picked up on jacket, trousers, and gloves.
**Pick-up factor equals percent of the ground contamination picked up on the uniform per meter of traversal.

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[illegible]

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TABLE 11

[illegible] TRIAL NO. 11

28 May 1958

Test Subject	G	D	B	H	C	[illegible]	F	T	[illegible]
Height (in.)	67	67	69	69	69	70	68	65	71
Weight (lb.)	135	165	155	175	185	160	195	150	165
Uniform No.	29	111	98	106	101	110	107	103	102
Contamination Density (g./sq.m.)	0.90	0.89	0.89	2.23	0.81	0.81	0.78	0.78	0.81
Particle Size (μ, AMD)	550	550	550	550	550	550	550	550	550
Traversal Time (min. - sec.)	3-0	4-0	3-45	3-0	6-0	5-45	5-45	5-45	2-15
Location of Pick-Up	Simulant Picked up (mg.) on Various Sections of Uniforms								
Jacket									
Chest, left	38	72	28	120	59	39	21	11	0
Chest, right	73	10	9	57	23	33	43	6	0
Upper Abdomen, left	36	134	55	156	78	74	54	33	20
Upper Abdomen, right	28	24	32	101	28	53	93	16	36
Upper Arm, left	6	20	11	18	13	14	56	6	5
Upper Arm, right	51	[illegible]	16	6	2	14	20	3	5
Elbow, left	22	[illegible]	57	61	141	82	15	97	55
Elbow, right	40	53	80	214	40	51	36	38	24
Forearm, left	45	74	11	67	[illegible]	72	39	50	44
Forearm, right	44	36	30	72	47	45	23	20	28
Trousers									
Lower Abdomen, left	52	101	33	216	21	25	161	25	29
Lower Abdomen, right	78	36	[illegible]	139	18	20	51	23	49
Thigh, left	21	35	61	157	33	33	153	29	25
Thigh, right	10	35	49	102	28	43	56	40	55
Knee, left	41	[illegible]	29	152	42	19	72	72	48
Knee, right	61	54	72	123	23	44	34	27	60
Lower Leg, left	0	40	13	131	13	14	21	4	2
Lower Leg, right	0	24	4	53	0	0	0	0	0
Gloves									
Left	138	[illegible]	[illegible]	[illegible]	100	70	73	204	61
Right	85	115	100	42	111	125	92	204	55
Miscellaneous									
Rifle	5	10		36	14	19	19	12	13
Underwear									
Cuff, left		2.7	0.5		2.2	0.6			2.7
Cuff, right			0.9		2.2	2.4	2.4		
Elbows	7.4			35.5			1.5		
Abdomen		0.4	0.4	0.6					
Neck		0.3	0.5						
Skin								9.7	
TOTAL*	774	1144	35	2819	898	876	1148	696	631
Pick-Up Factor**	1.72	2.57	1.88	2.23	2.22	2.16	2.94	1.79	1.56

REMARKS:

*Total quantity of simulant picked up on jacket, trousers, [illegible]

**Pick-up factor as a [illegible]

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Armed Services Technical Information Agency

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NOTICE: WHEN GOVERNMENT OR OTHER DRAWINGS, SPECIFICATIONS OR OTHER DATA ARE USED FOR ANY PURPOSE OTHER THAN IN CONNECTION WITH A DEFINITELY RELATED GOVERNMENT PROCUREMENT OPERATION, THE U. S. GOVERNMENT THEREBY INCURS NO RESPONSIBILITY, NOR ANY OBLIGATION WHATSOEVER; AND THE FACT THAT THE GOVERNMENT MAY HAVE FORMULATED, FURNISHED, OR IN ANY WAY SUPPLIED THE SAID DRAWINGS, SPECIFICATIONS, OR OTHER DATA IS NOT TO BE REGARDED BY IMPLICATION OR OTHERWISE AS IN ANY MANNER LICENSING THE HOLDER OR ANY OTHER PERSON OR CORPORATION, OR CONVEYING ANY RIGHTS OR PERMISSION TO MANUFACTURE, USE OR SELL ANY PATENTED INVENTION THAT MAY IN ANY WAY BE RELATED THERETO.

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TABLE 11

CHEMICAL CORPS TRIAL NO. 11

28 May 1958

Test Subject	G	D	E	H	J	K	P	T	A
Height (in.)	67	67	62	64	69	70	68	65	71
Weight (lb.)	135	165	155	175	185	160	195	150	165
Uniform No.	29	111	98	106	101	110	107	103	102
Contamination Density (g/sq.m.)	0.70	0.79	0.39	0.53	0.51	0.81	0.78	0.78	0.31
Particle Size (μ, AD)	550	550	550	550	550	550	550	550	550
Traversal Time (min. - sec.)	1-0	1-0	2-15	3-0	4-0	5-15	5-45	5-45	2-15
Location of Pick-up	Simulant Picked up (mg) on various sections of Uniform								
Jacket									
Chest, left	38	22	28	120	59	29	21	11	2
Chest, right	23	10	7	57	23	23	43	6	2
Upper Abdomen, left	30	124	55	156	78	74	51	33	20
Upper Abdomen, right	25	24	32	101	28	53	93	16	36
Upper Arm, left	4	20	11	12	12	11	50	6	5
Upper Arm, right	51	5	16	6	2	11	20	3	5
Elbow, left	22	20	57	61	141	32	15	24	65
Elbow, right	11	13	46	74	10	51	36	36	24
Forearm, left	15	7	11	25	13	72	39	50	14
Forearm, right	11	30	32	32	42	45	25	20	21
Trousers									
Lower Abdomen, left	32	171	32	221	21	25	171	2	29
Lower Abdomen, right	74	22	25	134	19	25	51	23	49
Thigh, left	21	2	61	157	33	22	153	29	25
Thigh, right	20	33	45	120	24	17	50	40	59
Knee, left	21	24	32	152	10	17	72	32	12
Knee, right	11	24	72	173	23	11	31	27	29
Lower Leg, left	0	11	12	222	13	11	31	2	2
Lower Leg, right	3	21	1	32	0	2	0	1	0
Gloves									
Left	32	1	2	2[illegible]	100	72	73	201	61
Right	35	212	192	12	111	195	32	201	65
Miscellaneous									
Rifle	5	20		30	11	15	17	12	13
Underwear									
Cuff, left		0.7	0.5		0.2	3.6			0.7
Cuff, right	7.4		0.2	35.5	0.2	2.4	0.4		
Elbows		0.1	0.1	0.6					
Abdomen		0.3	0.3						
Neck								0.7	
Skin									
TOTAL*	776	1114	32	2813	598	576	1114	32	631
Pick-up factor**	1.72	2.27	1.[illegible]	[illegible]	0.22	0.16	2.24	1.7[illegible]	1.50

REMARKS:

*Total quantity [illegible] of uniform.
**Pick-up factor [illegible]

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Table 12

Pick-up [illegible] Simulant Trials

19 June 1950

Test [illegible]	A	A	A	A	A	A	A	A	A	A
[illegible] (in.)	71	71	71	71	71	71	71	71	71	71
Weight (lbs.)	165	165	165	165	165	165	165	165	165	165
[illegible]	108	112	114	115	129	92	92	93	95	96
[illegible] Density (gm./sq. in.)	1.45	0.99	0.40	2.34	0.734	1.44	3.11	5.22	7.70	10.62
Particle Size (μ, [illegible])	Large	Large	Large	Large	Large	Small	Small	Small	Small	Small
Treatment [illegible]	1-7	1-7	1-[illegible]	3-2	0-58	1-4	1-2	1-50	1-3	1-2
Location of Pick-up	Simulant [illegible] (mg.) in various sections of Uniform									
Jacket										
Chest, [illegible]	67	11	29	10	14	0	5	16	30	21
Chest, [illegible]	74	11	32	0	13	0	2	22	25	30
Upper [illegible], left	46	33	77	14	13	3	24	63	98	164
Upper [illegible], right	155	63	[illegible]	7	9	14	31	45	93	130
Lower arm, left	41	70	14[illegible]	6	16	7	29	0	9	32
Lower arm, right	74	27	19	[illegible]	6	7	1	12	7	8
[illegible], left	2[illegible]	146	240	92	59	46	127	156	206	290
[illegible], right	2[illegible]	15[illegible]	2[illegible]	61	33	46	37	68	134	148
Forearm, left	113	233	134	3[illegible]	37	23	61	93	129	160
Forearm, right	117	113	135	53	29	[illegible]	23	33	110	181
Trousers										
Lower [illegible], left	111	1[illegible]	22[illegible]	76	16	33	74	137	187	173
Lower [illegible], right	221	149	271	[illegible]	[illegible]	2[illegible]	[illegible]	135	56	254
[illegible], left	1[illegible]	126	1[illegible]	22	5	0	37	42	113	167
[illegible], right	67	25	53	14	5	0	11	16	126	202
Knee, left	134	146	243	63	31	14	92	135	131	158
Knee, right	163	117	15	[illegible]	27	36	50	145	85	75
Lower leg, left	25	133	117	14	0	0	13	59	213	100
Lower leg, right	125	27	36	29	0	0	95	257	150	135
Glove										
Left	63[illegible]	1[illegible]	1[illegible]	16	37	68	10[illegible]	145	254	335
Right	51[illegible]	351	127	23	26	[illegible]	162	33[illegible]	562	650
Helmet										
Helmet	21	[illegible]	94	7	[illegible]	24	15	30	64	86
Footwear										
Shoe, left	1.0	2.0					1.0	1	2	1
Shoe, right	1.0			2.0	4.0		1.0	3	4	4
Socks	3.0	1.0	17.0							
Socks							1.0		3.0	
Skin	1.0	1.0								
TOTAL*	2356	2308	2335	365	393	400	991	1,65	9688	3413
Pick-up Factor**	1.279	1.329	1.295	1.023	2.115	1.264	1.274	1.486	1.395	1.311

REMARKS:

*Total quantity of simulant picked up on jacket, trousers, and gloves.
**Pick-up factor equals percent of the ground contamination picked up on the uniform per meter of traversal.

TABLE 12

Pick-up on Man in Man-Vs.-Roller Trials

19 June 1958

Test Subject	A	A	A	A	A	A	A	A	A	A
Height (in.)	71	71	71	71	71	71	71	71	71	71
Weight (lb.)	165	165	165	165	165	165	165	165	165	105
Uniform No.	108	112	114	113	109	91	92	93	95	96
Contamination Density (g./sq.m.)	10.5	6.95	9.42	2.96	0.734	1.44	3.11	5.29	7.70	10.42
Particle Size (μ, mm)	Large	Large	Large	Large	Large	Small	Small	Small	Small	Small
Traversal Time (min. & sec.)	1-7	1-7	1-10	1-2	0-55	1-4	1-9	1-50	1-3	1-2
Location of Pick-up	Simulant Picked up (mg.) on Indicated Sections of Uniform									
Jacket										
Chest, left	62	11	29	10	14	0	5	16	30	21
Chest, right	74	11	32	0	13	0	2	22	25	30
Upper Abdomen, left	96	33	77	11	13	3	24	63	98	164
Upper Abdomen, right	105	63	65	7	9	14	31	65	93	130
Upper Arm, left	41	70	112	9	18	7	27	6	9	32
Upper Arm, right	74	27	19	9	6	7	1	10	7	8
Elbow, left	265	166	210	99	52	46	127	156	206	290
Elbow, right	263	157	205	61	33	46	37	45	134	148
Forearm, left	123	133	134	36	37	23	61	93	129	160
Forearm, right	147	113	125	53	23	26	25	33	110	181
Trousers										
Lower Abdomen, left	111	102	279	76	16	38	74	137	187	173
Lower Abdomen, right	221	199	221	[illegible]	8	29	65	235	56	254
Thigh, left	142	126	125	22	5	0	37	42	113	167
Thigh, right	227	92	83	19	5	6	11	16	196	202
Knee, left	234	146	253	63	31	44	92	105	131	158
Knee, right	183	117	150	65	22	36	50	105	85	75
Lower Leg, left	93	133	117	14	0	0	13	57	113	100
Lower Leg, right	105	87	36	29	0	-	25	257	150	135
Gloves										
Left	239	156	155	46	37	66	109	145	254	335
Right	512	351	327	93	46	94	162	325	562	650
Miscellaneous										
Rifle	21	21	24	7	4	14	15	30	64	86
Underwear										
Cuff, left	4.0	2.0					1.0	1	2	1
Cuff, right	4.0			2.0	4.0		1.0	3	4	4
Elbows	3.0	1.0	10.0							
Tongue							1.0		3.0	
Vein	1.0	1.0								
TOTAL*	2356	2308	2835	765	388	400	991	1965	2688	3413
Pick-up Factor**	1.279	1.329	1.305	1.0[illegible]	2.115	1.264	1.274	1.486	1.395	1.311

REMARKS:

*Total quantity of simulant picked up on jacket, trousers, and gloves.
**Pick-up factor equals percent of the ground contamination picked up on the uniform per meter of traversal.

2

APPENDIX A

Table 13

Comparative Pick Up on Roller and Man

Date	Test subject	Contamination density	Approx particle size	Pick-Up		
				Roller	Man	Roller/Man
		g/sq m	μ	g	g	
19 Jun 58	A	10.5	Large	3.61	3.36	1.08
19 Jun 58	A	6.95	Large	2.66	2.31	1.15
19 Jun 58	A	9.42	Large	3.85	2.84	1.36
19 Jun 58	A	2.90	Large	0.94	0.77	1.22
19 Jun 58	A	0.72	Large	0.49	0.39	1.25
19 Jun 58	A	1.44	Small	0.94	0.46	2.04
19 Jun 58	A	3.11	Small	1.20	0.99	1.21
19 Jun 58	A	5.29	Small	1.91	1.97	0.97
19 Jun 58	A	7.70	Small	3.93	2.69	1.46
19 Jun 58	A	10.4	Small	4.00	3.41	1.17
14 Apr 58	E	2.13	1100	1.90	1.47	1.29
14 Apr 58	A	2.43	1000	2.07	1.97	1.05
14 Apr 58	[illegible]	2.08	900	1.48	1.46	1.01
17 Apr 58	D	12.1	2500	6.48	5.06	1.28
17 Apr 58	I	9.85	2500	5.00	3.43	1.46
17 Apr 58	R	8.00	2500	3.82	3.36	1.14
15 May 58	H	1.45	3100	1.09	0.85	1.28
15 May 58	G	0.81	3100	0.80	0.57	1.40
15 May 58	E	1.62	3100	1.45	1.01	1.44
28 May 58	G	0.90	600	1.24	0.77	1.61
28 May 58	H	2.53	600	3.08	2.82	1.09
28 May 58	A	0.81	600	1.32	0.63	2.09

Remarks:

1. Trials conducted on 19 Jun 58 were run in accordance with Test Plan No. 29. The other data presented were obtained in conjunction with "creep and crawl" trials.

2. Physical characteristics of test subjects appear in preceding tables.

APPENDIX A

Table 14

Comparative Transferability of Agent and Simulant

Trial no.	Contamination density	Particle size	Roller Pick-Up				
			First Traversal			Second Traversal	
			Top cloth	Under cloth	Ratio agent/sim*	Top cloth	Under cloth
	g/sq m		mg	mg		mg	mg
1	8.5	Small	2,440	23	0.68	27	1
2	13.9	Small	2,390	43	0.41	80	2
3	6.9	Small	2,530	40	0.89	17	2
4	3.6	Small	1,270	52	0.85	16	1
5	2.2	Small	250	25	0.29	10	1
6	10.0	Large	2,000	7	0.53	76	54
7	12.9	Large	1,200	23	0.25	60	59
8	8.2	Large	1,250	2	0.40	47	23
9	3.4	Large	1,100	15	0.85	18	11
10	1.0	Large	520	16	1.34	7	5

Remarks:

*In establishing the ratio of agent to simulant pick-up, corresponding values of simulant pick-up were obtained from curves in figure 3, appendix B, which were fitted to data obtained on 10 June 1958 as presented in table 13, this appendix.

APPENDIX B

GRAPHS AND CHARTS

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Figure 1 Distribution of Simulant on Uniforms of Test Subjects. 28
Figure 2 Distribution of Simulant on Uniforms of Test Subjects. 29
Figure 3 Pick-Up of Simulant on Cloth-Covered Roller. 30
Figure 4 Comparative Transferability of Agent and Simulant. 31

FIGURE 1

DISTRIBUTION OF SIMULANT ON UNIFORMS OF TEST SUBJECTS

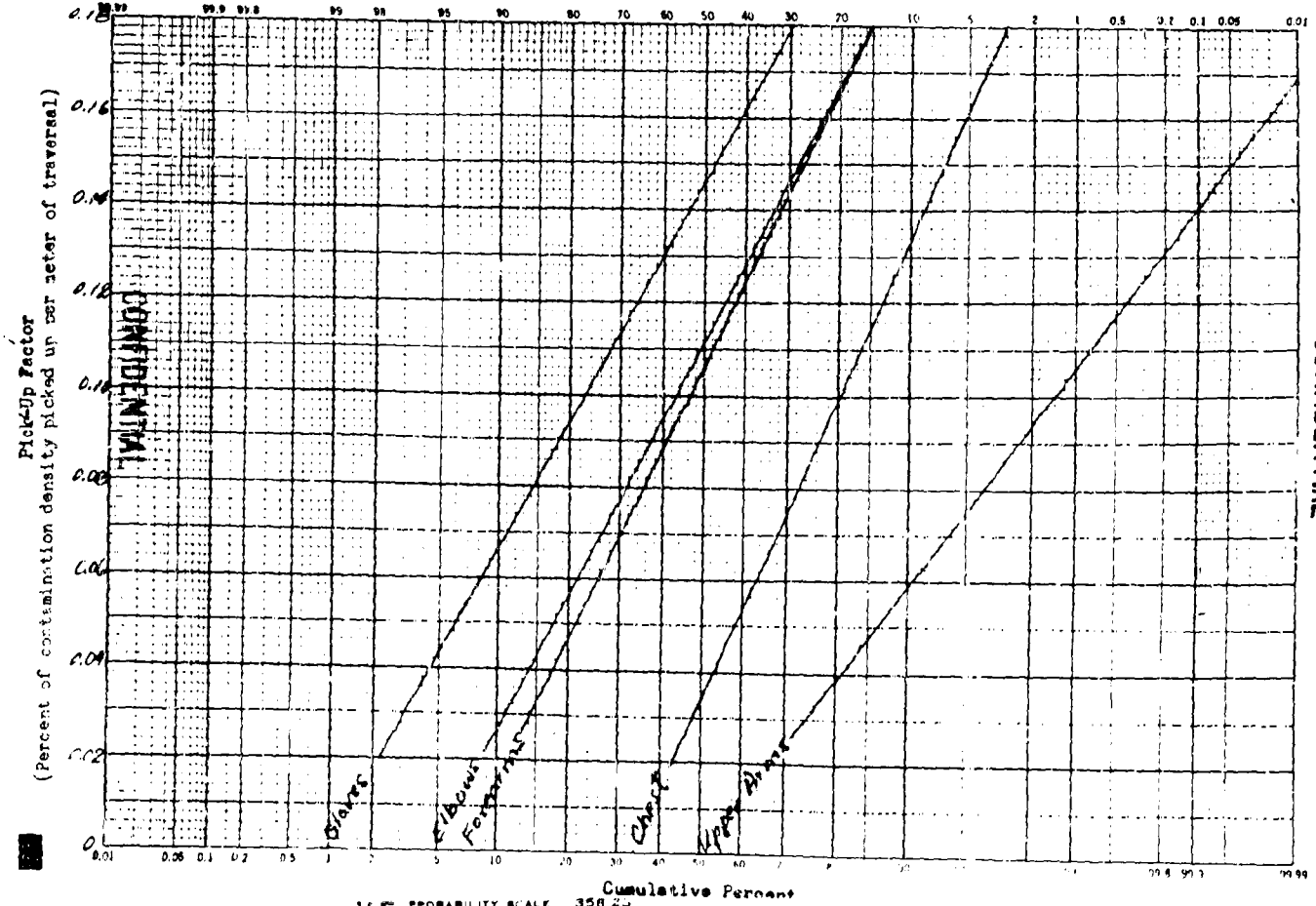

FIGURE 2

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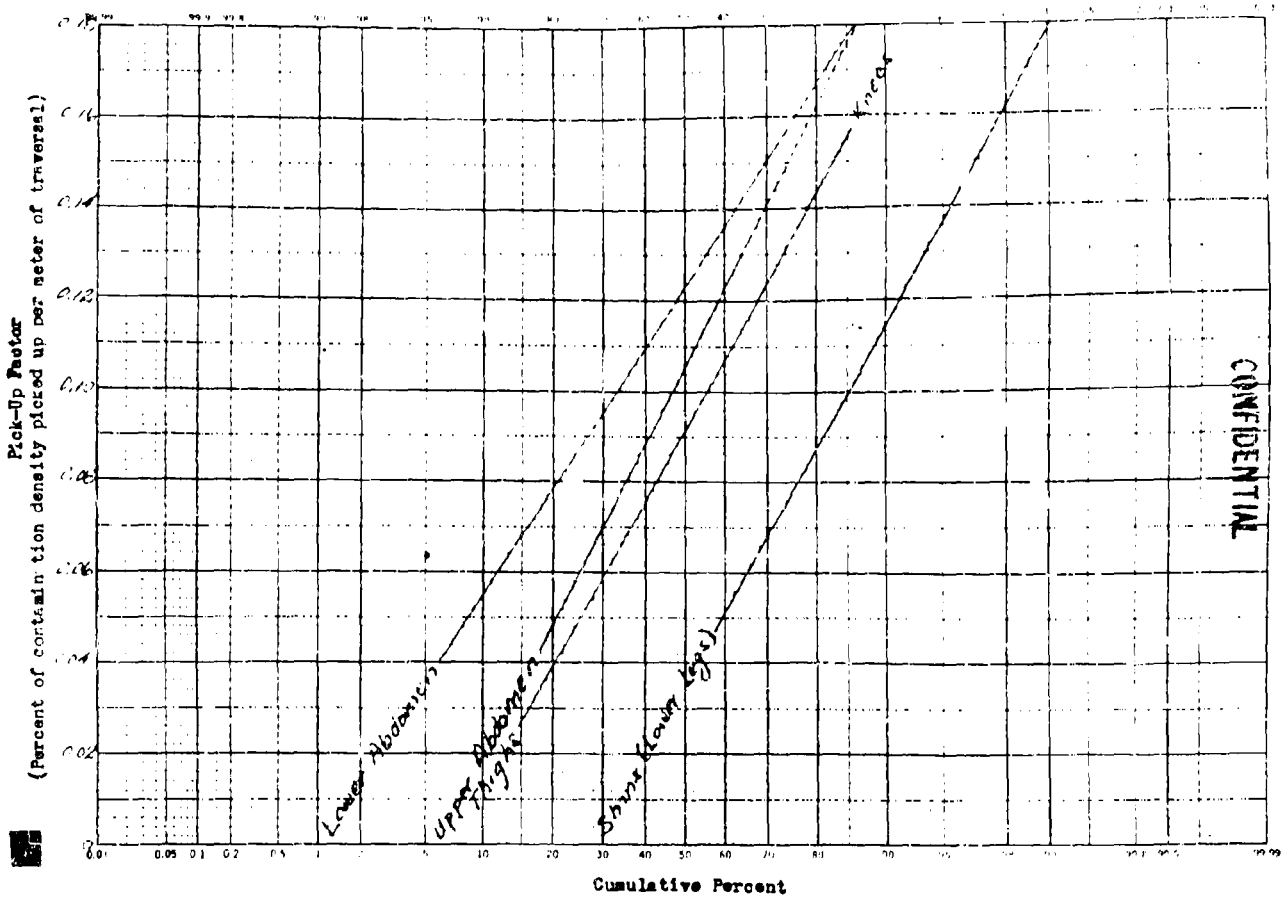
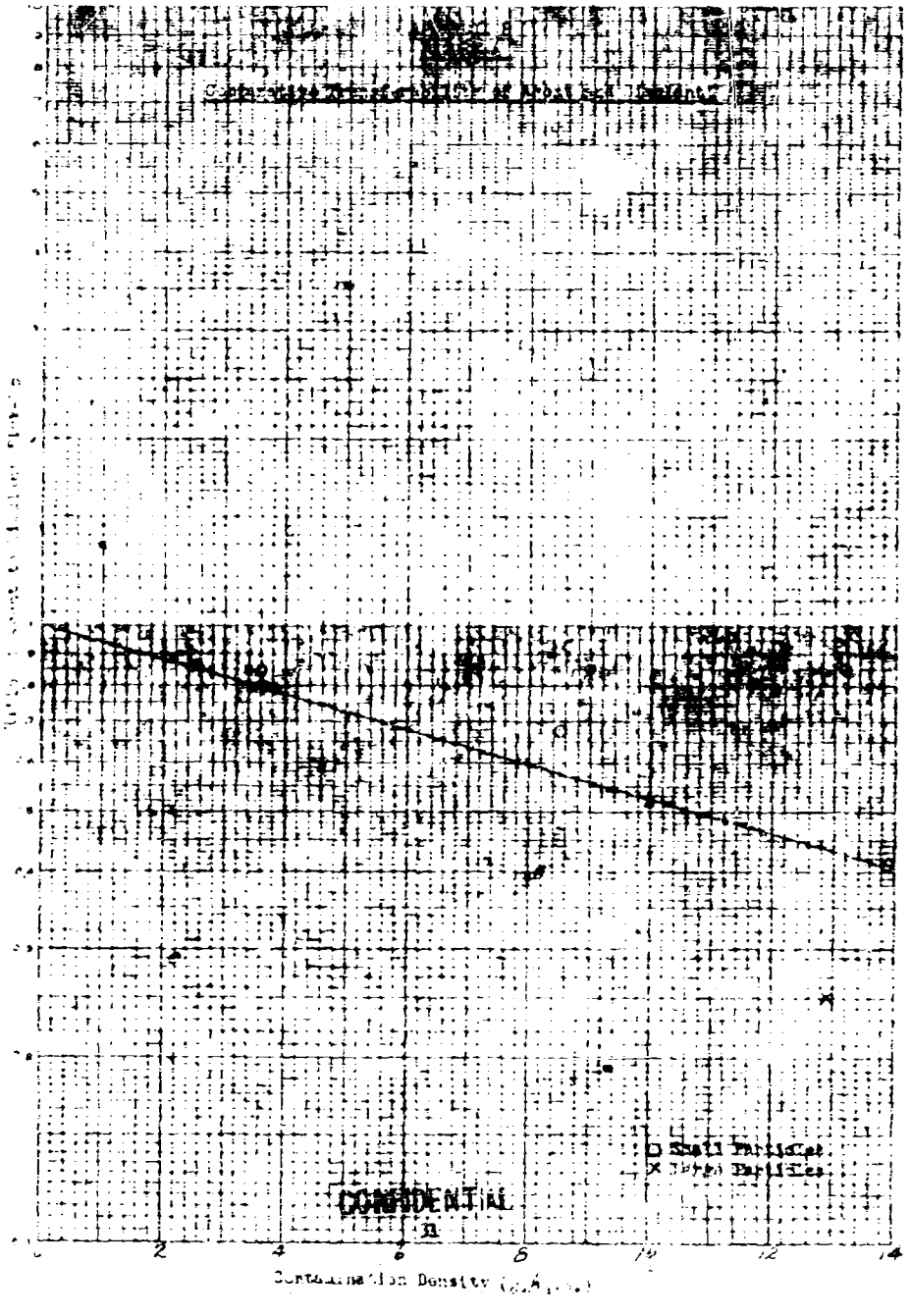
FIGURE 2

DISTRIBUTION OF SIMULANT ON UNIFORMS OF TEST SUBJECTS



Small particles
Large particles
Contaminant Density (g/m³)



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APPENDIX C

PHOTOGRAPHS

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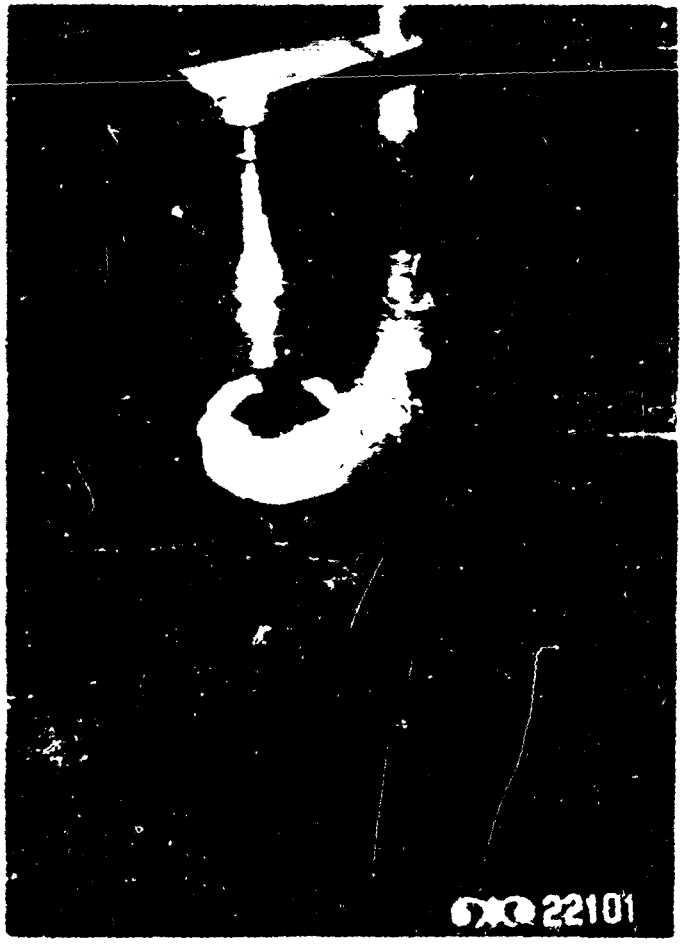


FIGURE 1

SPINNING TIP APPARATUS

View shows sled-mounted spinning tip apparatus employed in dispersing simulant in fine droplets.

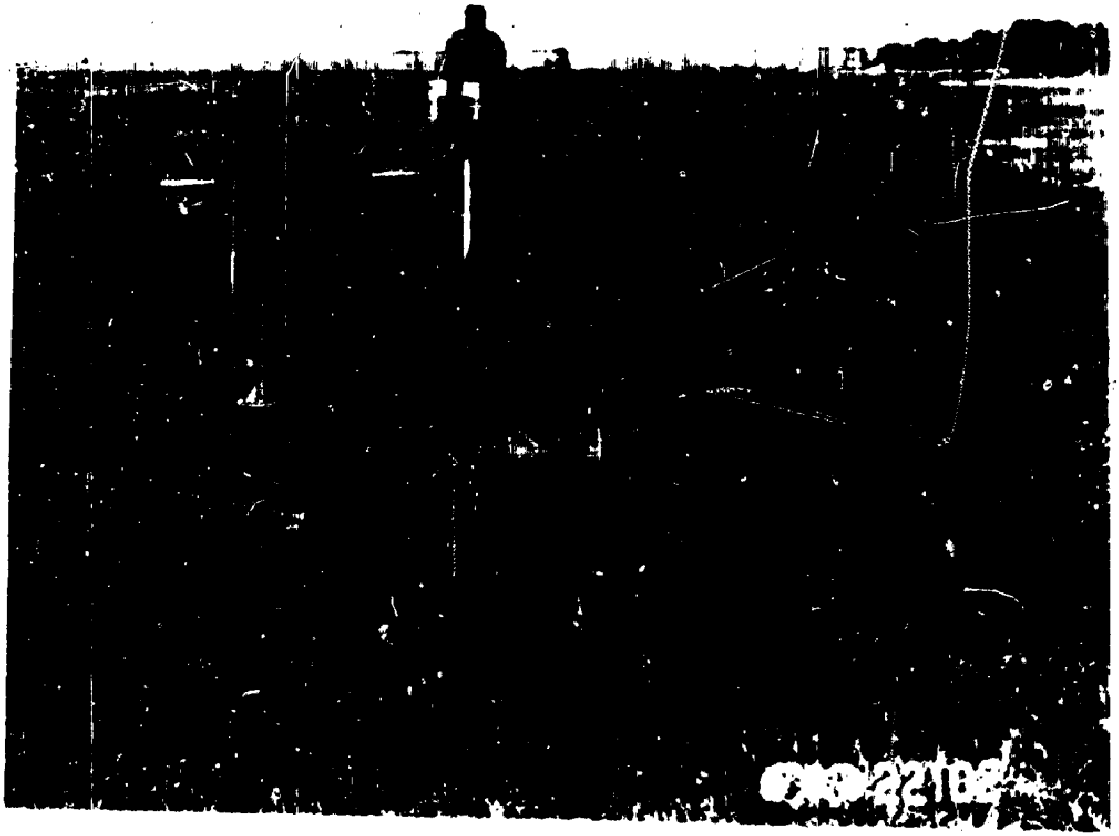


FIGURE 2

MULTIJET DISPERSER

View shows sled-mounted multijet disperser employed in the dissemination of large droplets. The sled for the spinning tip aerosolizer is seen in the background.

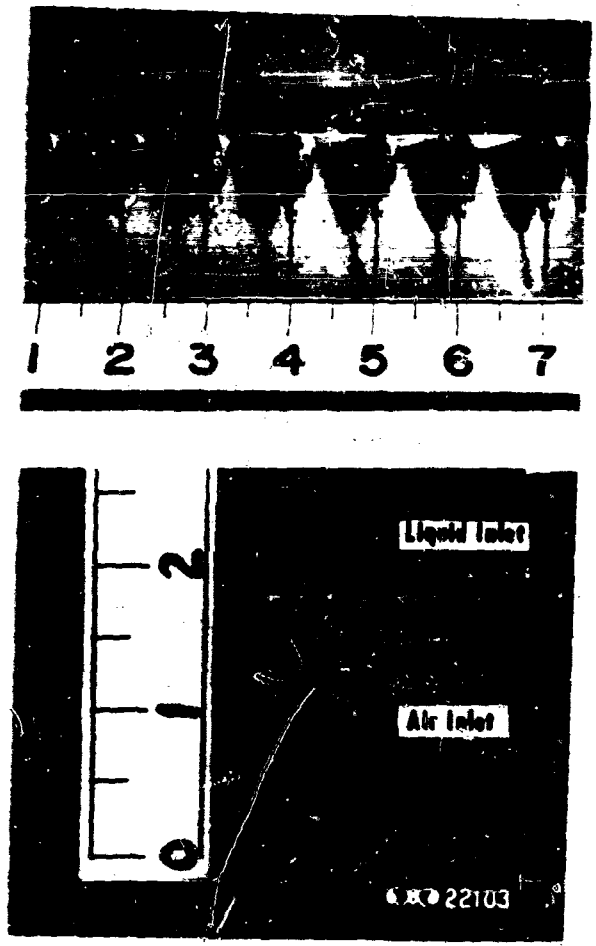
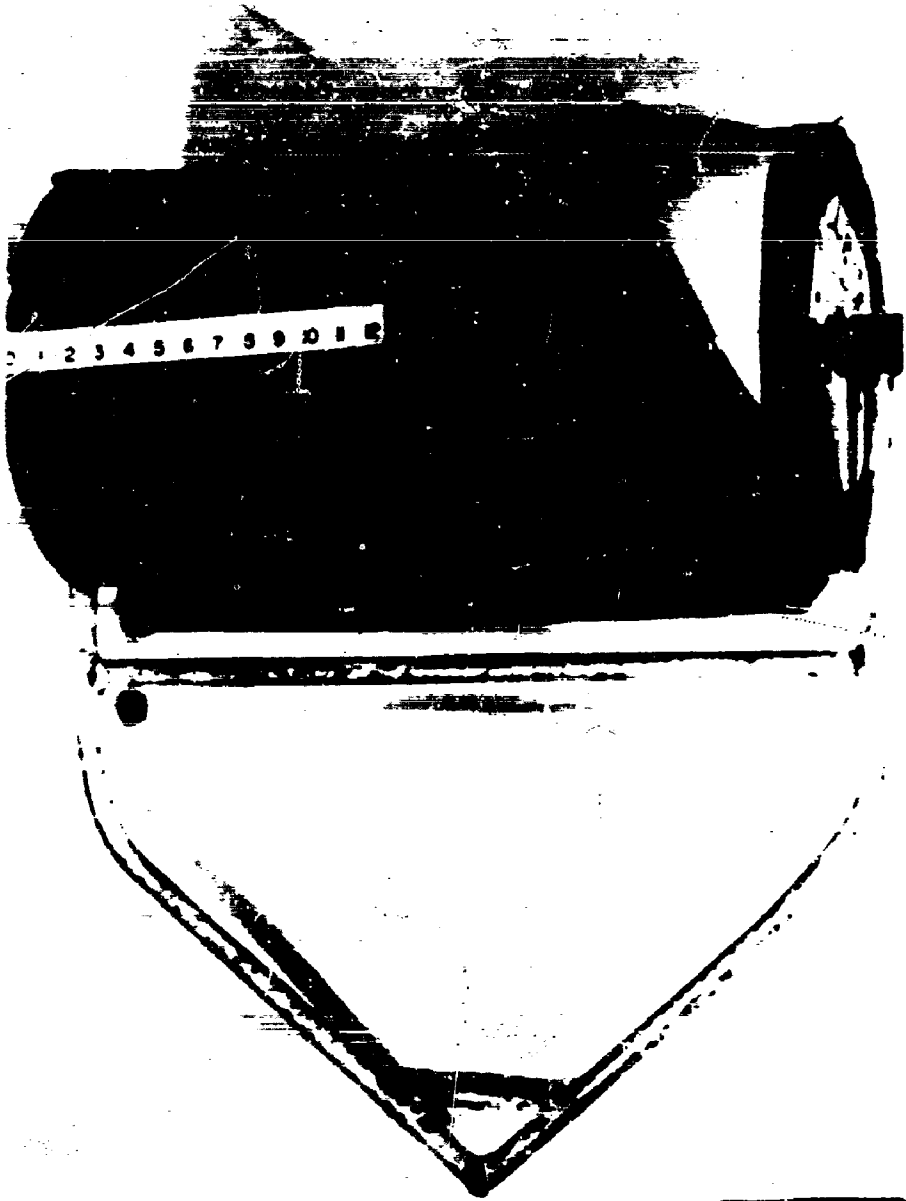


FIGURE 3

NOZZLES FOR MULTIJET DISPERSER

Top view shows a section of the disperser manifold with needles for disseminating 3 mm droplets. Bottom view shows nozzles for disseminating shattered droplets averaging less than 0.5 mm in diameter.



[redacted]

FIGURE 4

CLOTH-COVERED ROLLER

In this view the cotton sateen cover is lifted to show the 1/2-in. thick foam rubber pad covering the steel drum of the roller.

FIGURE 5

CONTAMINANT IMPORT (LIGHT)

FIGURE 6

CONTAMINATED UNIFORM (MEDIUM)

View shows contaminated clothing mounted on a plane surface after seams were cut.

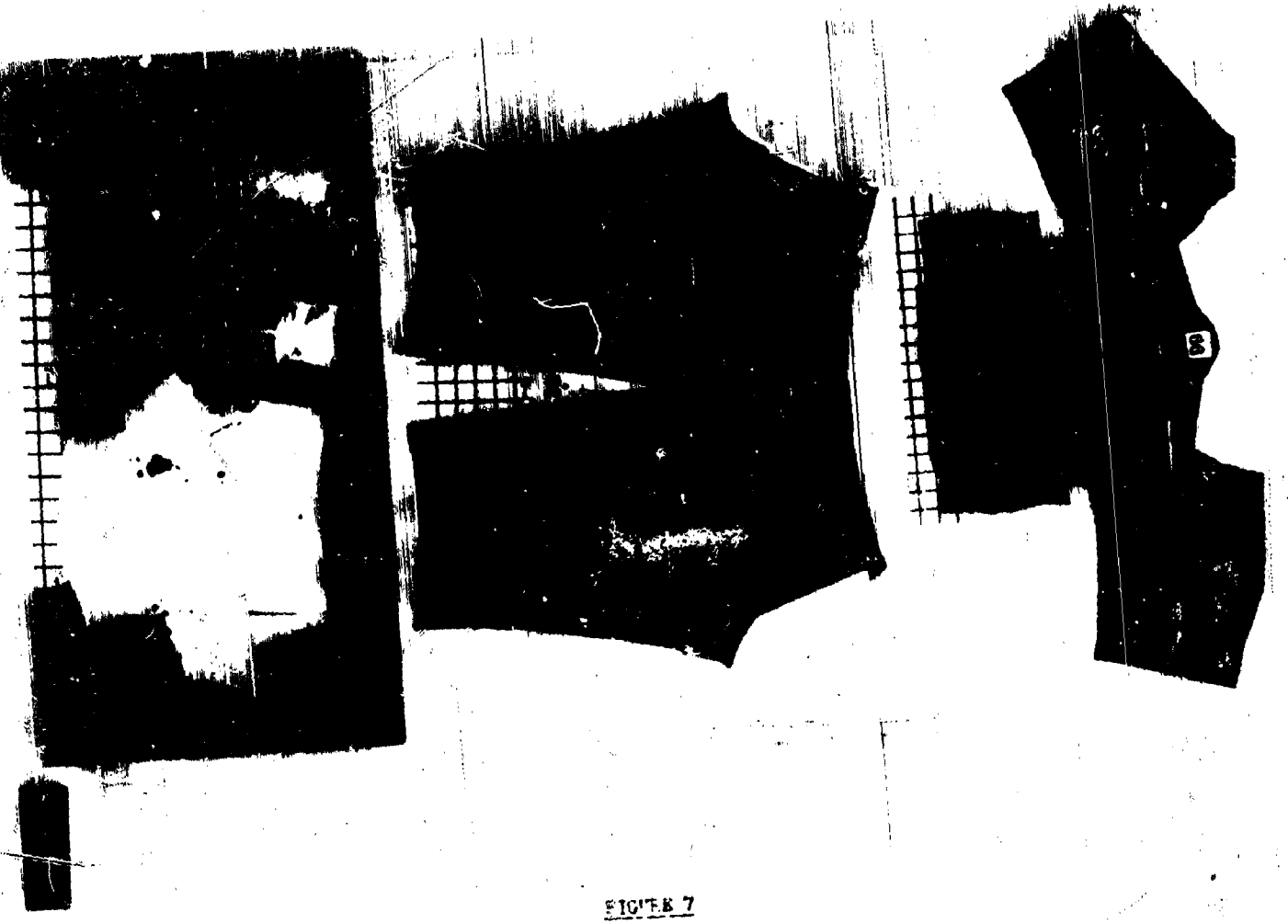


FIGURE 7

CONTAMINATED [illegible] (HEAVY)

View shows contaminated clothing [illegible] on a plane surface after seams were cut.

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1. Manthie, J.H., Heitkamp, D.H. Dorsey, R.W., Stark, W.C., Bona, D.M., Moore, R.D., and Cameron, K.P., *Mustard Contact Hazard, Correlation of Effects on Skin with Contamination Levels Recovered from Dental Dam and Painted Steel Surfaces*, CRDEC-TR-88142, August 1988 (Dist. B. - U. S. Government Agencies) **DTIC: CBRNIAC-CB-009397**

2. Manthei, J.H.; Heitkamp, D.H.; Dorsey, W.C.; Starke, W.C.; Braun, R.A.; Bona, D.M.; Moore, R.D.; Cameron, K.P.; Klein, J.M. *Toxic Hazard to the Rabbit from Direct and Vapor Contact with HD-Contaminated Plexiglas, Concrete, or XM40 Nylon Carrier Material*; CRDEC-TR-86072; U.S. Army Chemical Research, Development and Engineering Center: Aberdeen Proving Ground, MD, 1986 (Dist. B. - U. S. Government Agencies) **DTIC: ADB105323**

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