410655

OPERATION CASTLE

A VERY PRELIMINARY REPORT OF THE RESULTS [redacted]

Submitted by

Task Group 7.1

[redacted]

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JT-8022

13 APR - 27 APR 1954
(Date)

[redacted]

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INTRODUCTION

The [DELETED] was the test of an approximately [DELETED] using [DELETED]. It was fired on a barge [DELETED] that is, on Namu Island at Bikini Atoll. The detonation took place at approximately 6:30 AM, March 27, 1954, local time.

[DELETED]

[redacted]

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Fallout from this shot was observed to be strongly different from the [redacted] There was very little local throwout, so that a few hours after the shot extra activity was observable only on Namu and Bokobyaadaa.. A small fallout was observed about 48 hours after the shot. Fallout collectors seem to show that most material was either very small particles or liquid.

Water waves from the shot caused some damage on Eninman and Eniirikku. The waves did not, in general, sweep clear over the islands.

The reports following are preliminary statements from the various projects and programs of Task Unit 1, Task Unit 7, Task Unit 13, and Task Unit 15. The before and after pictures were taken by Task Unit 9. Reports concerning the work of other Task Units will be made at a later time. The reader is cautioned that none of the numbers reported here are final, but they should furnish a general idea of the results

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PROGRAM 2 - NUCLEAR EFFECTS

Program Director - LtCol E. A. Martell, USA

Project 2.1 - GAMMA RADIATION DOSIMETRY

Project Officer - Major R. Dempsey

Objective

To measure the gamma radiation exposure at various locations following a nuclear detonation.

Instrumentation

Film and chemical dosimeters were placed in ¼ inch wall aluminum cannisters mounted on 2 inch aluminum stakes. The detectors were placed at a height of 3 ft above ground for the land stations. The beach stations were set so that the detectors were 1 ft above maximum high tide level. Both detecting systems were calibrated against an 11-Mev betatron. (See Table 2.1-1)

Results

[DELETED]

An analysis of stations 34 thru 41 shows that part of [redacted]. (See Table 2.1-2)

An analysis of the resultant [redacted] fails to produce a consistent decay expression for stations 34 thru 41.

this leads to the conclusion that other processes than normal radioactive decay entered into changing the contamination level following [redacted] There may have been waves over the islands, which would have altered the contamination situation, or the patterns may have been changed by winds and rain.

TABLE 2.1-1
GAMMA EXPOSURES -

Station	Type	Location	Exposure (r)	Rate at Recovery (r/hr)	Recovery Time (hrs)	Act* Rate (r/hr)
12	Land	Yurochi	215	.500	78	1.4
13	Beach	Yurochi	16.9	.060	78	.120
14	Beach	Yurochi-Uorikku	19	.075	78	.120
15	Land	Uorikku	214	.600	78	1.40
16	Bluff	Aomoen	83	.200	78	.500
17	Beach	Romurikku	19.6	.100	78	.150
18	Land	Romurikku	258	.600	78	2.10
19	Beach	Romurikku	37.1	.120	78	.100
20	Beach	Romurikku-Aomoen	37.1	.120	78	.200
34	Land	Eniirikku	4.1	.032	100	.014
37	Land	Chieerete	4.0	.040	100	.010
38	Land	Arriikan	4.6	.035	100	.010
39	Land	Ourukaen	5.4	.042	100	.014
40	Land	Bokoaetoku	6.6	.041	100	.015
41	Land	Bokororyuru	8.0	.050	100	-.014

* Act rate is the rate existing at the time the detectors were placed in the field (minus 209 hours.) The residual radiation was a result of the detonation

[redacted]

[redacted]

[redacted]

15

[redacted]

[redacted]

Project 2.2 - GAMMA DOSE VS TIME

Project Officer - P. Brown

(P. Brown)

Objective

To obtain gamma rates vs time for various distances from a nuclear detonation.

Instrumentation

Gamma exposure rates were obtained using scintillation detectors set one foot above ground. The detector outputs were recorded as a function of time on continuous recorders.

Instrument stations on Bokobyaadaa and Namu had been destroyed by blast DELETED making it impossible to install instrumentation for close-in measurements.

Stations were installed on Airukiiji, Airukiraru and Yurochi Islands, Bikini Atoll, DELETED

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Results

All stations operated, and showed negligible gamma exposure rates for the period of zero time to plus 36 hours.

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[redacted]

[redacted]

Project 2.3 - NEUTRON FLUX MEASUREMENTS

Project Officer - T. D. Hanscome

Objectives

Participation in [redacted] on the basis of maximum participation without duplication of Project 14.1 work. The physical installation [redacted] planned and effected on the islands west of Aomoen. When the shot location was changed, participation was reduced to the amount indicated.

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Instrumentation

Detectors were installed on the 1403 line as shown in Table 2.3-1.

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[redacted]

Results

Results of the exposed germanium are not available (samples sent to ZI for analysis).

The fission detectors that were recovered were countable in spite of the high background resulting from the late fall-out on Parry Island.

[redacted] the counting was begun on D+6. For [redacted] However, calibration of the samples extends only 25 hours and the figures given are estimates resulting from an extrapolation. Long-time calibration will be made for this project in the composite preliminary report for Castle to be submitted later.

Apparently the stability of the 1403 concrete stations was disturbed [redacted] (though they were not removed). [redacted] the line, and moved stations large distances. The unrecovered stations had disappeared.

Project 2.5a - DISTRIBUTION AND INTENSITY OF FALL-OUT

Project Officer - E. R. Tompkins

Objectives

The following objectives were sought in this experiment:

Magnitude and downwind extent of the primary, or militarily significant fall-out.

At close-in stations, the time of arrival of the fall-out.

The physical nature of the fall-out.

Instrumentation

All available stations in the lagoon and in the atoll islands were fully instrumented. A limited number of free-floating buoys were placed about the shot point. The calculated positions of the buoys at shot time are given in Table 2.5a-1. This table also includes the drop position of the buoys and the computed drifts and sets of the buoys.

Results

No fall-out was found in the collectors placed in the lagoon or in those placed on the atoll islands. Collections were obtained from some of the free-floating buoys. These collections were in the polyethylene bottles and on the gum papers. T1B radiac meter data of the bottles and paper are included in Table 2.5a-2. These figures have been corrected for background at time of assay.

The implications of the reported data cannot be reported on-site since laboratory analyses and correlations with other measurements are required. However, all information collected indicate that the contaminant arrived in the form of a fine mist or liquid aerosol.

TABLE 2.5a-1
POSITION, DRIFT AND SET OF BUOYS

Buoy Number	Drop Position of the Buoys Latitude	Longitude	Position of Buoys at Shot Time Latitude	Longitude	Drift of Buoys (knots)	Set of Buoys (degree)
2-S-O4-TC	11-29	164-46.7	11-28.2	164-45	0.19	238
2-S-P4-TC	11-44	164-43.5	11-41.8	164-42.7	0.21	204
2-S-Q4-TC	11-56.5	164-48	11-55.2	164-45	0.25	249
2-S-R4-TC	12-04.7	164-52	12-03.3	164-48.5	0.27	251
2-S-S4-TC	12-12.8	165-00.2	Not Recovered			
2-S-T4-TC	12-16.2	165-09	12-20	165-59.5	0.65	293
2-S-A4-TC	12-19	165-22	12-23.3	165-10.0	0.77	291
2-S-A5-TC	12-35.5	165-21	12-30.7	165-04.3	1.18	255
2-S-B5-TC	12-31	165-39	Not Recovered			
2-S-C5-TC	12-24.2	165-50.9	Not Recovered			
2-S-D5-TC	12-14	166-01.8	12-11.6	165-58.8	0.38	232
2-S-E5-TC	11-57.5	166-11.0	11-54.6	166-08.7	0.45	215
2-S-F5-TC	11-42.1	166-11.0	11-38.8	166-09.4	0.48	207
2-S-G5-TC	11-25	166-08.1	11-22.8	166-06.3	0.44	216

TABLE 2.5a-2
RADIOACTIVITY IN POLYETHYLENE BOTTLES AND ON GUM PAPER COLLECTORS

Buoy Number	Radioactivity of Bottles (mr/hr)[1]	Radioactivity of Gum Papers (mr/hr)[2]
2-S-O4-TC	Not Detectable	5 at 271930
2-S-P4-TC	Not Detectable	20 at 272045
2-S-Q4-TC	120	280 at 281823
2-S-R4-TC	160	5000 at 280845
2-S-T4-TC	1100	2200 at 281210
2-S-A4-TC	760	1200 at 281313
2-S-A5-TC	180	1400 at 281518

1 Reading obtained at 281800

2 Reading obtained at noted recovery time

In addition, signal flags on buoys 2-S-R4-TC, 2-S-T4-TC, and 2-S-A4-TC were reading 30,000 mr, 30,000 mr and 14,000mr respectively, at time of recovery.

Project 2.5b - FALL-OUT DISTRIBUTION STUDIES

Project Officer - E. F. Wilsey

Objectives

The objectives of this project include the collection of fall-out samples for the documentation of the physical characteristics as a function of time and distance, and to provide samples for chemical and radio-chemical analysis for Project 2.6b.

Instrumentation

The following seventeen stations were instrumented with two intermittent fall-out collectors each: Yurochi, Uorikku, Romurikku, Aomoen, Bikini, Rochikarai, Enyu, Airukiiji, Eninman, Eniirikku, Rukoji, Chieerete, Arriikan, Ourukaen, Bokoaetokutoku, Bokororyuru, and Bokobyaadaa. One instrument at each station was set to collect twenty-four samples in 5-minute intervals; the other collector to collect twenty-four samples in 30-minute intervals.

Recovery

Recovery was poor due to the following reasons: Station deterioration, the result of the sixteen day delay between station activation [redacted] and damage to instruments caused by the tidal wave. Daily field maintenance was performed on the collectors; however, the uncertainty of the firing date precluded a thorough job.

Results

Approximately fifty percent of the collectors functioned

partially or completely. Little in the way of results can be reported at this time since most of the samples are being analysed at CRL, Edgewood, Md. However, samples retained for early decay measurements suggest:

Fall-out at the upwind stations; Rochikarai, Airukiiji, Rukoji, Chieerete, Ourukaen, and Bokororyuru was inconsequential. Samples from these stations read only two or three times background on R+3.

Fall-out at the crosswind station Aomoen was slight but significant.

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Project 6.4 - PROOF TESTING ON AN SHIP COUNTERMEASURES

Project Officer - G. G. Molumphy, CAPT, USN

General

The actual passage of the project drone ships through the fall-out is graphically presented in Fig. 1. From the recovery points, the ships were returned to Parry where survey, recovery of samples and recorded data, and decontamination were accomplished.

The proposed course was 80° but it was impossible to turn the YAG-40 to that course due to a personnel error occurring during debarking. This inactivated radio control of course only; recurrence will be prevented in the future by an additional check which has been introduced. Attempts to keep the YAG-39 with the YAG-40 failed due to malfunction of radio control apparatus which converted a speed change to a shut down signal. The net effect was that the two ships cannot be said to have been subjected to even approximately the same fall-out. Operating the YAG-39 manned is expected to [redacted]

[redacted]

Gamma Instrumentation

Gamma radiation was measured continuously at stations equipped each with 3 or 4 incremental dose ion chambers. On the YAG-39 there were 65 such stations and on the YAG-40 there were 72 with ink-on-paper recorders in central recording rooms. There were no failures but performance was substandard on 6% of the

channels. The data are plotted by a special purpose computer located at Parry.

Gamma field intensity records (Fig. 6.4A1) indicate that both ships entered the contaminating event at about H+2 hours. Figs. 6.4A3 and 6.4A4 apply to the flight decks which received only about 30% of the average level of contamination for each ship. Dosage rates on the flight decks peaked at about 400 mr/hr (H+3½ hours) on YAG-39 and about 8 r/hr (H+10 hours) on the YAG-40. The dosage accumulated at the flight deck stations for the period to H+100 hours were 2 and 220 roentgens, respectively.

Washdown

The different amounts and times of arrival of contamination on the two ships precludes a direct washdown evaluation. Accumulations on the unprotected ship were high enough at some points to give lethal doses within 24 hours. Some not completely consistent and thus far incompletely evaluated data indicate a washdown effectiveness of greater than 90%. The qualitative nature of this figure must be emphasized, as must the extreme importance of obtaining much more conclusive data from a highly contaminating simultaneous exposure of both ships before making a quantitative evaluation of washdown effectiveness. Interesting correlation between relative wind and contamination may be inferred from isodose rate lines. See Fig. 6.4A9.

Shielding

Shielding by the ship's structure reduced gamma radiation levels in below deck spaces to roughly 0.1 the values on the weather deck. Additional shielding by the 12" thich concrete slab of the instrument recording room gave a reduction to 0.001 the above deck value on the YAG-40.

Generally, shielding effectiveness increased somewhat with time. Absorption data from detectors in a series of steel pipes mounted on deck, with wall thickness varying from 1/8 inch to 4 inches, clearly showed a decrease in effective radiation energy over the interval H+5 to H+75 hours.

Radiological Survey and Photography

Prior to, during, and after decontamination, a complete radiological survey was made of both ships. All readings were taken in a prescribed manner at measured distances from previously marked stations. The T1B gamma survey meter and the USNRDL Beta Probe proved to be the most useful instruments. The USNRDL directional gamma instrument was found to operate successfully, but its weight limits its applicability.

The technical survey personnel supplied (untrained) by the Task Force have been used successfully to supplement the small group regularly assigned to this duty. On the whole, the technical survey support has been very satisfactory.

An attempt to photograph the fall-out with equipment capable of recording all particles $\geq 100\ \mu$ was unsuccessful due

to a later period of fall-out than expected. For the next event the camera station will be turned on at a later hour with more hope of success.

Ship Decontamination Studies

Adequate data have been obtained for the evaluation of firehosing, hand-scrubbing and hot liquid jet cleaning in the decontamination of naval ships. A gross reduction of 82% in the dose rate aboard the YAG-40 was obtained by use of these methods. No decontamination was required aboard the YAG-39.

The radiological protective coating was not as readily removable with the hot liquid jet as it had been during laboratory scale tests. An on-the-spot procedure was therefore developed. This procedure successfully removed from 90 to 95% of the paint with a corresponding removal of 75 to 90% of the radioactive contaminant itself. An adjacent area not coated with this paint, was decontaminated by means of the same procedure and a resultant reduction of 40 to 60% of the radioactive level was obtained.

An additional reduction of 10% in the initial dose rate aboard the YAG-40 was obtained by high pressure - high temperature - high volume liquid jet cleaning of steel surfaces and by surface removal of wood decking. Total decontamination effectiveness was therefore 92%. The average final dose rate throughout the weather surface of the ship was 52 mr/hr.

Aircraft Studies

The contamination level on the YAG-39 aircraft was so low that a decontamination study was not warranted and the effectiveness of the washdown system could not be evaluated accurately. The YAG-40 aircraft was sufficiently contaminated to warrant an experimental decontamination study. This study began on R+5 and ended on R+9 days. A series of decontamination processes were employed which, with the aid of one rain squall and decay, reduced the gamma radiation level at the cockpit from 850 mr/hr to 45 mr/hr. At the same time, the gamma intensity level on an area on a wing section was reduced from 10 r/hr to 85 mr/hr. The left magneto on the YAG-39 aircraft would not check out when the aircraft was turned up after the test, but no material damage was detected on the YAG-40 aircraft.

Interior Contamination

Air samplers and particle collectors operated normally over the designed time interval after debarking, shutting off at H+4½ hours. Maximum field intensity indicated by gamma detectors on the YAG-40 occurred at about H+8 hours. However, precut sections of ventilation duct continued to be exposed to activity deposition until H+19½ hours. Neither air samplers nor duct sections showed appreciable activity. Two topside millipore filters showed moderately high activity but here the existence of surface streaks leads to suspicion of direct fallout contamination rather than collection of airborne particulate

matter.

A tentative conclusion may be inferred that the airborne contamination hazard is relatively less serious than previously believed.

Instrumentation on the YAG-40 was on the whole successful although only partial results were obtainable on 5 out of the 19 air samplers, while 3 out of 5 were inoperative on the YAG-39. All the samples taken have been returned to USNRDL for evaluation.

Air Monitor

A prototype of a semi-portable air monitoring unit designed for future shipboard and/or land use were evaluated. Time intensity records of airborne beta contamination were taken.

Present instrument gives adequate warning against airborne hazards in external fields up to 1 r/hr. This warning can be given within a minute of arrival of hazard. Instrument appears useful also to forewarn ships, land stations, etc., of possible background level buildup.

Personnel Protection Studies and Radiological Safety

During the YAG recovery operations, the greatest dose rate observed was aboard the YAG-40 and was estimated to be 10 r/hr at H + 30. The USS MOLALA (ATF 106) personnel involved with the recovery of the YAG-40 received an average dose of 200 mr.

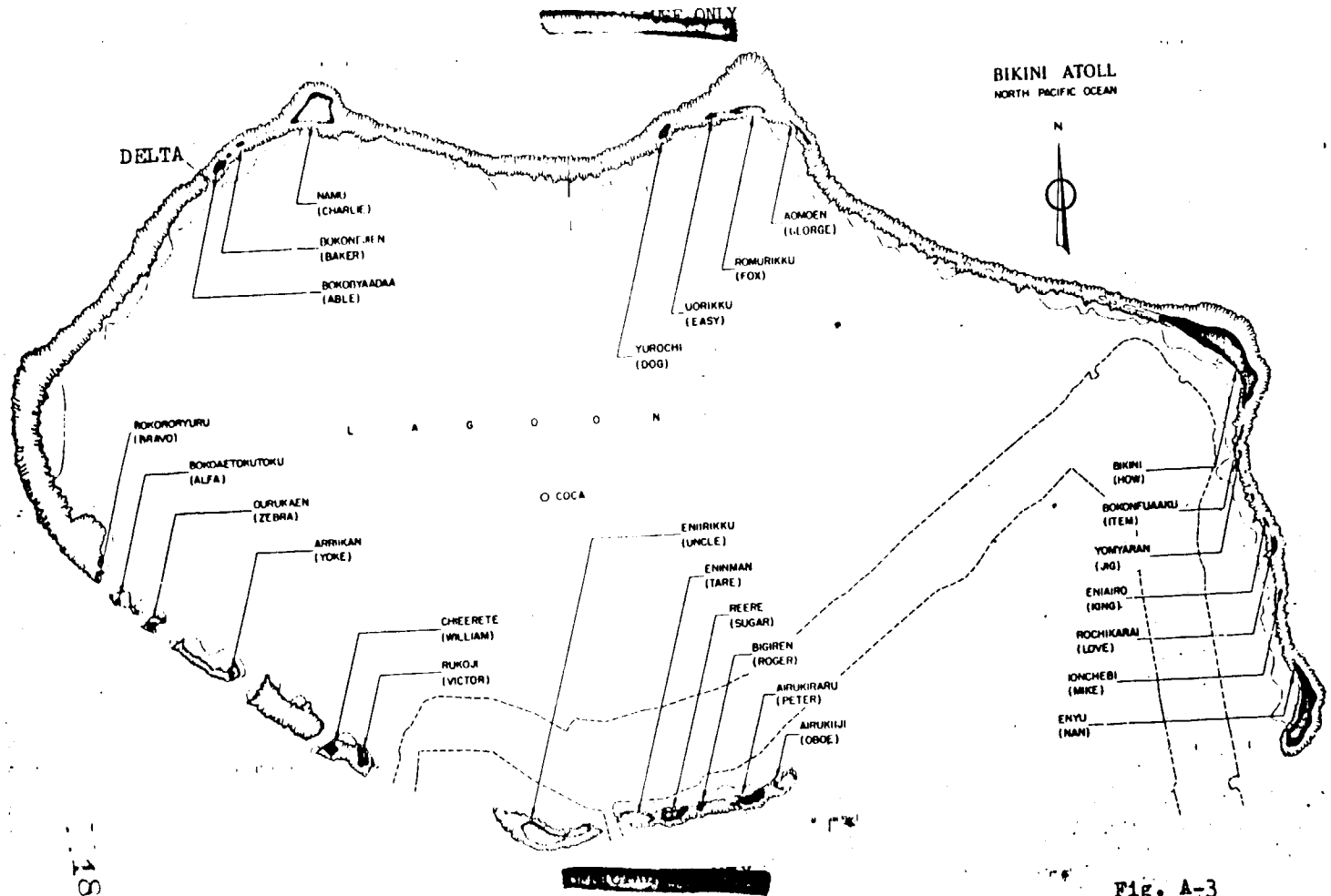
During the decontamination operations the total dosage

received by the crews was kept to a minimum through careful dosage control of personnel and continuous monitoring of ship's spaces. Of more than 400 people involved in the operation, only about 50 received doses of more than 2 roentgens, with seven exceeding 3 r and one receiving approximately 7 r.

[redacted]

Fig. A-2. Post-shot picture Ground Zero. B = Barge

[redacted]


BIKINI ATOLL
NORTH PACIFIC OCEAN
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DELTA
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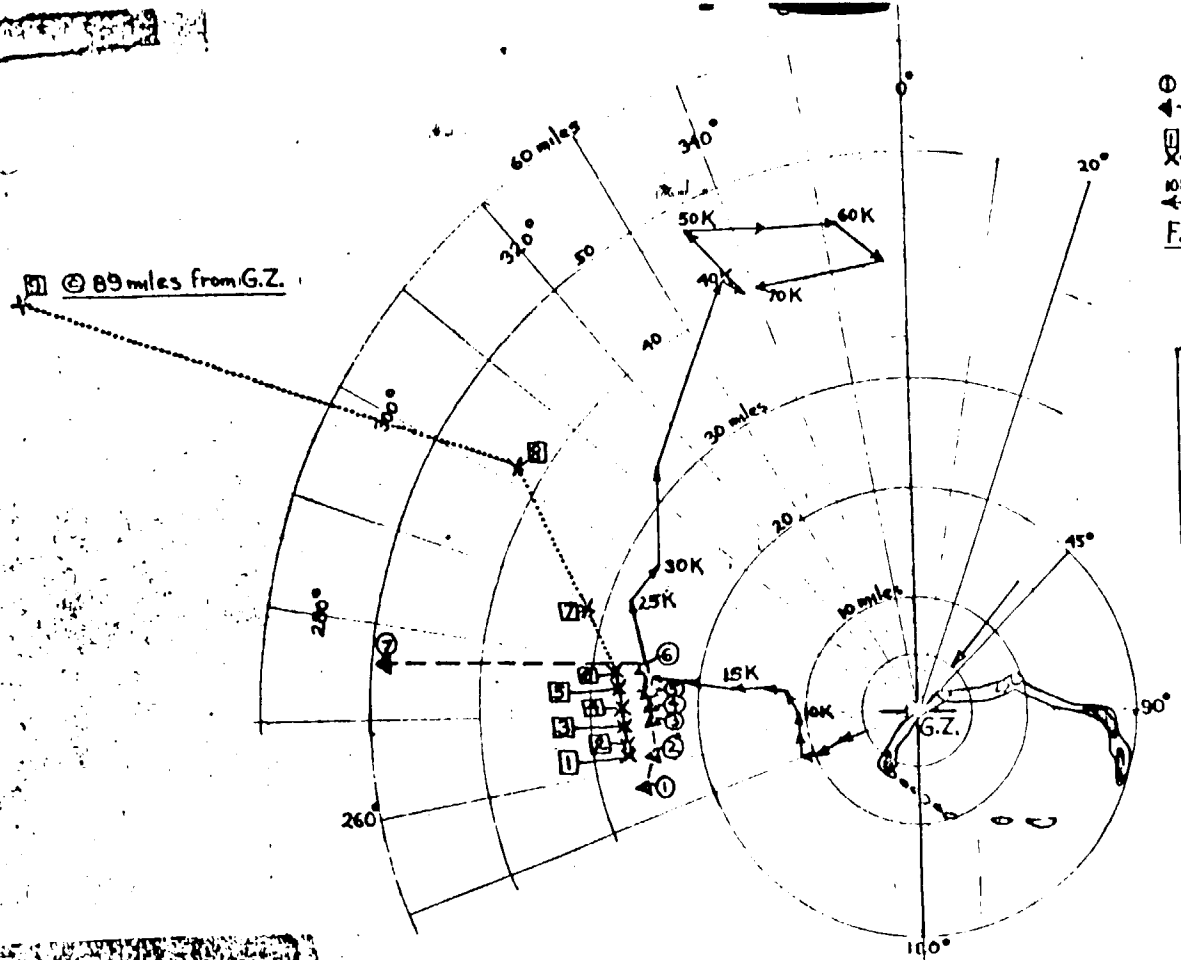
BOKONTOREN (BAKER)
BOKONYAADAA (ABLE)
AOMOEN (GEORGE)
ROMURIKKU (FOX)
UORIKKU (EASY)
YUROCHI (DOG)
ROKORORYURU (BRAVO)
BOKDAETOKUTOKU (ALFA)
OURUKAEN (ZEBRA)
ARRIKAN (YOKE)
CHEERETE (WILLIAM)
RUKOJI (VICTOR)
L A G O O N
O COCA
ENIIRIKKU (UNCLE)
ENINMAN (TARE)
REERE (SUGAR)
BIGIREN (ROGER)
AIRUKIRARU (PETER)
AIRUKIIJI (OBOE)
BIKINI (HOW)
BOKONFUAARU (ITEM)
YOMYARAN (JIG)
ENIAIRO (KING)
ROCHIKARAI (LOVE)
IONCHEBI (MIKE)
ENYU (NAN)

Fig. A-3



Symbols

① ② Track of YAG 39

[1] [2] Track of YAG 40

10K 20K Track of Predicted Fallout from Various Altitudes

eg. 20K = 20,000 Ft.

Time	YAG 39 Position	YAG 39 Dose Rate r/hr	YAG 40 Position	YAG 40 Dose Rate r/hr
327-0415	①	0	[1]	0
-0500		0	[2]	0
-0515	②	0		0
-0600	③	0	[3]	0
-0700		0	[4]	0
-0800	④	~0.001	[5]	~0
-0900	⑤	0.12	[6]	0.15
-0930	⑥*	0.42		
-1000			[7]	5.7
-1200			[8]*	26.5
328-0500	⑦	0.025		
-1200			[9]	9.4

* Ship Dead in Water

Fig 1- Track of Test Ships in Fallout Region

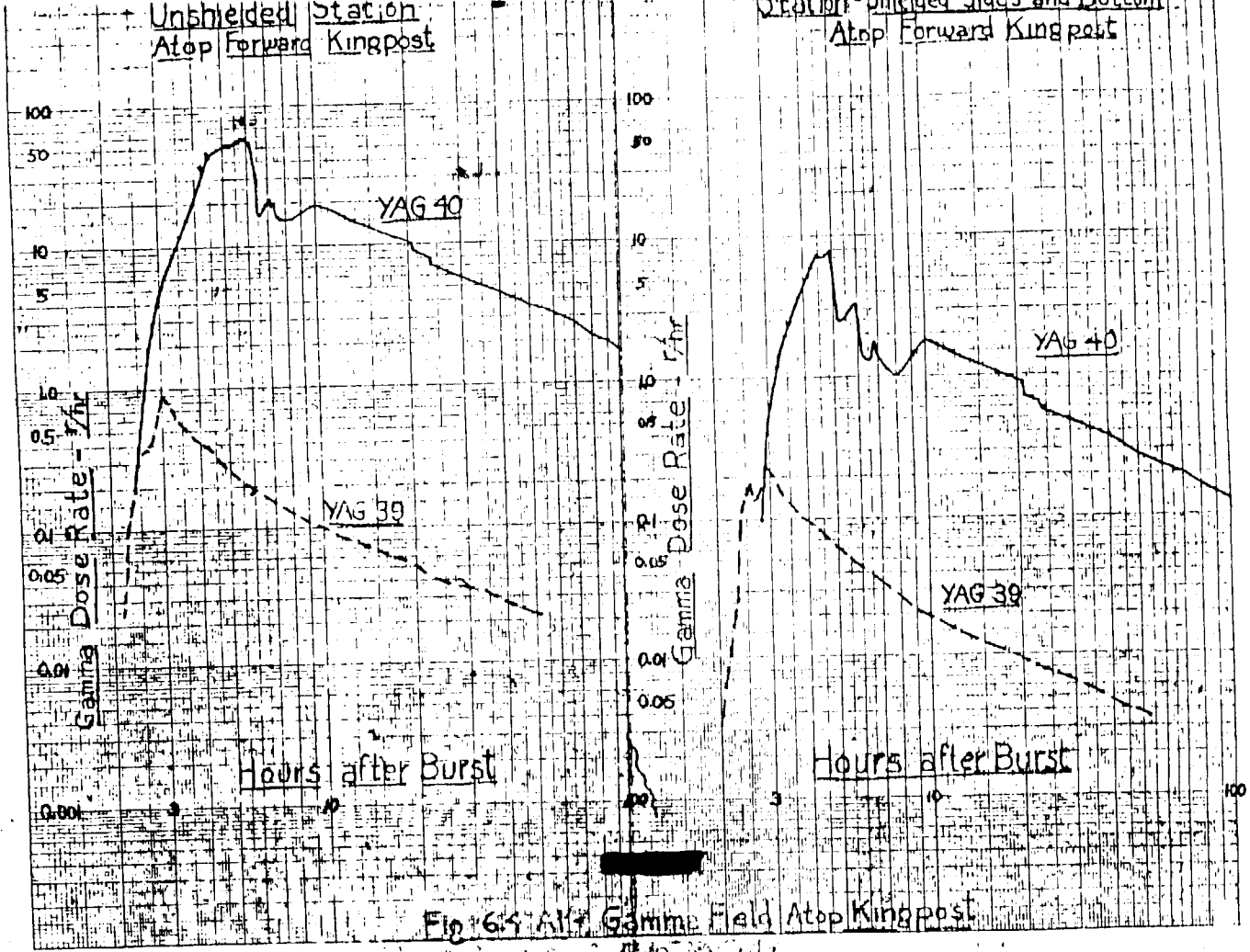


Fig 6.5 Air Gamma Field Atop Kingpost

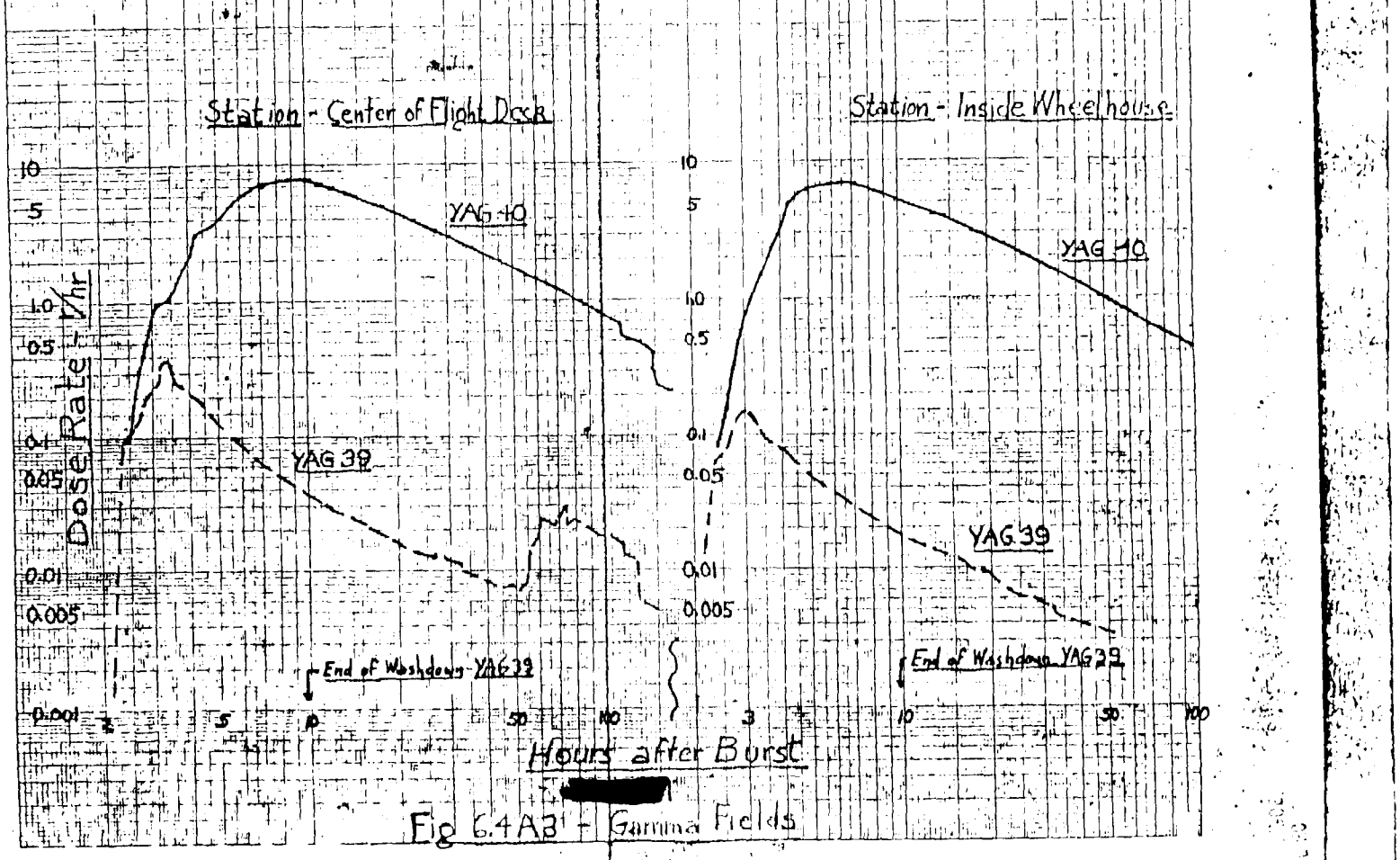


Fig 6.4A3 - Gamma Fields

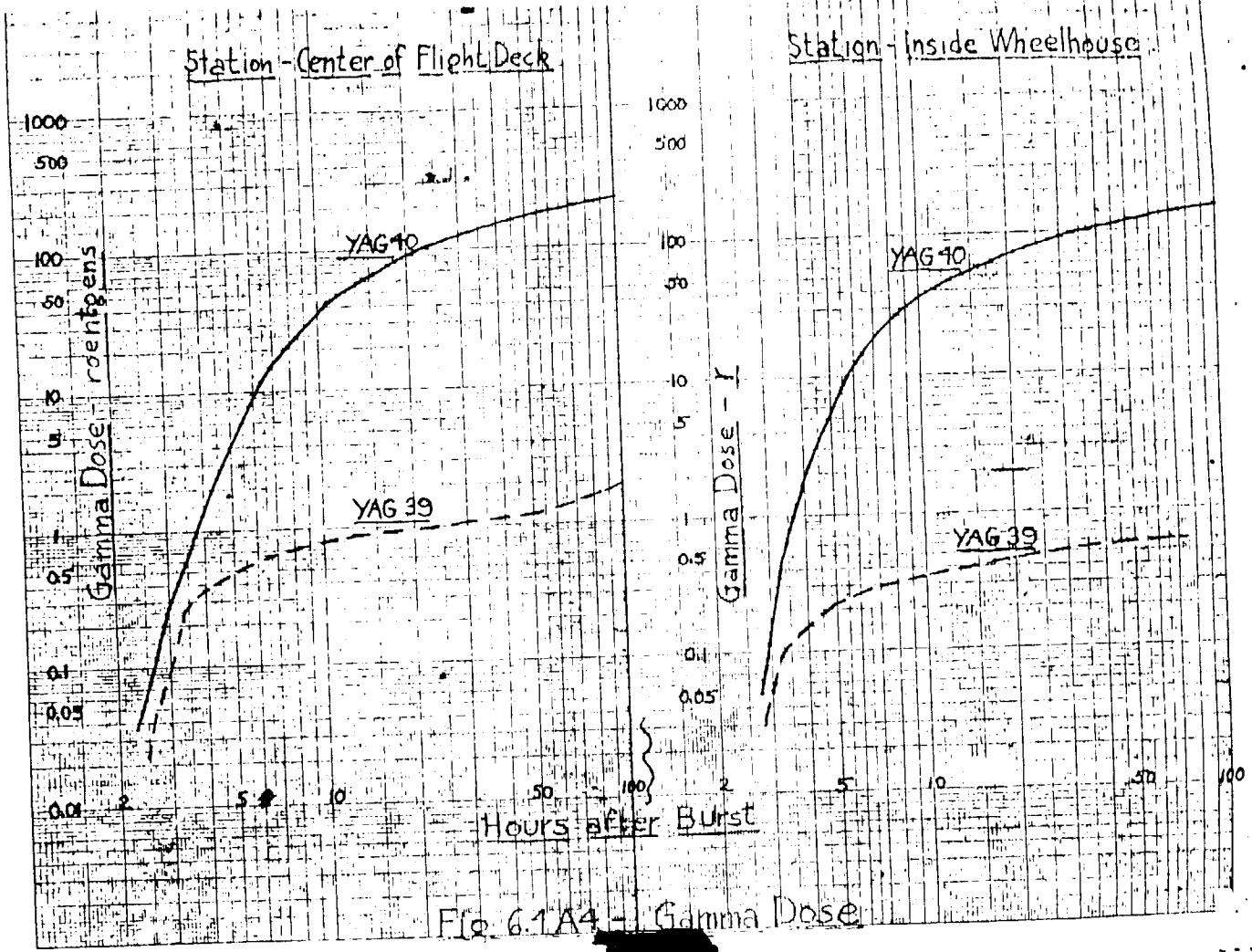


Fig. 6.1A4 - Gamma Dose

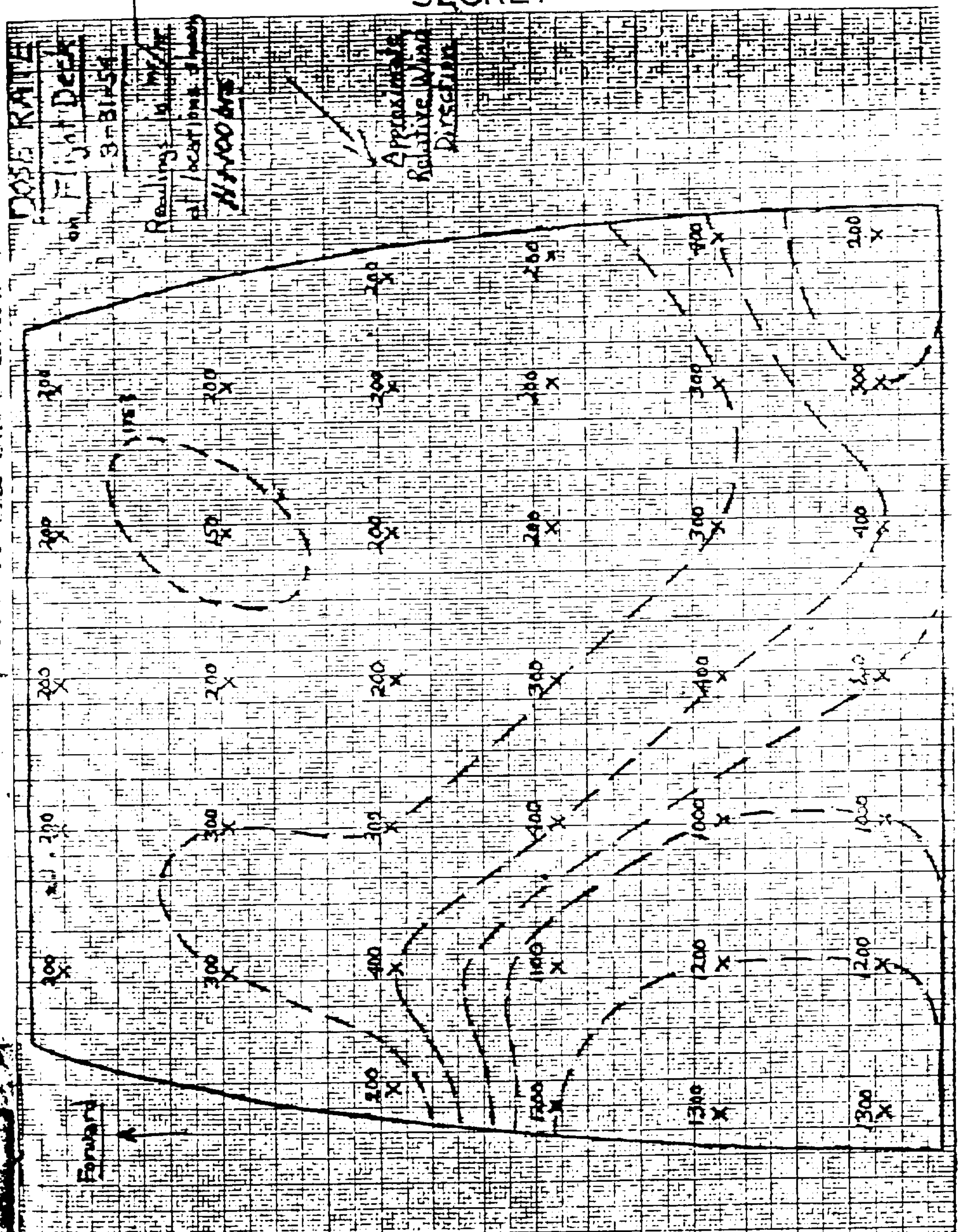


Fig - 6.4A9 - Gamma Field - YAG 40 Flight Deck

Project 6.5 - DECONTAMINATION AND PROTECTION

Project Officer - J. C. Maloney

Objectives

The objectives of this project are: (1) To determine relative contamination and decontaminability of outside construction surfaces exposed to fall-out from [redacted] (2) To determine the effect of salt water wash-down and simple pre-protection measures in minimizing contamination.

Instrumentation

A set of fourteen four-feet-square panels of widely used exterior construction surfaces were mounted at their normal orientations on each of the two drone ships (Project 6.4) which were operated in the high-intensity fall-out area following the shot.

Procedure

Panels were recovered from the ships and moved to the Parry decontamination area. Gamma and station intensity readings were taken at sixteen locations on each panel. The panels from the washdown protected ship were of such low intensity that decontamination was not necessary. The panels from the unprotected ship were subjected to various hosing and scrubbing techniques with gamma and station intensity readings taken between each decontamination pass.

Intensity readings on all panels were taken at the beginning and end of each day's operations to be used for direct

correction of overnight decay. Readings taken during the day's operations were corrected back to the initial readings for that day by applying the -1.2 law.

Results

The average initial gamma intensity and residual gamma intensity percentages are summarized on Table 6.5-1 for each surface.

Preliminary data indicates that salt water washdown is effective in minimizing contamination of construction surfaces under the conditions of this test.

Conclusions

The contamination resulting from this detonation is of a very tenacious nature.

Under the conditions of this contaminating event, vertical surfaces became more highly contaminated than horizontal surfaces, with sloped surfaces having intermediate contamination.

The contamination as deposited under the conditions of this test presents a much more difficult removal problem than the dry contamination encountered at Operation JANGLE.

TABLE 6.5-1
DATA SUMMARY

Material	Coating	Panel Orientation	Initial gamma reading mr/hr	Residual fields in percent (corrected for decay and background)											
				Before decontamination	Low pressure hosing (10 psi) 1 minute	Repeat	Scrub with low pressure rinse 1 minute	Repeat	High pressure hosing (40 psi) 30 seconds	Scrub with detergent, 1 min.	Repeat	Hose 30 seconds (150 psi pressure)	Steam with cellars unit 30 seconds	Steam and scrub, 30 seconds
Asphalt Road	None	Horizontal	878	100	73	72	65	64	60	54	- -	49	43	- -
Concrete Road	None	Horizontal	1210	100	71	75	46	44	43	42	- -	40	39	- -
Concrete Road	Sealcoat	Horizontal	825	100	62	70	45	44	43	41	- -	39	38	- -
Asbestos Shingle	Sealed Joints	Vertical	2810	100	57	50	47	44	34	34	- -	31	25	23
Asbestos Shingle	Plain Joints	Vertical	2750	100	68	60	55	52	41	41	- -	38	30	27
Wood Siding	None	Vertical	2875	100	61	58	49	37	31	28	23	25	23	21
Wood Siding	Alkyd	Vertical	2760	100	72	69	41	31	25	20	15	15	13	11
Wood Siding	Lead & Oil Paint	Vertical	3490	100	57	53	33	23	18	16	14	14	13	- -
Wood Siding	Phenolae	Vertical	3350	100	47	47	28	20	16	11	10	10	9	- -
Geometry Effects	House	Vertical	310	100	80	80	45	34	22	25	- -	28	31	- -
Wood	Paint													
Sheet Metal	House Paint	Vertical	2255	100	48	53	23	26	20	9	6	6	5	- -
Sheet Metal	Phenolae	Vertical	2500	100	45	44	21	21	17	8	7	6	6	- -
Brick	None	Vertical	2530	100	74	69	51	42	34	35	- -	40	33	23
Brick	Painted	Vertical	4170	100	66	61	44	40	35	33	- -	36	33	24
Concrete Block	None	Vertical	2845	100	63	64	38	37	33	34	- -	29	30	- -
Concrete Block	Luminall	Vertical	1850	100	64	71	37	34	33	33	- -	25	25	- -
Cinder Block	None	Vertical	1840	100	72	57	39	44	40	45	- -	35	33	- -
Mineral Surface														

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TABLE 6.5-1 (Continued)
DATA SUMMARY

Material	Coating	Panel Orientation	Initial gamma reading mr/hr	Residual fields in percent (corrected for decay and background)											
				Before decontamination	Low pressure hosing (10 psi) 1 minute	Repeat	Scrub with low pressure rinse 1 minute	Repeat	High pressure hosing (40 psi) 30 seconds	Scrub with detergent, 1 minute	Repeat	Hose 30 seconds (150 psi) pressure	Steam with sellers unit 30 seconds	Steam and scrub, 30 seconds
Strip Shingle Roofing	Sealed Joints	Sloped	1240	100	85	70	60	52	46	46	--	41	38	--
Strip Shingle Roofing	Plain Joints	Sloped	1265	100	92	72	63	53	52	53	--	44	45	--
Roll Roofing	PVA Coated	Sloped	1425	100	80	76	46	45	40	39	38	34	33	--
Roll Roofing	None	Sloped	1690	100	80	70	38	36	31	27	24	22	19	--
Corrigated Metal Roofing	Asphalt (galbestos)	Sloped	1100	100	87	83	64	62	60	56	44	41	40	--
Tar-gravel Roofing	PVA	Horizontal	390	100	80	73	55	49	40	48	--	45	46	--
Tar-gravel Roofing	None	Horizontal	515	100	95	85	68	61	52	56	--	57	52	--

NOTE: Initial gamma reading is expressed in milliroentgens per hour and was taken at H+124 hours with an AN-PDR/T1B held 1 inch from panel surface.

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[redacted]

Aircraft Code	Type Aircraft and Number
Red 1	F-84G 037
Red 2	F-84G 038
Red 3	F-84G 033
Red 4	F-84G 055
White 1	F-84G 046
White 2	F-84G 054
White 3	F-84G 030
White 4	F-84G 053
Blue 1	F-84G 043
Blue 2	F-84G 042
Yellow 1	F-84G 032
Yellow 2	F-84G 045
Floyd 1	FB-36 1086
Floyd 2	FB-36 1083
Wilson 1	WB-29 2195

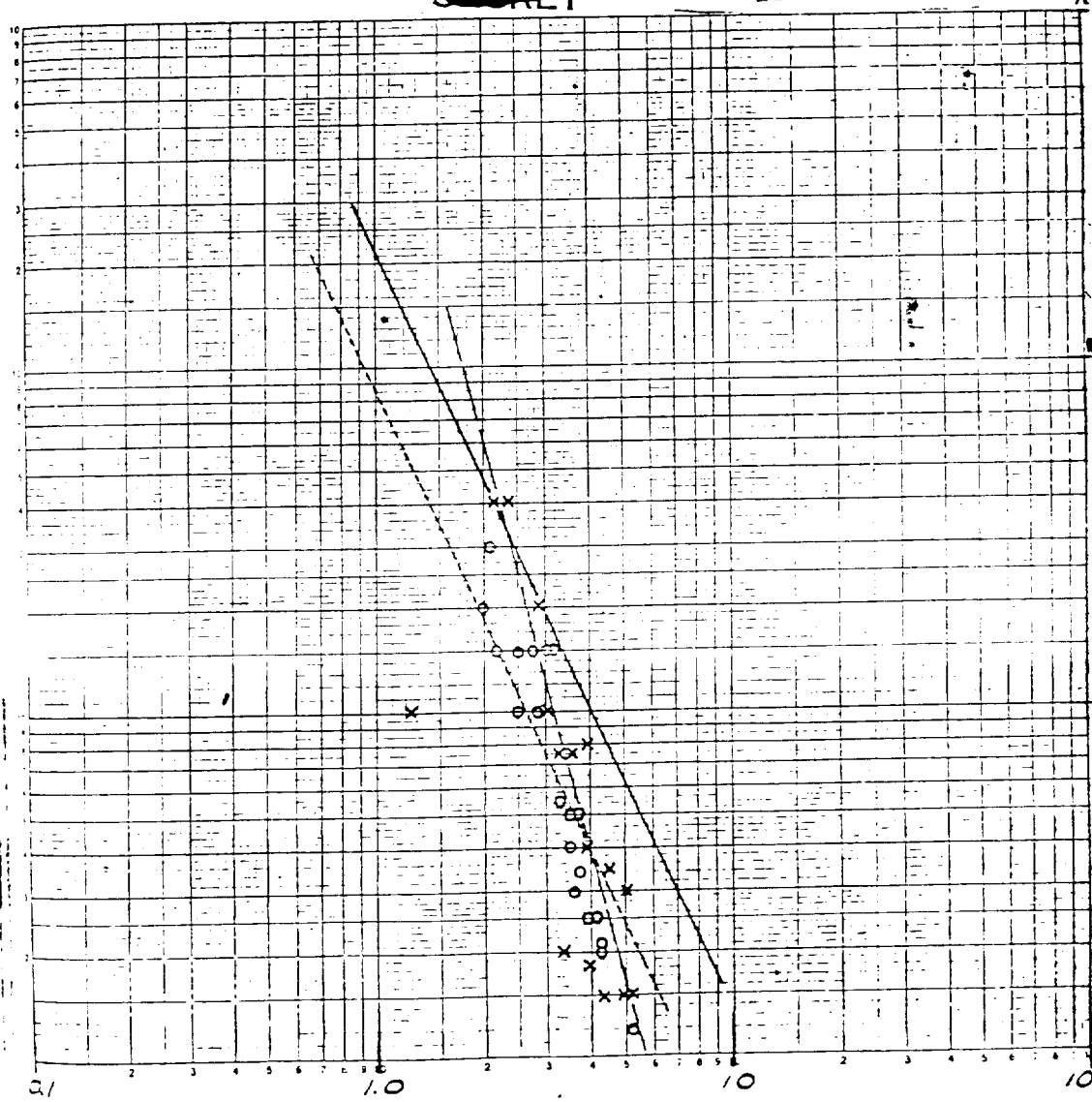
[redacted]

GAMMA RADIATION INTENSITY IN CLOUD vs. TIME AFTER BURST

NEVADA OBSVD.
CASTLE PREDICTED
CASTLE DATA

SECRET

DELETED



99 41

SECRET

FIG. 11.2-1

the Mike curve is derived from data at H+4 hours similar to t present data and extrapolated to earlier times by using the sl observed in Nevada, it is obvious that the present data can be better represented by a curve of greater slope. From the grea rate of decrease of intensity in the present operation it can concluded that both velocity and angular wind shear effects ex those on Mike Shot and that the persistent isokinetic layers observed in Nevada are not being found. Operationally, the ef of wind shear are anticipated by the use of plan-view projecti of the sheared cloud structure derived from winds observed in shot area as close to shot time as possible. From these proje altitudes and positions are chosen to give the best cloud persistence for the later sampling aircraft.

The factor of four increase in sample obtained by th B-29 was accomplished by approximately doubling the time after burst of cloud penetration and by almost doubling the radiatio exposure received by the crew. Because of the dependence of t background contamination acquired by this aircraft relative to in-cloud exposure upon the nature of the coral debris through which it flies, it has been necessary to calculate the limitin in-cloud exposure while in-flight from operational data report by the B-29 after one cloud penetration.

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The expected decrea

in return exposure was used to increase the in-cloud exposure and hence the sample collected [redacted] the ratio between th external exposure and that of the shielded personnel was found to be 3.0. [redacted] it was possible confidently to plan on an external exposure on landing of about 9 roentgens because an in-flight confirmation of this ratio was available from a proto type integrating electronic dosimeter supplied by H Division, LASL. Unlike the external dosimeter (Integron) ordinarily used for exposure control, this dosimeter is equipped with a small chamber which can be located in the film badge position on flight personnel with its dosage read on an external meter. It excellent energy response characteristics as well as its good correlation with film badge ratios indicate that this prototype could be used very satisfactorily to control sampling exposures

The low samples obtained by the two B-36's are though to be due to the effects of "cold saturation" at extreme altitu on the lubricant used on the filter units which resulted in the mal-function. Corrective measures have been taken to avoid the effects on future missions. An additional decrease in the size the second B-36 sample was caused by wide dispersal of the clou by H + 7½ hours, the delay beyond the normal sampling time of H- hours being caused by mechanical aircraft troubles.

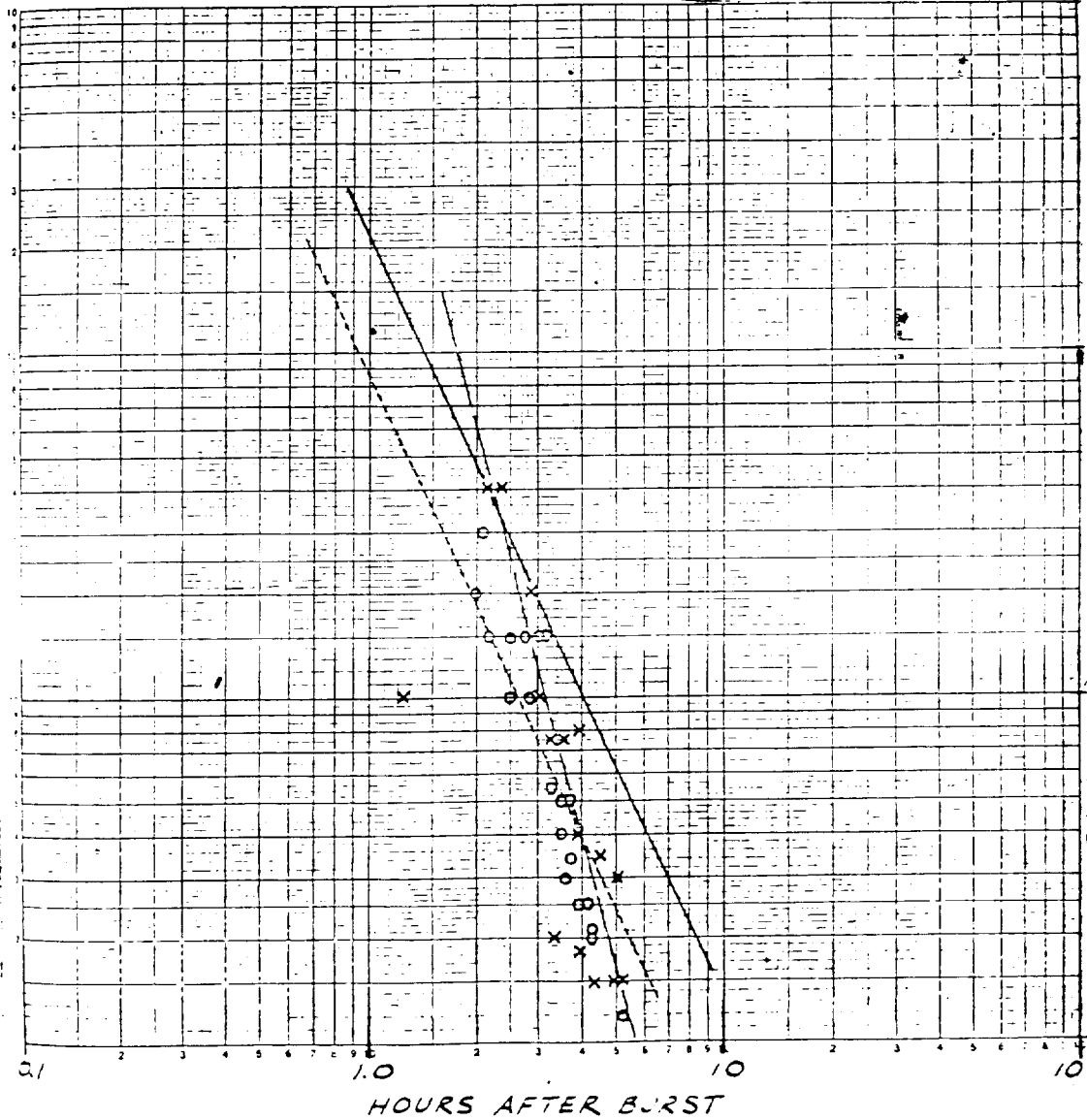
The study of the spectral distribution of gamma photo within the bomb cloud has been continued. Results from [redacted]

GAMMA RADIATION INTENSITY IN CLOUD vs. TIME AFTER BURST

NEVADA OBSVD.
CASTLE PREDICTED
CASTLE DATA

SECRET

DELETED



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SECRET

FIG. II.2-1

the Mike curve is derived from data at H+4 hours similar to the present data and extrapolated to earlier times by using the slope observed in Nevada, it is obvious that the present data can be better represented by a curve of greater slope. From the greater rate of decrease of intensity in the present operation it can be concluded that both velocity and angular wind shear effects exce those on Mike Shot and that the persistent isokinetic layers observed in Nevada are not being found. Operationally, the effec of wind shear are anticipated by the use of plan-view projections of the sheared cloud structure derived from winds observed in the shot area as close to shot time as possible. From these projectio altitudes and positions are chosen to give the best cloud persistence for the later sampling aircraft.

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The study of the spectral distribution of gamma phot within the bomb cloud has been continued. Results from

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[redacted]

cloud indicate the presence of a hard component approximately 0.8 Mev in energy and a soft component of either 80 or 160 Kev energy. It is intended to resolve the lead K-edge region by using copper absorbers on future shots.

Surface Sampling

One funnel-type sampler in the lagoon at Bikini and the two blower stations on Ourukaen Island were operated DELETED DELETED Although the Ourukaen units survived the water wave from the explosion, they collected no sample because no debris fell on the island. Use of such surface samplers at Bikini will be discontinued.

[redacted]

[redacted]

TASK UNIT 7 - J. D. Servis, Maj. USA

RADIOLOGICAL SAFETY

(J. D. Servis)

Rad-Safe Survey Summary *

A partial Rad-Safe survey was conducted on [redacted] day with incomplete atoll results. Results of this initial survey were conclusive enough to cancel all activities for B+1. First complete survey was conducted on B+2 days. As a result of wind conditions during B and B+1 day areas had become "spotty" in nature so the extrapolated values representing the H+4 hour readings can only be considered approximate. These extrapolated values are based on a $t^{-1.2}$ decay whereas laboratory analyses indicate a $t^{-1.8}$ decay during this period, thus indicating values in excess of those noted in Table TU-7-1.

Lagoon contamination, of consequence, was confined to lagoon areas containing suspended sediment. For the first few days this area was confined to the western quarter of the lagoon. This radioactive sediment washed over the western reef, out through the southwest passage or settled to the bottom of the lagoon in a period of three days.

No alpha activity was detected in swipes about the living areas of the Task Group.

* Included here because of inadvertantly omitting it from Report.

[redacted]

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TABLE TU-7-1
RADIATION SUMMARY (r/hr)

Island	Extrap. H+4 hours	B+2 days	B+7 days
Enyu	40 - 60	1 - 3	.38 - .40
Bikini	70 - 125	6 - 9	.8 - 2.1
Aomoen	25 - 180	1.2 - 9	.75
Romurikku	400.	20.	.90
Yurochi	600.	30.	1.0
Namu (Sta. 1200)	125.	6.	.45 - .6
Crater		.1	.02
Bokonejien	1500.	75.*	
Bokobyaadaa	280.	15.	2.0
Delta (Sta. 1341)	65.	3.0	
Bokororyuru thru Airukiiji	6 - 10	.1 - .22	.025 - .05
Bairoko (30 mi. SE of Enyu)	.25		

All readings with radiac instrument AN/PDR-39

* AN/PDR-18

[redacted]

TASK UNIT 7 - J. D. Servis, Maj. USA

RADIOLOGICAL SAFETY

(J. D. Servis)

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Rad-Safe Survey Summary

A partial Rad-Safe survey was conducted on [redacted] day with incomplete atoll results. Results of this survey (Table TU-7-2), indicated no extensive recontamination of the atoll except within the Bokobyaadaa - Namu chain. An unforeseen fallout of radioactive material less than 5 microns in size did occur on the night of R+1. This fallout covered the atoll and raised radiation levels by approximately 100 mr/hr. Because of the late period of fallout this radiation level would have corresponded to 3.5 r/hr fallout at H+2 hours. This fallout, because of small particle size, was much more difficult to decontaminate than the [redacted]

Secondary fall out levelled off between 0700-0800, R+2. Residual top-side levels on ships were: Ainsworth - 8 mr/hr, Estes - 12 mr/hr, and Bairoko - 30 mr/hr. Maximum levels were 20 mr/hr to 45 mr/hr.

Lagoon contamination covered the western quarter of the lagoon with levels [redacted] Lagoon flushing through the southwest passage materially increased background radiation levels in the vicinity of Ourukaen, Bokoaetokutoku, and Bokororyuru.

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[redacted]

[redacted]

TABLE TU-7-2
RADIATION SUMMARY (r/hr)

Island	Extrap. H+4 hours	R+1 day	R+2 days
Enyu	.03	.03	.06
Bikini	.20	.12	.14
Aomoen	.80	.80	.60
Romurikku	1.6	1.7	.75
Uorikku	.8 - 1.4	1.4	.85
Yurochi	.8 -1.0	1.3	1.0
Namu	2000.		100.
Bokobyaadaa	1000.	50.0#	55.
Ourukaen	.04	.10 *	.16 *
Arriikan	.02	.40 *	.32 *
Eniirikku	.005	.005	.05
Airukiiji	.02	.01	.08
Eninman	.012	.012	.06
Crater			.03
Ships			.02 - .04

DELETED

Two hundred ft altitude.
* Radiation shine from water in southwest passage.

Underlined islands indicate islands contaminated

DELETED

[redacted]

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PART IV

TASK UNIT 15

and

GENERAL INFORMATION

[redacted]

Task Unit 15 - TIMING AND FIRING (H. Grier)

(H. Grier)

World Time

The time of the DELETED shot read from the world time clocks was 06:30 00.373 ± 1 msec.

Timing & Firing System

The operation of the timing and firing system including radio signals was normal.

50

[redacted]

TABLE A-1
WEATHER (BIKINI ATOLL) AT 0600M, 27 MARCH 1954

Surface Pressure 1012.4 mb
Surface Temperature 80° F
Surface Humidity 77%

Altitude (ft)	Wind Direction (degrees)	Velocity (knots)	Temp. (°C)	Dew pt. (°C)	Relative Humidity
2000	070	14	21.5	18.2	79
4000	060	11	17.8	14.0	76
6000	080	05	14.0	8.0	58
6900			12.5	4.0	44
8000	170	08	14.8	-7.7	21
10000	180	08	13.0		
12000	150	10	8.8		
14000	100	10	5.2		
16000	090	15	1.1		
18000	100	17	-3.5		
20000	100	20	-7.0		
22520			-12.5		
25000	170	14	-14.2		
30000	220	08	-27.0	-35.0	46
35000	180	18	-39.5		
40000	200	36	-52.5		
45000	300	05	-64.3		
50000	140	15	-75.0		
55000	270	15	-82.2		
60000	270	13	-77.2		
65000	310	10	-70.5		
67620	080	22	-66.3		

[redacted]

Fig. A-1. Pre-shot picture
Ground Zero. [illegible]
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[redacted]