DEPARTMENT OF THE NAVY
MILITARY SEA TRANSPORTATION SERVICE, PACIFIC AREA
FORT MASON P-24
SAN FRANCISCO, CALIFORNIA 94129 14 January 1965

MEMORANDUM

From: Director, Training Division, IRO
To: Masters, MSTSPAC Civil Service-Manned Ships (USNS)

Subj: Phase II Nuclear Defense Training

Ref: (a) NAVPERS 10099-ABC Warfare Defense
(b) Publication - "The Effects of Nuclear Weapons," 1962

Encl: (1) Decontamination Doctrine for Nuclear, Biological, and Chemical Warfare
(2) Table I - Fallout Activities at Various Times After a Nuclear Explosion
(3) Table II - Allowable Stay Time in Area Contaminated by Fallout From a Nuclear Explosion

1. Enclosures (1), (2), and (3) are forwarded to assist ship's officers in carrying out the continuing shipboard damage control training program, Phase II.

2. Enclosure (1) was extracted from reference (a) which contains basic information on NBC Defense. It is recommended that copies of enclosure (1) be posted conspicuously in all areas used as personnel decontamination stations.

3. Enclosures (2) and (3) are extracts from Chapter XII of reference (b). Reference (b), published by the U. S. Atomic Energy Commission contains a comprehensive summary on the complex nature of nuclear weapons effects.

4. The tables illustrated in enclosures (2) and (3) can be of considerable value to the Damage Control Officer and the NBC Officer in matters concerning NBC Defense i.e., rapid calculation of dose rates and/or stay time. In most cases, the tables require interpolation. To obtain accuracy in calculations, the Radiation Dosage Calculator should be used in conjunction with enclosures (2) and (3).

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DECONTAMINATION DOCTRINE

FOR

NUCLEAR, BIOLOGICAL, AND CHEMICAL WARFARE

1. Following a Nuclear, Biological, or Chemical Warfare Attack personnel will be directed by signs or guides to an improvised decontamination station. Washroom and showers can be used as decontamination stations with only minor modification. Where practicable, and where no loss of sanitary or living facilities result, a separate entrance and exit will be provided for these stations. Entrance should always be from a contaminated part of the ship into the station; exit should always be from the station to a clean part of the ship.

   a. The general procedure for decontamination at a personnel decontamination station is as follows:

      (1) The contaminated or unclean section of the decontamination station shall be utilized as the undressing area.

      (2) Upon entering this section remove and discard shoes and outer clothing. Containers, usually G.I. cans, with tight fitting lids will be provided as receptacles for contaminated garments. Note that underwear, socks, and protective mask are kept on.

      (3) Pass to the entrance of the washing area where you will remove your underwear and socks, depositing them in appropriate containers.

      (4) Enter the washing area and take a shower, spending at least five minutes in soaping, scrubbing, and rinsing. The following steps are recommended:

         (a) Get wet all over.

         (b) Scrub the hands for one minute with soap. Give special attention to the fingernails.

         (c) Soap the body for one minute with soap. Give special emphasis to the hairy portions.

         (d) Rinse for ½ minute.

         (e) Remove the protective mask and put it in an appropriate can with a lid.

         (f) Soap your hair for one minute; rinse.

         (g) Soap and wash entire body again; rinse.

      (5) Proceed to the clean section of the decontamination station and dry yourself. Clean, uncontaminated towels will be provided.

      (6) If Nuclear Warfare contamination is involved, monitoring will be accomplished at this point. If you are not free from contamination the washing process will be repeated as often as necessary.

      (7) Pass to the dressing area and put on clean clothing.

      (8) Dress and leave station through uncontaminated exit.

ENCLOSURE (1)

TABLE I

FALLOUT ACTIVITIES AT VARIOUS TIMES AFTER A NUCLEAR EXPLOSION

TIME AFTER EXPLOSION	DOSE RATE IN ROENTGENS																	
6 min	32	66	95	127	159	318	477	636	795	954	1,272	1,590	-------	-------	-----	-------	-----	-------
12 min	14	28	41	55	69	138	207	276	345	414	552	691	1,380	-------	-----	-------	-----	-------
18 min	8.6	17	25	34	43	86	129	172	216	259	344	431	862	1,290	-----	-------	-----	-------
30 min	4.5	9.1	13	18	23	45	68	91	114	136	182	227	456	681	908	1,140	-----	-------
42 min	3.0	6.0	9.1	12	15	30	46	61	76	91	122	152	304	456	608	760	912	1,220
1 hr	2.0	4.0	6.0	8.0	10	20	30	40	50	60	80	100	200	300	400	500	600	800
1½ hr	1.2	2.4	3.7	4.9	6.1	12	18	24	31	37	48	61	122	183	244	305	366	488
2 hr	0.9	1.8	2.6	3.5	4.4	8.7	13	18	22	26	35	44	87	131	175	219	262	350
3 hr	0.5	1.1	1.6	2.1	2.7	5.4	8.0	11	13	16	21	27	54	80	107	134	161	214
5 hr	0.3	0.6	0.9	1.2	1.5	2.9	4.4	5.8	7.3	8.7	12	15	29	44	58	73	87	116
7 hr	----	0.4	0.6	0.8	1.0	1.9	2.9	3.9	4.9	5.8	8	10	19	29	39	49	58	78
10 hr	----	----	0.4	0.5	0.6	1.3	1.9	2.5	3.2	3.8	5.1	6.4	13	19	25	32	38	51
15 hr	----	----	----	0.3	0.4	0.8	1.2	1.6	1.9	2.3	3.2	3.9	7.8	12	16	19	23	31
1 day	----	----	----	-----	-----	0.5	0.7	0.9	1.2	1.3	1.8	2.3	4.5	6.8	9.0	12	13	18
1 d 12 hr..	----	----	----	-----	-----	0.3	0.4	0.6	0.7	0.9	1.2	1.5	2.9	4.4	5.8	7.3	8.7	12
2 d	----	----	----	-----	-----	-----	-----	0.4	0.5	0.6	0.8	1.0	1.9	2.9	3.9	4.9	5.8	7.8
4 d	----	----	----	-----	-----	-----	-----	-----	-----	-----	0.3	0.4	0.8	1.3	1.7	2.1	2.5	3.3
1 wk	----	----	----	-----	-----	-----	-----	-----	-----	-----	-------	-------	0.5	0.7	0.9	1.2	1.4	1.8
2 wk	----	----	----	-----	-----	-----	-----	-----	-----	-----	-------	-------	-------	-------	0.3	0.4	0.5	0.6
4 wk	----	----	----	-----	-----	-----	-----	-----	-----	-----	-------	-------	-------	-------	-----	-------	-----	0.3

If the radiation dose rate (in roentgens per hour) is known at a certain time, the above table may be used to determine the dose rate at any other time. This is based upon the assumption that fallout has ceased. The table may also be utilized to determine the time after the explosion at which the dose rate will have attained a specific value. Example: 5 hours after the explosion the dose rate is 6 roentgens per hour. When will it have decreased to 1 roentgen per hour? In the left hand column find 5 hr. and follow it horizontally until the nearest value to 6 (5.8) is reached. Proceed vertically down this column until the indicated value is approximately 1 roentgen per hour; which establishes the time after explosion at approximately 25 hours by interpolation.

ENCLOSURE (2)

TABLE II

ALLOWABLE STAY TIME IN AREA CONTAMINATED BY FALLOUT FROM A NUCLEAR EXPLOSION

TIME OF ENTRY IN HOURS AFTER THE EXPLOSION

$\frac{D}{R}$	0.5	1	2	3	4	5	6	7	8	9	10	12	15	20	24	30
Duration of exposure (in hours and minutes) required to produce specified values of $\frac{D}{R}$ for various times of entry after the explosion																
0.2	0-15	0-14	0-13	0-12	0-12	0-12	0-12	0-12	0-12	0-12	0-12	0-12	0-12	0-12	0-12	0-12
0.3	0-22	0-22	0-20	0-19	0-19	0-19	0-19	0-18	0-18	0-18	0-18	0-18	0-18	0-18	0-18	0-18
0.4	0-42	0-31	0-27	0-26	0-26	0-25	0-25	0-25	0-25	0-25	0-25	0-24	0-24	0-24	0-24	0-24
0.5	1-02	0-42	0-35	0-34	0-32	0-32	0-32	0-31	0-31	0-31	0-31	0-31	0-31	0-30	0-30	0-30
0.6	1-26	0-54	0-44	0-41	0-39	0-39	0-38	0-38	0-38	0-37	0-37	0-37	0-37	0-37	0-37	0-36
0.7	2-05	1-08	0-52	0-49	0-47	0-46	0-45	0-45	0-44	0-44	0-44	0-44	0-43	0-43	0-43	0-43
0.8	2-56	1-23	1-02	0-57	0-54	0-53	0-52	0-51	0-51	0-51	0-50	0-50	0-49	0-49	0-49	0-49
0.9	4-09	1-42	1-12	1-05	1-02	1-00	0-59	0-58	0-58	0-57	0-57	0-57	0-56	0-55	0-55	0-55
1.0	5-56	2-03	1-23	1-14	1-10	1-08	1-06	1-05	1-05	1 04	1-04	1-03	1-02	1-02	1-02	1-01
1.25	15-30	3-13	1-54	1-38	1-31	1-28	1-25	1-24	1-23	1-22	1-21	1-20	1-19	1-18	1-17	1-17
1.5	48-20	4-57	2-30	2-05	1-54	1-49	1-45	1-43	1-41	1-40	1-39	1-37	1-36	1-34	1-33	1-33
2.0	1,562-00	11-52	4-06	3-13	2-46	2-35	2-29	2-24	2-20	2-18	2-16	2-13	2-10	2-08	2-06	2-05
2.5	∞	31-00	6-26	4-28	3-48	3-28	3-16	3-08	3-03	2-59	2-55	2-51	2-46	2-45	2-40	2-38
3.0	--------	96-39	9-54	6-09	5-01	4-28	4-10	3-58	3-49	3-43	3-38	3-30	3-24	3-17	3-14	3-11
4.0	--------	3,124-00	23-43	11-05	8-12	6-57	6-16	5-50	5-33	5-19	5-10	4-58	4-44	4-32	4-26	4-20
6.0	--------	∞	193-19	35-35	19-48	14-43	12-19	10-55	10-02	9-24	8-57	8-19	7-46	7-15	7-01	6-48
10.0	--------	--------	∞	728-49	124-00	59-18	39-34	30-39	25-42	22-35	21-32	17-52	15-41	13-57	13-05	12-24

$\frac{D}{R}$ = Allowable dose in roentgens divided by dose rate in roentgens per hour at time of entry.

If the dose rate at the time of entry is known, the above table may be used to determine the stay time. Example: 8 hours after the explosion, the dose rate (R) is 45 roentgens per hour. Maximum permissible exposure dose (D) has been established at 25 roentgens. How long can a person stay in the area? The maximum permissible exposure dose (D) is divided by the dose rate (R) at the time of entry to give $\frac{D}{R}$, i.e., $\frac{25}{45} = 0.55$. Enter Dose Rate column with 0.55 which falls between two values, the smaller is taken. Follow the $\frac{D}{R} = 0.5$ line horizontally until the 8 hour after explosion column is reached. The stay time is seen to be 31 minutes and for $\frac{D}{R} = 0.6$ the stay time is 38 minutes. So the actual permissible stay time would be about 34 minutes by interpolation.