

DNA 1251-2-EX

**COMPILATION OF LOCAL FALLOUT DATA  
FROM TEST DETONATIONS 1945-1962  
EXTRACTED FROM DASA 1251**

1362

142

**Volume II -Oceanic U.S. Tests**

General Electric Company—TEMPO  
DASIAC  
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1 May 1979

Extract

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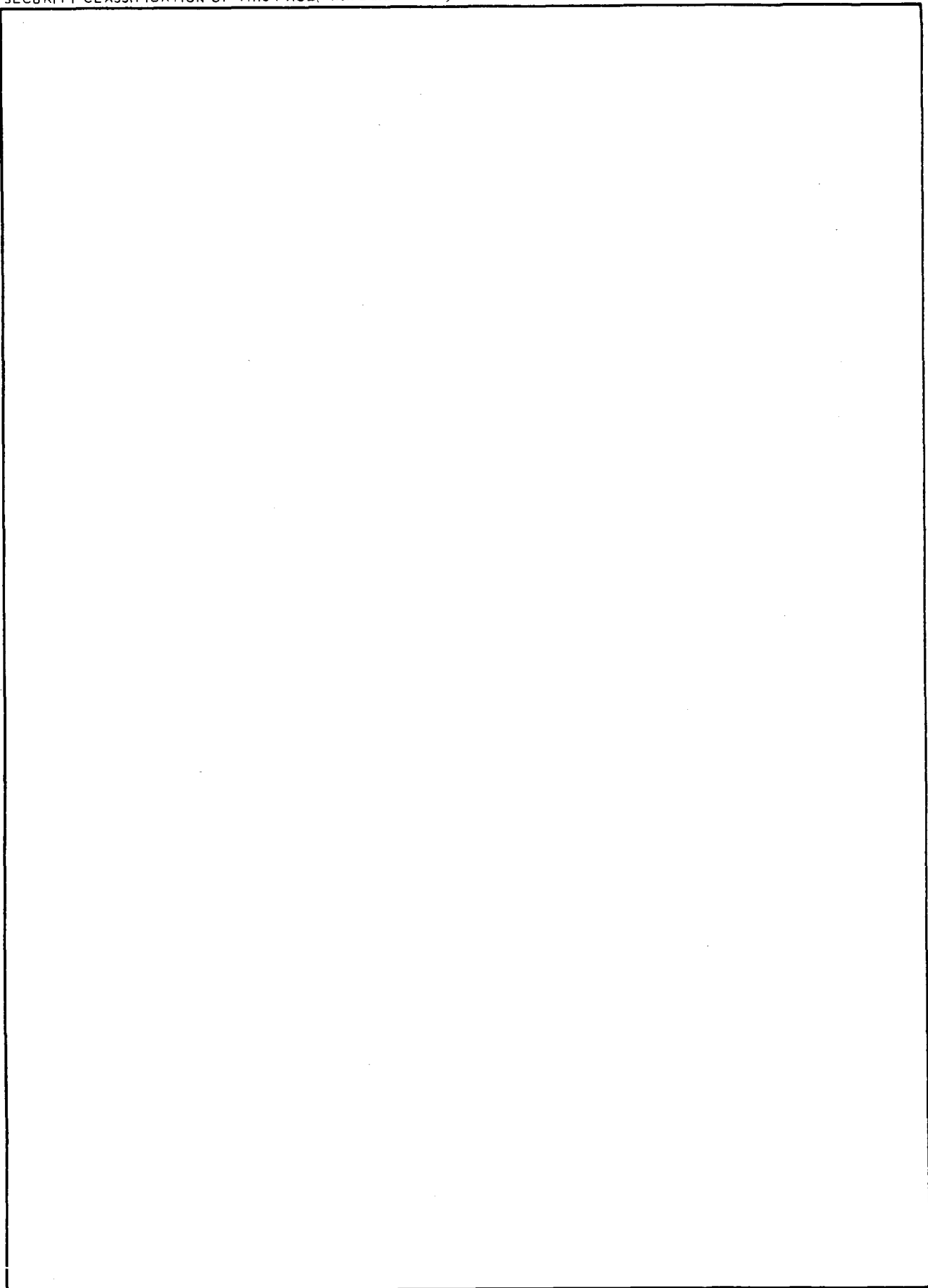
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20. ABSTRACT (Continue on reverse side if necessary and identify by block number) Fallout patterns from U.S. oceanic nuclear weapons tests. Also given are time and place of test and ambient winds.		

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## INTRODUCTION

The objective of this report is to provide a ready reference of fallout patterns and related test data for those engaged in the analysis of fallout effects.

This compilation was extracted from DASA 1251 "Local Fallout from Nuclear Test Detonations " (U) Vol. 2 "Compilation of Fallout Patterns and Related Test Data" (U) Parts 1 through 3. DASA 1251 Vol. 2 was the work of Manfred Morgenthau, Harvy Meieran, Richard Showers, Jeffrey Morse, Norman Dombeck, and Arnoldo Garcia of the U.S. Army Nuclear Defense Laboratory under Defense Atomic Support Agency (now Defense Nuclear Agency) sponsorship.

Although local (early) fallout is emphasized, the data presented will be useful to those studying world-wide (delayed) fallout as well. In this report local fallout is defined as all fallout which consists principally of the larger particles that are deposited within 24 hours after the detonation. World-wide or delayed fallout is defined as fallout which consists of very small particles which descend very slowly over large areas of the earth's surface.

Data resulting from each U.S. detonation are presented chronologically. For each detonation, the basic information useful for an interpretation of the fallout data is tabulated first. This is followed by both on-site and off-site fallout patterns where available. A graph of the growth-rate of the cloud and stem is presented next. Wind speed and direction are then tabulated as a function of altitude, and hodographs are drawn from these data.

## EXPLANATION COMMENTS ON DATA PRESENTED

### Fallout Patterns

One or more fallout patterns are given for each event, except for those shots for which no significant residual radiation was observed downwind of GZ or for which no patterns were found in the literature. In the remarks included on the basic data sheet for each shot, the individual fallout patterns are discussed briefly; some comments are made for those shots for which no patterns were available. The dose-rate contours for the fallout patterns have been drawn to show the gamma dose rate in roentgens per hour, three feet above the ground, in terms of the one hour after burst reference time. The  $t^{-1.2}$  approximation was used when no actual decay data was available to adjust radiation measurements to the one hour reference time. It is important to recognize the H+1 hour is used as a reference time, and that only the contours from low yield weapons are complete at one hour after burst. For high yield weapons, fallout over some parts of the vast areas

shown does not commence until many hours after the burst. The time of arrival of fallout is indicated on some of the fallout patterns by "dot-dash" lines. The time lines are intended to give only a rough average arrival time in hours as estimated from the wind reports and the available monitoring information.

#### Induced Activity Patterns

The contamination resulting from low air bursts is due primarily to the activity induced by neutrons which are captured by certain elements in the soil, notably sodium, manganese and aluminum. The resulting radiation field is circular and covers a limited area about ground zero. Weather conditions have very little influence on the location or shape of the induced radiation pattern. However, increasing the moisture content in soils can increase the induced activity levels. The rate of decay of the induced radiation field is different from the decay of fission products and depends on the composition of the soil over which the weapon was detonated. For Nevada soil, the sodium and manganese composition generally varies by a factor of 1.4 to 2 and the aluminum composition varies by a factor of 3 to 7 within and between test areas. For most induced activity patterns in this report, a general neutron-induced decay curve for Nevada soil was used to extrapolate the observed dose rates back to H+1 hour. For a few induced activity patterns,  $\text{Na}^{24}$  decay is used to extrapolate the observed dose rates to H+1 hour. This decay rate is not strictly applicable but it closely approximates the observed decay.

#### Wind Data

The tables of wind data give surface and upper air winds for heights up to at least the top of the nuclear cloud. These data are presented for times as close to shot time as possible and for several times after shot. Directions are in degrees from which the wind is blowing, and are measured clockwise from North. Velocities are in statute miles per hour. The height of the tropopause at shot time is given when available. Although the meteorological data were taken in close proximity to ground zero, they do not necessarily represent the wind field downwind from ground zero in space and time.

The hodographs are drawn for a constant balloon rise rate of 5,000 ft/hr and are presented for illustrative purposes only. The fall rates of particles vary considerably with altitude; therefore, errors will result from the use of a constant fall-rate hodograph for fallout prediction. In general, particles in higher altitude levels fall faster and the percentage change in the falling rate is greater for larger particles. The numbers on the hodographs represent altitudes in thousands of feet. The associated points represent the locations on the surface where particles having a constant fall-rate of 5,000 ft/hr would land if they originated over GZ at the altitudes shown. The letter S on the hodographs stands for "Surface" and the number next to it in parenthesis (for the Nevada shots) is the site elevation of ground zero in feet above MSL.

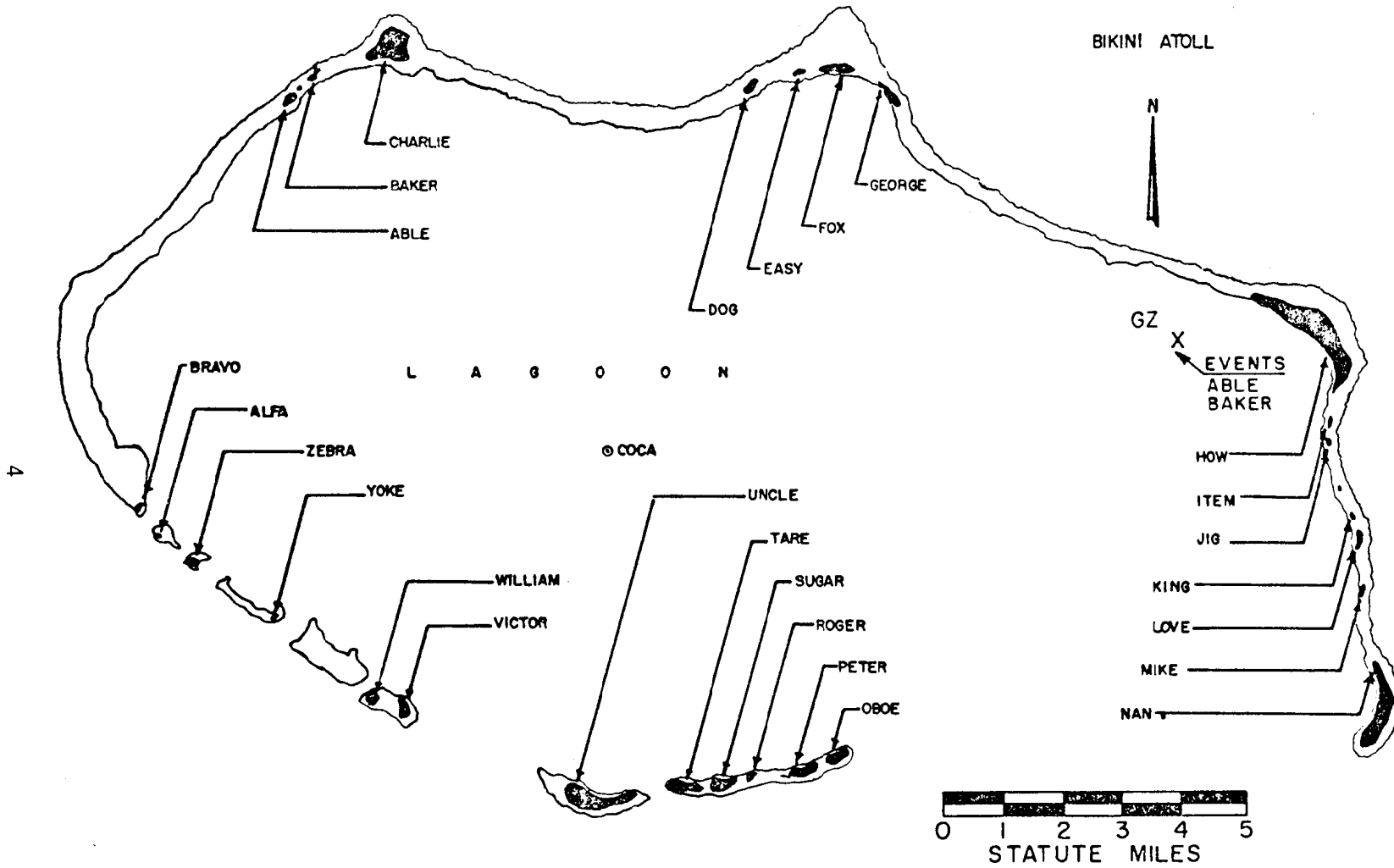


Figure 1 Operations CROSSROADS, Shot Locations.



OPERATION CROSSROADS -

Able

	<u>PPG time</u>	<u>GMT</u>
<u>DATE:</u>	1 Jul 1946	30 June 1946
<u>TIME:</u>	0900	2200

Sponsor: IASL and DOD

SITE: PPG - Bikini  
11° 37' 10" N  
165° 29' 28" E  
Site elevation: Sea level

TOTAL YIELD: 23 kt

HEIGHT OF BURST: 520 ft

TYPE OF BURST AND PLACEMENT:  
Air burst over water

FIREBALL DATA:

Time to 1st minimum: NM  
Time to 2nd maximum: NM  
Radius at 2nd maximum: ~ 576 ft

CLOUD TOP HEIGHT: 40,000 ft MSL

CLOUD BOTTOM HEIGHT: Not available

CRATER DATA: No crater

REMARKS:

The residual radioactivity on target vessels was low. On D+1 day, radioactivities greater than 0.1r per 24 hours were found on only 13 vessels. The residual radioactivity in the water after H-hour was negligible.

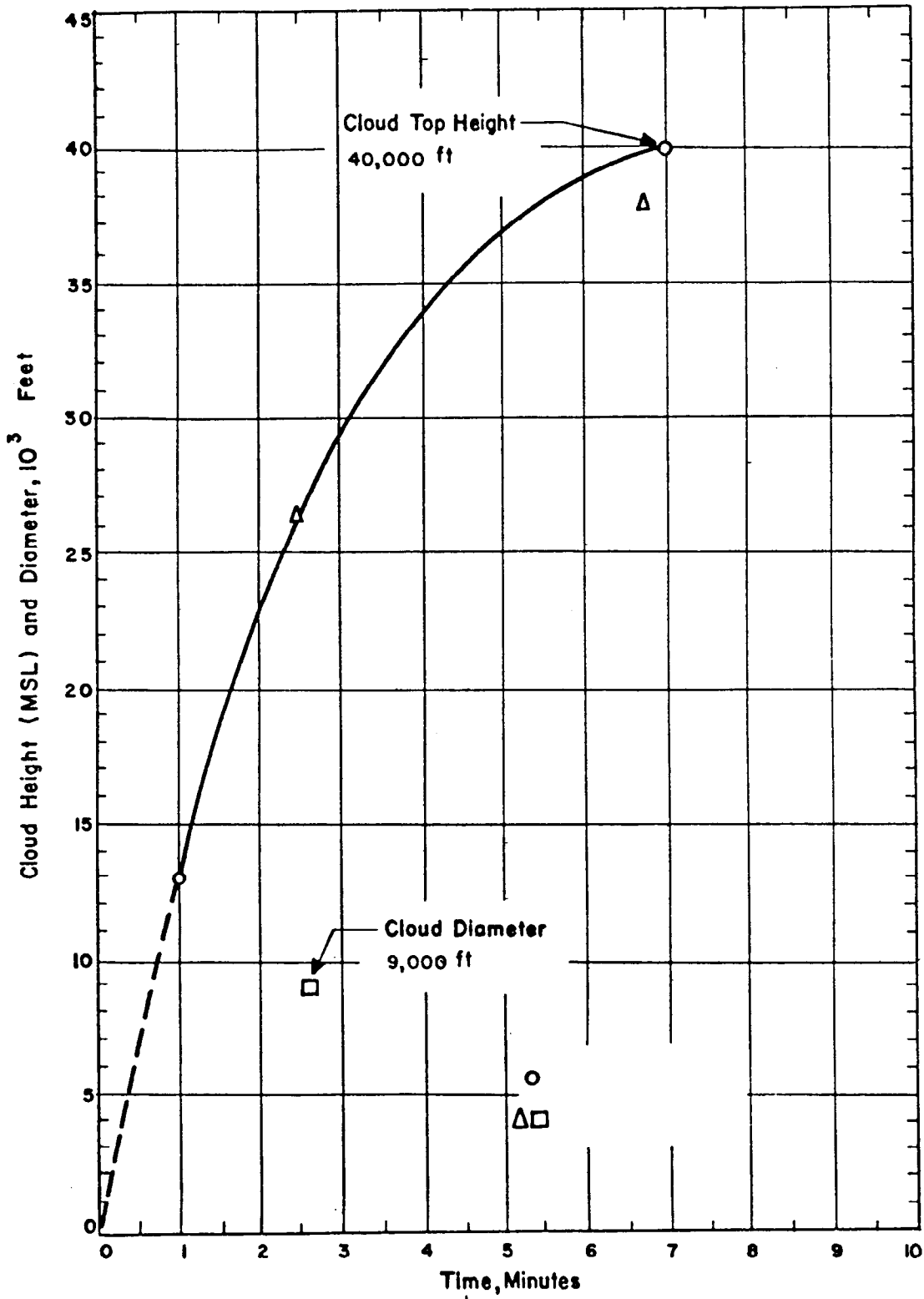


Figure 2. Cloud Dimensions: Operation CROSSROADS - Able.

TABLE 1 BIKINI WIND DATA FOR OPERATION CROSSROADS,

ABLE

Altitude (MSL) feet	H-hour		H+5 hours		H+8 hours	
	Dir degrees	Speed mph	Dir degrees	Speed mph	Dir degrees	Speed mph
Surface	(070)	(09)	045	09	070	08
2,000	130	15	---	--	---	--
4,000	130	16	130	16	120	14
5,000	(130)	(16)	(130)	(15)	(120)	(14)
6,000	140	17	130	14	120	15
8,000	120	13	120	14	020	16
10,000	(120)	(19)	130	17	120	16
12,000	120	08	110	16	130	17
14,000	100	10	110	10	070	53
15,000	100	08	020	06	040	06
20,000	330	05	150	17	170	09
25,000	180	09	280	02	230	07
30,000	340	07	330	05	310	05
35,000	340	02	080	06	Calm	Calm
40,000	070	09	360	25	350	28
45,000	030	30	330	31	320	32

## NOTES:

1. Numbers in parentheses are estimated values.
2. Surface wind data was obtained on Bikini; upper wind data was obtained on board the Mt. McKinley.
3. Tropopause height was 54,000 to 60,000 feet (exact height is uncertain).
4. At H-hour the surface air pressure was 14.68 psi, the temperature 27.2°C and the dew point 23.4°C.

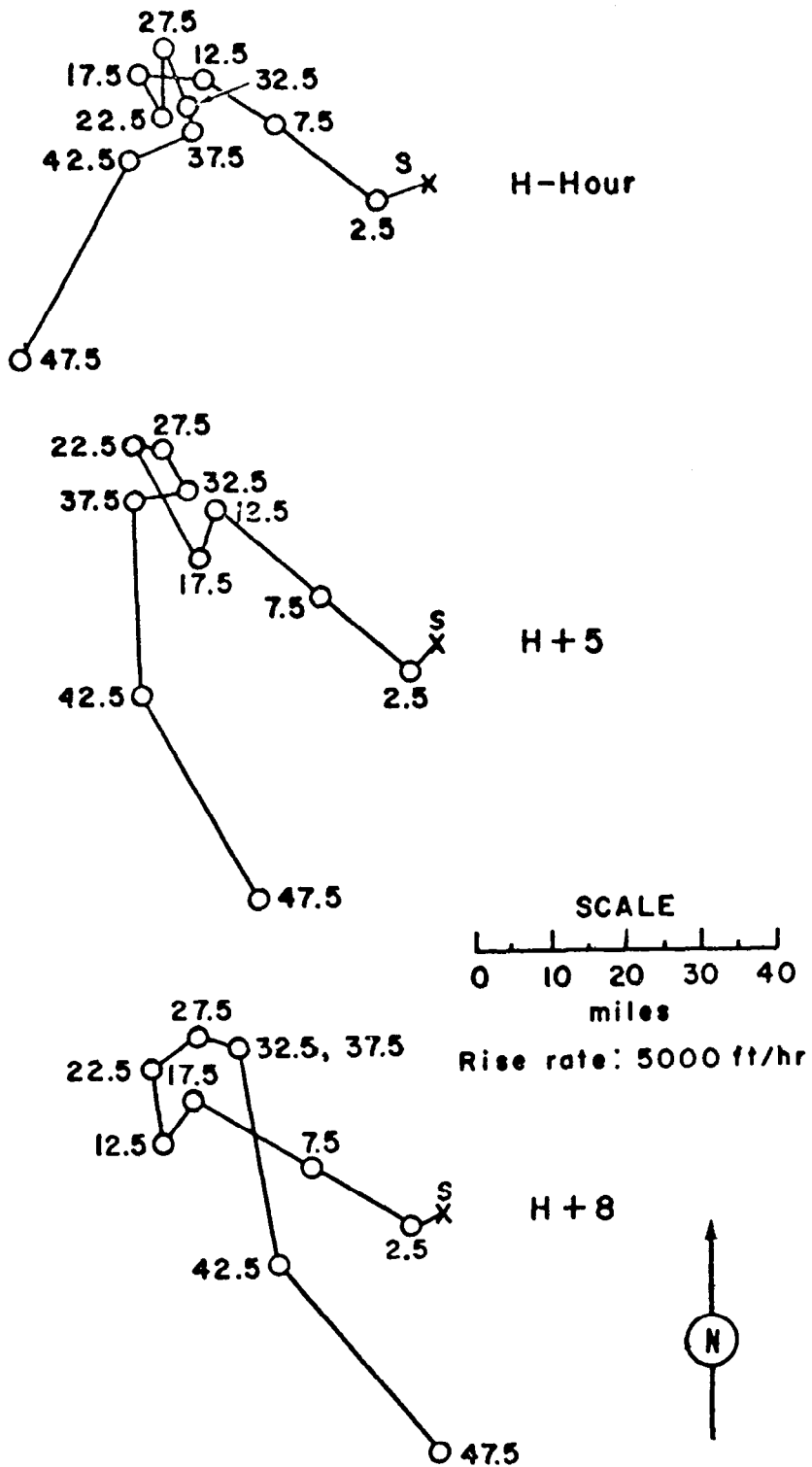


Figure 3. Hodographs for Operation CROSSROADS

- Able.

OPERATION CROSSROADS -

Baker

	PPG time	GMT
<u>DATE:</u>	25 Jul 1946	24 Jul 1946
<u>TIME:</u>	0835	2135

TOTAL YIELD: 23 kt

FIREBALL DATA:

Time to 1st minimum:	NM
Time to 2nd maximum:	NM
Radius at 2nd maximum:	NM

Sponsor: LASL and DOD

SITE: PPG - Bikini - Near How  
11° 37' 10" N  
165° 29' 28" E  
Site elevation: Sea level

HEIGHT OF BURST: -90 ft

TYPE OF BURST AND PLACEMENT:

Underwater - cable-supported  
90 ft above lagoon floor.  
Lagoon was 180 ft deep.

CLOUD TOP HEIGHT: 7,600 ft MSL

CRATER DATA:

Diameter: 3,300 ft maximum  
1,800 ft minimum  
Depth: 25 ft

REMARKS:

The contamination pattern is unreliable. The dose-rate readings used for the pattern were obtained from the total dose measured by film badges collected between D+10 days and D+15 days. The radioactivity on the target vessels diminished At its greatest extent the base surge extended about 2,000 yd upwind, 3,000 yd crosswind and 4,000 yd downwind. "The contamination resulted from fallout or radioactive rain from the mushroom head reinforced somewhat by condensation of the base surge. Ideally there should have been an annular infinitive-dose pattern as a result of fallout from the outer edges of the mushroom head. This ideal pattern was changed because of the intermittent behavior of the rain-out and because of the varying ability of the different target ships to retain the fallout activity."

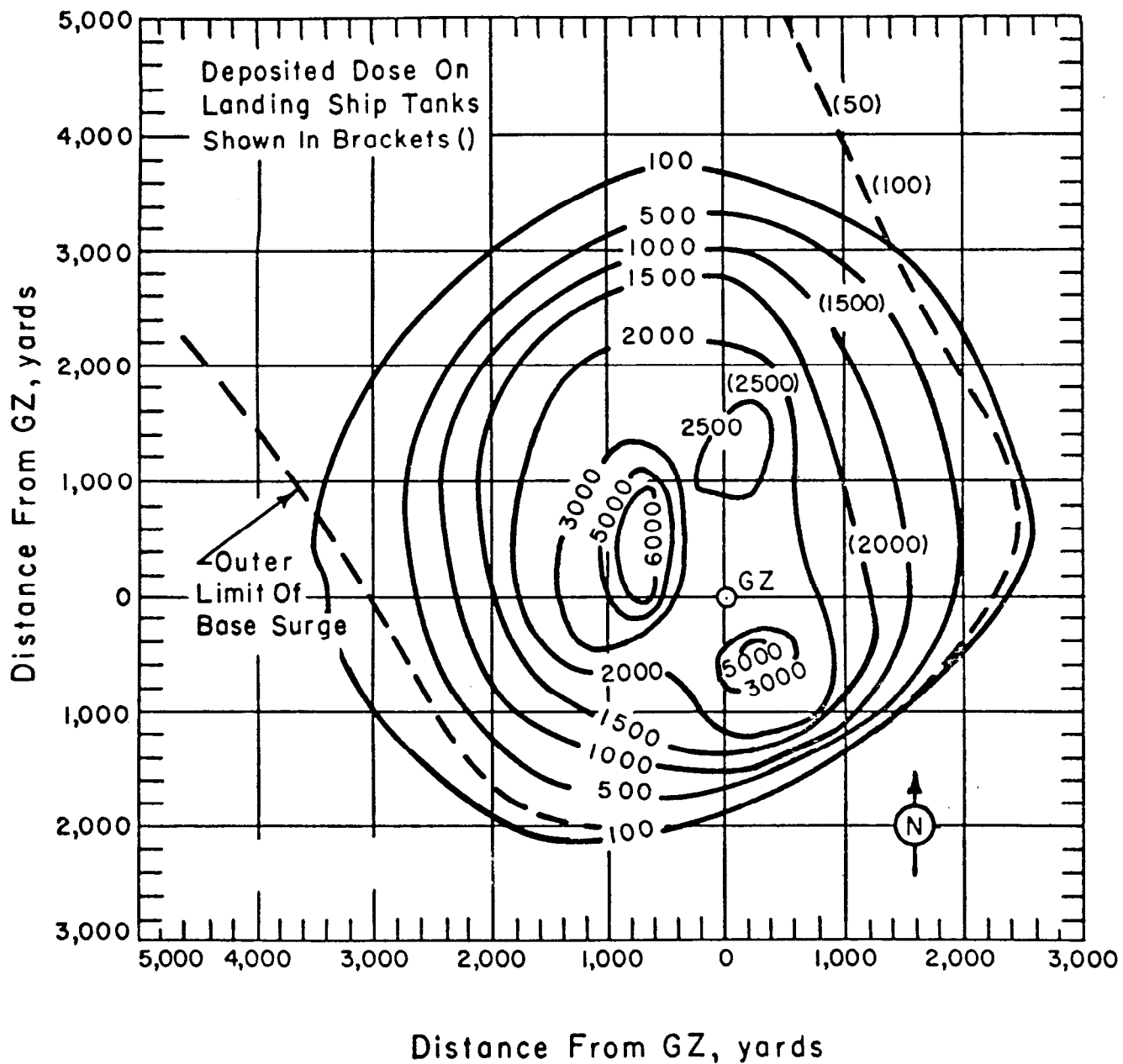


Figure 4. Operation CROSSROADS - Baker. On-site dose rate contours in r/hr at H+1 hour.

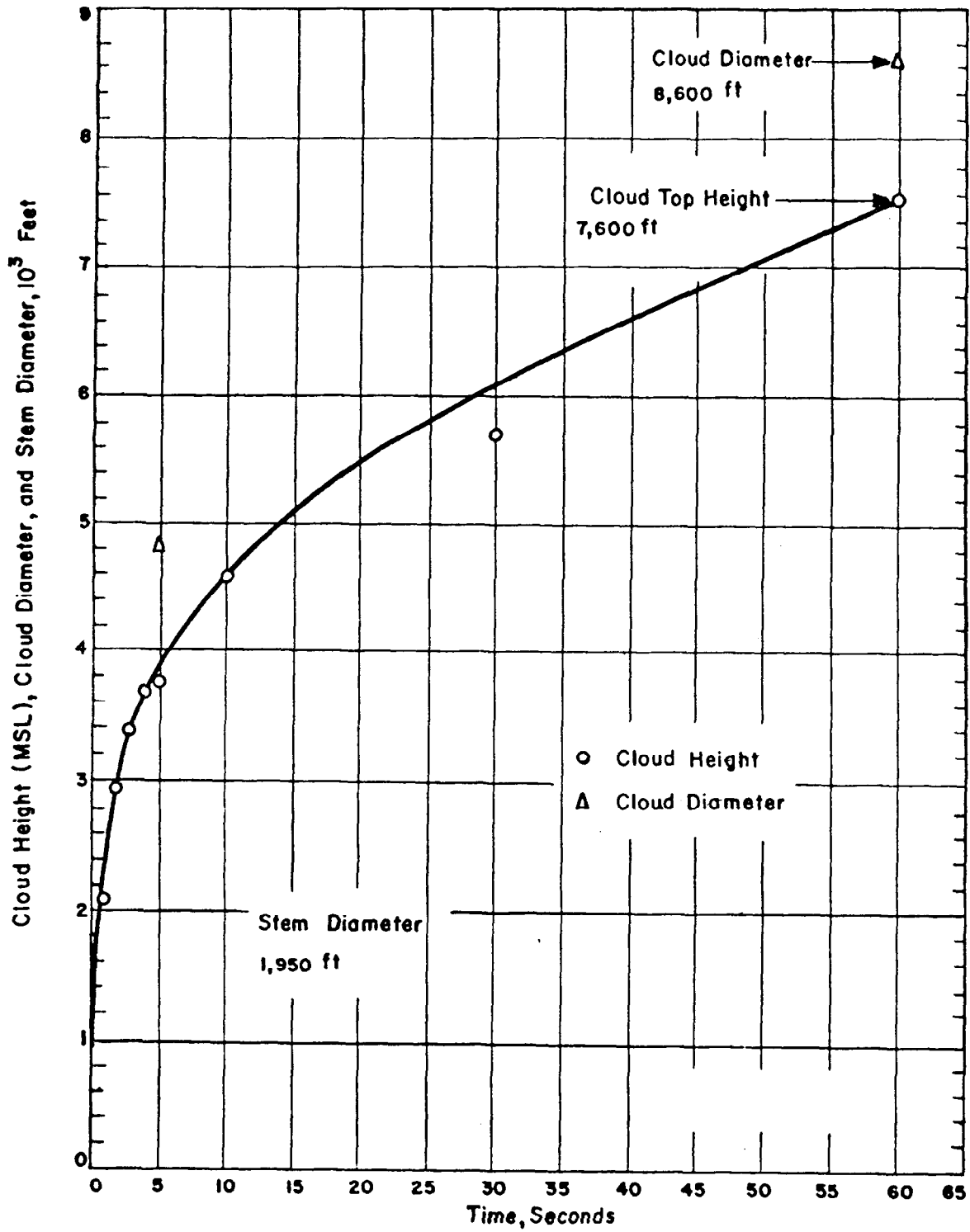


Figure 5. Cloud Dimensions: Operation CROSSROADS -

Baker.

TABLE 2 BIKINI WIND DATA FOR OPERATION CROSSROADS - BAKER

Altitude (MSL) feet	H-hour		Altitude (MSL) feet	H-hour	
	Direction degrees	Speed mph		Direction degrees	Speed mph
Surface	200	03	14,000	080	09
2,000	160	12	15,000	080	09
4,000	160	12	16,000	080	13
6,000	150	09	20,000	110	09
8,000	150	08	25,000	050	12
10,000	120	09	30,000	040	20
12,000	110	14	35,000	060	32

NOTES:

1. Surface wind data was obtained at H+1 hour on Bikini; upper wind data was obtained on board the "Fall River."
2. Tropopause height was 54,000 to 60,000 feet (exact height is uncertain).
3. At H-hour the surface air pressure was 14.68 psi, the temperature 28.9°C and the dew point 25.0°C.

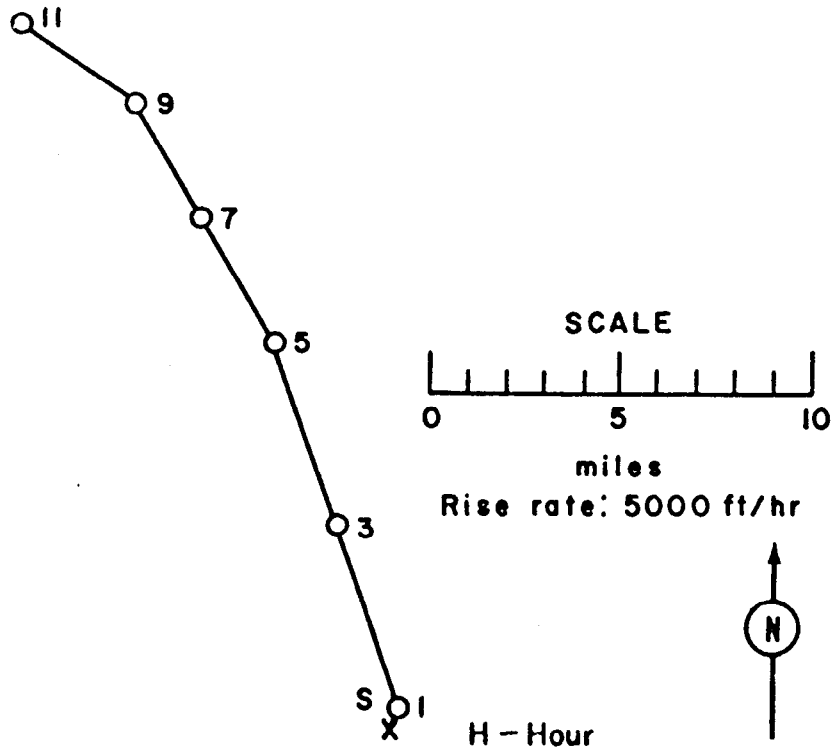


Figure 6. Hodographs for Operation CROSSROADS - Baker



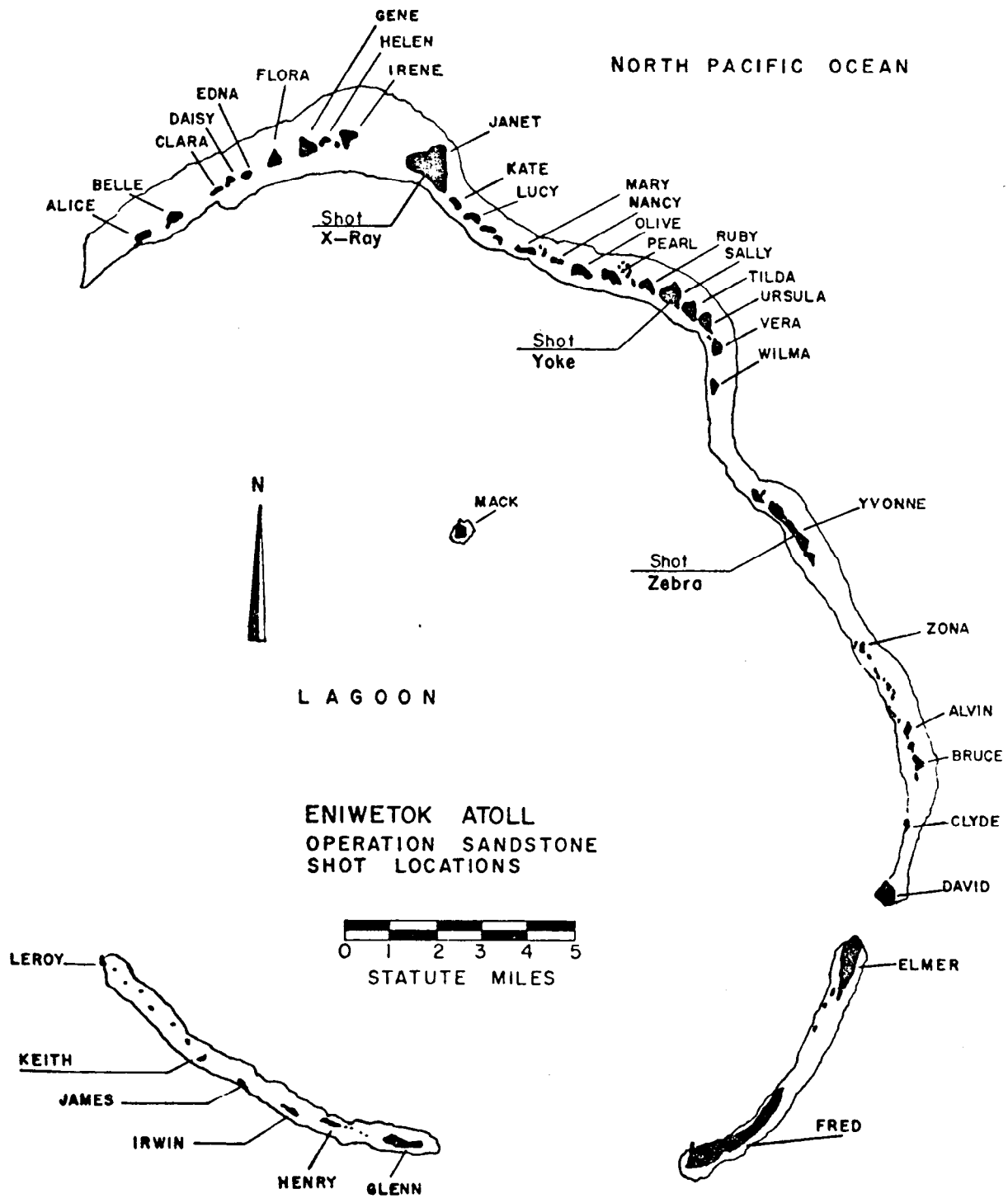


Figure 7. Operation SANDSTONE, Shot Locations.

OPERATION SANDSTONE - X-Ray

	<u>PPG Time</u>	<u>GMT</u>
<u>DATE:</u>	15 Apr 1948	14 Apr 1948
<u>TIME:</u>	0617	1817

Sponsor: LASL

SITE: PPG - Eniwetok - Janet  
11° 40' N  
162° 14' 37" E  
Site elevation: Sea level

TOTAL YIELD: 37 kt

HEIGHT OF BURST: 200 ft

TYPE OF BURST AND PLACEMENT:  
Tower burst over coral soil

FIREBALL DATA:

Time to 1st minimum: NM  
Time to 2nd maximum: NM  
Radius at 2nd maximum: NM

CLOUD TOP HEIGHT: 56,000 ft MSL  
CLOUD BOTTOM HEIGHT: 25,000 ft MSL

CRATER DATA: Not available

REMARKS:

No fallout pattern available. Radioactive samples were taken from Ground Zero and showed a decay activity due to Na<sup>24</sup> was observed. Cloud reached the tropopause in 12 minutes. Also much

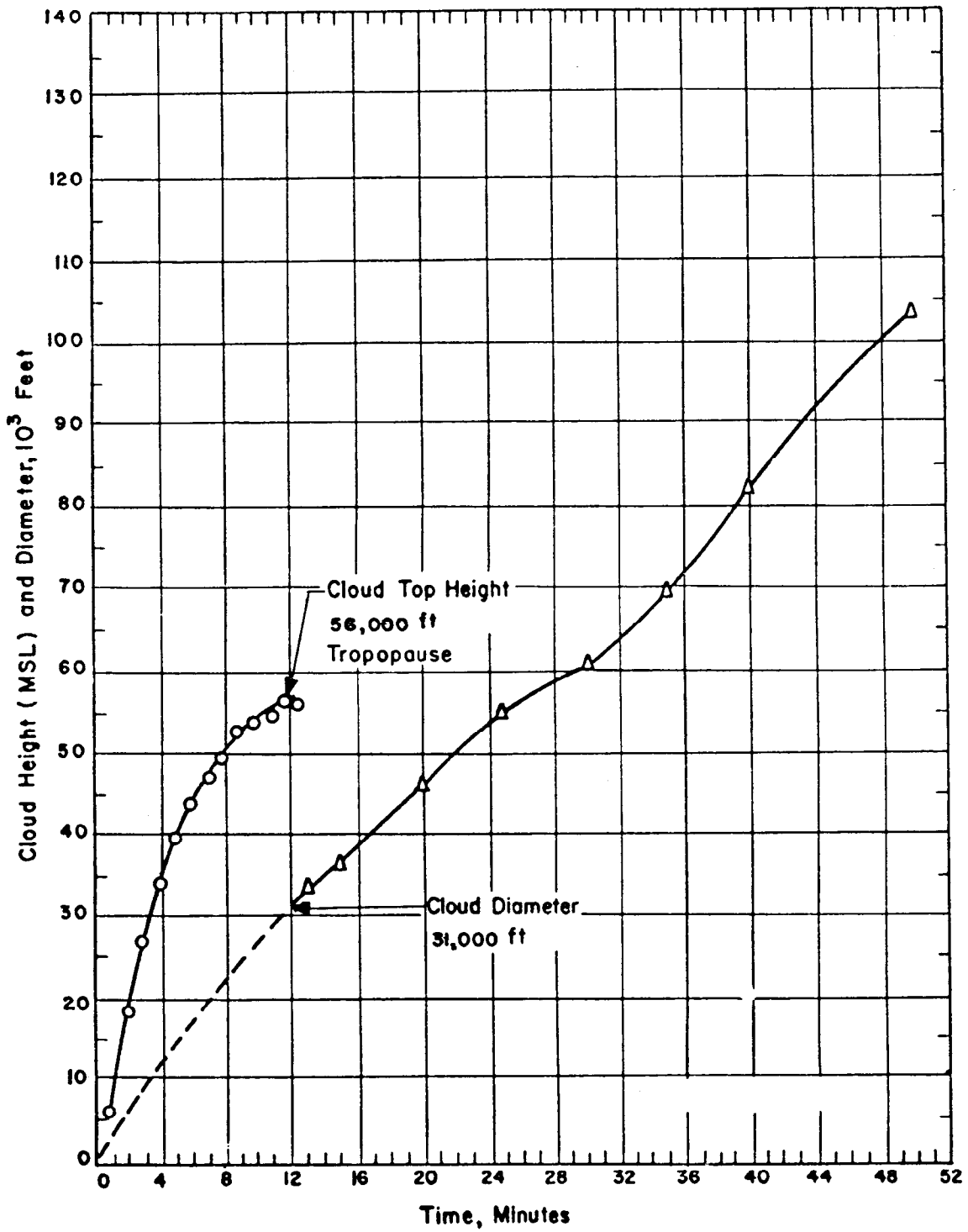


Figure 8. Cloud Dimensions: Operation SANDSTONE - X-Ray

TABLE 3 ENIWETOK WIND DATA FOR OPERATION SANDSTONE - X-RAY

Altitude (MSL) feet	H-hour		H+2 hours		H+3 hours	
	Dir degrees	Speed mph	Dir degrees	Speed mph	Dir degrees	Speed mph
Surface	090	10	090	12	070	16
2,000	---	--	100	15	070	23
4,000	---	--	100	12	090	23
5,000	100	14	(100)	(12)	(095)	(24)
6,000	---	--	090	12	100	25
8,000	---	--	110	21	090	23
10,000	130	14	130	15	080	16
12,000	---	--	120	13	080	12
14,000	---	--	140	09	070	09
15,000	150	09	(140)	(09)	(075)	(08)
16,000	---	--	140	10	080	07
18,000	---	--	140	09	360	07
20,000	160	09	140	02	210	02
25,000	230	12	220	12	120	09
30,000	240	14	210	15	---	--
35,000	220	23	210	21	---	--
40,000	220	15	220	21	---	--
45,000	220	34	220	37	---	--
50,000	230	23	230	21	---	--
55,000	220	14	---	--	---	--

NOTES:

1. Numbers in parentheses are estimated values.
2. Tropopause height was 55,000 ft MSL at H-hour.
3. The H-hour wind data was estimated by the USAF weather station on Eniwetok Island. The H+2 and H+3 hour winds were measured.
4. At H-hour the sea level pressure was 1190 mb, temperature 75°F, and the dew point 71°F.

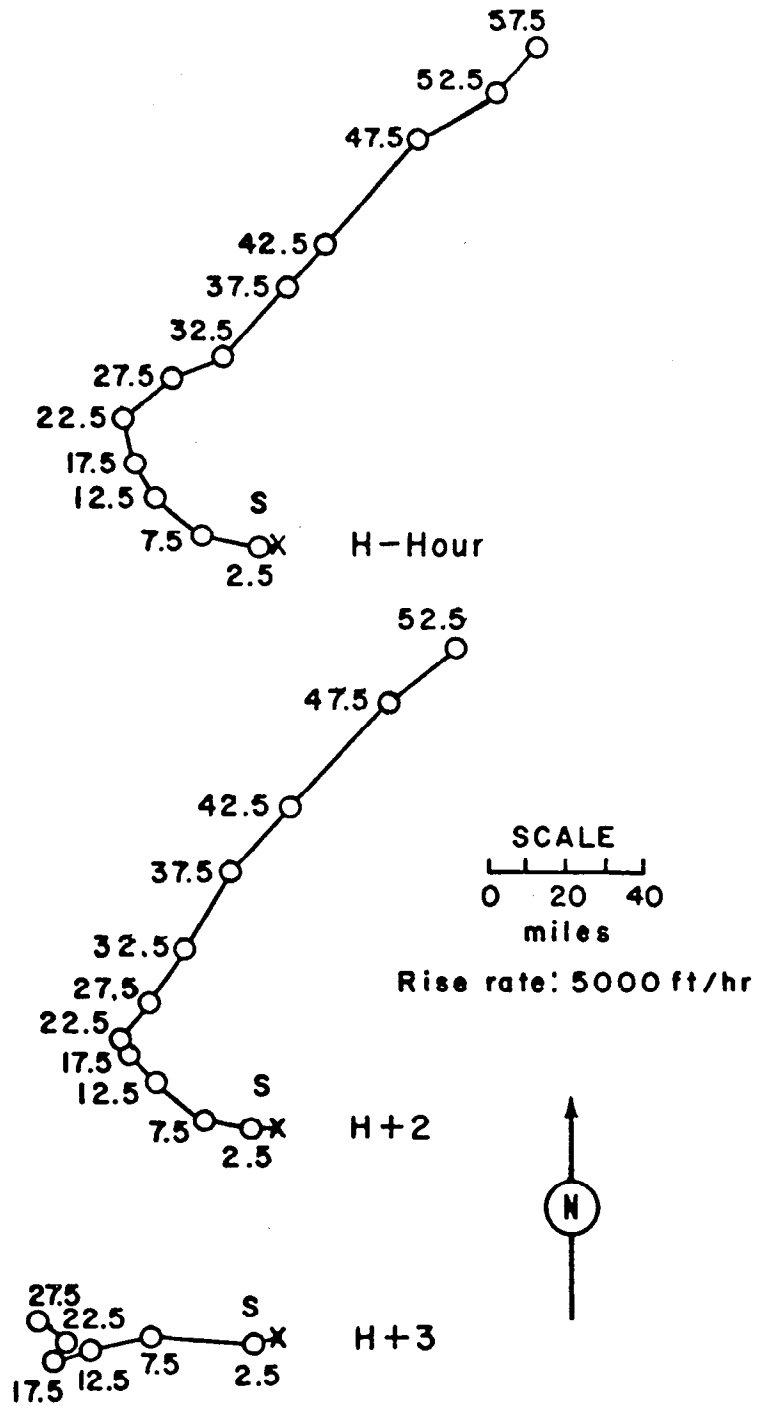


Figure 9. Hodographs for Operation SANDSTONE -

X-Ray.

OPERATION SANDSTONE -

Yoke

	<u>PPG time</u>	<u>GMT</u>
<u>DATE:</u>	1 May 1948	30 Apr 1948
<u>TIME:</u>	0609	1809

Sponsor: LASL

SITE: PPG - Eniwetok - Sally  
11° 37' 40" N  
162° 19' 27" E  
Site elevation: Sea level

TOTAL YIELD: 49 kt

HEIGHT OF BURST: 200 ft

FIREBALL DATA:

Time to 1st minimum:	NM
Time to 2nd maximum:	NM
Radius to 2nd maximum:	NM

TYPE OF BURST AND PLACEMENT:

Tower burst over coral soil

CLOUD TOP HEIGHT: 56,000 ft MSL

CLOUD BOTTOM HEIGHT: 35,000 ft MSL

CRATER DATA: Not available

REMARKS:

No fallout pattern available. Cloud reached tropopause in 12 minutes. Yoke rain-out was observed on Kwajalein at H+36 hours; rain fell for 10 hours and the maximum activity observed was 6 to 10 mr/hr.

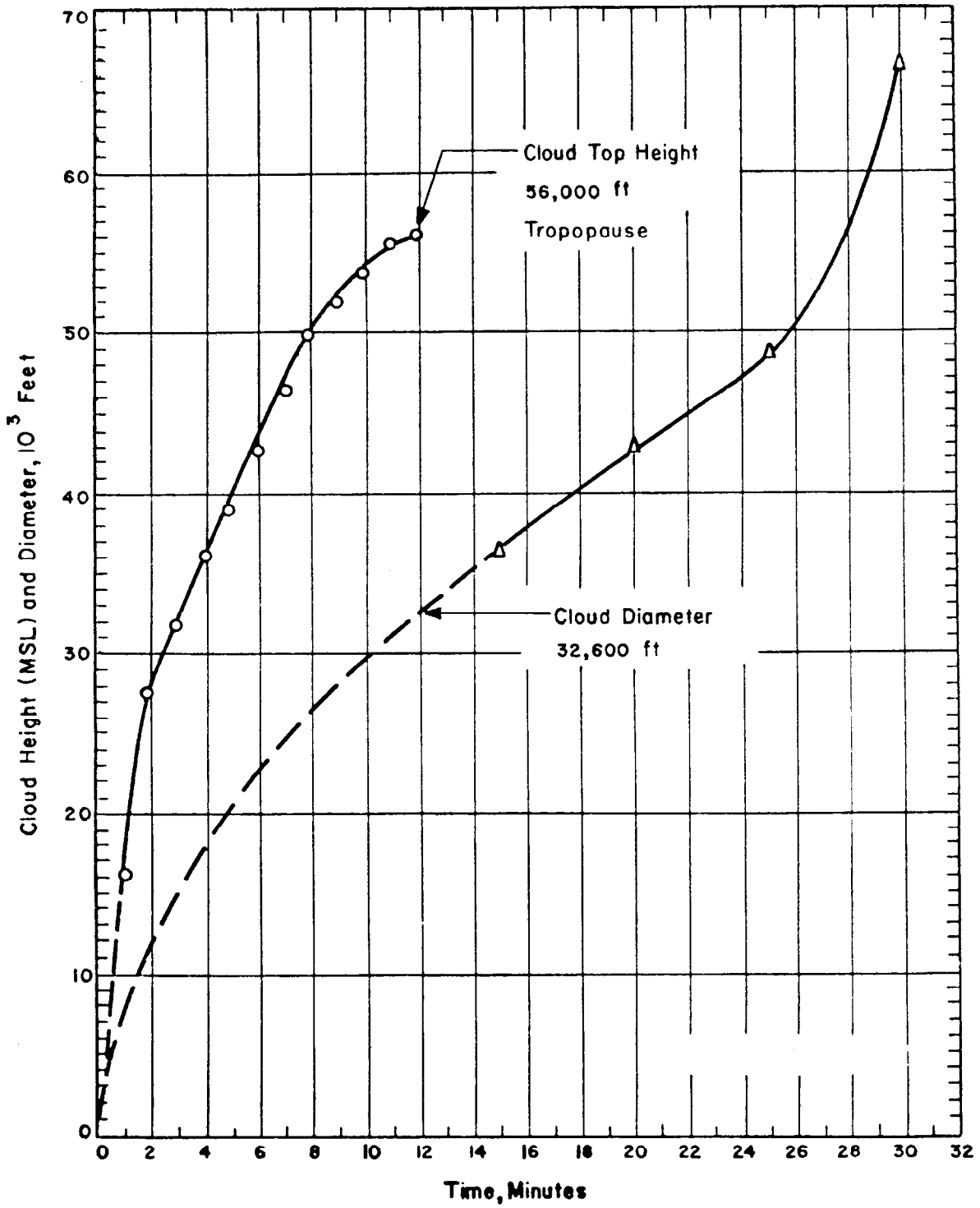


Figure 10. Cloud Dimensions: Operation SANDSTONE - Yoke.

TABLE 4 ENIWETOK WIND DATA FOR OPERATION SANDSTONE -

YOKE

Altitude (MSL) feet	H-hour		H+3 hours	
	Dir degrees	Speed mph	Dir degrees	Speed mph
Surface	080	16	070	15
2,000	---	--	070	21
4,000	---	--	090	12
5,000	090	14	170	07
6,000	---	--	180	08
10,000	160	12	150	39
14,000	---	--	080	41
15,000	090	07	090	29
16,000	---	--	100	28
20,000	220	12	170	42
25,000	210	16	250	70
30,000	210	24	270	47
35,000	220	48	---	--
40,000	210	57	---	--
45,000	210	54	---	--
50,000	200	49	---	--
55,000	200	40	---	--

## NOTES:

1. Tropopause height was estimated to be 56,000 ft MSL at H-hour.
2. The H-hour wind data was estimated by the USAF weather station on Eniwetok Island. The H+3 hour winds were measured.
3. At H-hour the sea level pressure was 1050 mb, the temperature 79°F, and the dewpoint 72°F.



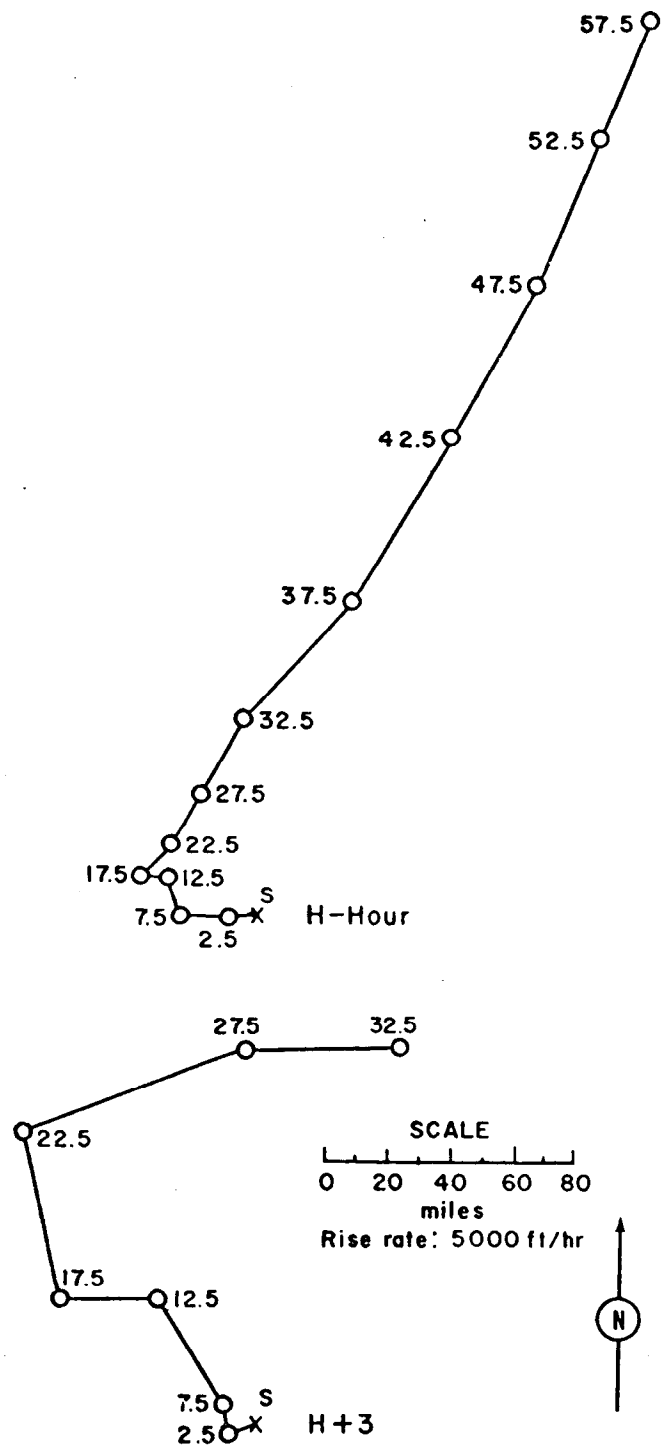


Figure 11. Hodographs for Operation SANDSTONE - Yoke.

OPERATION SANDSTONE -

Zebra

	<u>PPG time</u>	<u>GMT</u>
<u>DATE:</u>	15 May 1948	14 May 1948
<u>TIME:</u>	0604	1804

Sponsor: LASL

SITE: PPG - Eniwetok - Yvonne  
11° 33' 15" N  
162° 21' 24" E  
Site elevation: Sea level

TOTAL YIELD: 18 kt

HEIGHT OF BURST: 200 ft

TYPE OF BURST AND PLACEMENT:  
Tower burst over coral soil

FIREBALL DATA:

Time to 1st minimum:	NM
Time to 2nd maximum:	NM
Radius at 2nd maximum:	NM

CLOUD TOP HEIGHT: 28,400 ft MSL  
CLOUD BOTTOM HEIGHT: 20,000 ft MSL

CRATER DATA: Not available

REMARKS:

No fallout pattern available.

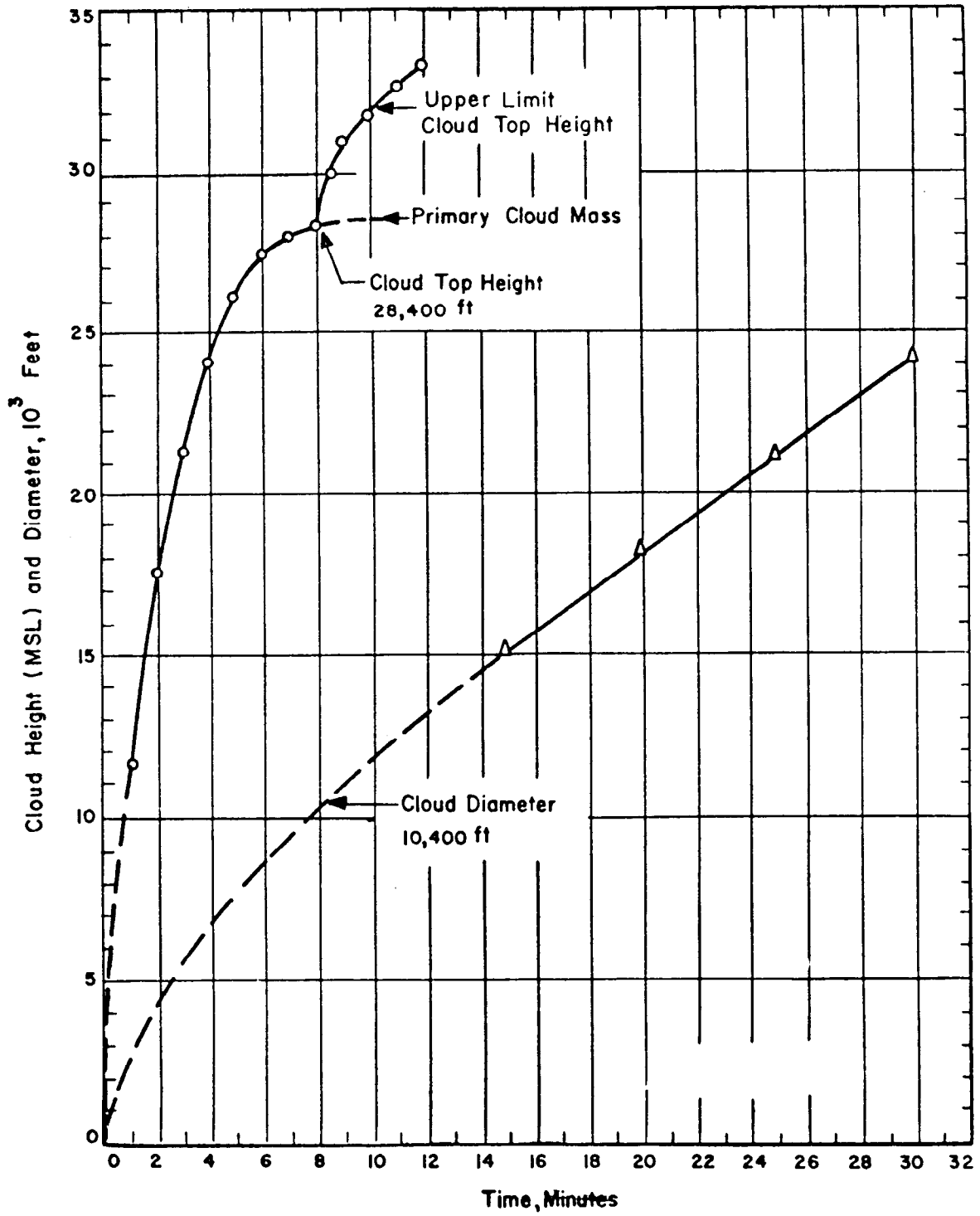


Figure 12. Cloud Dimensions: Operation SANDSTONE -

Zebra.

TABLE 5 ENIWETOK WIND DATA FOR OPERATION SANDSTONE -

ZEBRA

Altitude (MSL) feet	H-hour		H+2 hours		H+3 hours	
	Dir degrees	Speed mph	Dir degrees	Speed mph	Dir degrees	Speed mph
Surface	080	10	100	09	090	09
2,000	100	17	110	16	100	17
5,000	130	13	110	15	110	14
10,000	220	13	190	12	220	14
15,000	270	14	240	07	240	08
20,000	240	21	250	20	260	24
25,000	250	31	260	29	250	36
30,000	270	50	260	45	270	44
35,000	280	50	260	46	290	44
40,000	270	83	290	48	290	56
45,000	270	40	280	48	270	55

## NOTES:

1. Tropopause height was 54,000 feet MSL at H-hour.
2. The H-wind data was estimated by the USAF weather station on Eniwetok Island. The H+2 and H+3 hour winds were measured.
3. At H-hour the sea level pressure was 810 mb, the temperature 81°F, and the dew point 74°F.

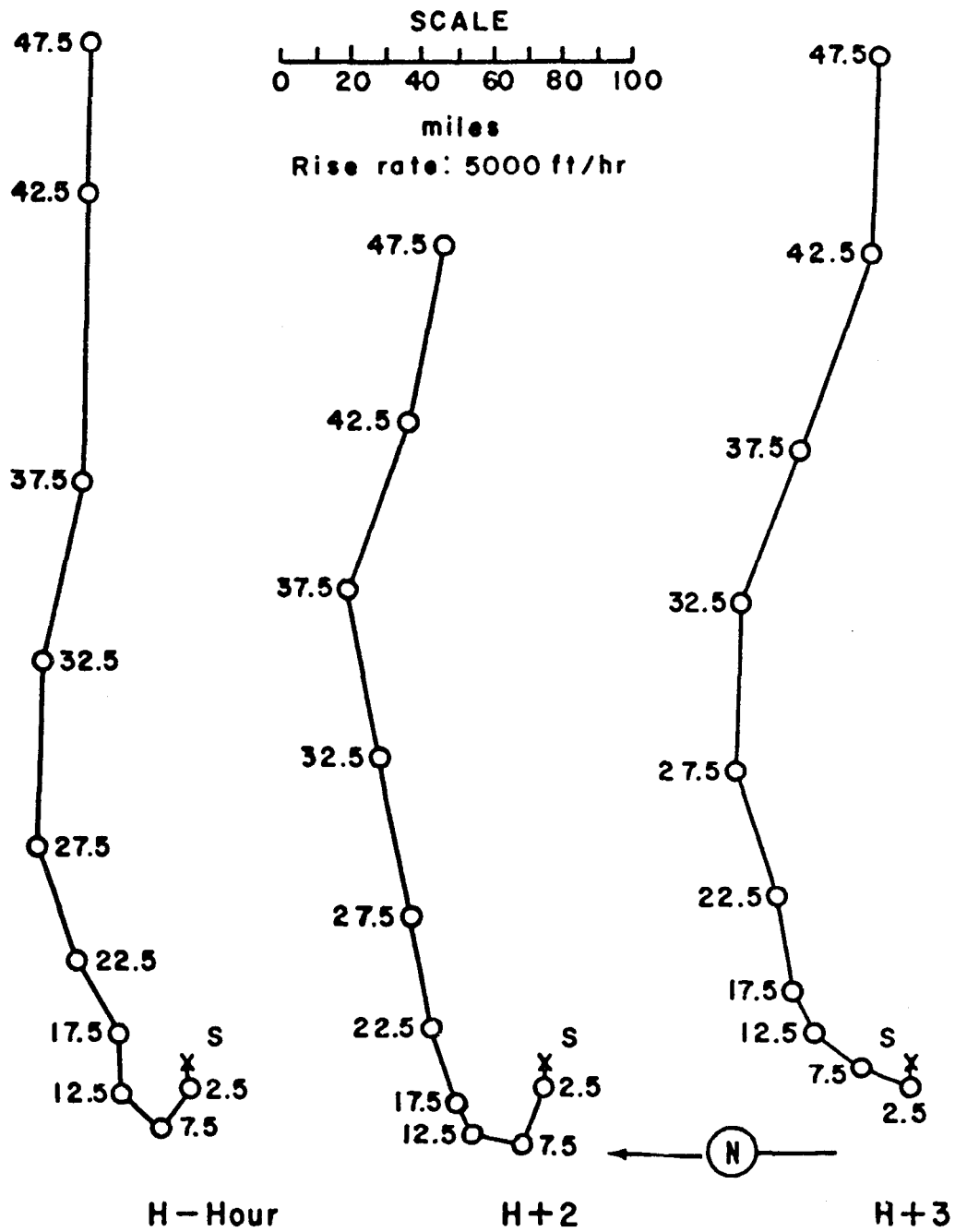


Figure 13. Hodographs for Operation SANDSTONE -

Zebra

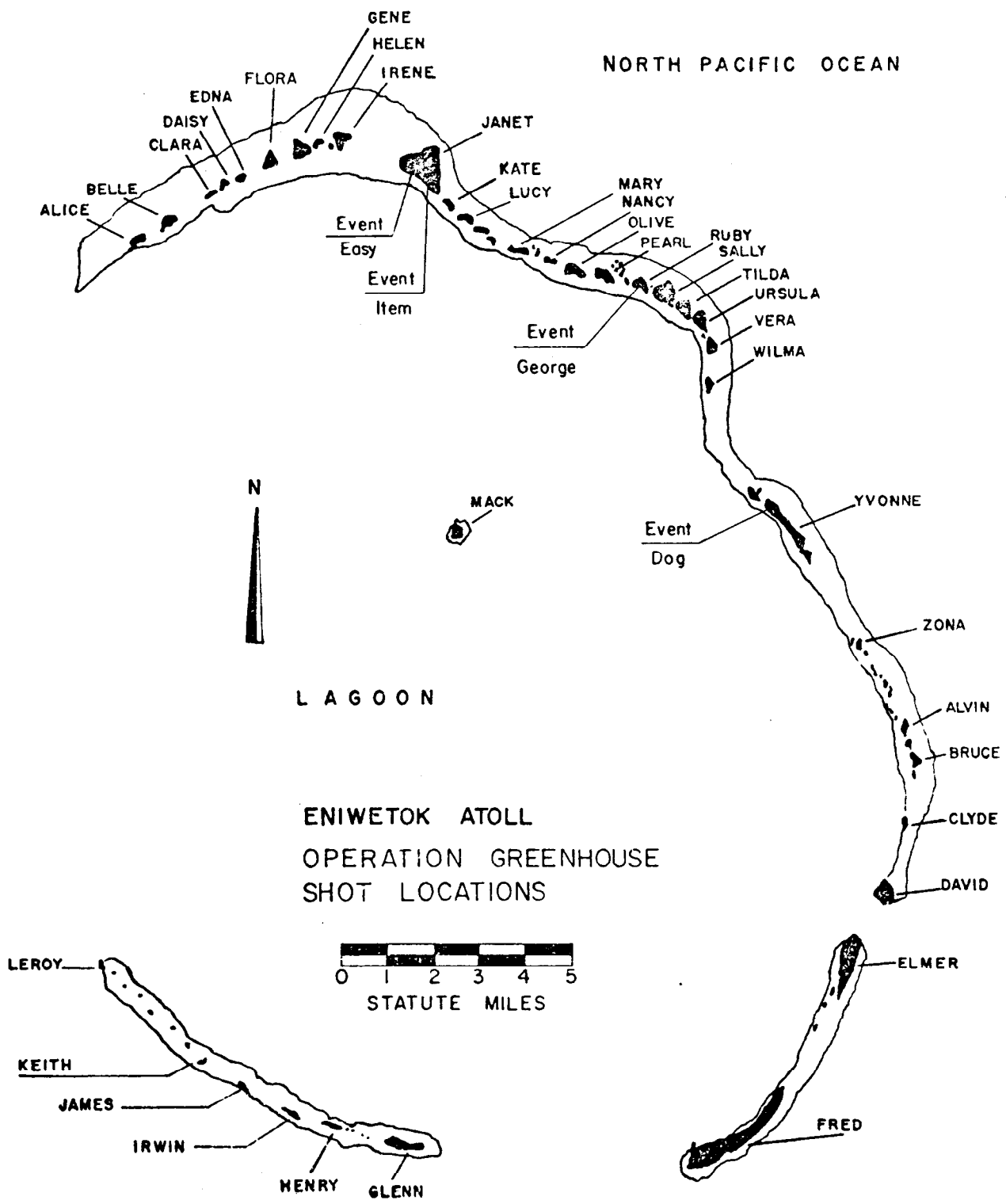


Figure 14. Operation GREENHOUSE, Shot Locations

OPERATION GREENHOUSE -

Dog

	<u>PPG time</u>	<u>GMT</u>
<u>DATE:</u>	8 Apr 1951	7 Apr 1951
<u>TIME:</u>	0634	1834

Sponsor: LASL

SITE: PPG - Eniwetok - Yvonne  
11° 33' 21" N  
162° 21' 16" E  
Site elevation: Sea level

HEIGHT OF BURST: 300 ft

TYPE OF BURST AND PLACEMENT:  
Tower burst over coral soil

CLOUD TOP HEIGHT: 56,000 ft MSL  
CLOUD BOTTOM HEIGHT: 33,000 ft MSL

REMARKS:

The dose-rate readings were corrected to H+1 hour by applying the  $t^{-1.2}$  law to measurements made by the Radiological Safety organization. Measurements on Yvonne were made at H+8½ hours. Many of the measurements were obtained from a helicopter flying at an altitude of 10 to 20 feet above the ground. These readings may therefore be low by as much as 20 to 50 percent. The wind shear at about 20,000 feet accounts for the higher dose rates on the southeastern part of the atoll, as compared to the southern end of the shot island.

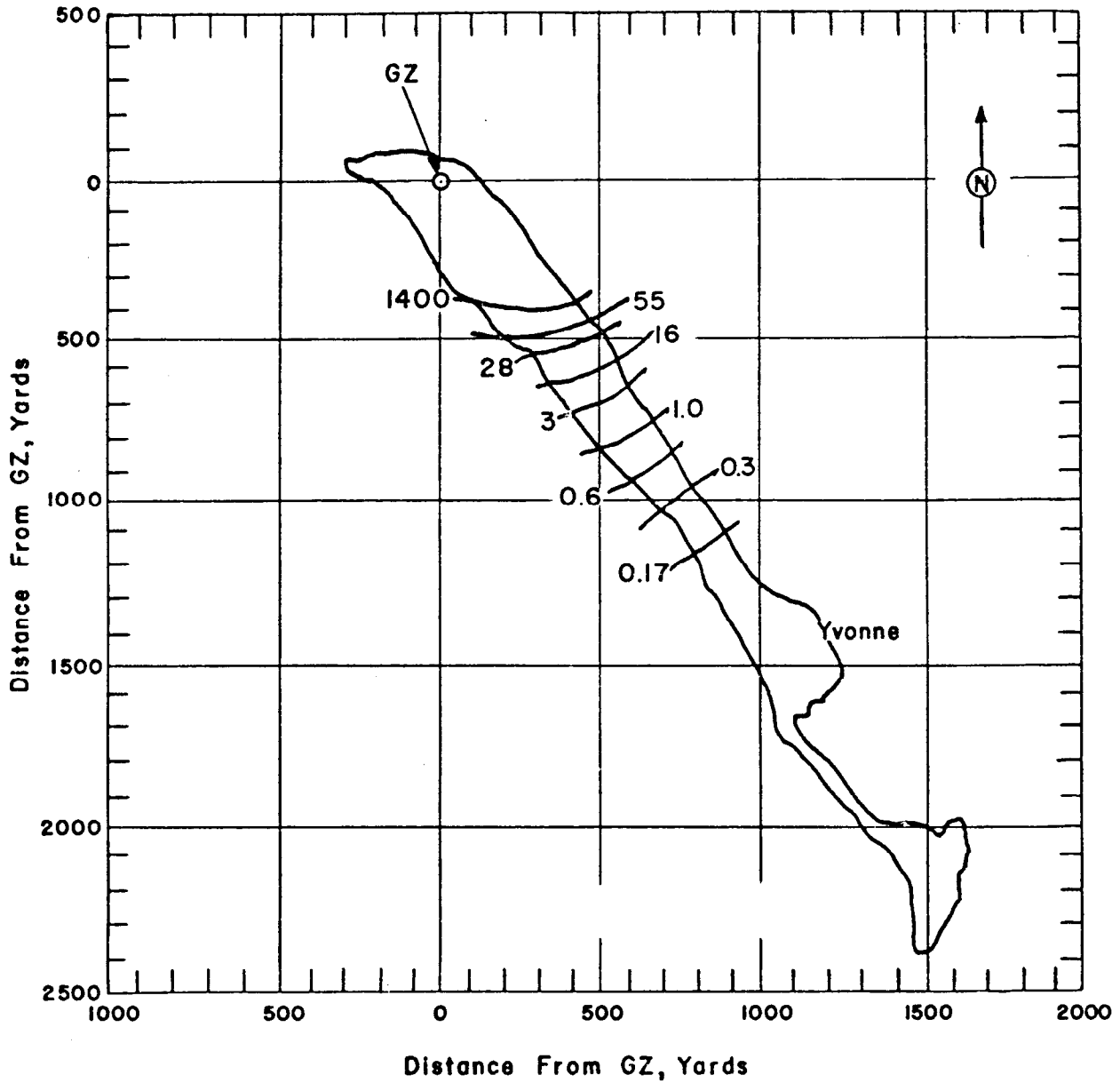


Figure 15. Operation GREENHOUSE - Dog.  
 Shot - Island dose rate contours in r/hr at H+1 hour.



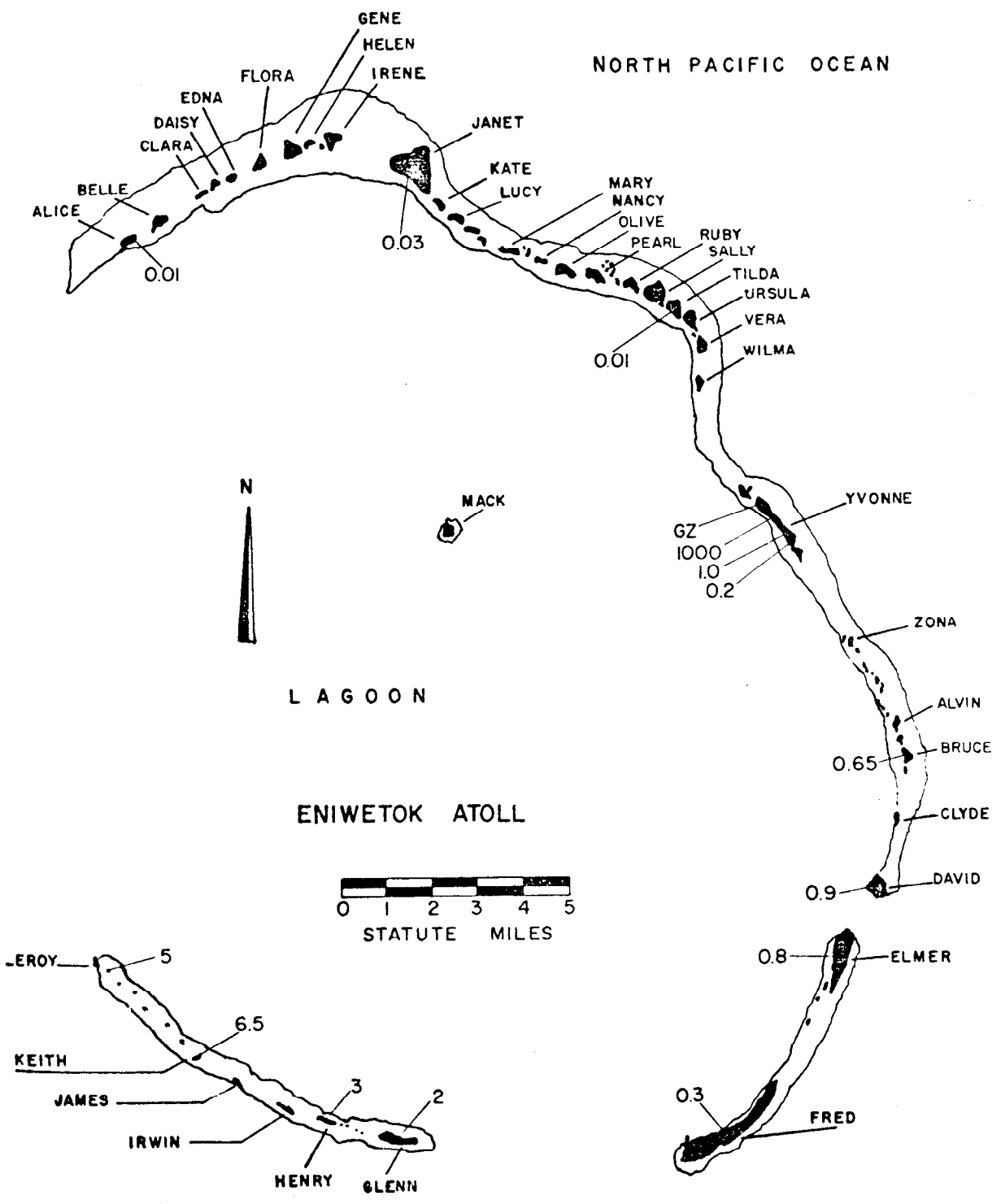


Figure 16. Operation GREENHOUSE - rates in r/hr at H+1 hour.

Dog. Atoll dose

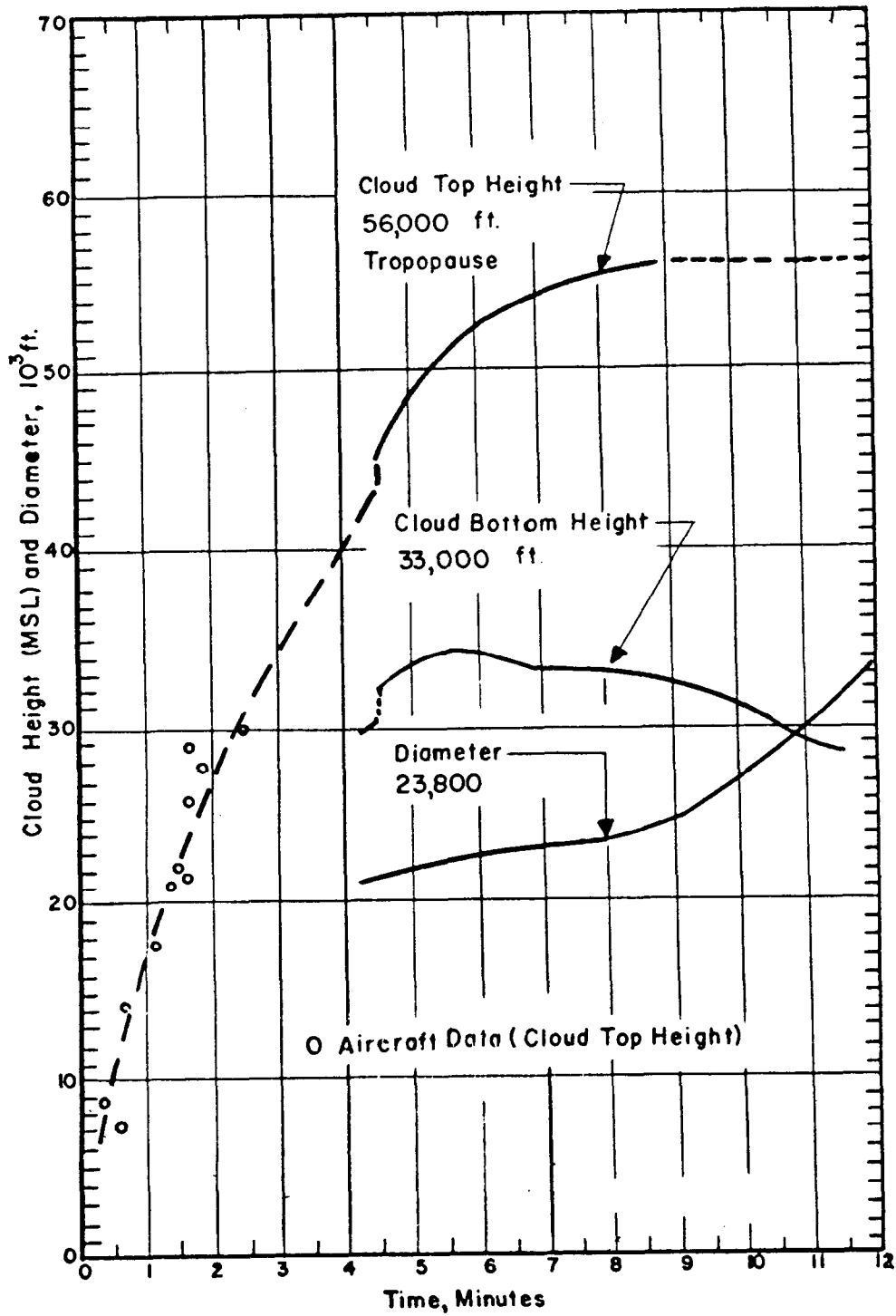


Figure 17. Cloud Dimensions: Operation GREENHOUSE -

Dog.

TABLE 6 ENIWETOK WIND DATA FOR OPERATION GREENHOUSE -

DOG

Altitude (MSL) feet	H-hour		H+2½ hours	
	Dir degrees	Speed mph	Dir degrees	Speed mph
Surface	070	22	040	21
4,000	080	33	---	--
5,000	(080)	(30)	090	24
6,000	080	26	---	--
10,000	080	22	100	25
14,000	070	21	070	25
15,000	(070)	(24)	(070)	(25)
16,000	070	29	070	24
20,000	030	22	050	22
25,000	300	12	340	17
30,000	280	31	290	29
35,000	230	29	230	29
40,000	220	33	230	37
45,000	280	26	250	31
50,000	310	22	330	29
55,000	340	31	360	36
60,000	030	33	---	--

## NOTES:

1. Numbers in parentheses are estimated values.
2. Tropopause height was 55,000 ft MSL at H-hour.
3. At H-hour at a pressure of 1000 mb the temperature was 25°C and the dew point 22°C.

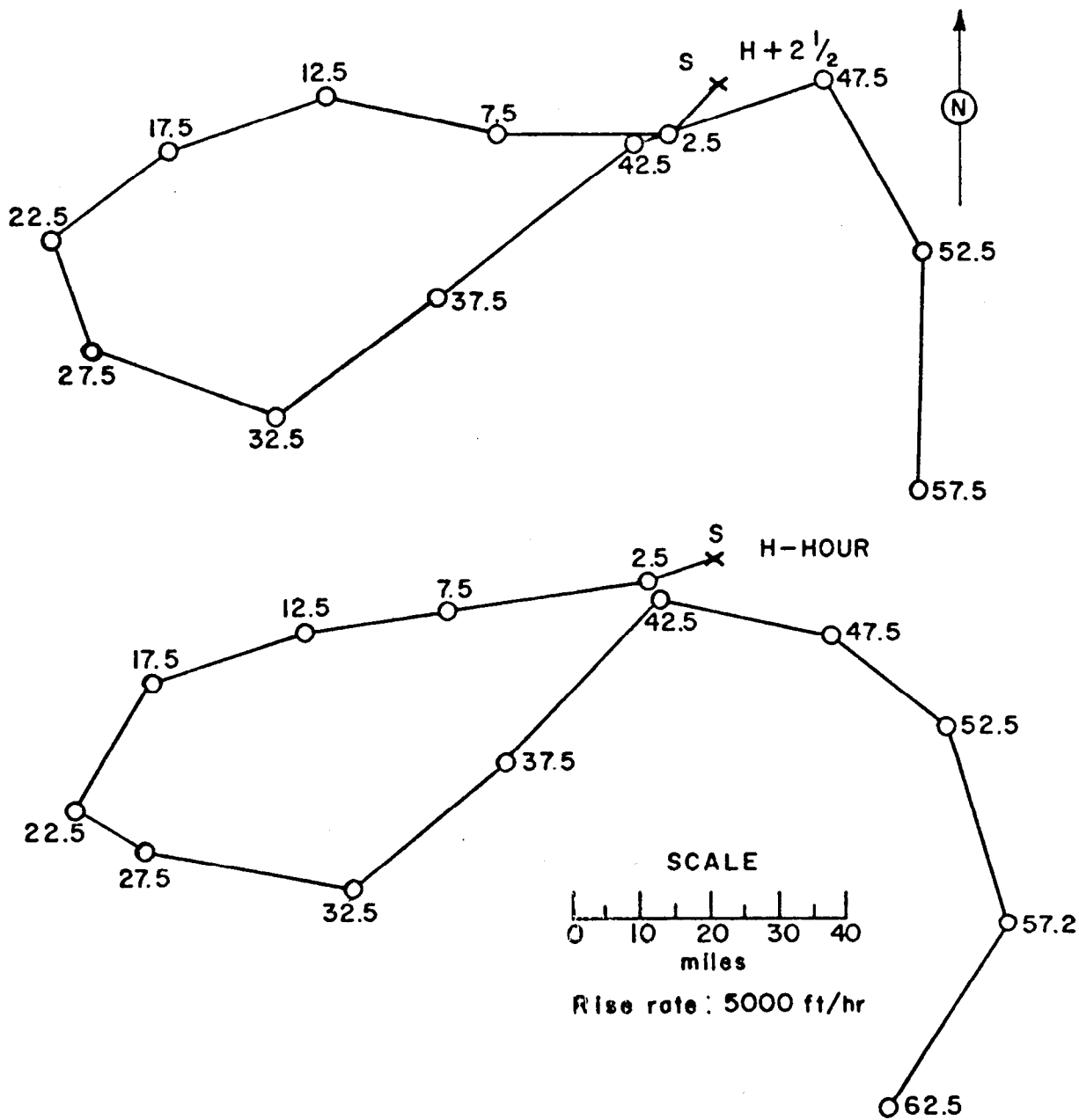


Figure 18. Hodographs for Operation GREENHOUSE - Dog.

OPERATION GREENHOUSE -

Easy

	<u>PPG time</u>	<u>GMT</u>
<u>DATE:</u>	21 Apr 1951	20 Apr 1951
<u>TIME:</u>	0627	1827

Sponsor: LASL

SITE: PPG - Eniwetok - Janet  
11° 40' 08" N  
162° 14' 25" E  
Site elevation: Sea level

TOTAL YIELD: 47 kt

HEIGHT OF BURST: 300 ft

TYPE OF BURST AND PLACEMENT:  
Tower burst over coral soil

FIREBALL DATA:

Time to 1st minimum: 19 to 29.5 msec  
Time to 2nd maximum: 200 to 230 msec  
Radius at 2nd maximum: NM

CLOUD TOP HEIGHT: 41,000 ft MSL  
CLOUD BOTTOM HEIGHT: 30,000 ft MSL

CRATER DATA: Diameter: 836 ft  
Depth: 2.4 ft

REMARKS:

The fallout readings on the shot island were obtained by the Radiological Safety organization at H+28 hours and corrected to H+1 hours, using the  $t^{-1.2}$  decay approximation. Dose rates shown for other islands are based upon daily surveys made to determine field decay rates. Readings were made 1 meter above the ground with gamma ionization chambers. The values shown were corrected to H+1 hour by extrapolating from the experimental decay curves. There was a wind shear at about 15,000 feet.

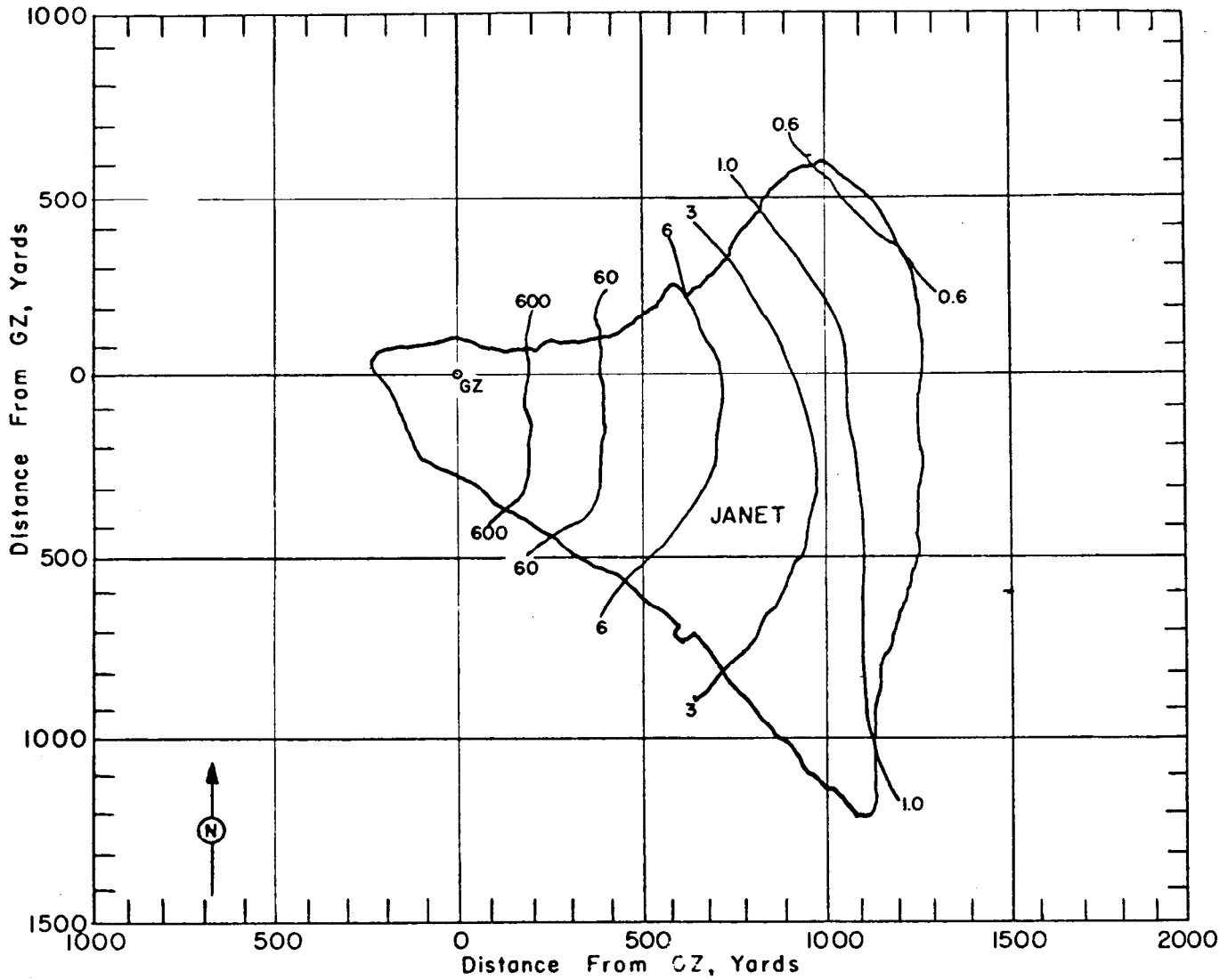


Figure 19. Operation GREENHOUSE - Easy. Shot Island dose rate contours in r/hr at H+1 hour.

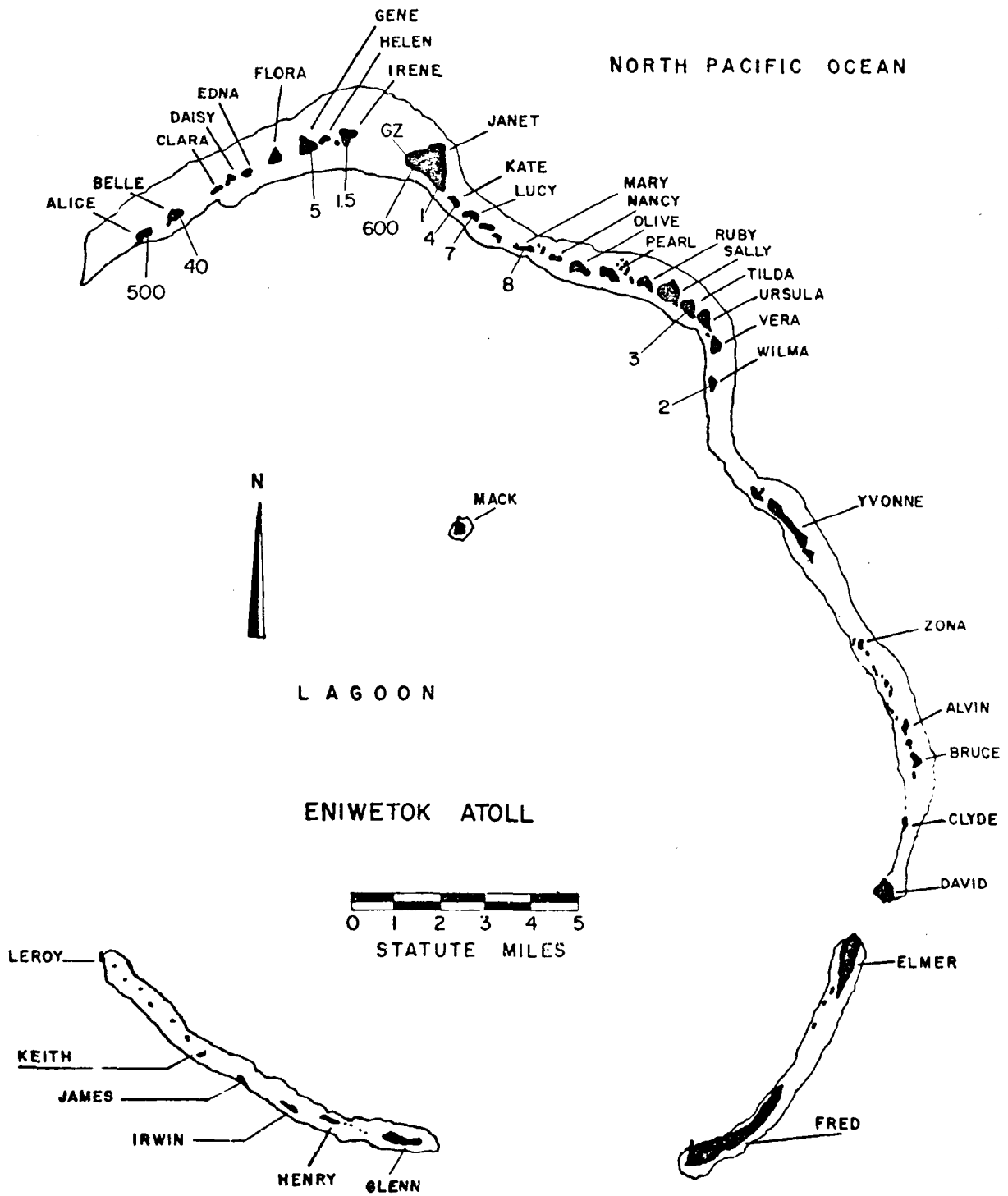


Figure 20. Operation GREENHOUSE - rates in r/hr at H+1 hour.

Easy. Atoll dose

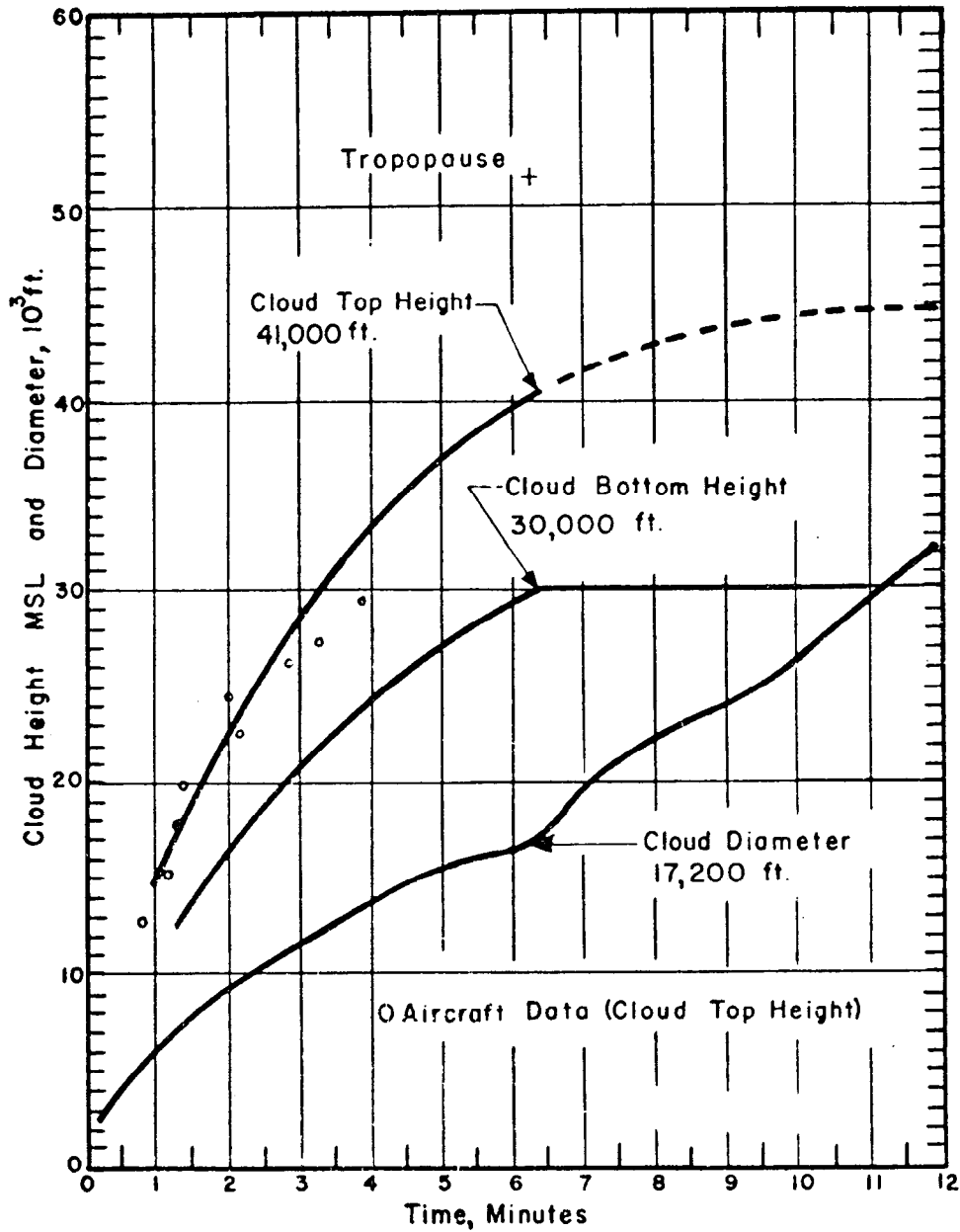


Figure 21. Cloud Dimensions: Operation GREENHOUSE -

Easy.



TABLE 7 ENIWETOK WIND DATA FOR OPERATION GREENHOUSE - EASY

Altitude (MSL) feet	H-3 $\frac{1}{2}$ hours		H-hour		H+2 $\frac{1}{2}$ hours		H+8 $\frac{1}{2}$ hours	
	Dir degrees	Speed mph	Dir degrees	Speed mph	Dir degrees	Speed mph	Dir degrees	Speed mph
Surface	050	16	060	16	070	17	070	20
5,000	100	09	080	13	070	16	090	06
10,000	070	08	090	06	100	05	200	14
14,000	210	03	---	--	220	07	210	07
15,000	---	--	240	06	(230)	(07)	(230)	(08)
16,000	280	07	---	--	250	07	260	10
20,000	310	03	330	04	360	05	Calm	Calm
25,000	320	13	350	13	300	08	310	22
30,000	260	20	270	28	270	15	270	40
35,000	270	28	280	31	280	35	270	46
40,000	280	32	280	37	280	40	270	40
45,000	260	35	270	38	260	37	240	28
50,000	270	28	260	32	260	30	250	30
55,000	350	35	240	23	340	12	230	06
60,000	330	15	330	15	---	--	---	--

NOTES:

1. Numbers in parentheses are estimated values.
2. H-hour values were determined by interpolating between the H-3 $\frac{1}{2}$  and H+2 $\frac{1}{2}$  hour values.
3. Tropopause height was 53,000 ft MSL at H-hour.
4. At H-hour at a pressure of 1,000 mb the temperature was 25°C and the dew point 21°C.

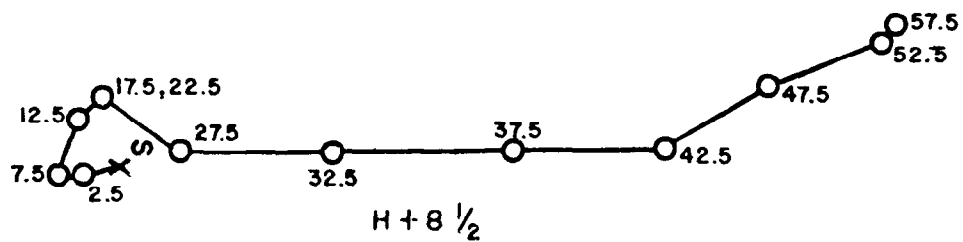
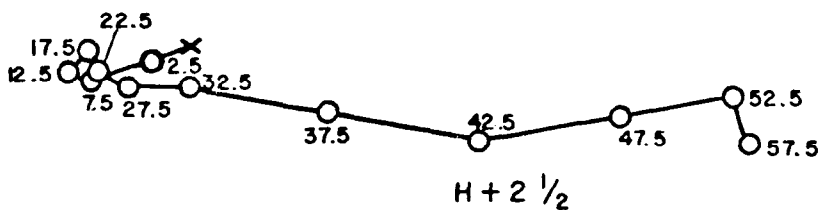
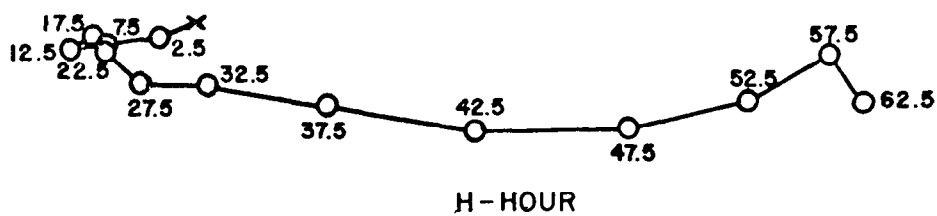
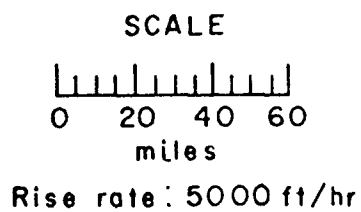


Figure 22. Hodographs for Operation GREENHOUSE -

Easy.

OPERATION GREENHOUSE -

George

	<u>PPG time</u>	<u>GMT</u>
<u>DATE:</u>	9 May 1951	8 May 1951
<u>TIME:</u>	0930	2130

Sponsor: IASL

SITE: PPG - Eniwetok - Ruby  
11° 37' 37" N  
162° 18' 53" E

Site elevation: Sea level.

HEIGHT OF BURST: 200 ft

TYPE OF BURST AND PLACEMENT:  
Tower burst over coral soil

CLOUD TOP HEIGHT: 56,000 ft MSL  
CLOUD BOTTOM HEIGHT: 41,000 ft MSL

REMARKS:

The survey readings on the shot island were obtained at H+24 hours and extrapolated to H+1 hour using the  $t^{-1.2}$  decay approximation. Since the winds were from the west-southwest throughout their entire structure, no radiation reading higher than twice background was observed on islands beyond 2,000 yards from ground zero.

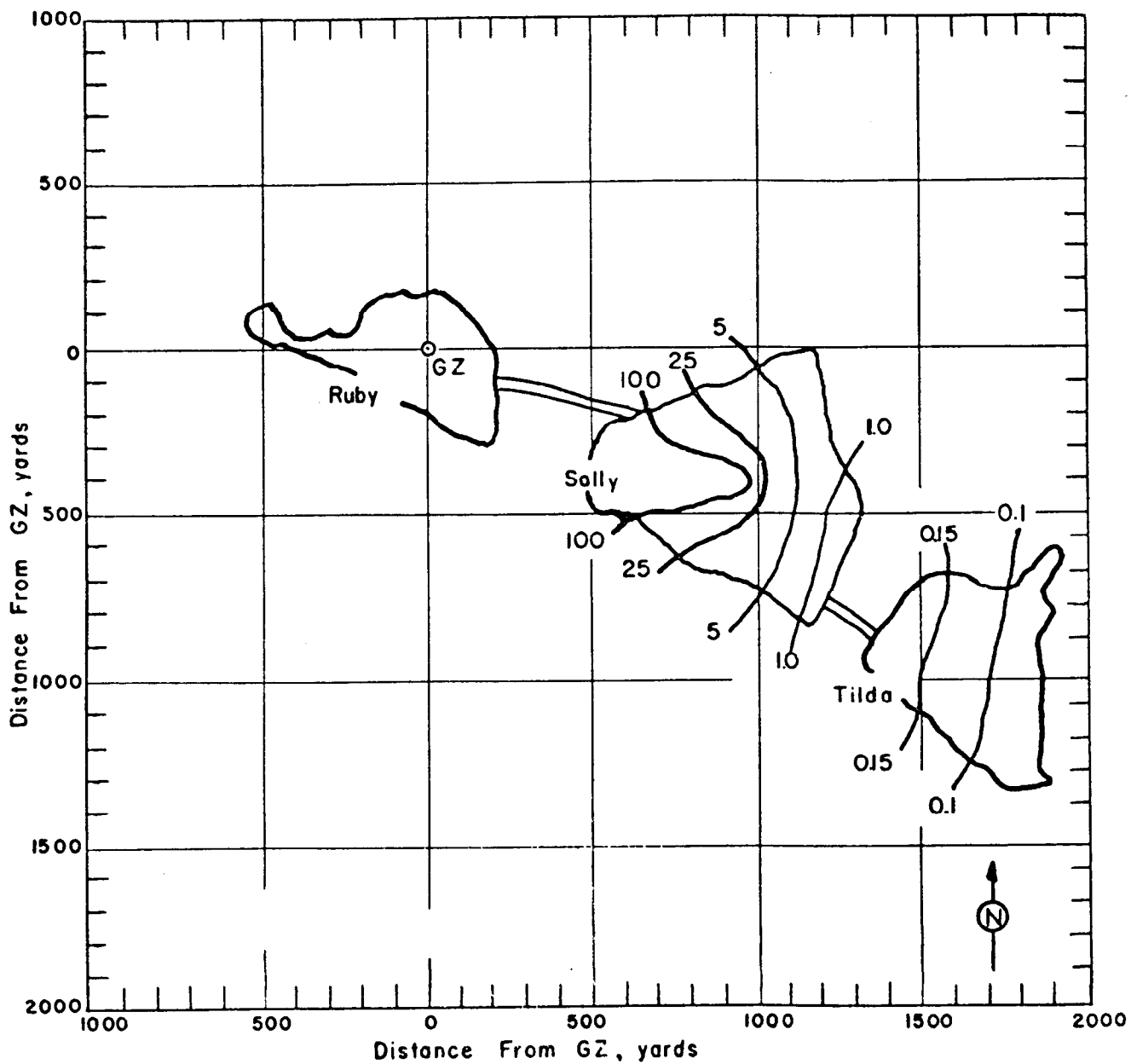


Figure 23. Operation GREENHOUSE - George. On-site dose rate contours in r/hr at H+1 hour.

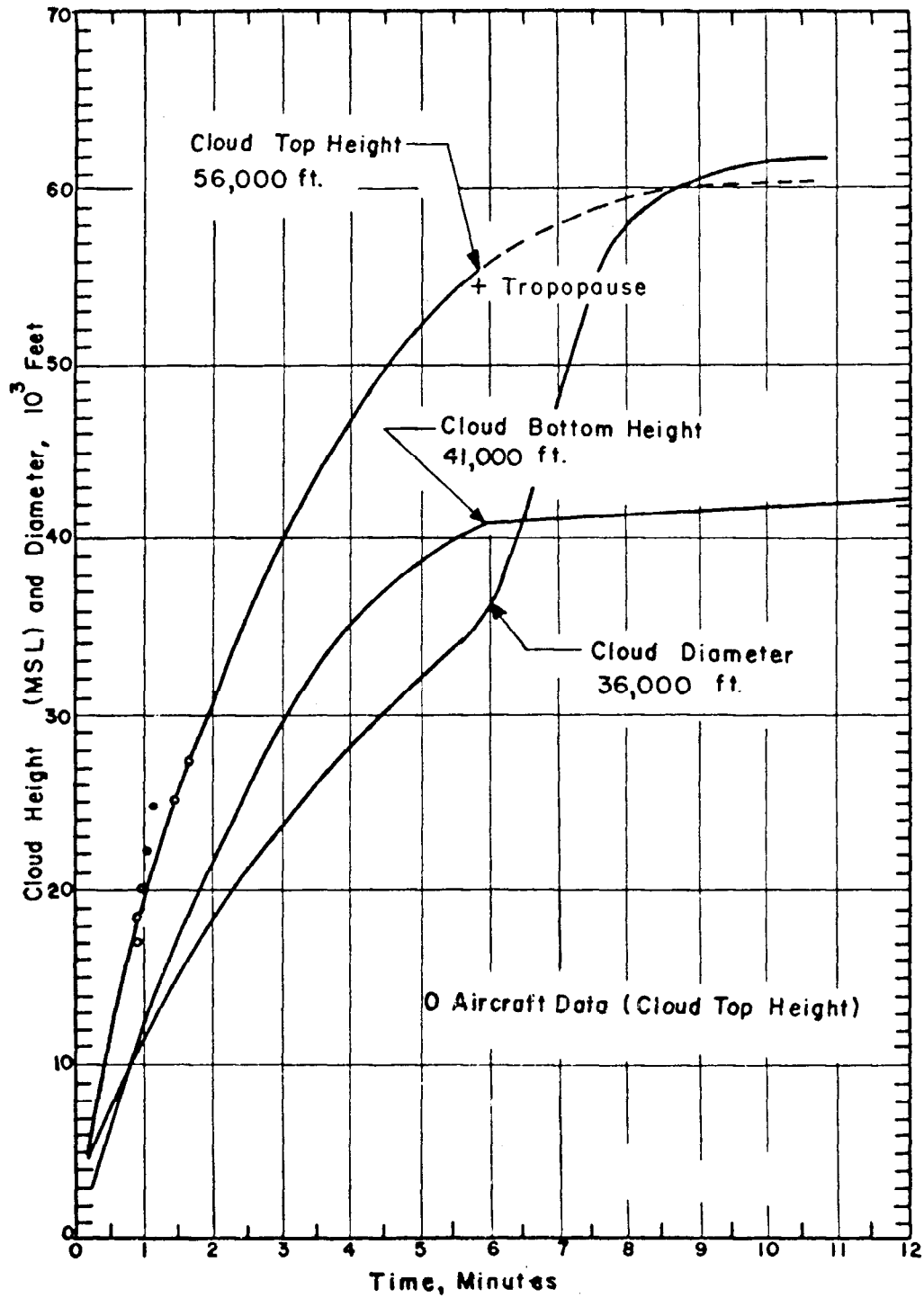


Figure 24 . Cloud Dimensions: Operation GREENHOUSE -

George.

TABLE 8 ENIWETOK WIND DATA FOR OPERATION GREENHOUSE -

GEORGE

Altitude (MSL) feet	H-hour		H+6 hours		H+12 hours	
	Dir degrees	Speed mph	Dir degrees	Speed mph	Dir degrees	Speed mph
Surface	240	14	260	16	130	12
4,000	260	35	---	--	---	--
5,000	(250)	(32)	260	25	220	15
6,000	250	31	---	--	---	--
10,000	250	48	270	31	260	26
14,000	---	--	260	30	270	41
15,000	260	26	(260)	(31)	(260)	(40)
16,000	---	--	260	32	260	39
20,000	230	23	220	32	260	23
25,000	190	25	200	23	240	37
30,000	230	24	180	20	180	33
35,000	270	20	160	18	160	31
40,000	290	18	200	13	160	26
45,000	170	03	010	07	170	16
50,000	310	15	---	--	030	41
55,000	020	12	---	--	---	--

## NOTES:

1. Numbers in parentheses are estimated values.
2. Tropopause height was 55,000 ft MSL at H-hour.
3. At H-hour at a pressure of 1,000 mb the temperature was 27°C and the dew point 23°C.

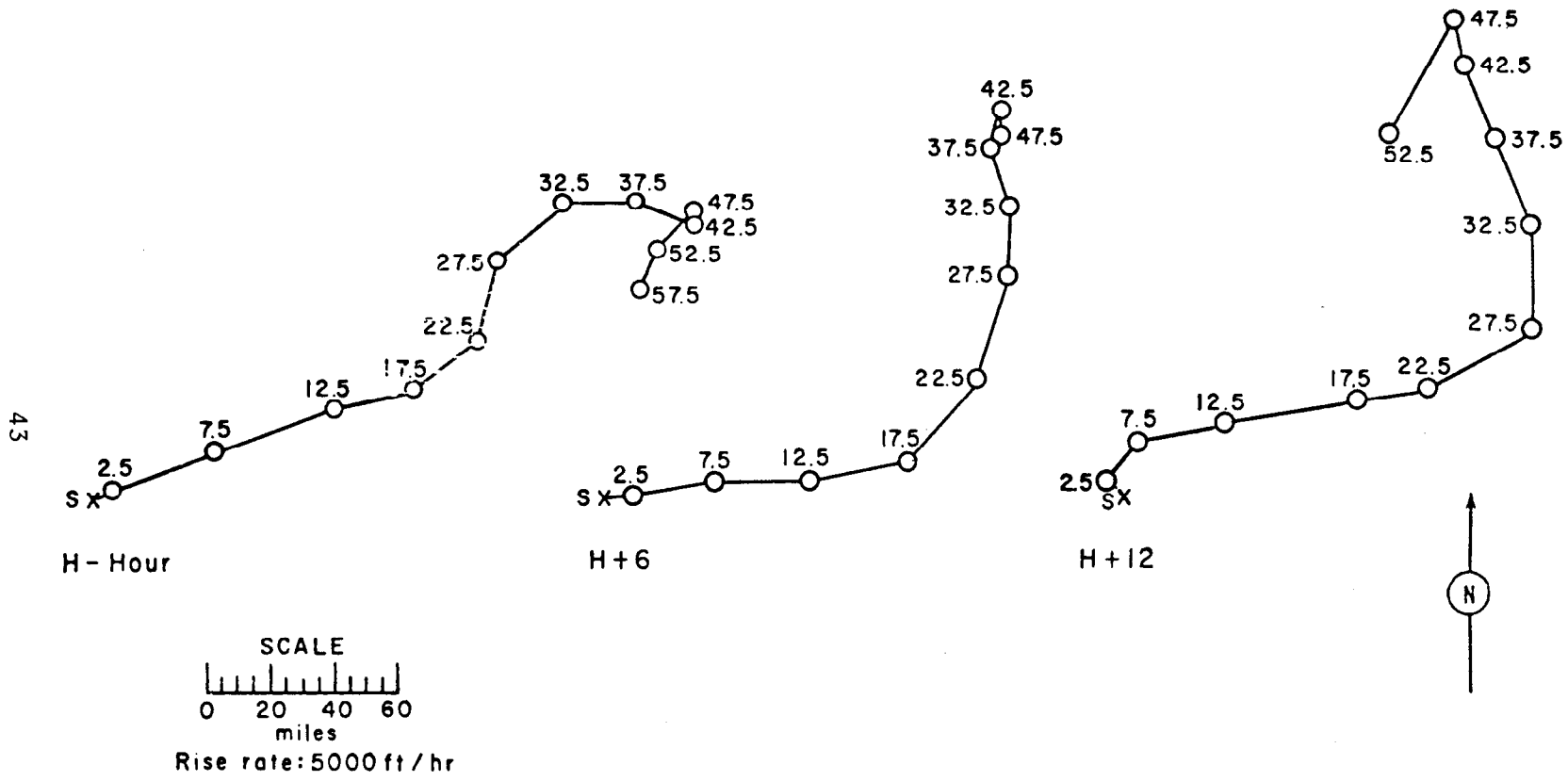


Figure 25. Hodographs for Operation GREENHOUSE -

George.

OPERATION GREENHOUSE -

Item

	<u>PPG Time</u>	<u>GMT</u>
<u>DATE:</u>	25 May 1951	24 May 1951
<u>TIME:</u>	0617	1817

Sponsor: LASL

SITE: PPG - Eniwetok - Janet  
11° 40' 23" N  
162° 14' 55" E  
Site elevation: Sea level

HEIGHT OF BURST: 200 ft

TYPE OF BURST AND PLACEMENT:  
Tower burst over coral soil

CLOUD TOP HEIGHT: 40,000 ft MSL  
CLOUD BOTTOM HEIGHT: NM

REMARKS:

The survey readings of the shot island, Janet, were obtained by the Radiological Safety Organization at H+24 and H+72 hours and extrapolated to H+1 hour by the  $t^{-1.2}$  decay approximation. Most readings were obtained from a helicopter flying at an altitude of 10 to 20 feet and the observations were considered representative of readings 3 feet above ground. Such readings may be low by 20 to 50 percent.



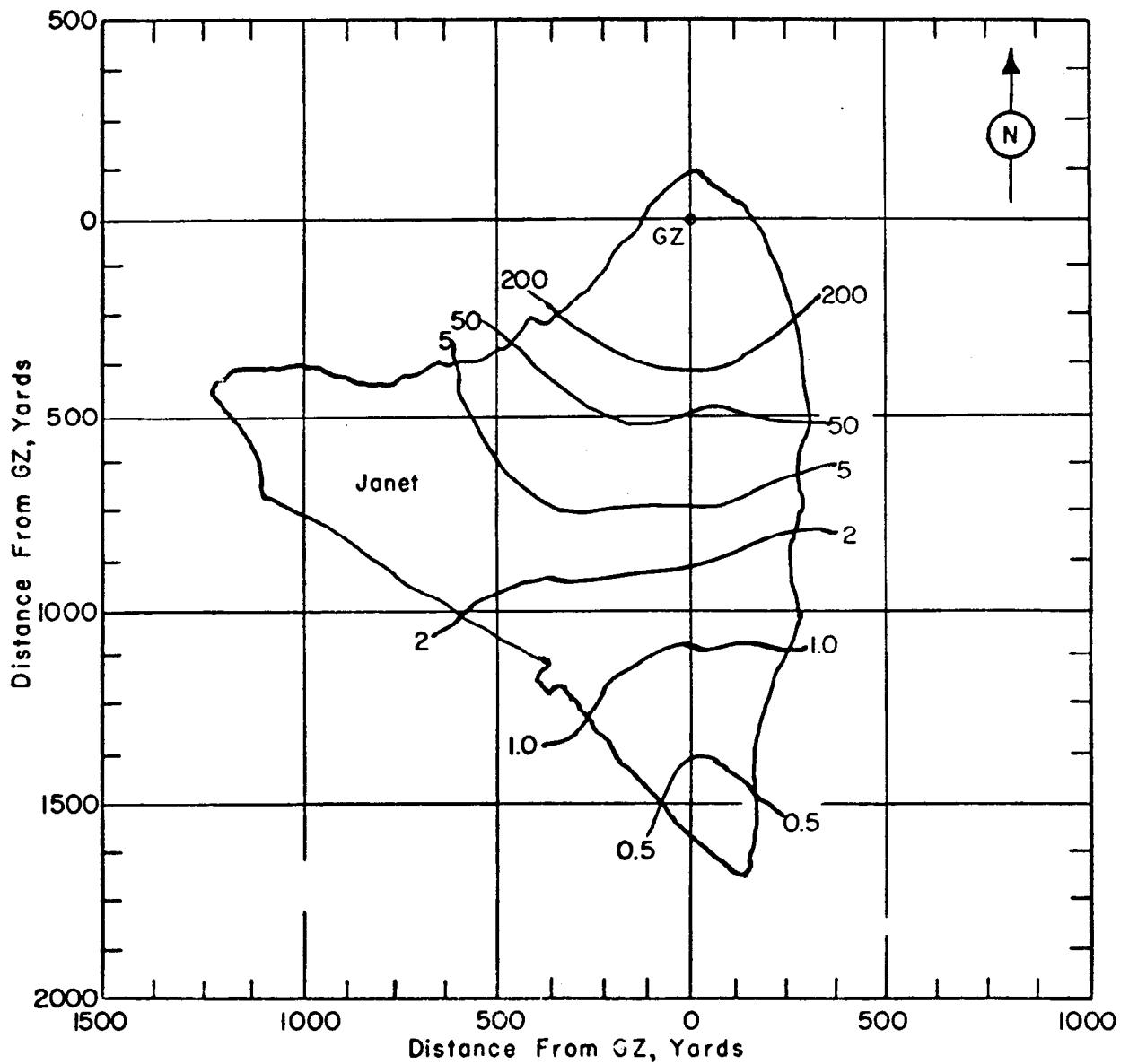


Figure 26 . Operation GREENHOUSE - Item. Shot Island  
dose rates in r/hr at H+1 hour.

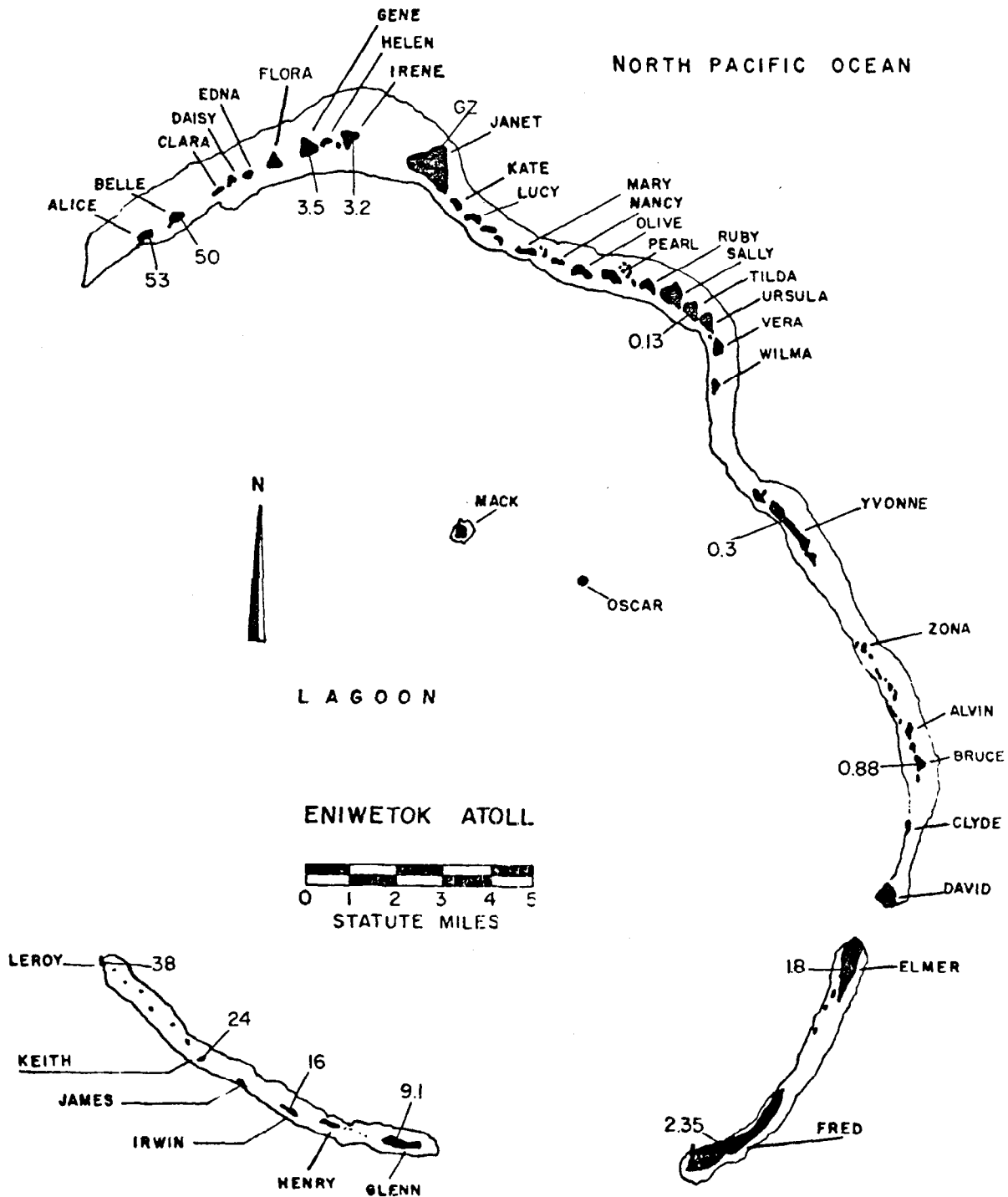


Figure 27 . Operation GREENHOUSE - rates in r/hr at H+1 hour.

Item. Atoll dose

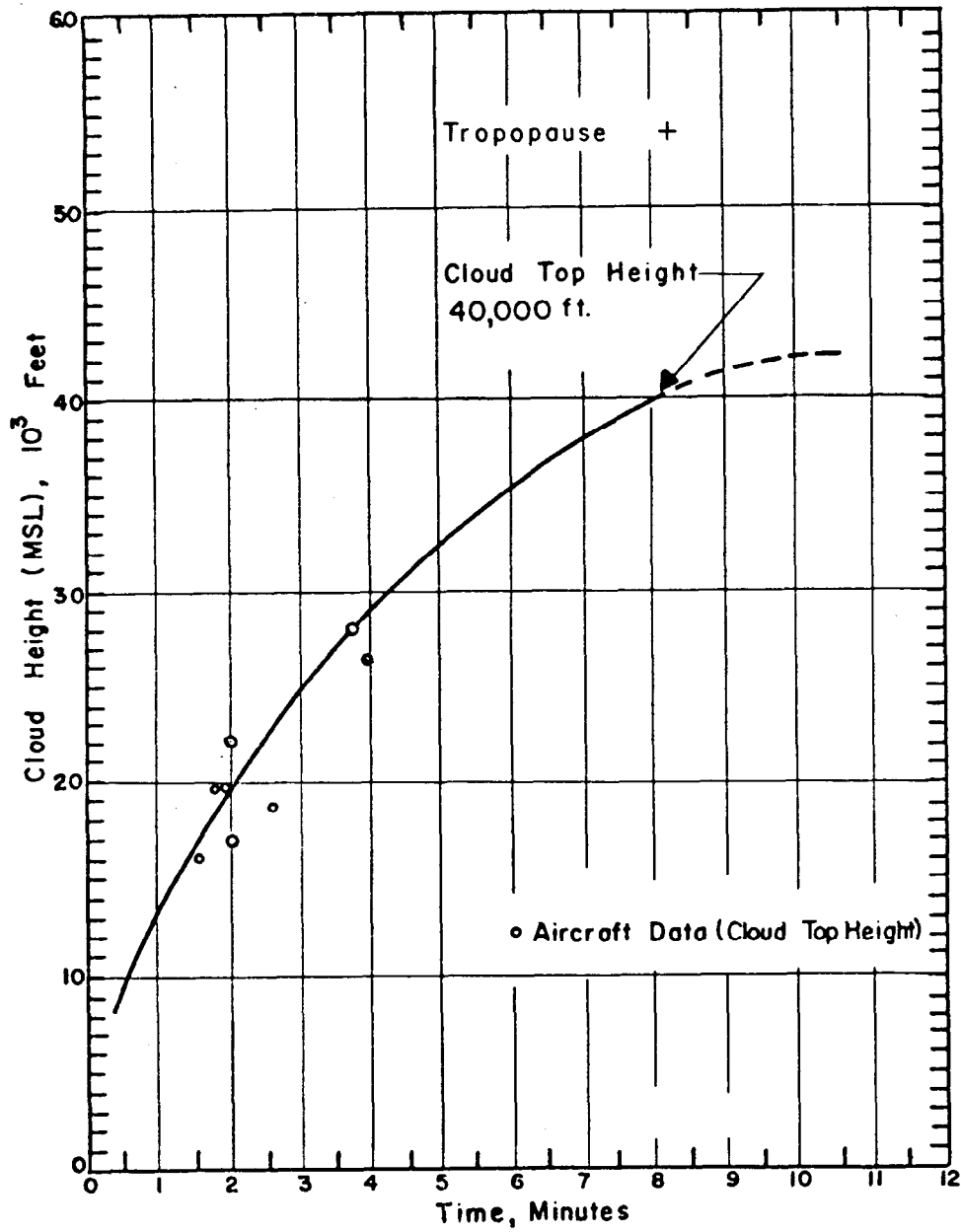


Figure 28. Cloud Dimensions: Operation GREENHOUSE -

Item

TABLE 9 ENIWETOK WIND DATA FOR OPERATION GREENHOUSE -

ITEM

Altitude (MSL) feet	H-hour		H+2 $\frac{3}{4}$ hours		H+8 $\frac{3}{4}$ hours	
	Dir degrees	Speed mph	Dir degrees	Speed mph	Dir degrees	Speed mph
Surface	070	15	070	22	070	15
5,000	090	16	080	17	090	15
10,000	090	05	060	02	Calm	Calm
14,000	250	10	250	10	250	09
15,000	(260)	(09)	(260)	(09)	(270)	(10)
16,000	280	(08)	270	09	290	13
20,000	290	09	300	10	310	16
25,000	250	12	360	09	350	13
30,000	360	10	---	--	350	12
35,000	250	09	---	--	250	06
40,000	280	08	---	--	---	--
45,000	150	08	---	--	---	--
50,000	330	10	---	--	---	--

## NOTES:

1. Numbers in parentheses are estimated values.
2. Tropopause height was 55,000 ft MSL at H-hour.
3. At H-hour at a pressure of 1,000 mb the temperature was 31°C and the dew point 23°C.

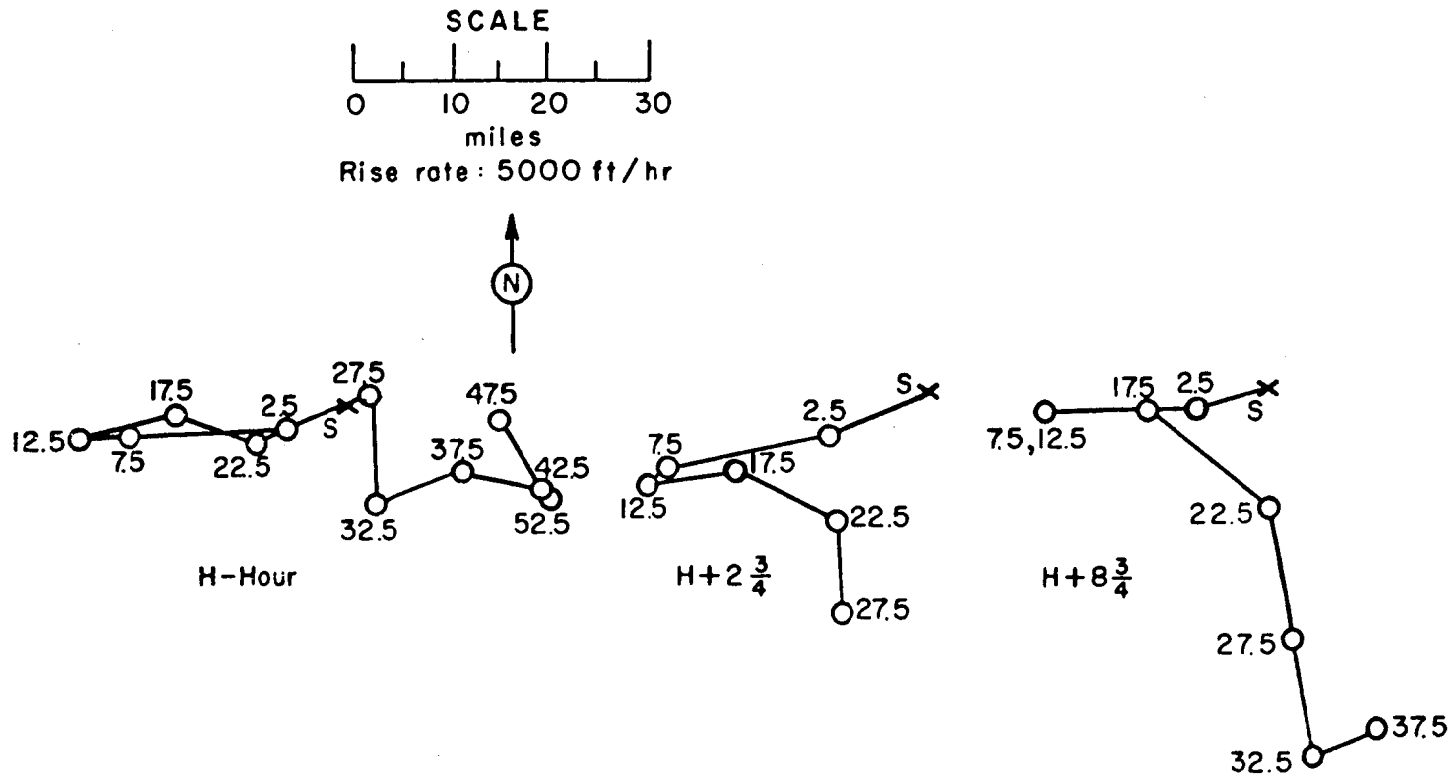


Figure 29. Hodographs for Operation GREENHOUSE -

Item.

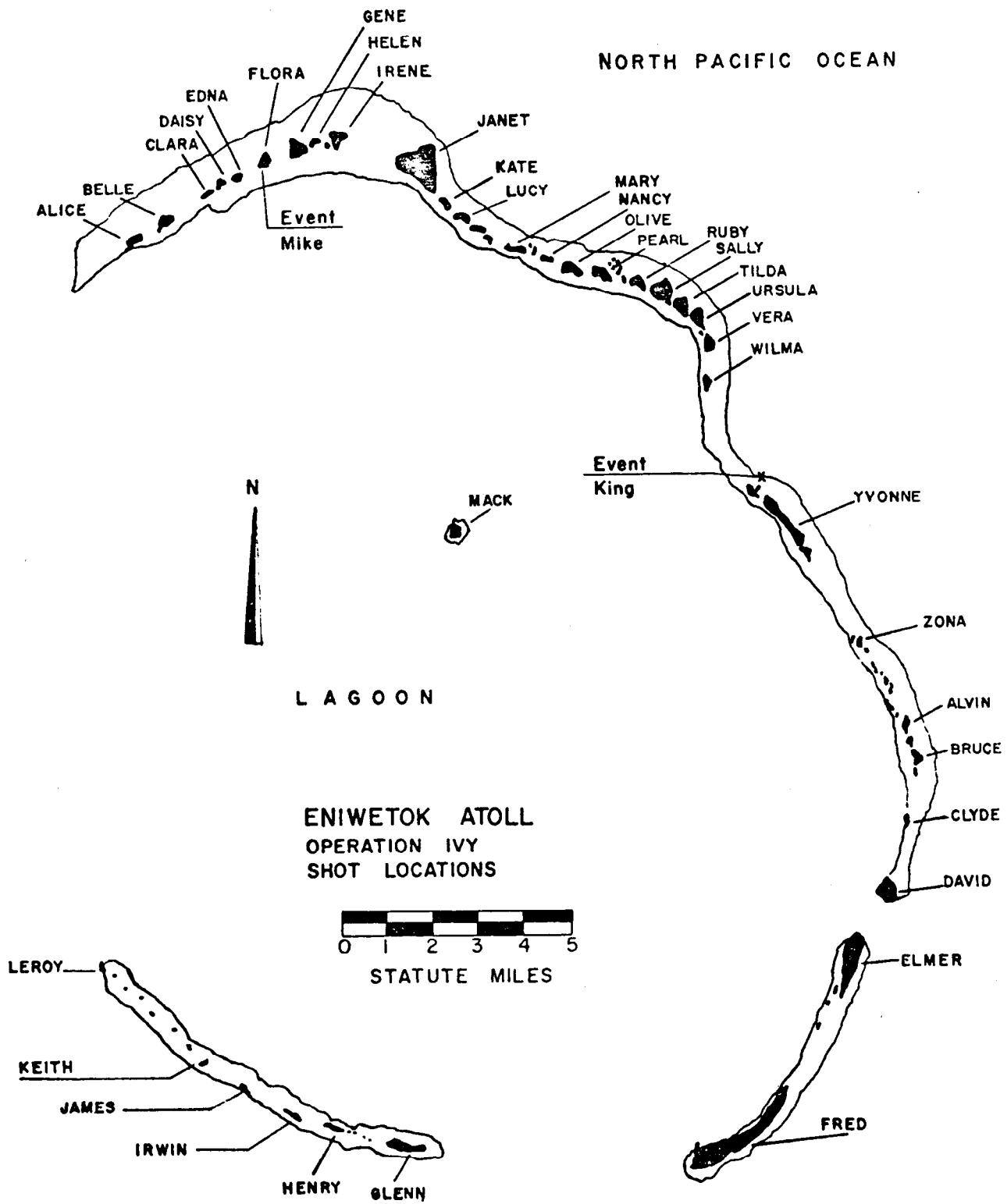


Figure 30. Operation IVY, Shot Locations.

OPERATION IVY - Mike

	<u>PPG time</u>	<u>GMT</u>
<u>DATE:</u>	1 Nov 1952	31 Oct 1952
<u>TIME:</u>	0715	1915

Sponsor: LASL

SITE: PPG - Eniwetok - Flora  
11° 14' 14" N  
162° 11' 41" E  
Site elevation: Sea level

TOTAL YIELD: 10.4 mt

HEIGHT OF BURST: Surface

FIREBALL DATA:

Time to 1st minimum: 270 to 310 msec  
Time to 2nd maximum: 3 to 3.5 sec  
Radius at 2nd maximum: NM

TYPE OF BURST AND PLACEMENT:  
Surface burst on coral soil  
and water

CLOUD TOP HEIGHT: 98,000 ft MSL  
CLOUD BOTTOM HEIGHT: 59,000 ft MSL

CRATER DATA: Diameter: 6,240 ft  
Depth: 164 ft

REMARKS:

Most of the fallout occurred over the open sea. Documentation of the fallout was thus limited to the islands and the lagoon of Eniwetok atoll. The lagoon dose rates were determined by multiplying the readings obtained on rafts by the factor 7. This factor is based upon the ratio of Operation Jangle field dose rates and readings taken over flat plates after their removal from the contaminated area. The data presented for the lagoon stations can thus be considered as approximations only. The island dose rates are based upon ground- and aerial-survey readings and were adjusted to H+1 hour by using the  $t^{-1.2}$  law to approximate the decay.

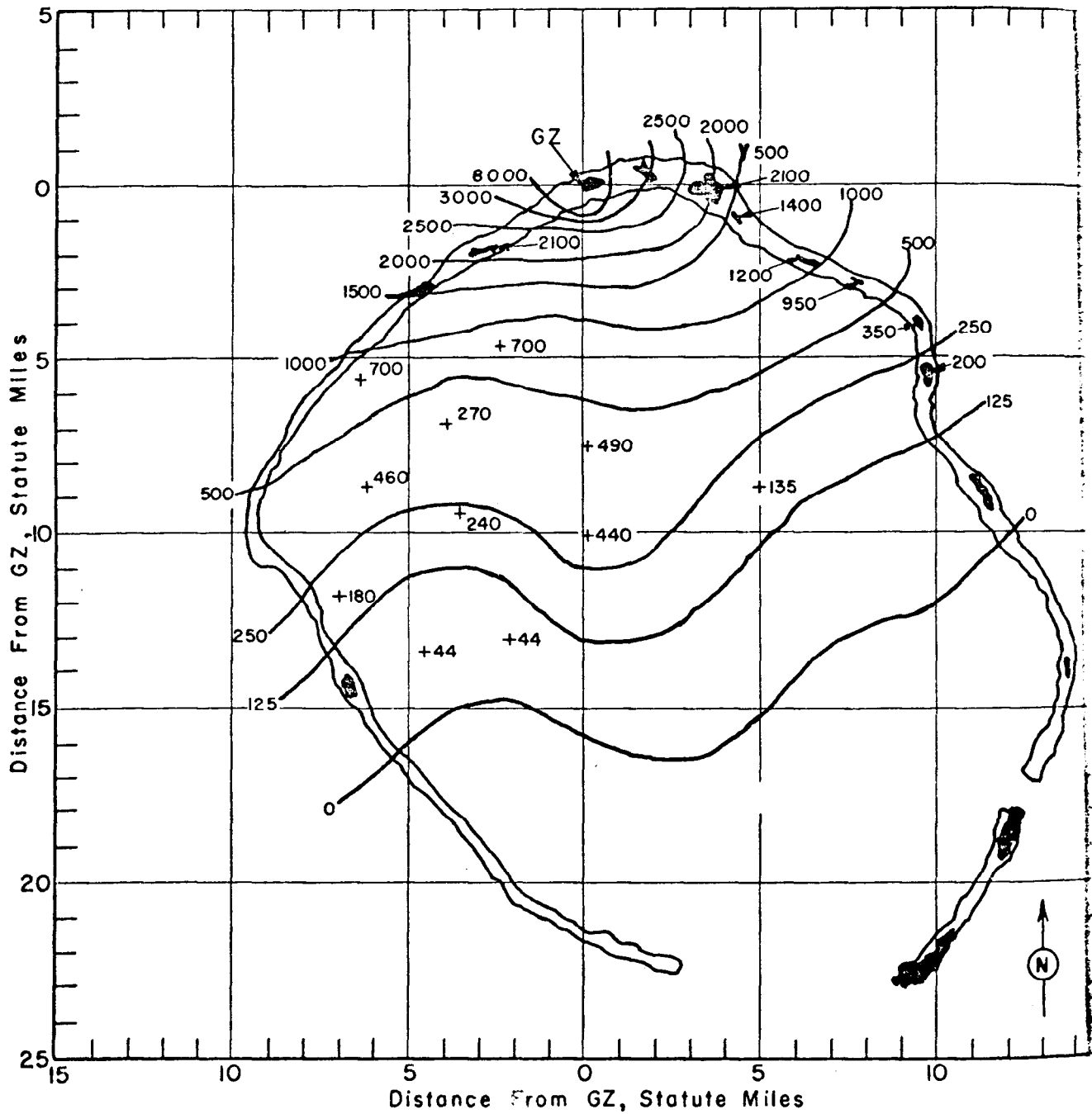


Figure 31 Operation IVY - Mike. Atoll dose rate contours in r/hr at H+1 hour.



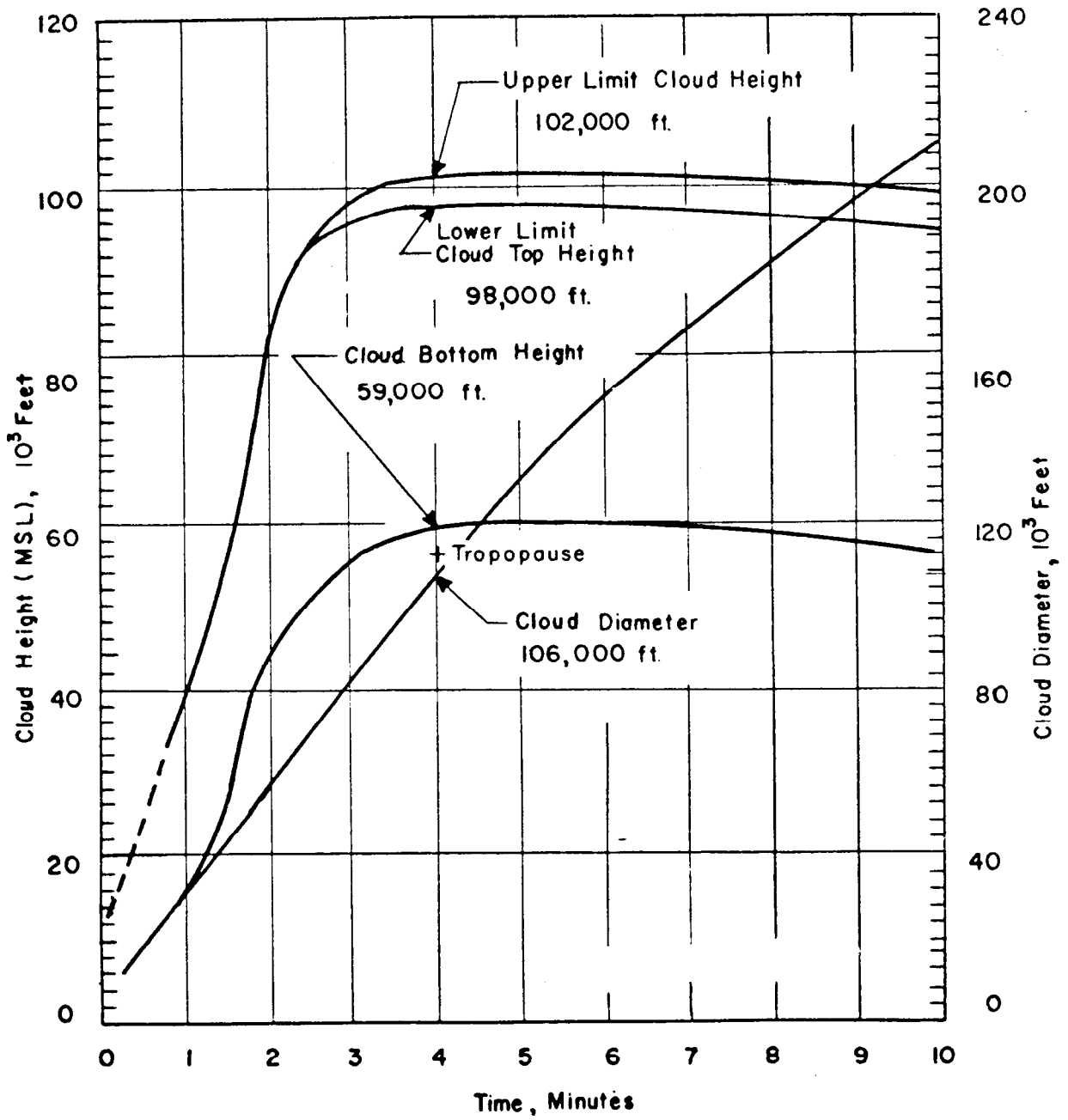


Figure 32 . Cloud Dimensions: Operation IVY - Mike.

TABLE 10 ENIWETOK WIND DATA FOR OPERATION IVY -

MIKE

Altitude (MSL) feet	H-hour	
	Dir degrees	Speed mph
Surface	090	05
5,000	090	16
10,000	095	17
15,000	115	17
20,000	125	14
25,000	170	15
30,000	220	20
40,000	230	17
50,000	220	14
60,000	040	09
70,000	100	23
80,000	085	09
90,000	280	12
100,000	250	23
110,000	300	23
120,000	040	06
130,000	Calm	Calm
135,000	Calm	Calm

## NOTES:

1. Tropopause height was 56,000 ft MSL at H-hour.
2. The surface air pressure was 14.66 psi, the temperature 29.4°C and the dew point 23.8°C.

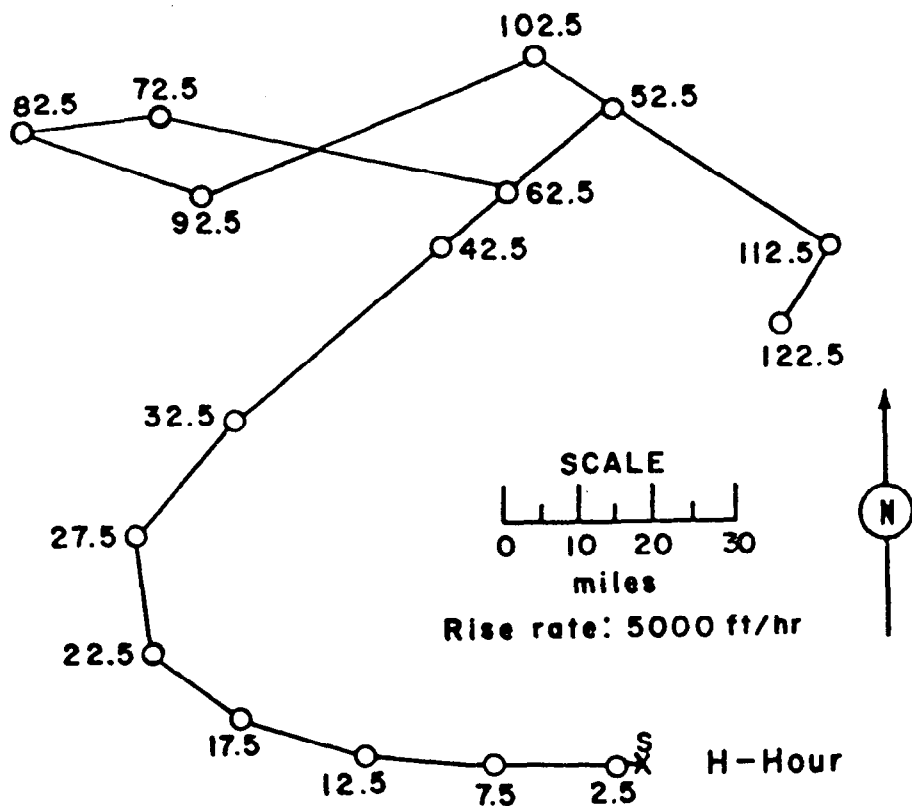


Figure 33 . Hodograph for Operation IVY - Mike.

OPERATION IVY - King

	<u>PPG time</u>	<u>GMT</u>
<u>DATE:</u>	16 Nov 1952	15 Nov 1952
<u>TIME:</u>	1130	2330

Sponsor: LASL

SITE: PPG - Reef northeast of  
north end of Yvonne  
11° 33' 44" N  
162° 21' 09" E  
Site elevation: Sea level

TOTAL YIELD: 500 kt

FIREBALL DATA:

Time to 1st minimum: 62 to 70 msec  
Time to 2nd maximum: 700 to 850 msec  
Radius at 2nd maximum: 1,968 ft

HEIGHT OF BURST: 1,480 ft

CRATER DATA: No crater

CLOUD TOP HEIGHT: 67,000 ft MSL  
CLOUD BOTTOM HEIGHT: 51,800 ft MSL

TYPE OF BURST AND PLACEMENT:  
Air burst over coral soil and  
sea water

REMARKS:

Contamination of the islands of Eniwetok atoll was generally masked by the contamination resulting from the earlier Mike shot. The dose rates indicated in figure 102 are estimates based upon readings taken from helicopters flying 25 feet above the ground. The estimates are corrected for dose-rate levels existing on D-1.

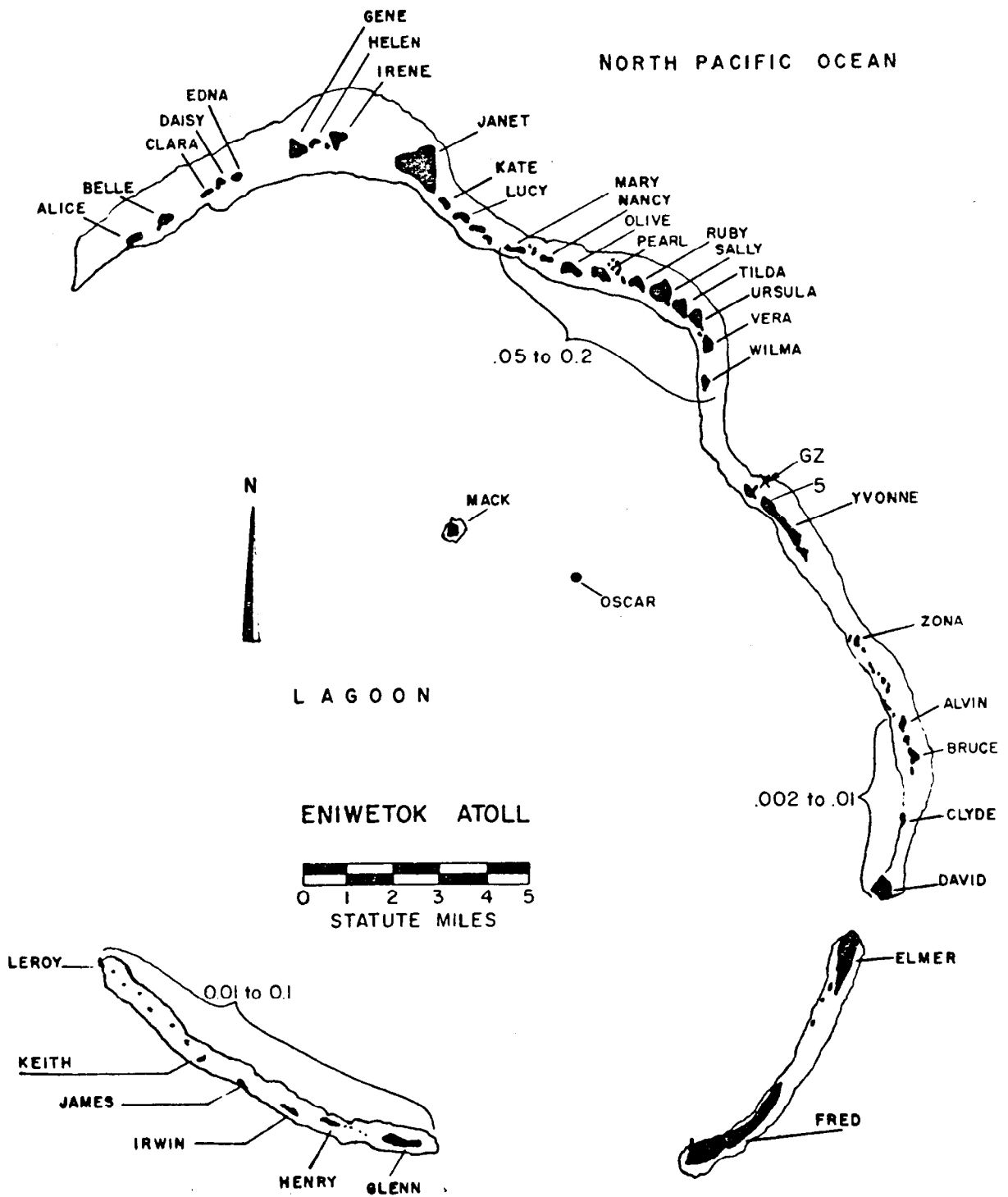


Figure 34. Operation IVY - King.  
Atoll dose rates in r/hr at H+1 hour.

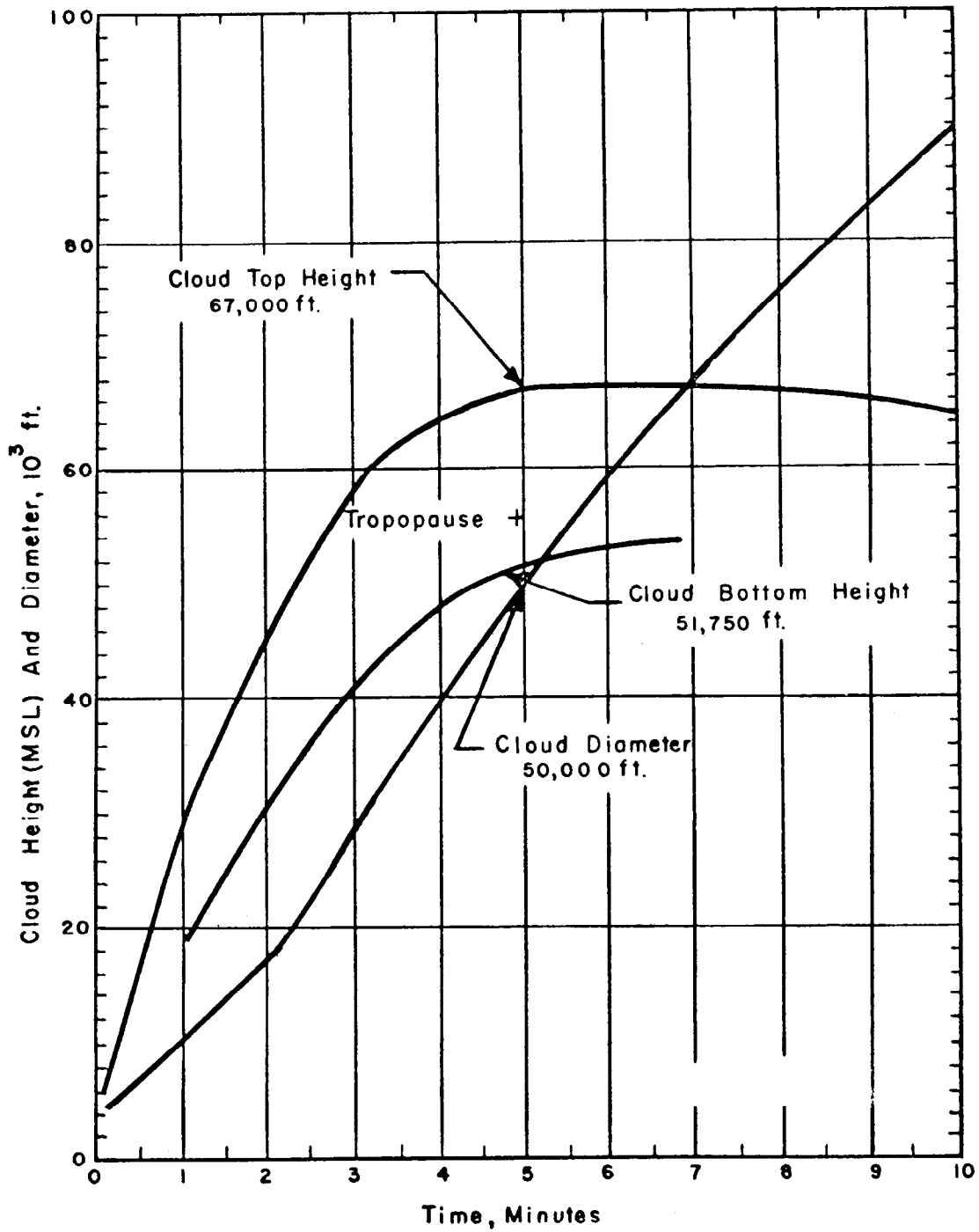


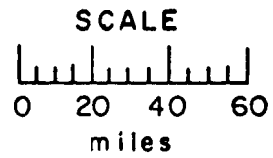
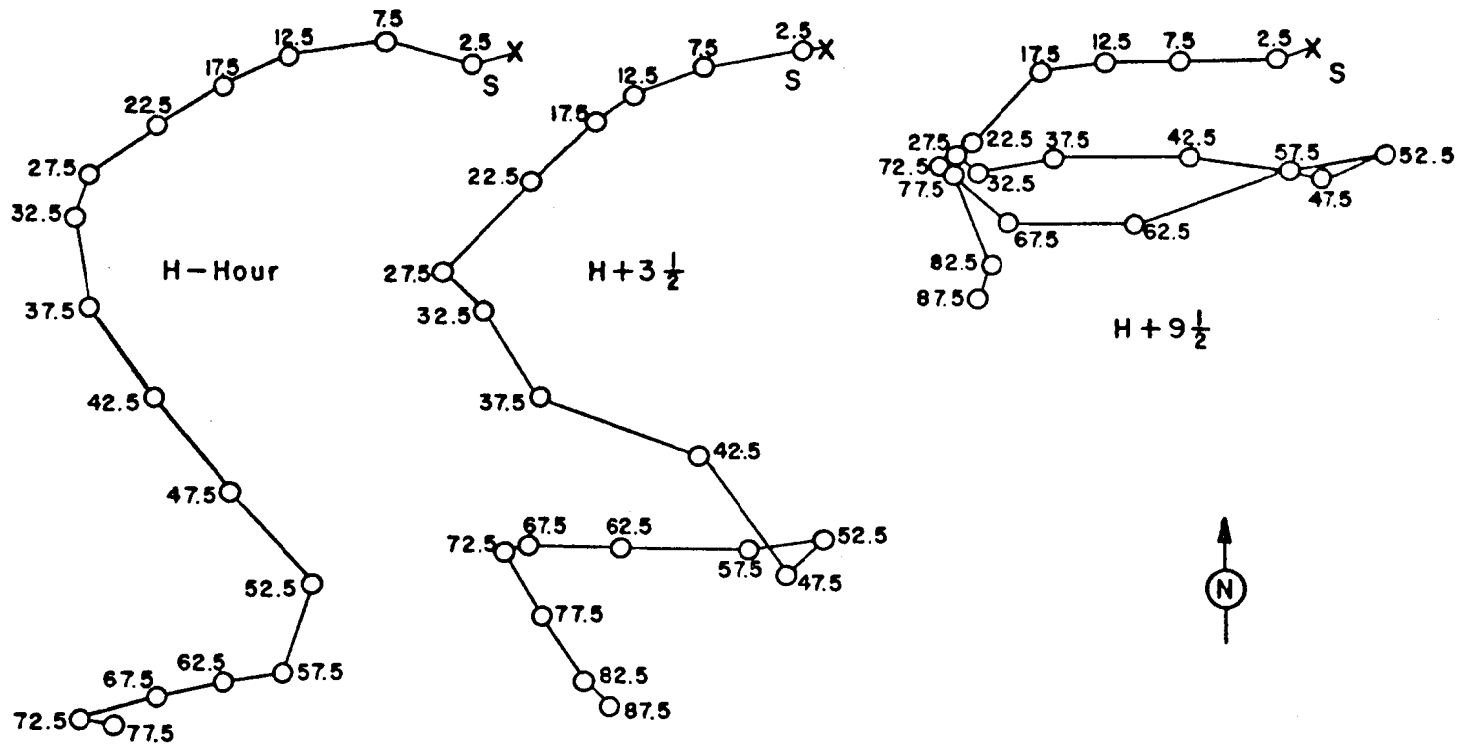
Figure 35. Cloud Dimensions: Operation IVY - King.

TABLE 11 ENIWETOK WIND DATA FOR OPERATION IVY - KING

Altitude (MSL) feet	H-hour		H+3½ hours		H+9½ hours	
	Dir degrees	Speed mph	Dir degrees	Speed mph	Dir degrees	Speed mph
Surface	070	20	080	22	070	24
5,000	105	23	080	26	090	26
10,000	085	23	070	20	090	20
14,000	---	--	070	12	080	13
15,000	069	19	---	--	---	--
16,000	060	16	040	12	070	17
20,000	059	20	050	23	040	25
25,000	056	24	050	33	050	05
30,000	018	13	310	13	300	06
35,000	(351)	(21)	330	26	260	18
40,000	325	28	290	44	070	33
45,000	(322)	(29)	320	36	280	45
50,000	320	30	230	08	050	17
55,000	(021)	(22)	080	20	080	26
60,000	083	14	090	33	070	43
65,000	(079)	(17)	090	24	090	32
70,000	076	21	070	05	130	23
75,000	288	07	330	18	300	05
80,000	---	--	320	18	340	23
85,000	---	--	310	09	020	08
90,000	---	--	320	06	---	--
95,000	---	--	260	32	---	--

NOTES:

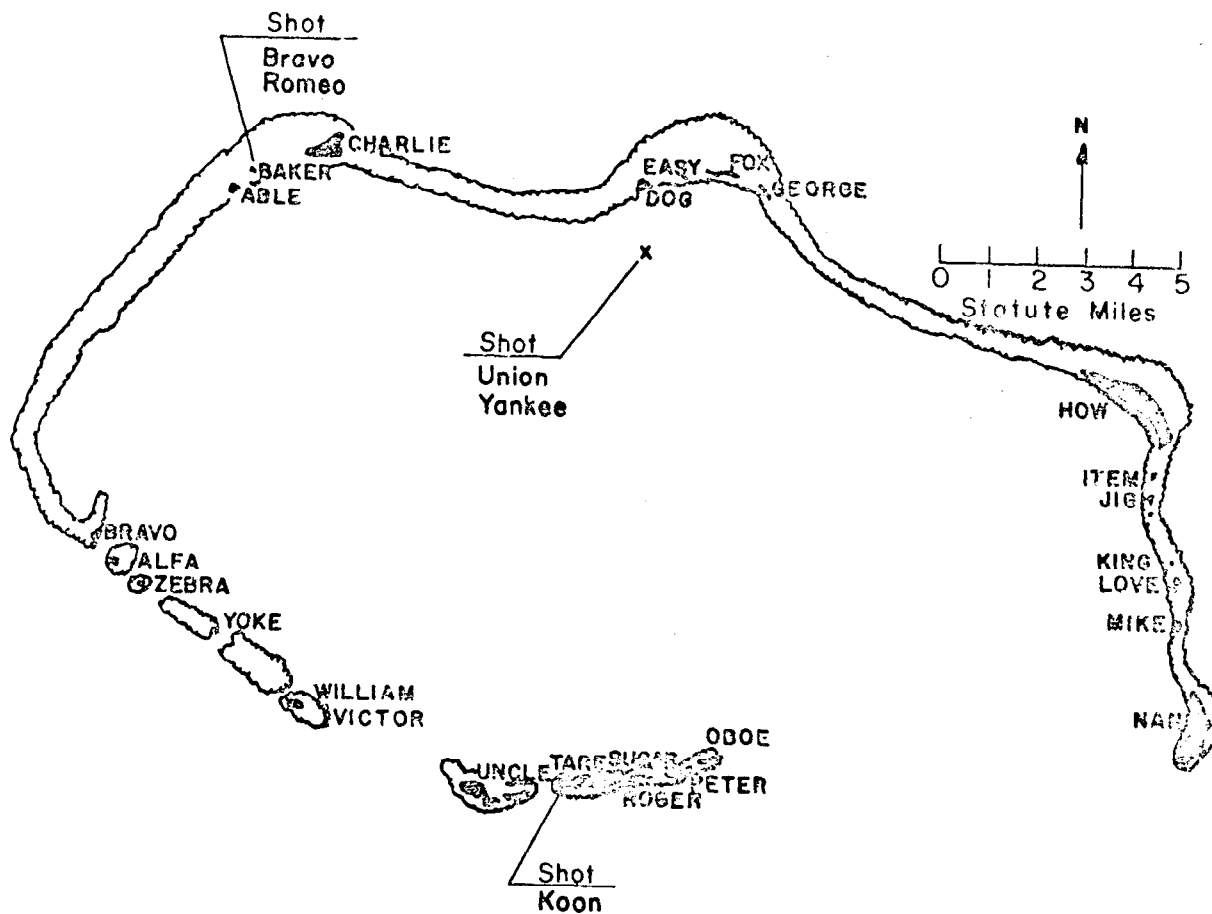
1. Numbers in parentheses are estimated values.
2. Tropopause height was 56,000 ft MSL at H-hour.
3. The surface air pressure was 14.66 psi, the temperature 28.0°C and the dew point 23.5°C.



Rise rate: 5000 ft/hr

Figure 36. Hodographs for Operation IVY - King.





BIKINI ATOLL  
OPERATION CASTLE  
SHOT LOCATIONS

Figure 37. Operation CASTLE, Shot Locations.

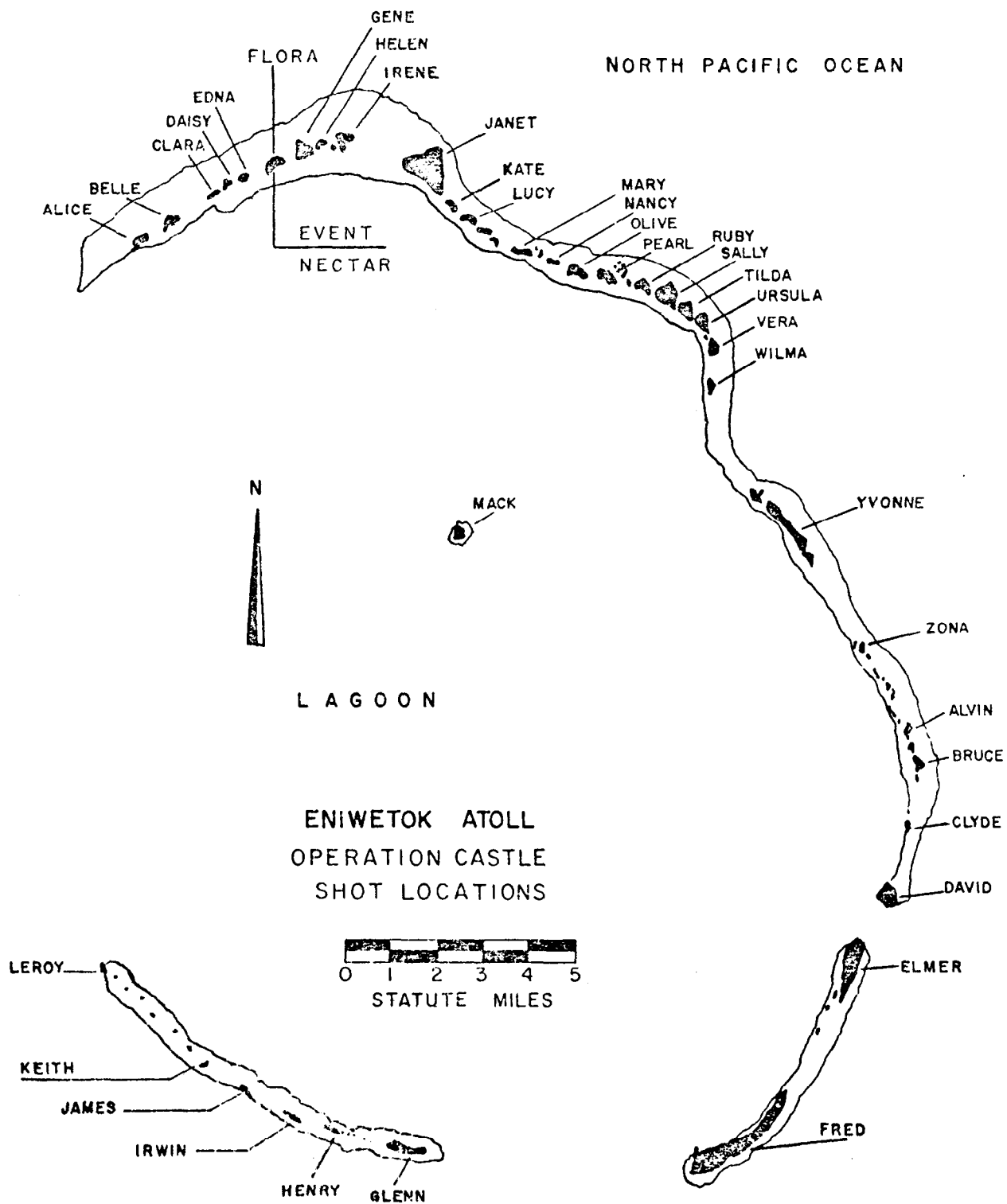


Figure 38. Operation 'CASTLE, Shot Locations.

OPERATION CASTLE -

Bravo

PPG Time                      GMT  
DATE: 1 Mar 1954      28 Feb 1954  
TIME: 0645              1845

Sponsor: IASL

TOTAL YIELD: 15 Mt

SITE: PPG - Bikini - on reef between  
Baker and Charlie  
11° 41' 27" N  
165° 16' 25" E  
Site elevation: Sea level

FIREBALL DATA:

Time to 1st minimum: 313 to 350 msec  
Time to 2nd maximum: 3.54 to 3.95 sec  
Radius at 2nd maximum: 9,512 ft

HEIGHT OF BURST: 7 ft

CLOUD TOP HEIGHT: 114,000 ft

CLOUD BOTTOM HEIGHT: 55,300 ft

TYPE OF BURST AND PLACEMENT:

Surface burst from platform on  
Coral soil

CRATER DATA: Diameter: 6,000 ft  
Depth: 240 ft  
Lip: Apparently  
washed away

REMARKS:

The on-site fallout pattern was constructed from survey measurements on Bikini Atoll, and from samples obtained with the total collectors and gummed paper collectors. The free-floating sea stations were not in the correct location to receive primary fallout. The data were extrapolated to H+1 hour by the composite gamma-ionization-decay curve obtained from samples measured in the laboratory.

This is the only megaton shot where some downwind land areas were unexpectedly contaminated; thus, partial documentation of fallout effects was possible. However, the major portion of the fallout occurred over the open ocean and was not documented. Because this shot is one of those used as the basis of fallout prediction for megaton yield weapons, three off-site fallout patterns are presented. The most widely known pattern is shown in Figure 40. It was constructed immediately after the event from the preliminary data available at Iqs, AFSWP. The second pattern was constructed by NRDL by establishing an experimental model; the field data plus a thorough analysis of the wind structure existing at and after shot time was used. The third pattern was constructed by RAND Corp., by supplementing field observations with model calculations.

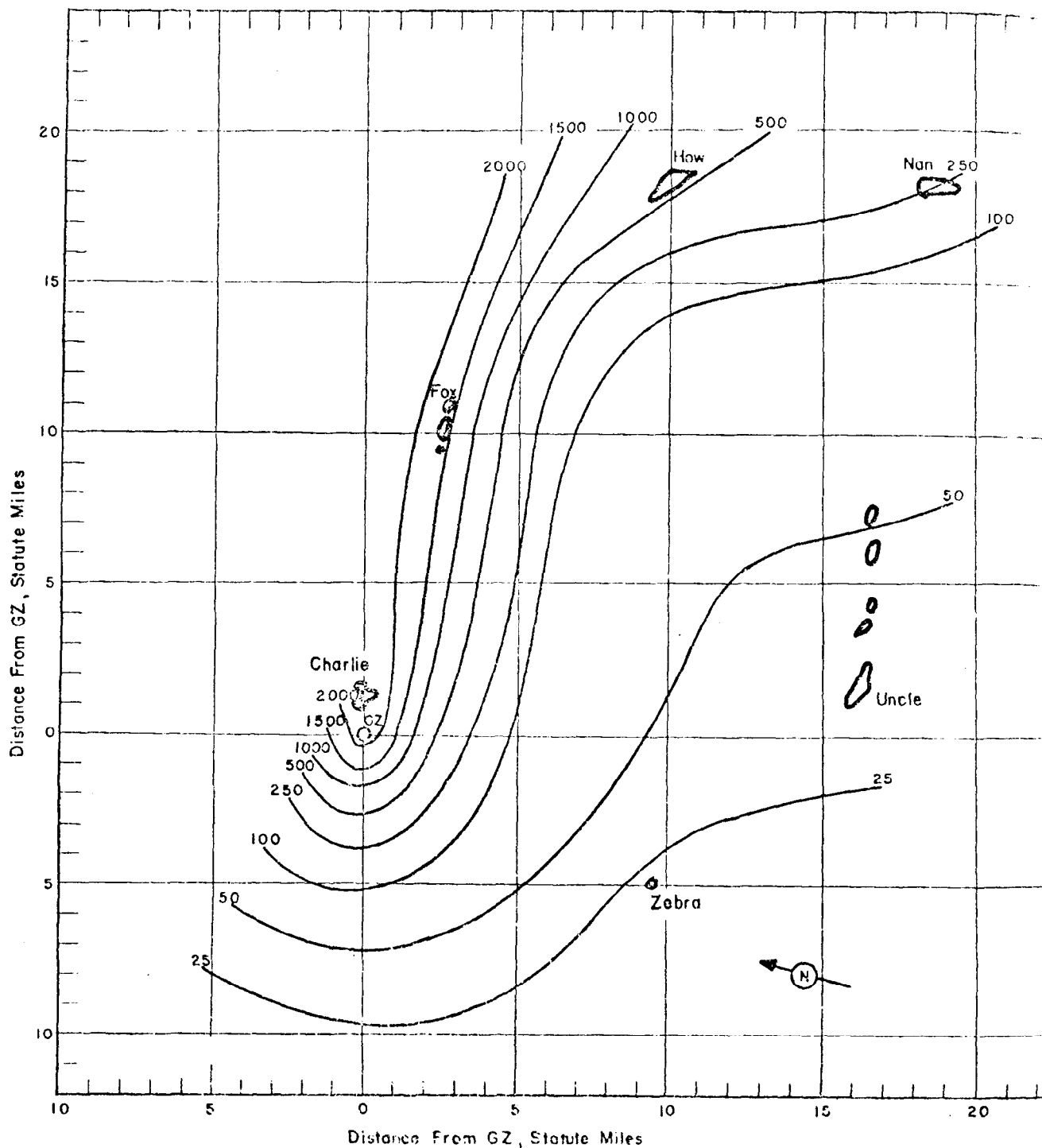


Figure 39. Operation CASTLE - Bravo.  
On-site dose rate contours in r/hr at H+1 hour.

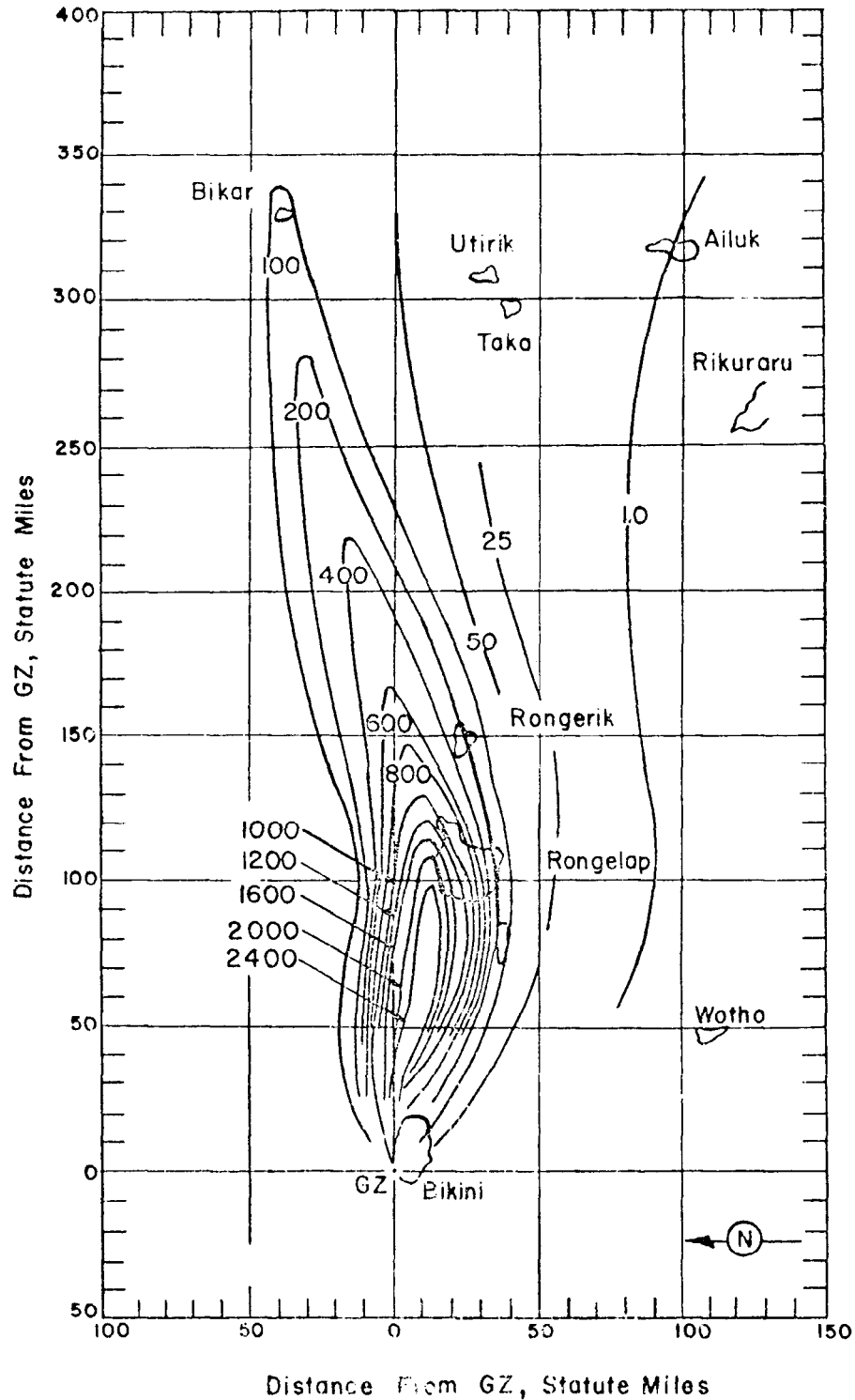


Figure 40 . Operation CASTLE - Bravo.  
Off-site dose rate contours in r/hr at H+1 hour (AFSWF).

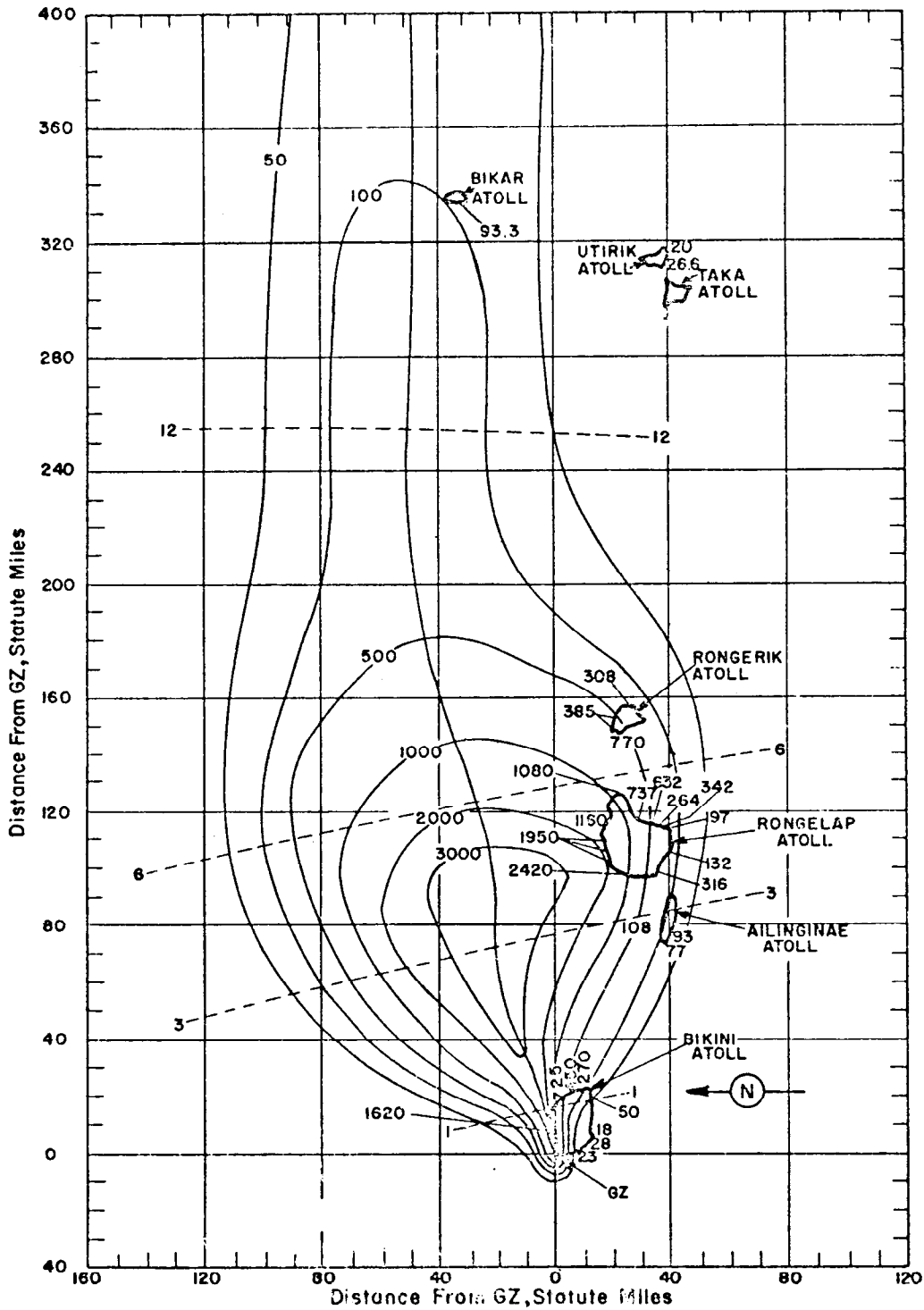


Figure 41 Operation CASTLE - Bravo.  
Off-site dose rate contours in r/hr at H+1 hour (NRDL).

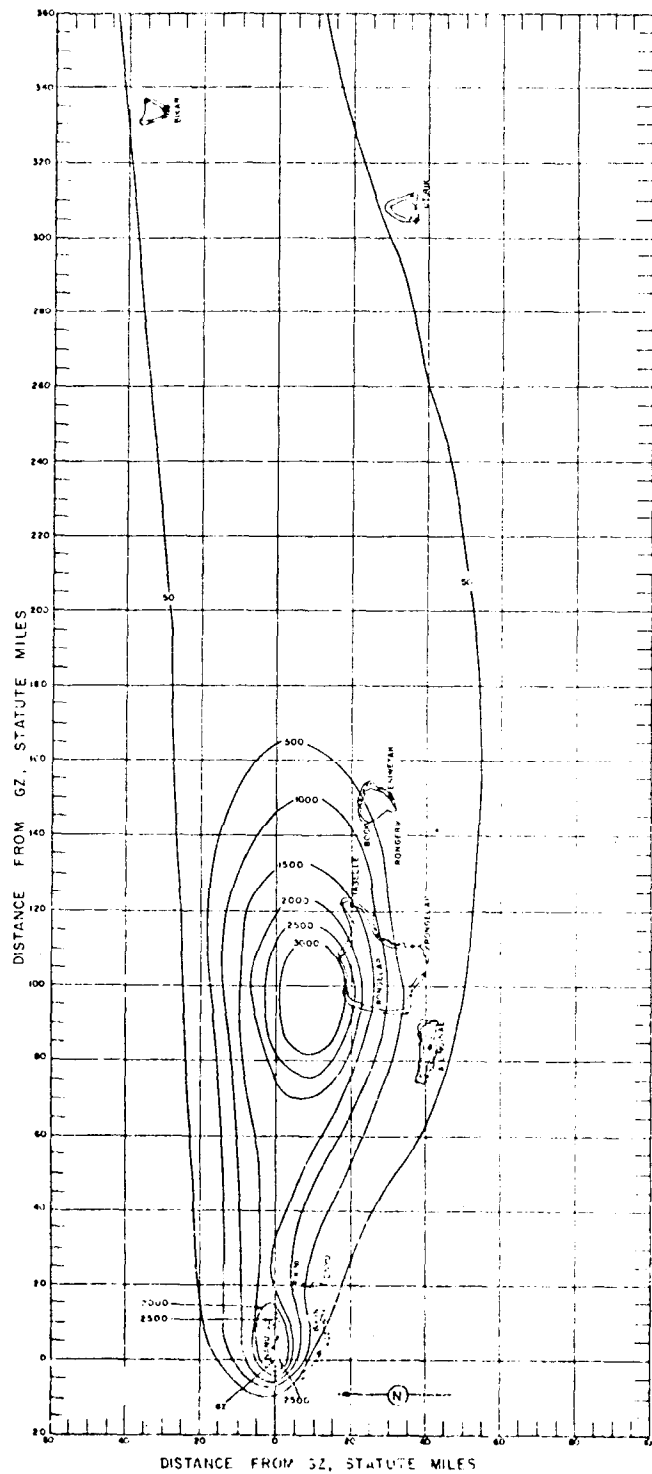


Figure 42. Operation CASTLE - Bravo.  
Off-site dose rate contours in r/hr at H+1 hour (RAND).

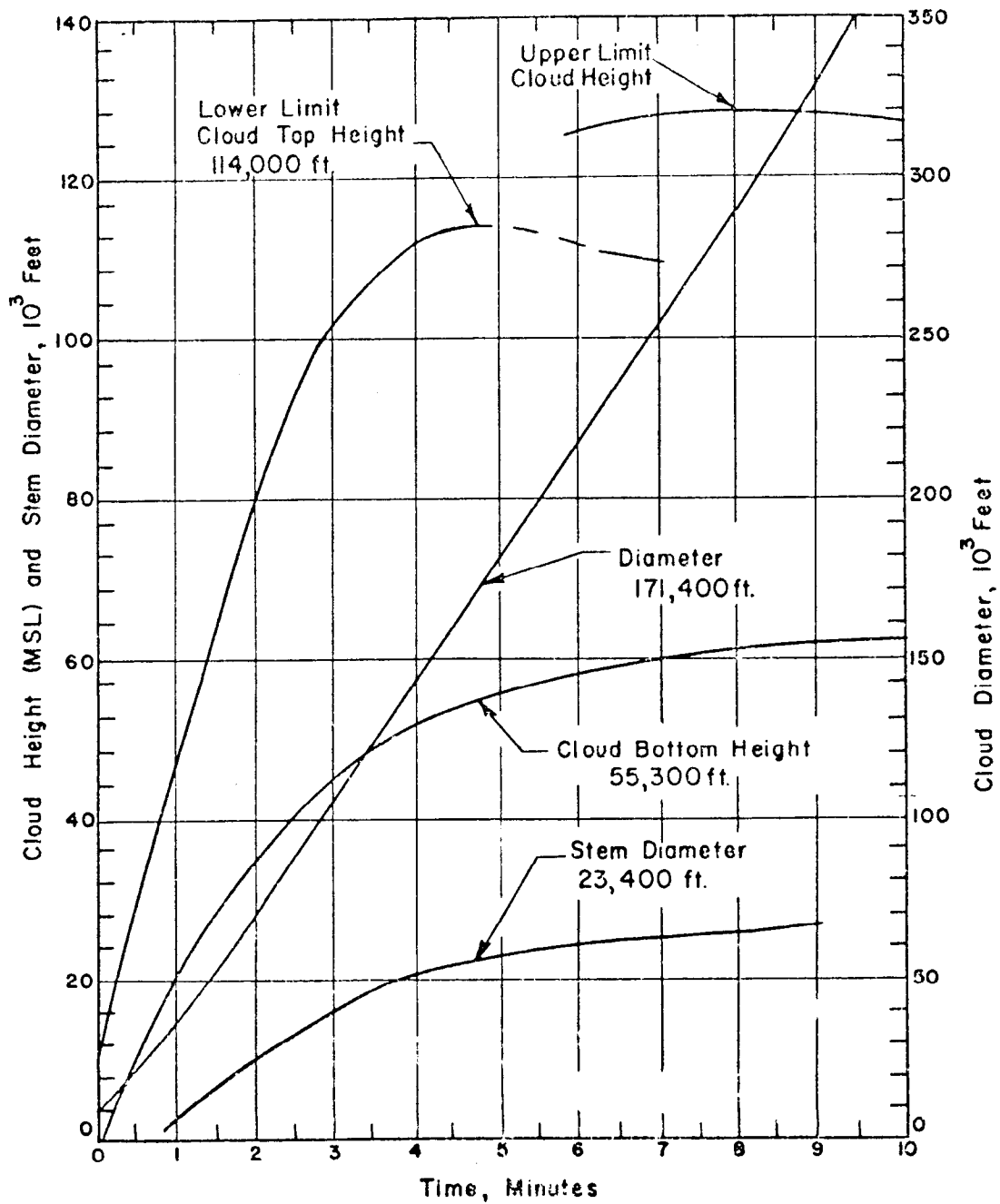


Figure 43. Cloud Dimensions: Operation CASTLE - Bravo.



TABLE 12 WIND DATA FOR OPERATION CASTLE -

BRAVO

Altitude (MSL) feet	H-hour		H+3 hours		H+6 hours	
	Dir degrees	Speed mph	Dir degrees	Speed mph	Dir degrees	Speed mph
Surface	060	14	070	17	060	20
1,000	070	20	---	--	---	--
2,000	090	21	070	23	090	16
3,000	090	20	---	--	---	--
4,000	090	16	090	12	100	16
5,000	(100)	(10)	(090)	(10)	(090)	(13)
6,000	120	05	080	13	080	09
7,000	310	05	---	--	---	--
8,000	310	05	300	07	350	03
9,000	320	08	---	--	---	--
10,000	310	06	150	13	300	17
12,000	310	12	320	21	330	17
14,000	290	16	330	12	300	12
15,000	(290)	(15)	(330)	(14)	(300)	(12)
16,000	290	15	320	17	300	12
18,000	290	15	300	26	310	16
20,000	280	15	290	26	290	20
25,000	260	22	210	25	250	28
30,000	250	30	230	36	250	33
35,000	240	40	---	--	260	55
40,000	230	40	---	--	250	51
45,000	250	52	---	--	260	51
50,000	250	36	---	--	270	92
55,000	200	18	---	--	350	13
57,000	340	31	---	--	---	--

## NOTES:

1. Numbers in parentheses are estimated values.
2. H-hour wind data was obtained on board the U.S.S. Curtiss.
3. Tropopause height was 55,000 ft MSL.
4. At H-hour the sea level pressure was 1006.1 mb, the temperature 80°F, the dew point 72°F and the relative humidity 77%.

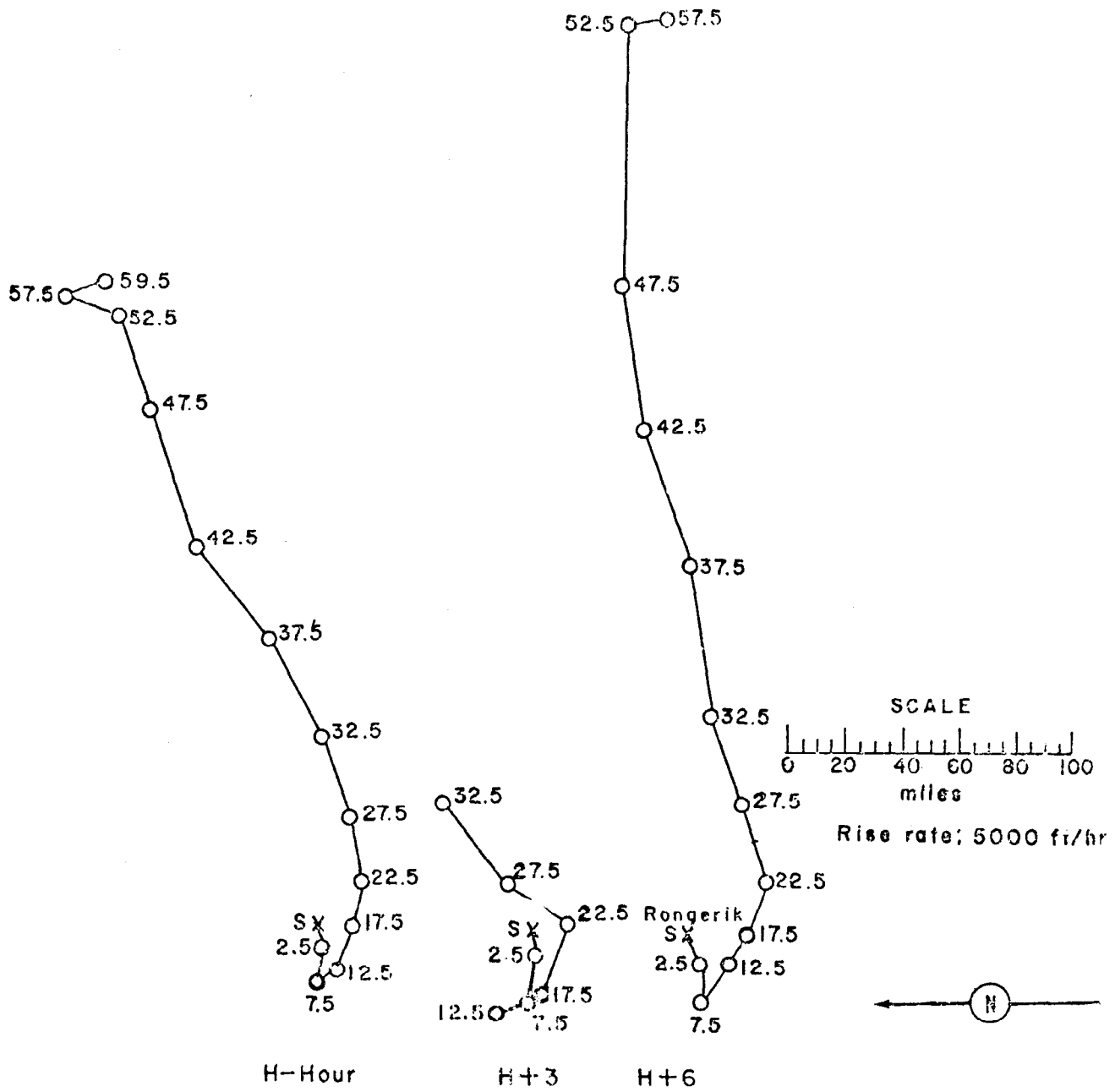


Figure 44 . Hodographs for Operation CASTLE - Bravo.

OPERATION CASTLE

- Romeo

	<u>PPT time</u>	<u>GMT</u>
<u>DATE:</u>	27 Mar 1954	26 Mar 1954
<u>TIME:</u>	0630	1830

Sponsor: LASL

SITE: PPG - Bikini - Shot 1 Crater  
11° 41' 27" N  
165° 16' 23" E  
Site elevation: Sea level

TOTAL YIELD: 11 Mt

HEIGHT OF BURST: 7 ft

CLOUD TOP HEIGHT: 110,000 ft MSL  
CLOUD BOTTOM HEIGHT: 48,500 ft MSL

TYPE OF BURST AND PLACEMENT:

Surface burst from barge on water  
Water depth: 240 ft

REMARKS:

The individual island dose rates were taken from aerial surveys by the Radiological Safety organization and corrected to H+1 hour with the  $t^{-1.2}$  decay approximation. The contamination due to previous shots was subtracted.

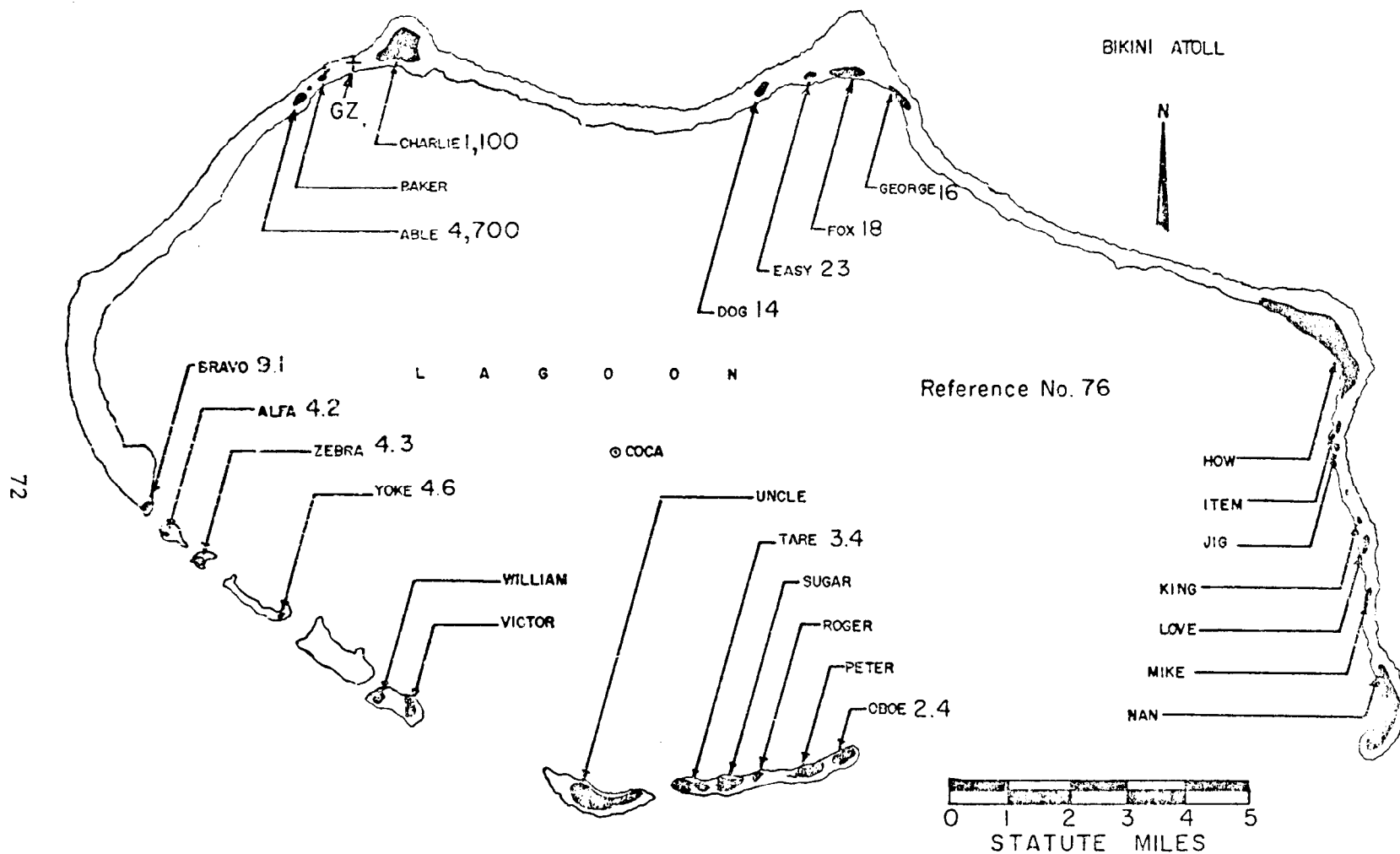


Figure 45 . Operation CASTLE - Romeo.  
Island dose rates in r/hr at H+1 hour.

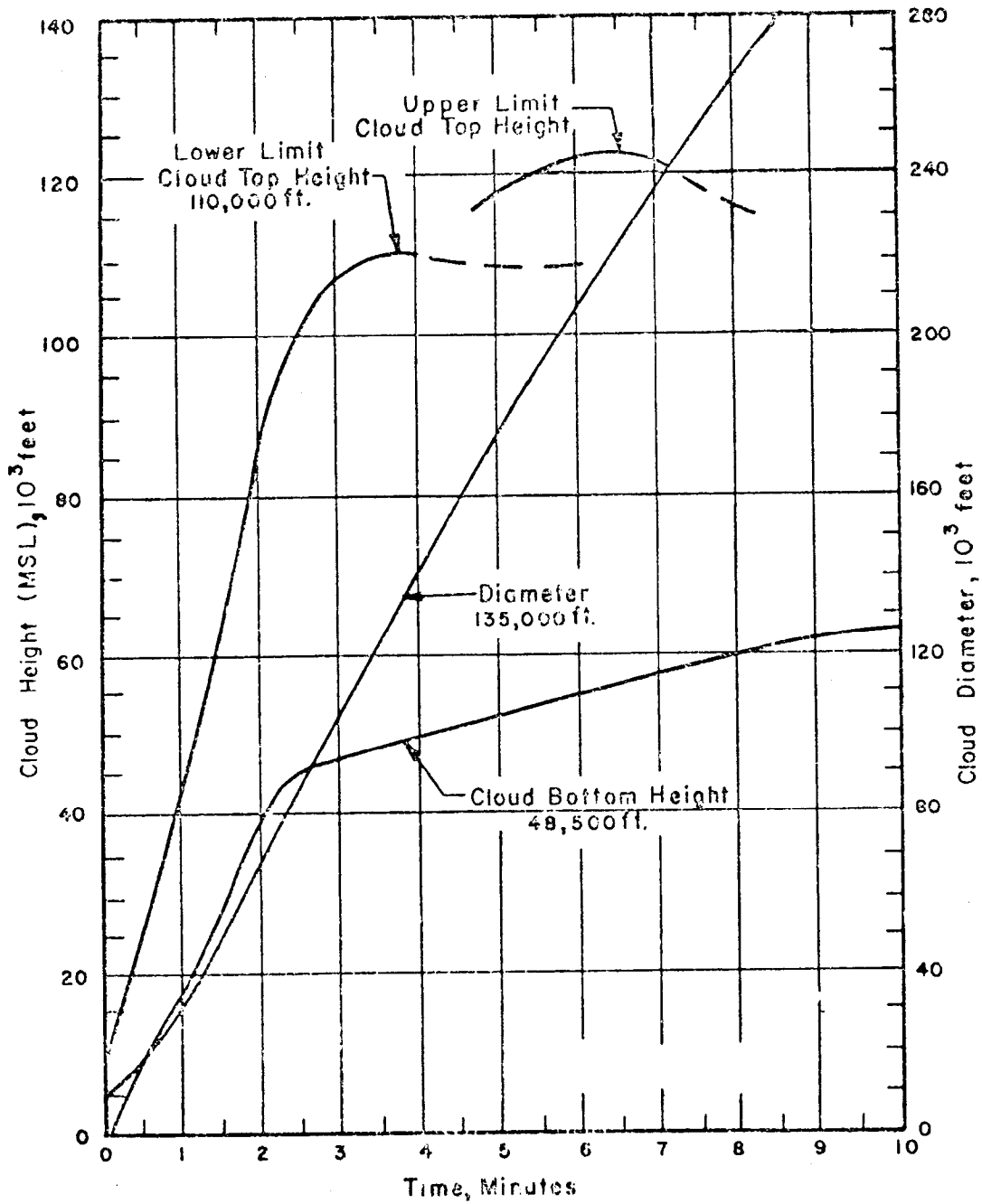


Figure 46 . Cloud Dimensions: Operation CASTLE -

Romeo.

TABLE 13 BIKINI WIND DATA FOR OPERATION CASTLE--

ROMEO

Altitude (MSL) feet	H-hour		H+3 hours		H+9 hours	
	Dir degrees	Speed mph	Dir degrees	Speed mph	Dir degrees	Speed mph
Surface	040	12	070	12	070	20
1,000	060	15	070	17	060	21
2,000	070	16	070	17	070	18
3,000	060	15	070	14	090	21
4,000	060	13	090	10	110	21
5,000	060	08	120	12	120	17
6,000	080	06	100	13	(140)	(15)
7,000	160	07	160	14	150	15
8,000	170	09	140	06	170	12
9,000	---	--	120	06	190	09
10,000	180	09	180	06	200	06
12,000	150	12	140	12	150	08
14,000	100	12	100	13	110	17
15,000	(100)	(15)	(100)	(17)	(100)	(18)
16,000	090	17	090	22	(090)	(20)
18,000	100	20	100	22	100	30
20,000	100	23	120	29	(080)	(17)
25,000	170	16	180	07	200	02
30,000	220	09	130	05	170	32
35,000	180	21	180	20	220	15
40,000	200	41	190	15	290	08
45,000	300	06	250	10	200	17
50,000	140	17	150	10	150	20
55,000	270	17	200	12	170	05
56,000	---	--	160	07	---	--
60,000	270	15	---	--	240	15
62,000	---	--	---	--	260	12
65,000	320	12	---	--	---	--
67,000	080	25	---	--	---	--

## NOTES:

1. Numbers in parentheses are estimated values.
2. Wind data was obtained on board the U. S. S. Curtiss.
3. Tropopause height was 55,000 ft MSL.
4. At H-hour the sea level pressure was 1012.4 mb, the temperature 80°F, the dew point 72°F and the relative humidity 77%.



OPERATION CASTLE

- Koon

	<u>PPG time</u>	<u>GMT</u>
<u>DATE:</u>	7 Apr 1954	6 Apr 1954
<u>TIME:</u>	0620	1820

Sponsor: UCRL

SITE: PPG - Bikini - Tare  
11° 29' 48" N  
165° 22' 03" E  
Site elevation: Sea level

TOTAL YIELD: 110 kt

HEIGHT OF BURST: 13.6 ft

FIREBALL DATA:

Time to 1st minimum: 52.5 ± 2 msec  
Time to 2nd maximum: NM  
Radius at 2nd maximum: NM

CLOUD TOP HEIGHT: 53,000 ft MSL  
CLOUD BOTTOM HEIGHT: NM

CRATER DATA: Diameter: 800 ft  
Depth: 75 ft

TYPE OF BURST AND PLACEMENT:

Surface burst from platform on  
coral soil

REMARKS:

The on-site fallout pattern was constructed from survey readings made by technical project personnel and by the Radiological Safety organization, plus conversion of activity measurements of fallout samples collected on rafts and free-floating buoys anchored in the lagoon. The fallout occurred ideally with respect to the measurement stations so that more readings than usual were available. The dose-rate readings were extrapolated to H+1 hour by using actual field decay rates.



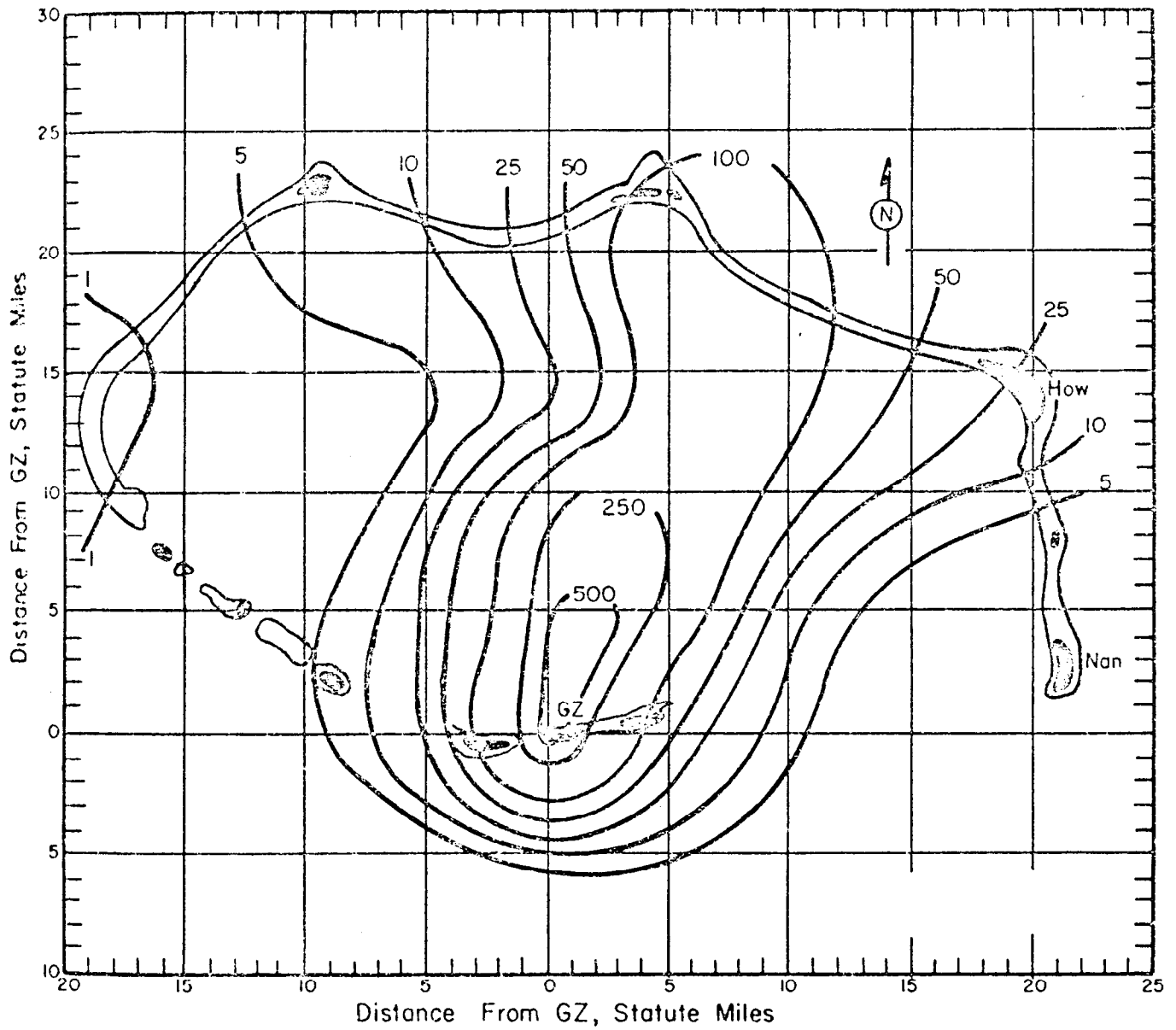


Figure 48 . Operation CASTLE - Koon.  
On-site dose rate contours in r/hr at H+1 hour.

TABLE 14 BIKINI WIND DATA FOR OPERATION CASTLE -

K00N

Altitude (MSL) feet	H-hour		H+3 hours		H+9 hours	
	Dir degrees	Speed mph	Dir degrees	Speed mph	Dir degrees	Speed mph
Surface	040	23	070	20	080	15
1,000	070	20	---	--	---	--
2,000	060	18	080	23	080	17
3,000	090	09	---	--	---	--
4,000	120	08	090	14	100	22
5,000	(140)	(10)	(120)	(10)	(090)	(20)
6,000	170	14	150	10	080	17
7,000	170	20	---	--	---	--
8,000	190	16	160	14	100	15
9,000	200	16	---	--	---	--
10,000	200	16	170	14	140	07
12,000	180	20	160	14	150	12
14,000	200	09	170	10	180	12
15,000	(200)	(10)	(170)	(14)	(180)	(09)
16,000	190	12	170	17	180	08
18,000	200	12	180	22	280	03
20,000	220	05	210	18	260	12
25,000	190	23	200	23	210	18
30,000	210	25	250	24	220	36
35,000	210	32	240	28	220	36
40,000	230	39	250	38	250	55
45,000	280	28	260	43	240	51
50,000	240	40	260	37	250	47
52,000	230	45	---	--	---	--
55,000	---	--	250	21	260	33
60,000	---	--	290	15	240	07
65,000	---	--	130	17	160	26
70,000	---	--	150	40	110	26
75,000	---	--	---	--	080	29
79,000	---	--	---	--	090	26

## NOTES:

1. Numbers in parentheses are estimated values.
2. Wind data was obtained on board the U.S.S. Curtiss.
3. Tropopause height was 53,000 ft MSL.
4. At H-hour the sea level pressure was 1009.7 mb, the temperature 81°F, the dew point 75°F and the humidity 82%.

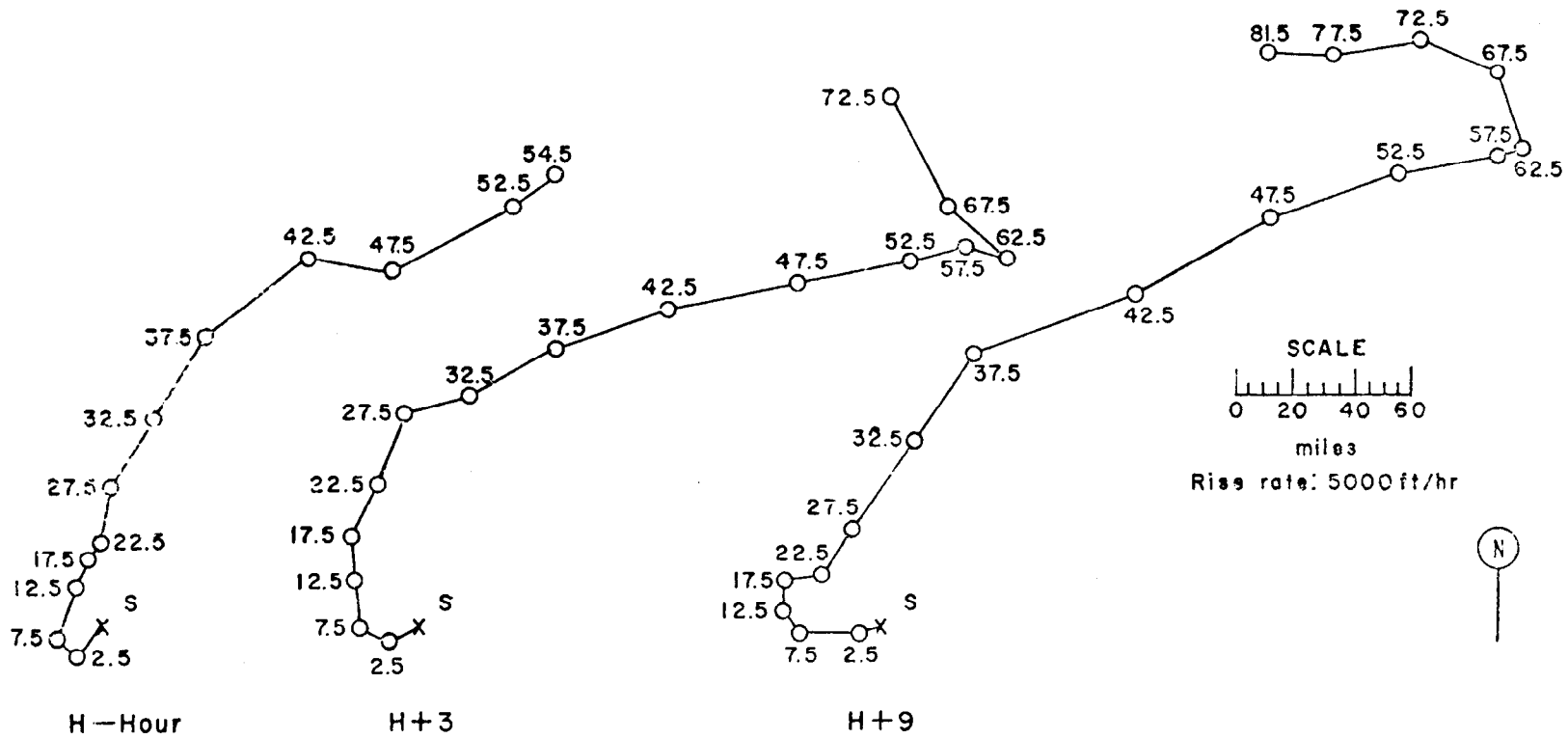


Figure 49. Hodographs for Operation CASTLE - Koon.

OPERATION CASTLE - Union

	<u>PPG time</u>	<u>GMT</u>
<u>DATE:</u>	26 Apr 1954	25 Apr 1954
<u>TIME:</u>	0605	1805

TOTAL YIELD: 6.9 Mt

Sponsor: IASL

SITE: PPG - Bikini - near Dog &  
Fox  
11° 39' 59" N  
165° 23' 14" E  
Site elevation: Sea level

HEIGHT OF BURST: 7 ft  
Water depth: 160 ft

CLOUD TOP HEIGHT: 94,000 ft MSL  
CLOUD BOTTOM HEIGHT: 51,500 ft MSL

REMARKS:

The on-site fallout pattern was drawn from land survey readings made by technical project personnel and by the Radiological Safety organization, plus conversion of the activity to dose-rate readings of samples from fallout collectors. The shot location and the winds localized the radiation levels of military significance to the northeastern portion of the atoll. The dose-rate readings were extrapolated to H+1 hour by using actual field-decay rates.

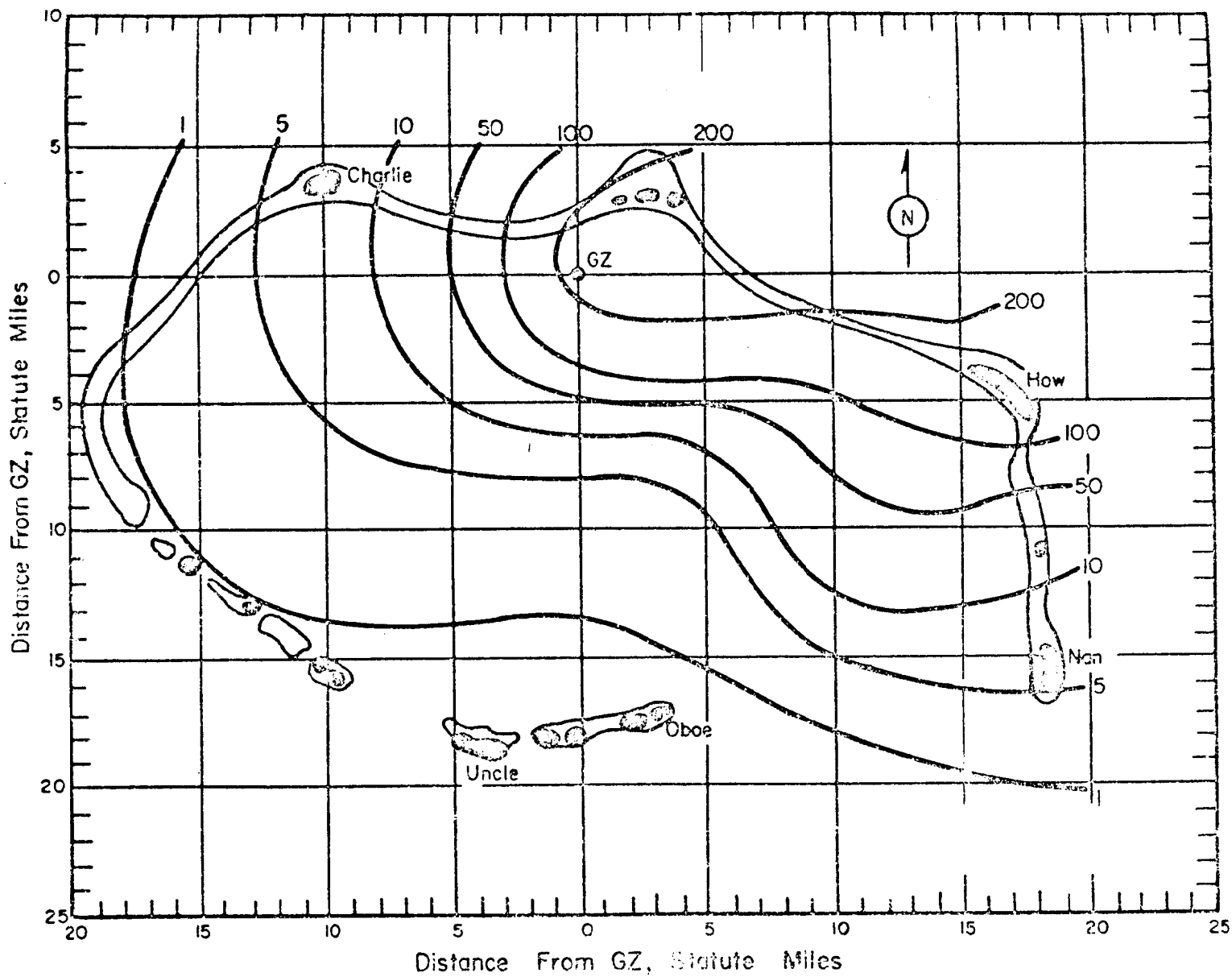


Figure 50. Operation CASTLE - Union. On-site dose rate contours in r/hr at H+1 hour.

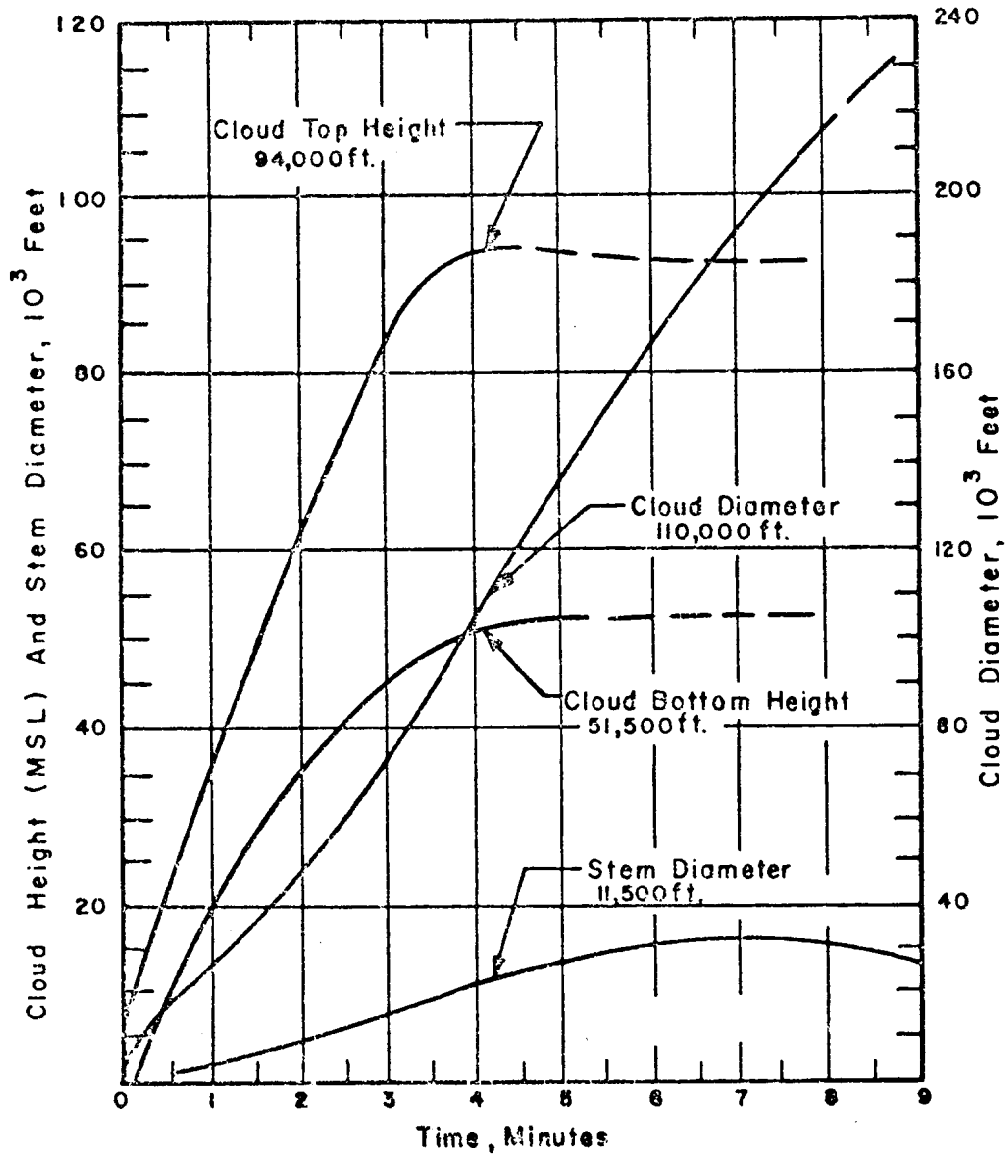


Figure 51. Cloud Dimensions: Operation CASTLE - Union.

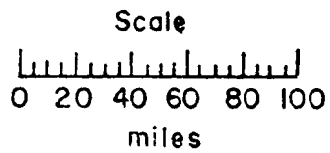
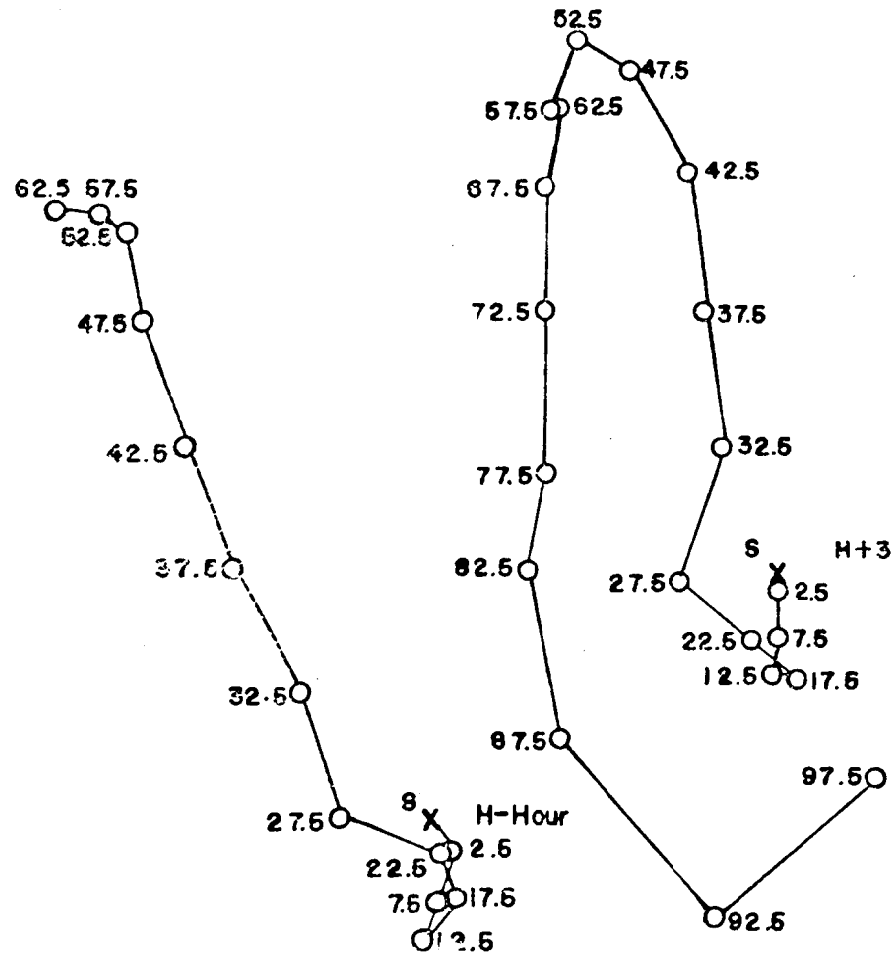
TABLE 15 BIKINI WIND DATA FOR OPERATION CASTLE-

UNION

Altitude (MSL) feet	H-hour		H+3 hours		H+6 hours	
	Dir degrees	Speed mph	Dir degrees	Speed mph	Dir degrees	Speed mph
Surface	050	20	090	16	080	18
1,000	060	24	---	--	---	--
2,000	080	21	090	22	100	14
3,000	090	20	---	--	---	--
4,000	090	21	090	20	090	10
5,000	(100)	(20)	(090)	(18)	(100)	(10)
6,000	110	21	080	17	110	12
7,000	120	21	---	--	---	--
8,000	130	20	080	17	130	14
9,000	120	18	---	--	---	--
10,000	110	14	100	16	130	15
12,000	350	04	060	08	090	04
14,000	360	07	020	08	360	07
15,000	(300)	(18)	(010)	(10)	(350)	(08)
16,000	240	29	360	12	340	09
18,000	290	16	260	09	240	08
20,000	260	17	220	20	230	14
25,000	200	38	220	34	210	18
30,000	250	46	290	50	250	33
35,000	240	51	260	48	240	36
40,000	250	46	260	48	270	39
45,000	250	46	240	45	260	44
50,000	260	32	210	24	260	50
55,000	220	10	110	29	150	29
60,000	180	17	340	02	190	16
65,000	---	--	100	33	090	20
70,000	---	--	090	46	100	31
75,000	---	--	090	58	110	50
80,000	---	--	100	36	100	47
85,000	---	--	080	62	120	47
90,000	---	--	050	85	---	--
95,000	---	--	320	78	---	--

## NOTES:

1. Numbers in parentheses are estimated values.
2. Wind data was obtained on board the U. S. S. Curtiss.
3. Tropopause height was 57,000 ft MSL.
4. At H-hour the sea level pressure was 1007.4 mb, the temperature 81°F, the dew point 76°F and the humidity 86%.



Rise rate: 5000 ft/hr

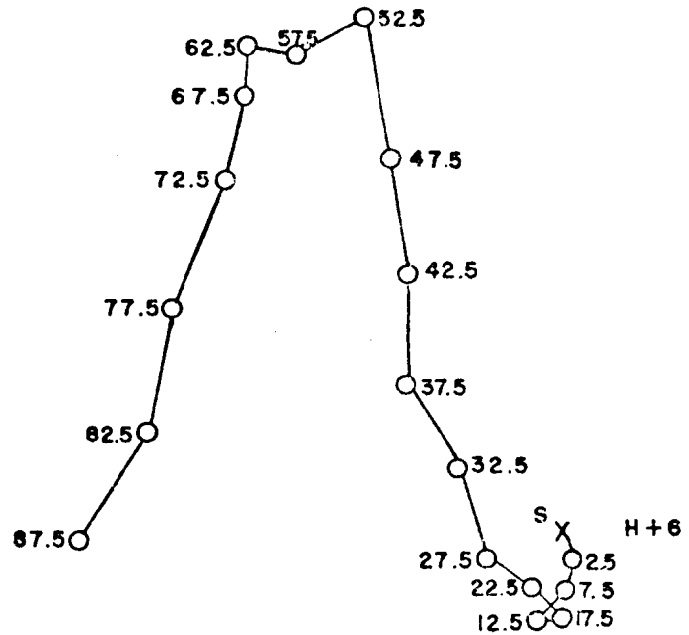


Figure 52. Hodographs for Operation CASTLE -

Union.



OPERATION CASTLE - Yankee

	<u>PPG time</u>	<u>GMT</u>
<u>DATE:</u>	5 May 1954	4 May 1954
<u>TIME:</u>	0610	1810

TOTAL YIELD: 13.5 Mt

Sponsor: IASL

SITE: PPG - Bikini - near Dog &  
Fox  
11° 39' 56" N  
165° 23' 13" E  
Site elevation: Sea level

HEIGHT OF BURST: 7 ft

CLOUD TOP HEIGHT: 110,000 ft MSI.  
CLOUD BOTTOM HEIGHT: 61,300 ft MSL

TYPE OF BURST AND PLACEMENT:

Surface burst from barge on water

REMARKS:

The individual island dose rates were computed from the D+1 day aerial-survey readings of the Radiological Safety organization. The various readings were corrected to H+1 hour, using the  $t^{-1.2}$  relationship, and extrapolated to 3 ft above the surface, using the air-to-ground conversion factors determined later for the REDWING Flathead shot 102. The Fox, George, Nan, Oboe, Uncle and William readings were taken at ground level. All other readings were obtained by aerial survey. The off-site fallout pattern was documented for the first time by a combined water-surface reading, aerial survey, and water-sampling operation. The dose-rate readings were extrapolated to H+1 hour by using actual decay rates.

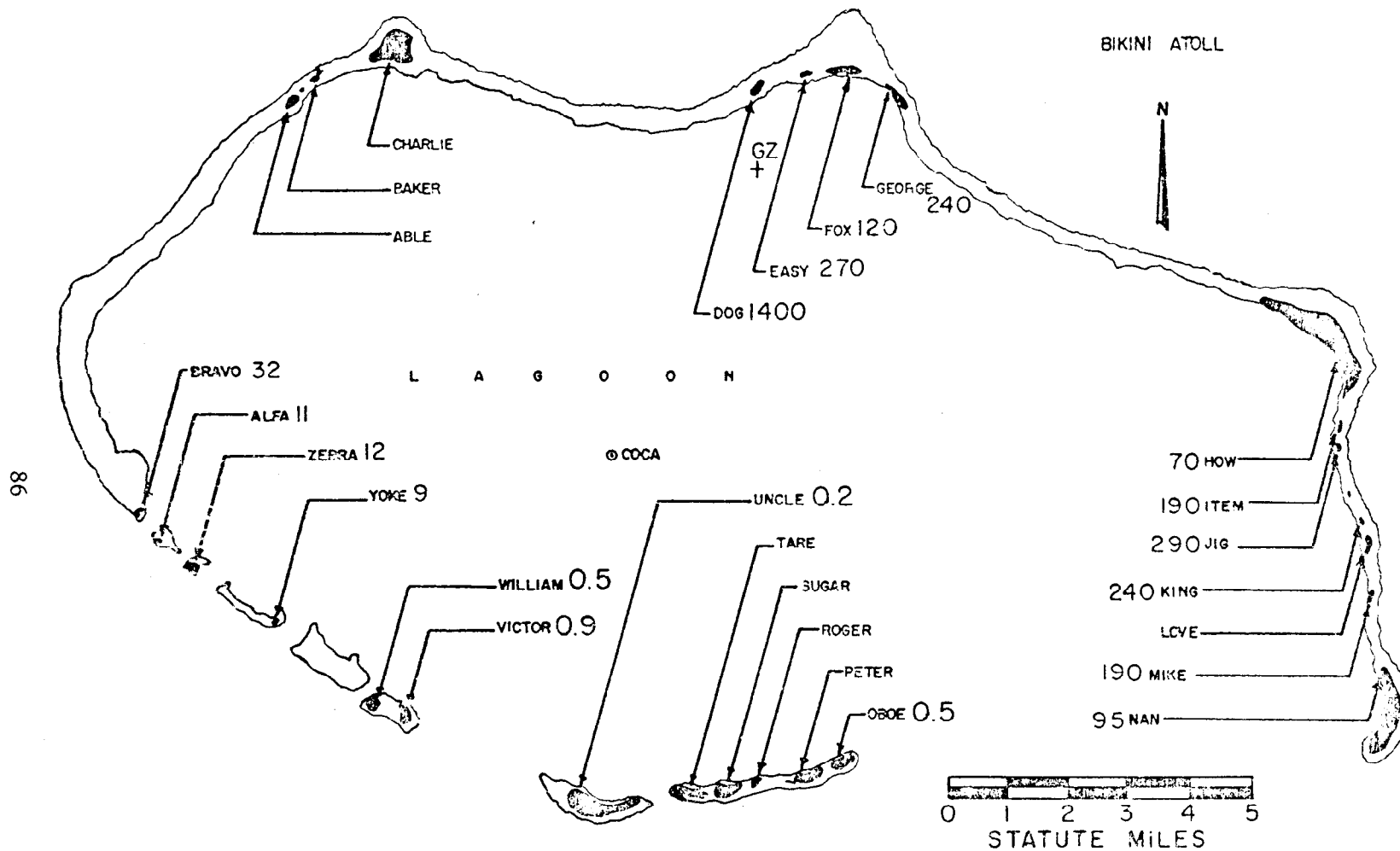


Figure 53. Operation CASTLE - Yankee.  
Island dose rates in r/hr at H+1 hour.

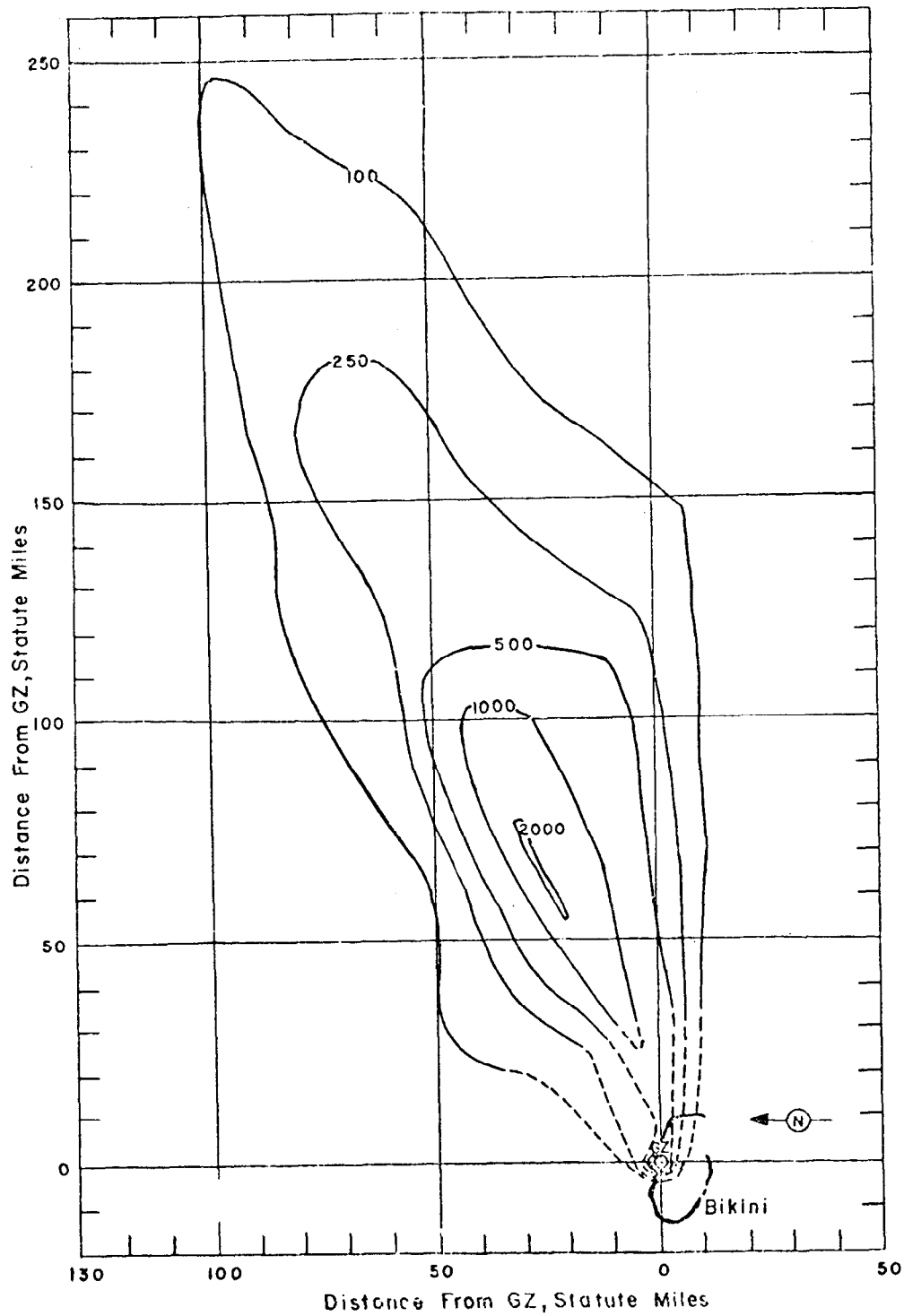


Figure 54. Operation CASTLE - Yankee.  
Off-site dose rate contours in r/hr at H+1 hour.

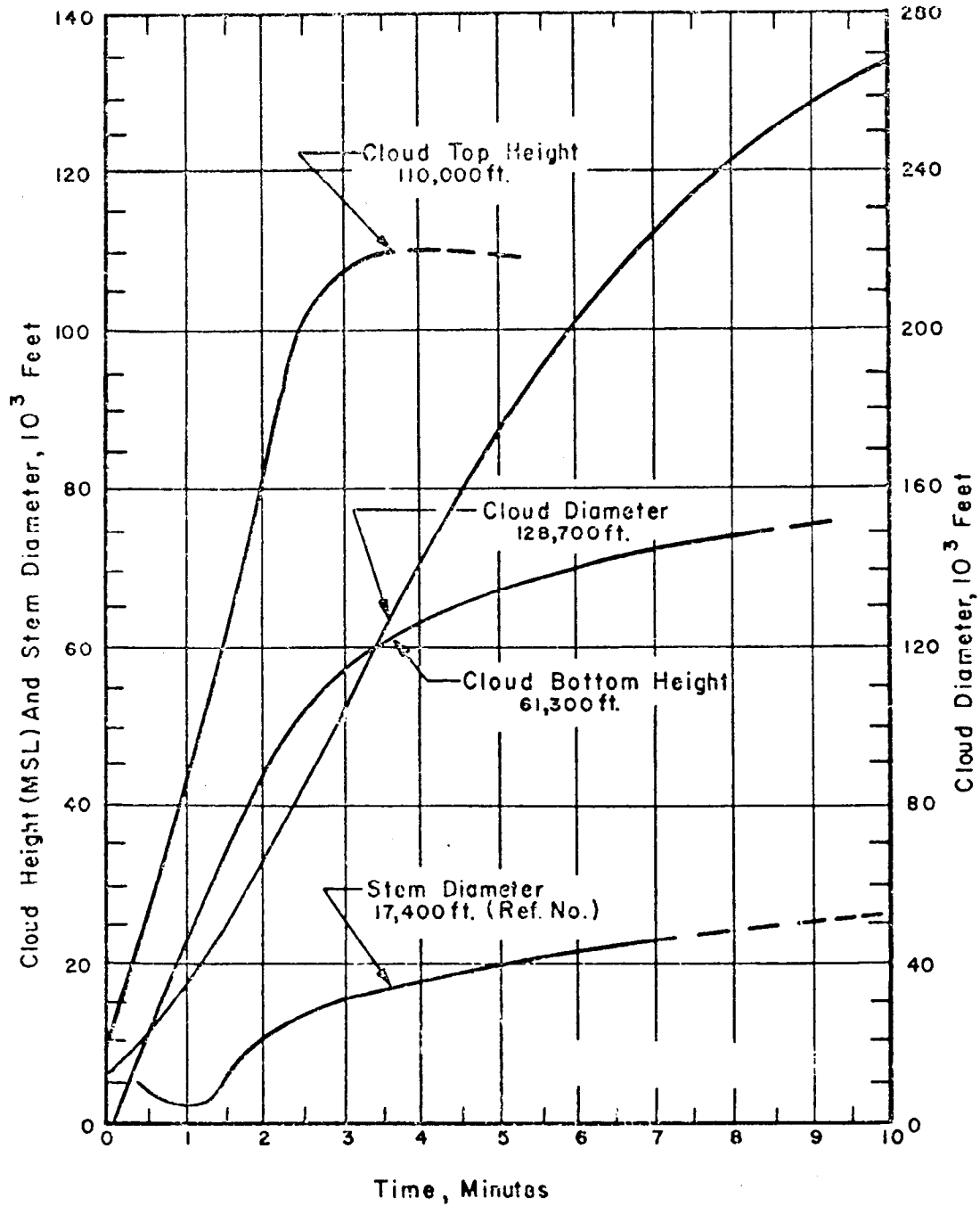


Figure 55. Cloud Dimensions: Operation CASTLE -

Yankee.

TABLE 16 BIKINI WIND DATA FOR OPERATION CASTLE -

YANKBE

Altitude (MSL) feet	H-hour		H+3 hours		H+6 hours		H+9 hours	
	Dir degrees	Speed mph	Dir degrees	Speed mph	Dir degrees	Speed mph	Dir degrees	Speed mph
Surface	080	28	050	18	060	20	020	15
1,000	070	26	---	--	---	--	---	--
2,000	080	29	070	29	090	26	080	22
3,000	080	28	---	--	---	--	---	--
4,000	080	26	070	25	110	30	090	23
5,000	(080)	(25)	(080)	(24)	(110)	(29)	(090)	(20)
6,000	070	23	090	23	110	29	090	18
7,000	070	21	---	--	---	--	---	--
8,000	070	13	040	13	090	24	110	12
9,000	040	07	---	--	---	--	---	--
10,000	020	06	320	02	080	17	140	10
12,000	010	06	290	02	060	08	180	07
14,000	340	06	350	09	110	03	210	05
15,000	(330)	(10)	(290)	(08)	(200)	(06)	(220)	(06)
16,000	320	15	240	07	290	08	230	06
18,000	280	10	330	13	290	14	240	12
20,000	290	16	260	10	280	12	260	10
25,000	230	26	250	40	280	36	250	32
30,000	220	39	240	18	280	33	260	42
35,000	---	--	260	16	280	31	270	66
40,000	---	--	260	29	280	29	260	57
45,000	280	64	280	46	280	25	280	14
50,000	250	51	---	--	270	62	170	30
55,000	200	53	---	--	260	33	140	37
60,000	---	--	---	--	---	--	140	46

## NOTES:

1. Numbers in parentheses are estimated values.
2. Wind data was obtained on board the U. S. S. Curtiss.
3. Tropopause height was 55,000 ft MSL.
4. At H-hour the sea level pressure was 1018.8 mb, the temperature 80.8°F, the dew point 75.0°F and the relative humidity 84%.

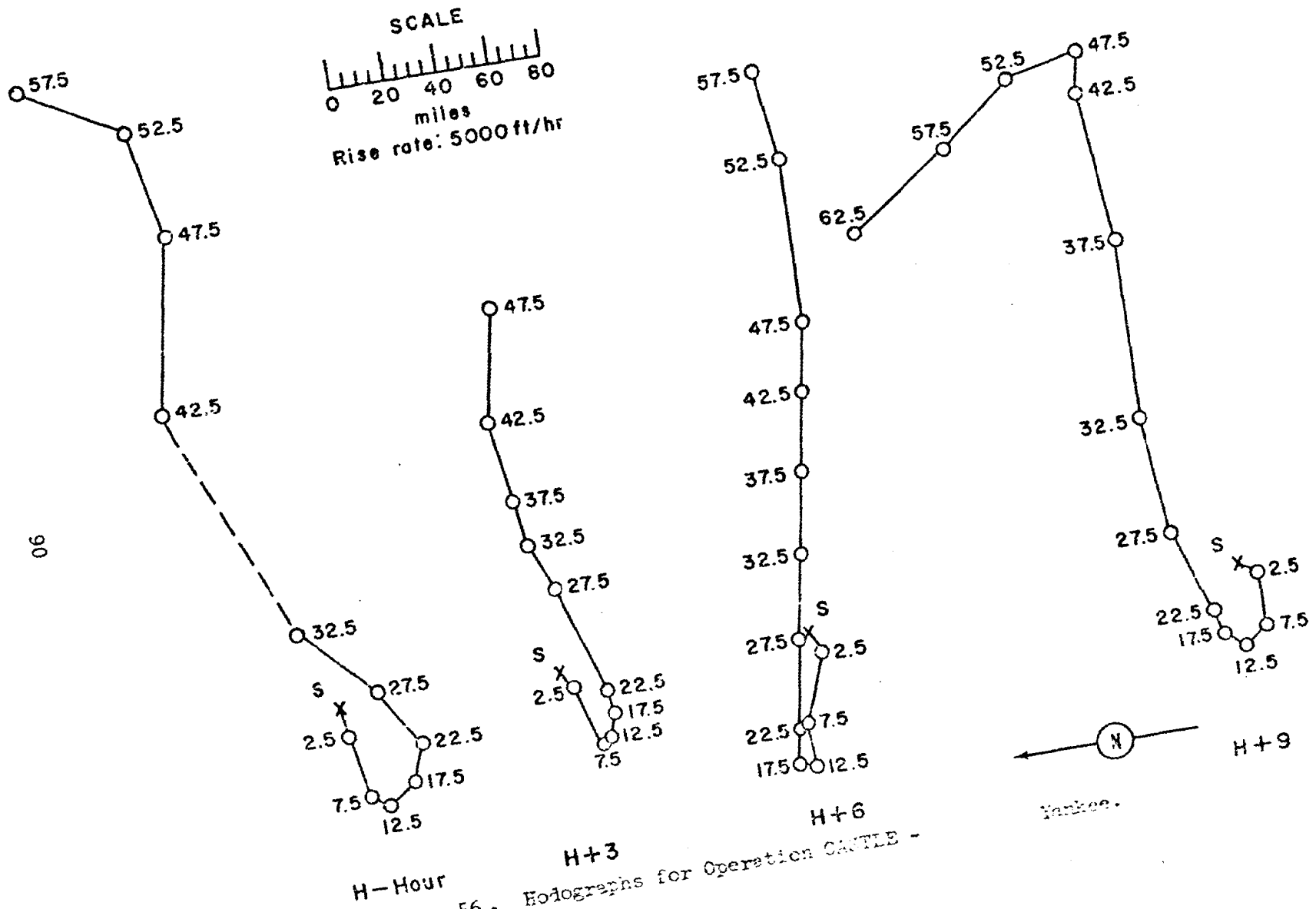


Figure 56. Hodographs for Operation CASTLE -

OPERATION CASTLE - Nectar

	<u>PPG time</u>	<u>GMT</u>
<u>DATE:</u>	14 May 1954	13 May 1954
<u>TIME:</u>	0620	1820

Sponsor: IASL

SITE: PPG - Eniwetok -  
Ivy Mike Crater  
11° 40' 14" N  
162° 11' 47" E  
Site elevation: Sea level

TOTAL YIELD: 1.69 Mt

HEIGHT OF BURST: 7 ft

CLOUD TOP HEIGHT: 71,000 ft MSL  
CLOUD BOTTOM HEIGHT: 40,500 ft MSL

TYPE OF BURST AND PLACEMENT:

Surface burst from barge on water

REMARKS:

The on-site fallout pattern was drawn from Radiological Safety organization data and by converting the readings obtained from fallout samples to equivalent dose-rate readings over land. Since the fallout went in a northerly direction from ground zero very few of the collecting stations received significant fallout. The fallout collected was primarily upwind fallout. Aerial survey was used for measurements north of the atoll, and two tugs gathered water samples throughout the fallout area. Analyses of the water samples, combined with an estimate of the depth of mixing, served to determine the land-equivalent exposure rate at a number of points. The aerial survey served to fill in the contours.

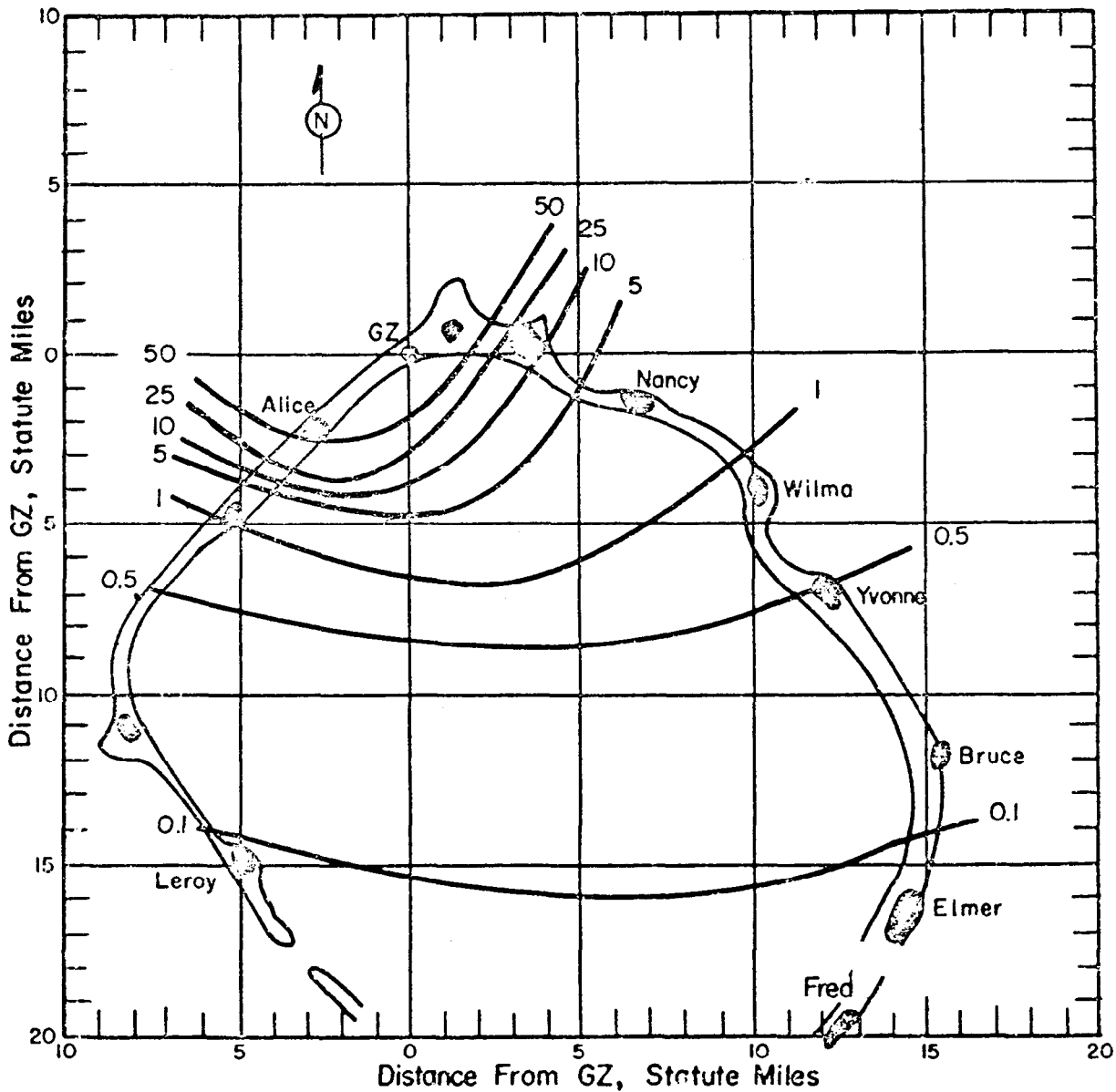


Figure 57. Operation CASTLE - Nectar.  
On-site dose rate contours in r/hr at H+1 hour.



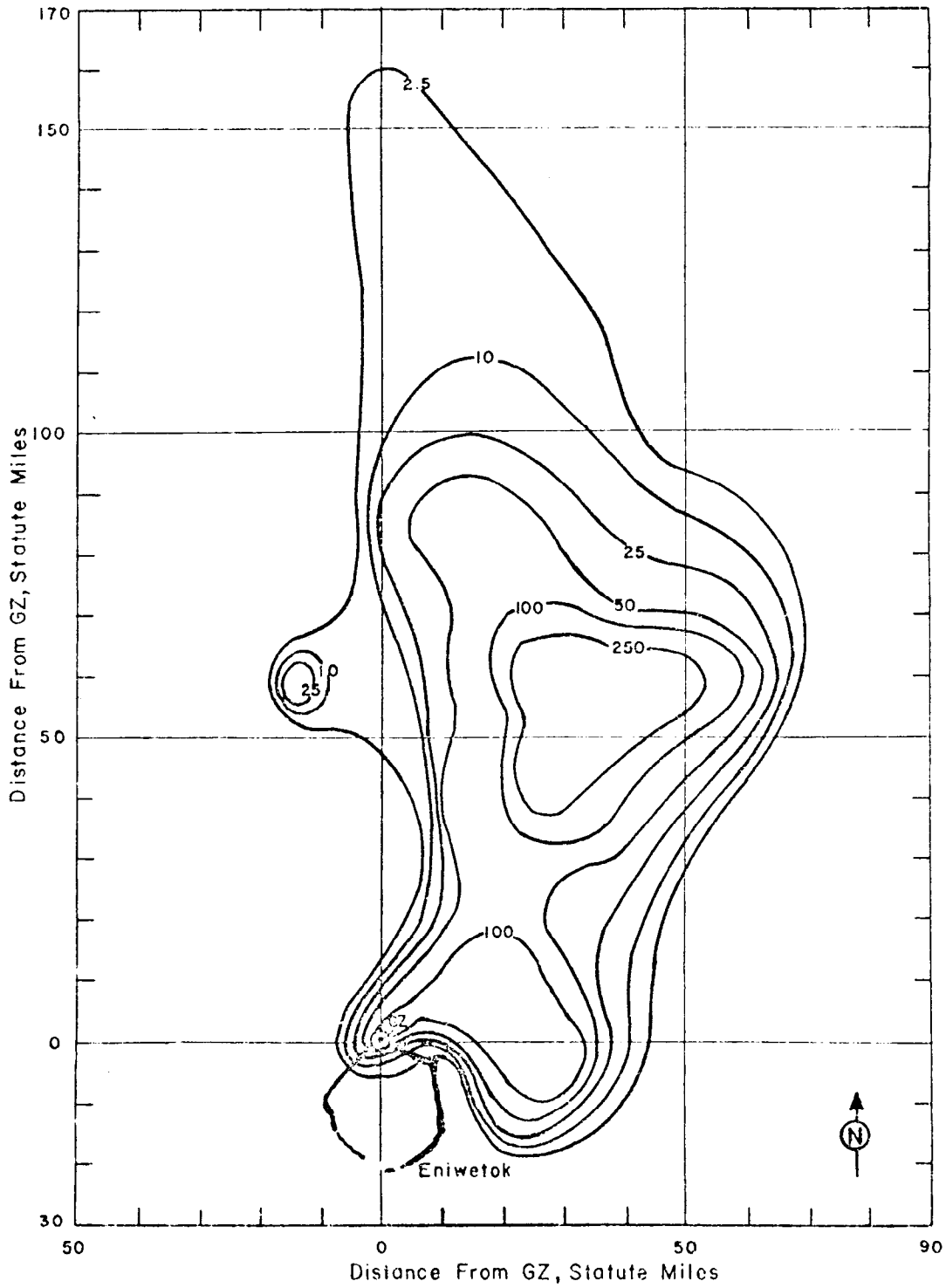


Figure 58. Operation CASTLE - Nectar.  
Off-site dose rate contours in r/hr at H+1 hour.

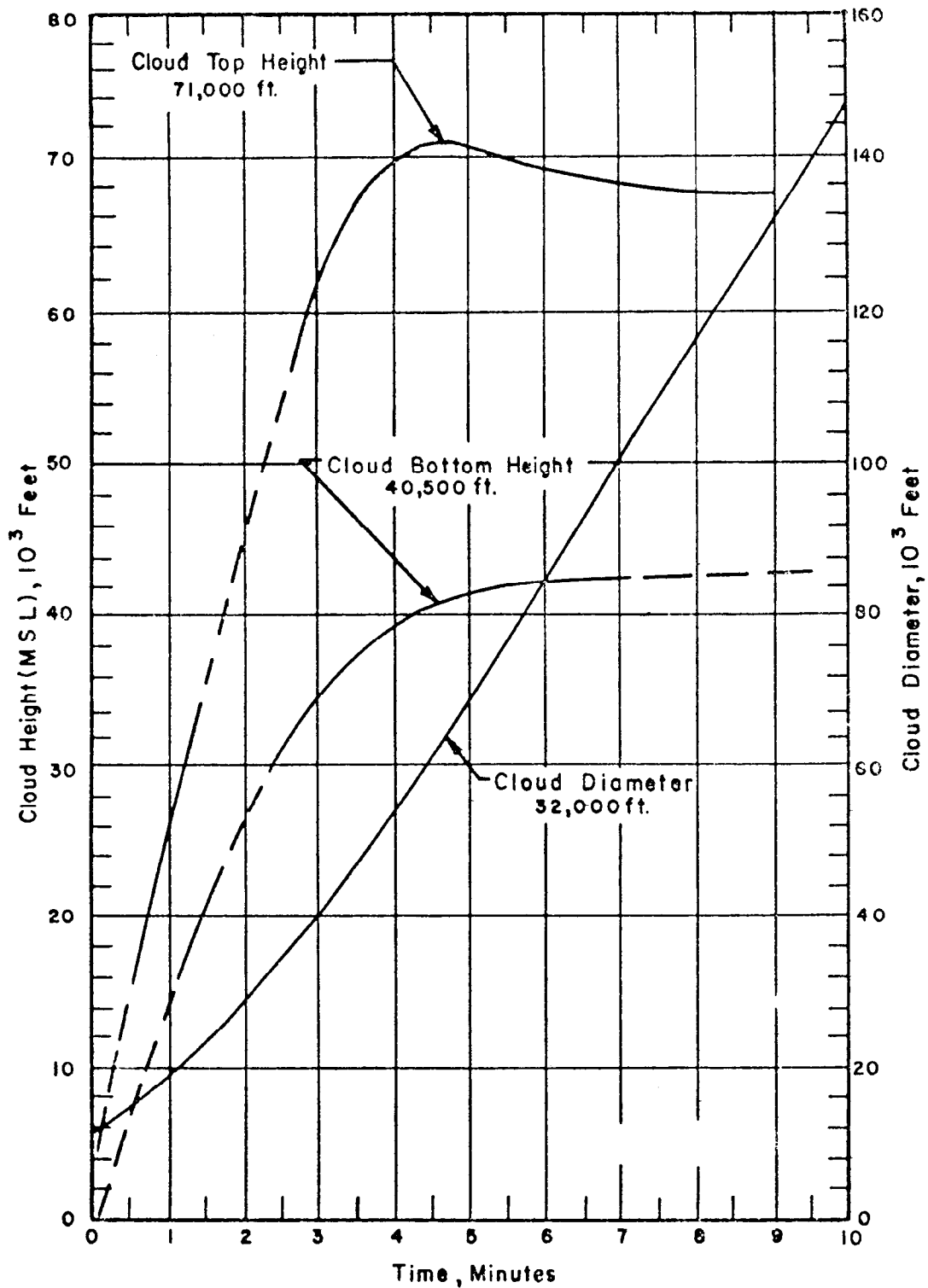


Figure 59 . Cloud Dimensions: Operation CASTLE - Nectar.

TABLE 17 ENIWETOK WIND DATA FOR OPERATION CASTLE -

NECTAR

Altitude (MSL) feet	H-hour		H+3 hours		H+9 hours	
	Dir degrees	Speed mph	Dir degrees	Speed mph	Dir degrees	Speed mph
Surface	090	22	070	23	090	23
1,000	090	24	---	--	---	--
2,000	100	20	110	24	100	20
3,000	110	22	---	--	---	--
4,000	110	22	110	20	140	16
5,000	(110)	(18)	(100)	(16)	(150)	(16)
6,000	110	16	100	14	160	17
7,000	100	14	---	--	---	--
8,000	100	12	120	13	160	16
9,000	110	13	---	--	---	--
10,000	110	16	130	16	170	16
12,000	120	20	140	12	190	20
14,000	110	21	120	16	200	21
15,000	(120)	(17)	(120)	(18)	(200)	(18)
16,000	130	14	120	18	200	17
18,000	140	14	200	08	190	17
20,000	130	09	150	21	190	15
25,000	190	07	210	06	Calm	Calm
30,000	230	19	200	14	Calm	Calm
35,000	210	10	210	29	180	16
40,000	210	29	210	31	180	10
45,000	230	37	240	24	Calm	Calm
50,000	280	40	280	27	Calm	Calm
55,000	290	44	310	30	230	14
60,000	---	--	---	--	240	18

## NOTES:

1. Numbers in parentheses are estimated values.
2. Wind data was obtained by the weather station on Eniwetok Island.
3. Tropopause height was 56,000 ft MSL.
4. At H-hour the sea level pressure was 1006.4 mb, the temperature 80°F, the dew point 75°F and the relative humidity 85%.

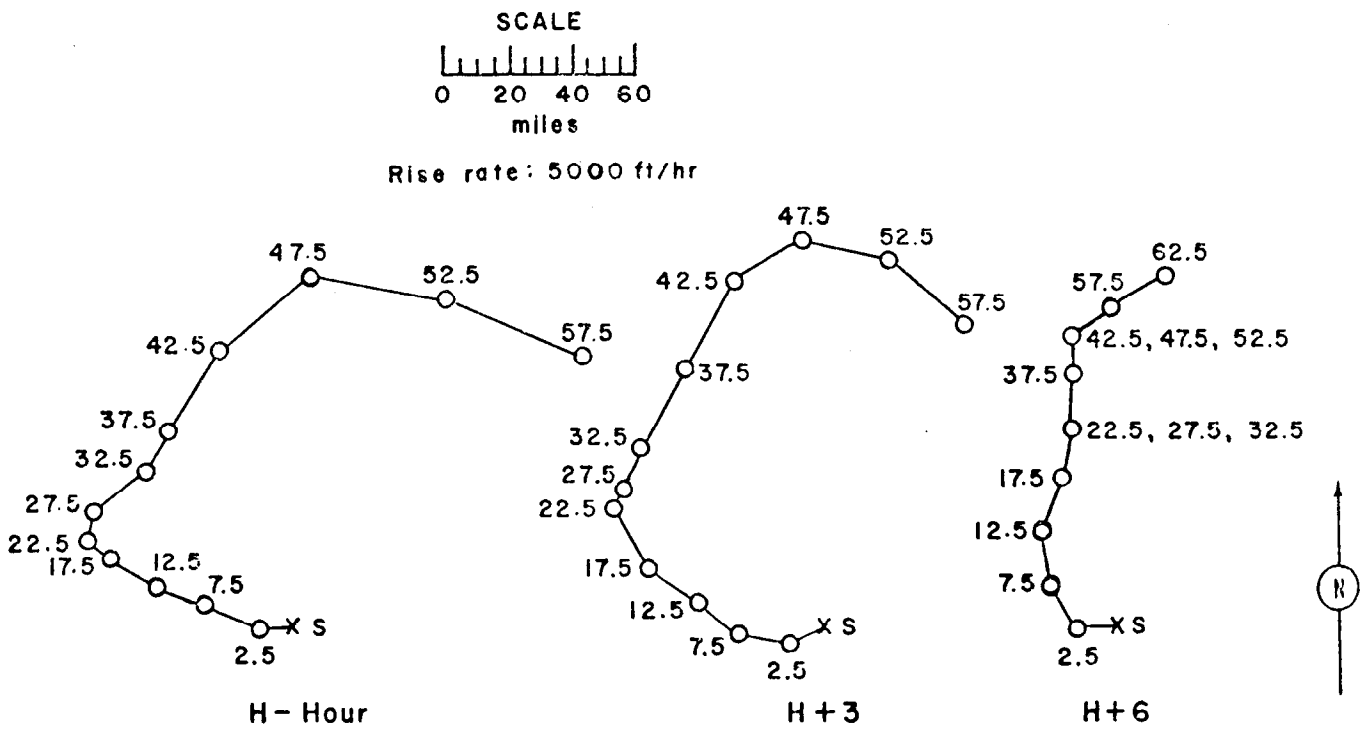


Figure 60. Hodographs for Operation CASTLE - Nectar.

OPERATION WIGWAM

	<u>PDP</u>	<u>GMT</u>
<u>DATE:</u>	14 May 1955	14 May 1955
<u>TIME:</u>	1300	2000

Sponsor: DOD

SITE: Pacific Ocean 400 miles  
Southwest of San Diego  
28° 44' N  
126° 16' W  
Site elevation: Sea level

TOTAL YIELD: 30 kt

HEIGHT OF BURST: 2000 ft under-  
water depth 16,000 ft

FIREBALL DATA:

Time to 1st minimum: NM  
Time to 2nd maximum: NM  
Radius at 2nd maximum: NM

TYPE OF BURST AND PLACEMENT:

Subsurface burst - Device  
suspended by cable from barge

SPRAY DOME HEIGHT: 880 ft MSL  
FIRST PLUME HEIGHT: 1,450 ft MSL

REMARKS:

"The contours given (for H+1.4 hour) were computed on the basis of surface and subsurface water samples and are reproduced here uncorrected. They do not represent fallout activity deposited on the surface. The activity was mixed throughout a surface zone whose depth remained roughly constant for the first two days. This contaminated zone resulted from debris thrown out locally during the surface events or from upwelling of contaminated water from below. The downwind airborne radioactivity varied with the base surge and yielded very little if any residual fallout."  
At H+19 minutes the contaminated water area was about 5.3 mi<sup>2</sup>. The area was contaminated in an irregular manner, the peak intensities being approximately three times the average intensity of 25 to 30 r/hr, 3 ft above the surface. The area circumscribed by a 50 mr/hr isointensity contour increased to 7.5 mi<sup>2</sup> at H+1.4 hr. At H+4.2 hr it had decreased to 3.5 mi<sup>2</sup>. Measurements of water samples indicated a radioactive decay exponent

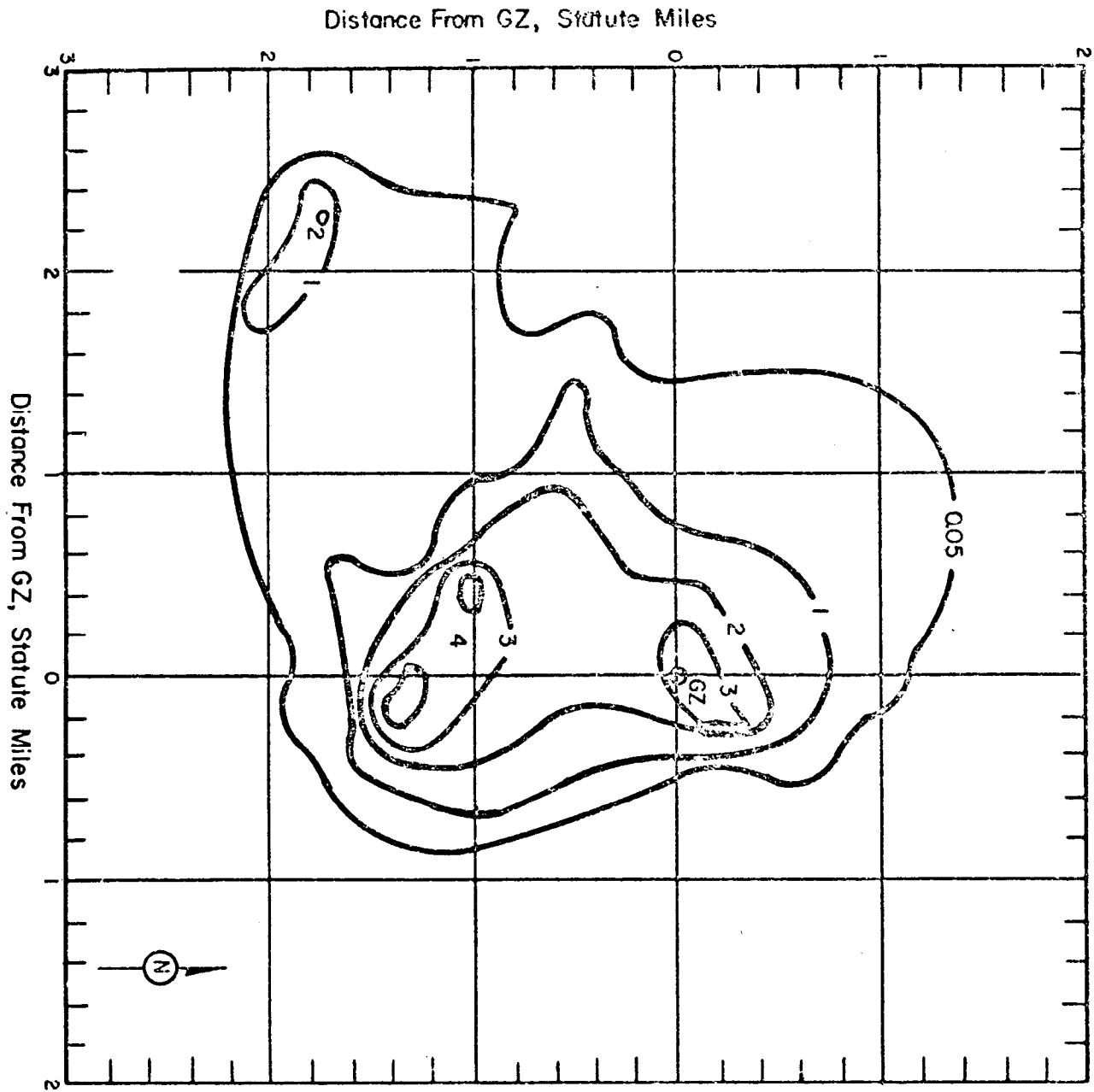


Figure 61. Operation WIGWAM. Off-site dose rate contours in r/hr at H+1.4 hours.

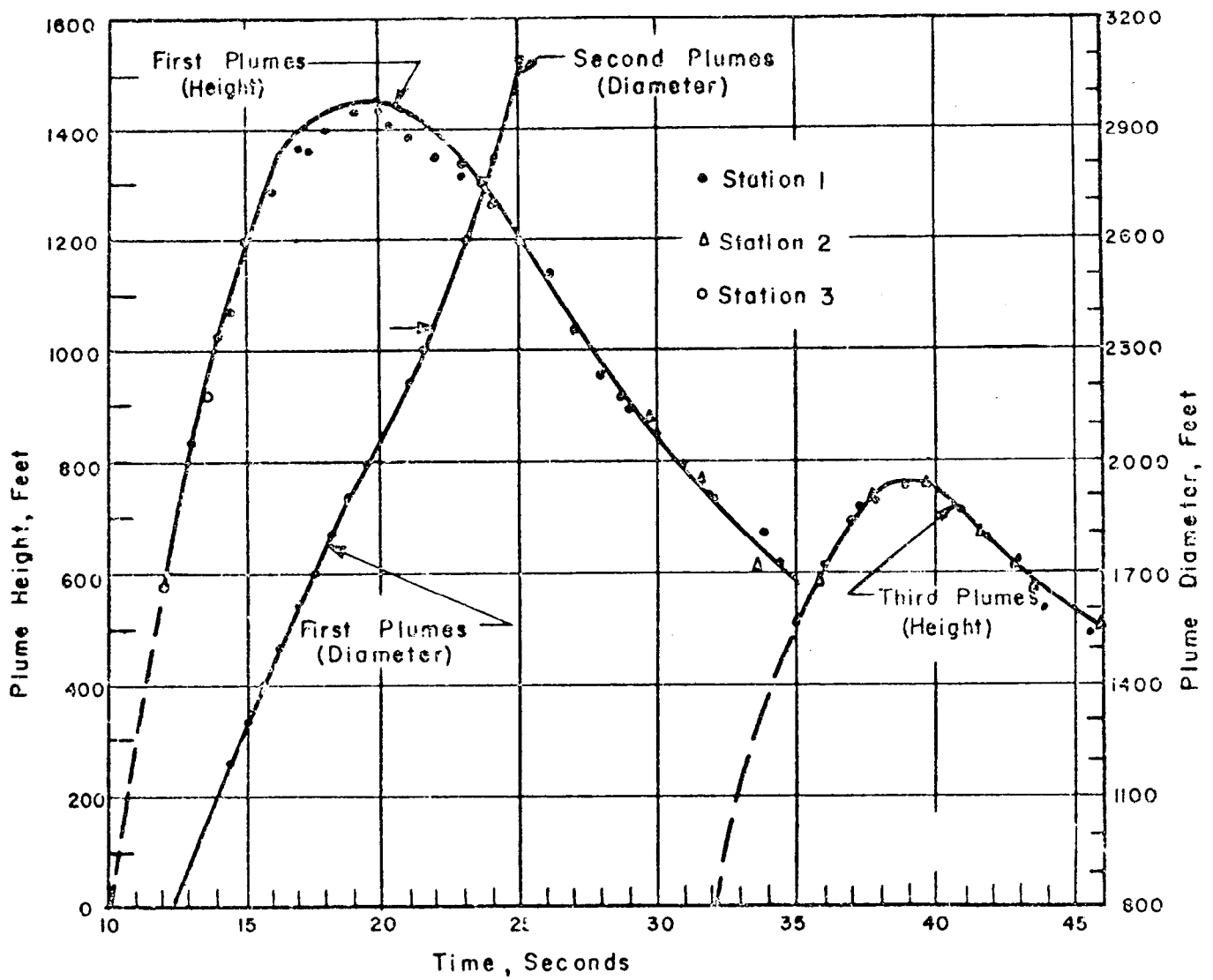


Figure 62. Plume Height Dimensions: Operation WIGWAM.

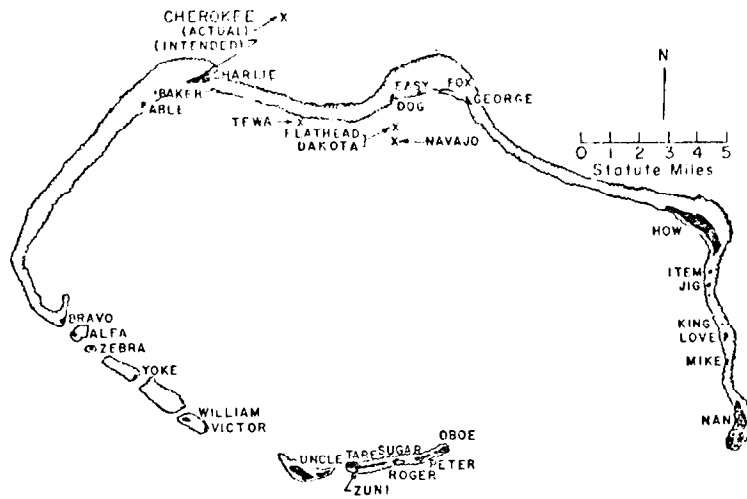


Figure 63. Operation REDWING, Shot Locations, Eniwetok Atoll.

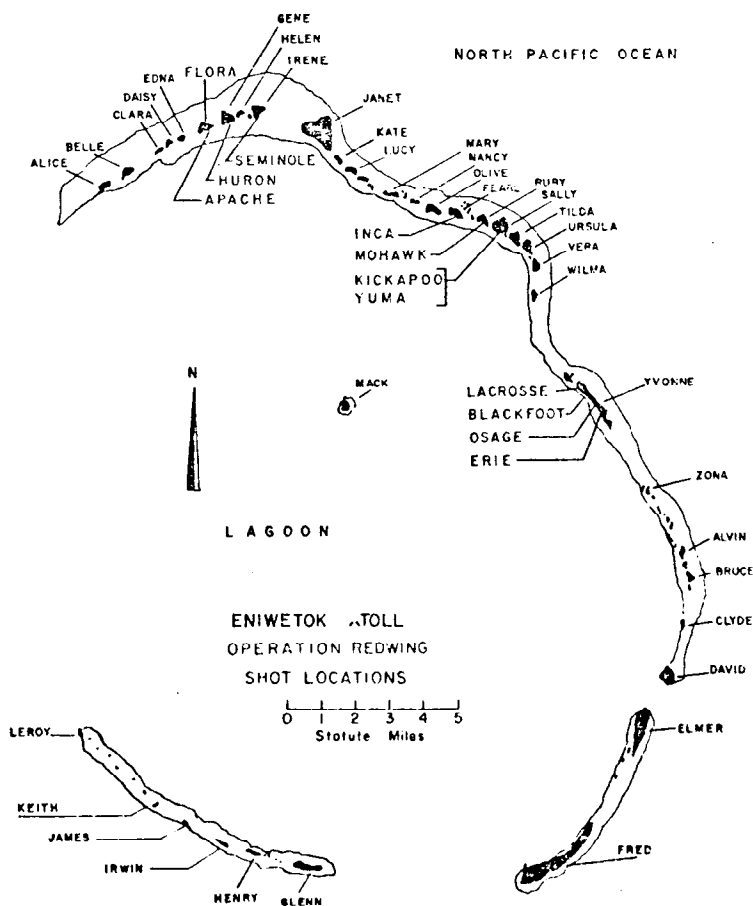


Figure 64. Operation REDWING, Shot Locations, Bikini Atoll.



OPERATION REDWING - LaCrosse

	<u>PPG Time</u>	<u>GMT</u>
<u>DATE:</u>	5 May 1956	4 May 1956
<u>TIME:</u>	0625	1825

Sponsor: LASL

SITE: PPG - Eniwetok - Yvonne  
11° 33' 28" N  
162° 21' 18" E  
Site elevation: Sea Level

TOTAL YIELD: 40 kt

HEIGHT OF BURST: 17 ft

FIREBALL DATA:

Time to 1st minimum: 18 to 34 msec  
Time to 2nd maximum: 190 to 254 msec  
Radius at 2nd maximum: 872.5 ft

TYPE OF BURST AND PLACEMENT:

Surface burst from platform on coral soil

CRATER DATA:

Diameter: 404 ft  
Depth: 44 ft  
Lip: 15 ft

CLOUD TOP HEIGHT:

38,000 ft MSL (Ref 105)  
40,000 ft MSL (Ref 112)

CLOUD BOTTOM HEIGHT:

22,000 ft MSL (Ref 105)  
13,000 ft MSL (Ref 112)

REMARKS:

The dose-rates shown for the islands of the atoll are based upon ground and aerial surveys made by the Radiological Safety organization and by Project 2.65. The dose-rate readings in the immediate environment of the crater were calculated from survey readings at low tide on D+1 day and D+2 days, after the reef around the crater had been flushed by at least two high tides. The measured field gamma decay exponent was used to extrapolate the readings to H+1 hour. The one reading which gave an H+1 hour dose rate of 57,000 r/hr was uniquely high and may have been due to one of the extremely radioactive, partially fused, pieces of metal scattered about near the crater.

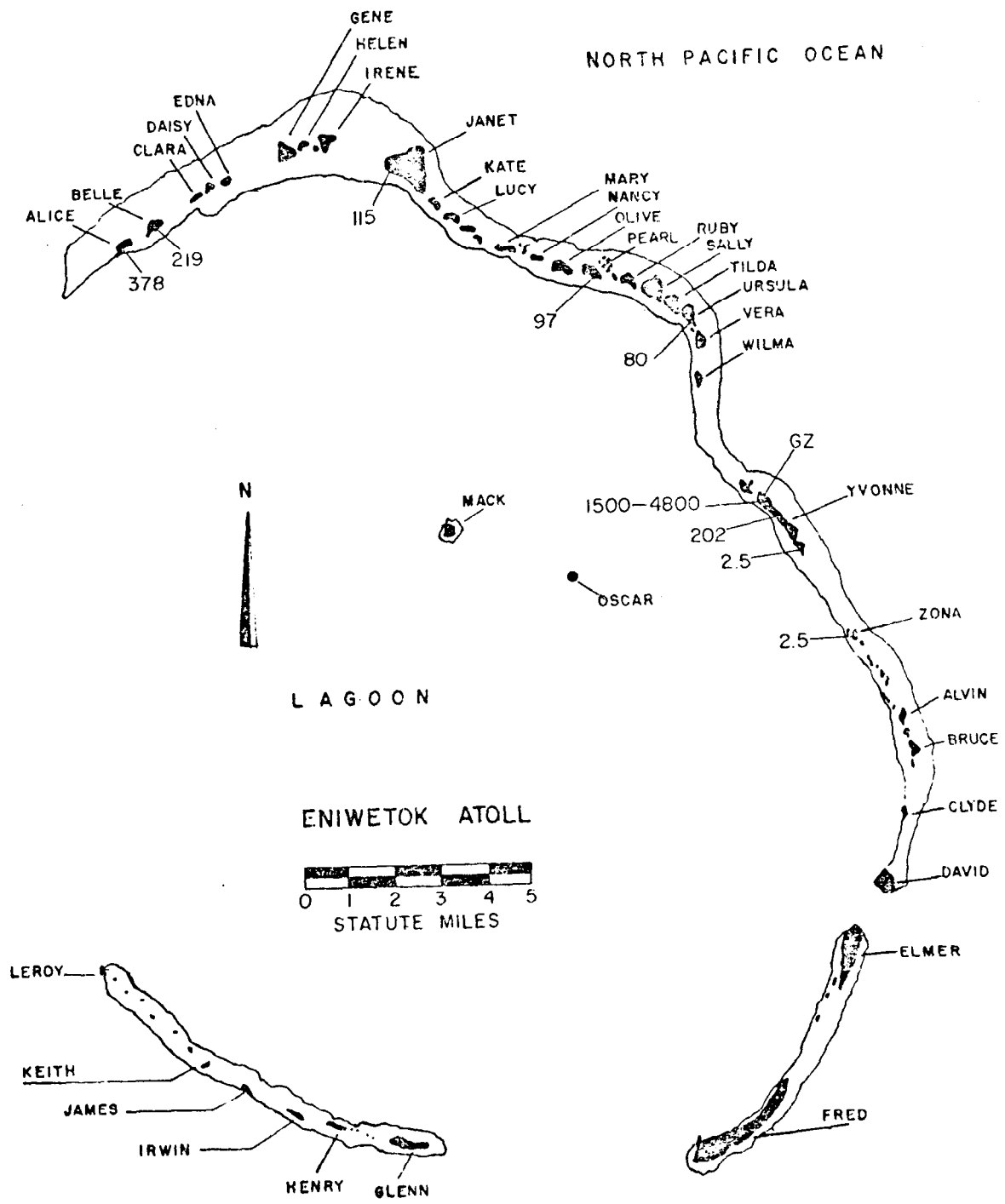


Figure 65. Operation REDWING - Lacrosse. Island dose rates in r/hr at H+1 hour.

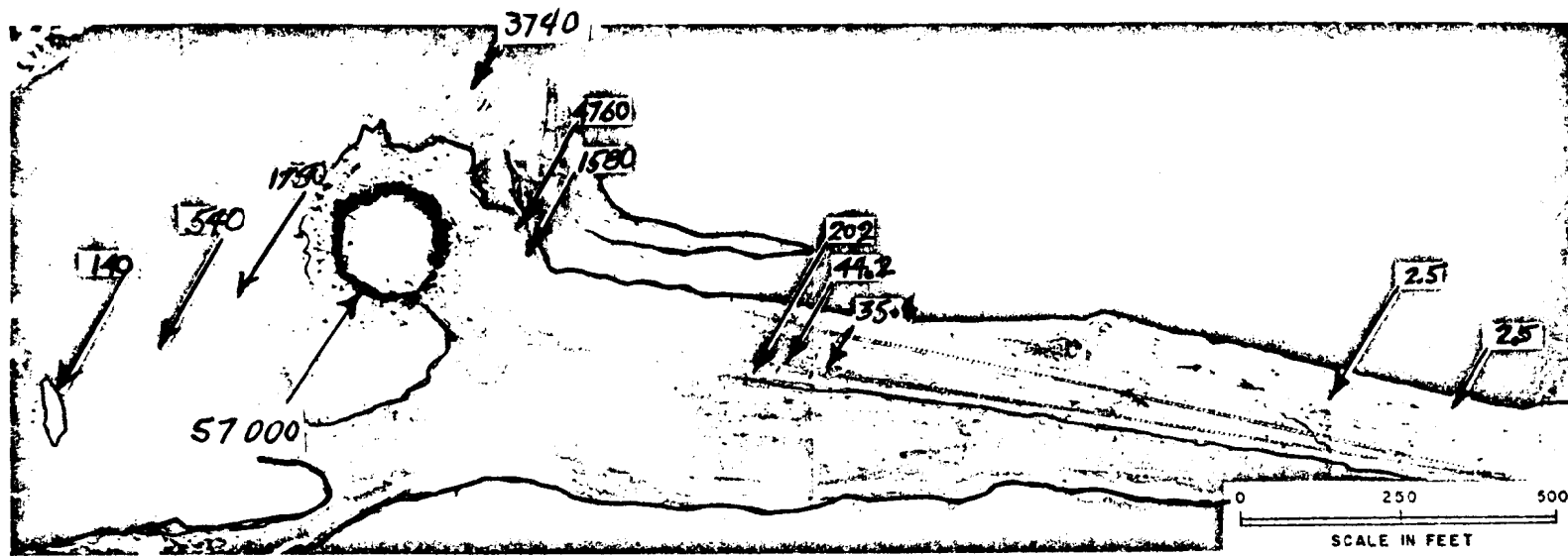


Figure 66. Dose rate readings near the Lacrosse crater in r/hr at H+1 hour.

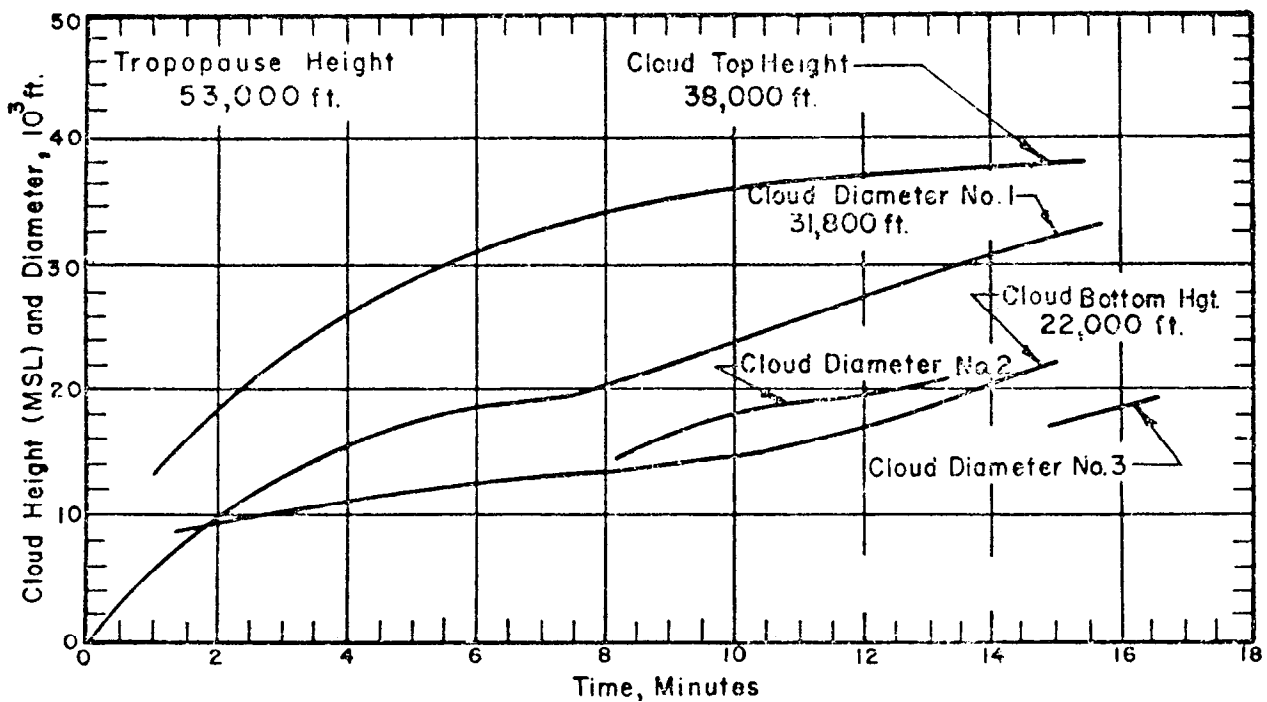


Figure 67. Cloud Dimensions: Operation REDWING - Lacrosse. Diameter-curve 1 represents the diameter of the main cloud; curve 2 refers to a portion of the cloud which resulted from a shear at 8 minutes; curve 3 represents the average diameter of two clouds which resulted from a shear of the second cloud at 15 minutes.

TABLE 18 ENIWETOK WIND DATA FOR OPERATION REDWING-

LACROSSE

Altitude (MSL) feet	H-hour		H+2½ hours		H+5½ hours		H+8½ hours	
	Dir degrees	Speed mph	Dir degrees	Speed mph	Dir degrees	Speed mph	Dir degrees	Speed mph
Surface	070	17	090	15	090	14	090	14
1,000	100	28	090	23	090	18	080	18
2,000	210	28	110	24	090	24	090	22
3,000	110	28	110	26	110	29	100	29
4,000	110	29	110	26	110	31	100	31
5,000	110	33	110	29	110	29	100	32
6,000	100	34	110	28	110	33	110	30
7,000	100	32	110	28	110	33	110	26
8,000	090	26	110	31	110	31	110	23
9,000	090	23	100	33	110	31	120	23
10,000	100	23	100	33	110	26	120	22
12,000	100	13	100	22	100	17	120	20
14,000	110	06	090	07	050	02	120	09
15,000	(180)	(06)	(020)	(07)	(020)	(02)	(040)	(08)
16,000	250	05	320	07	350	03	320	07
18,000	230	05	260	07	270	05	250	05
20,000	240	15	250	17	270	17	210	09
25,000	260	28	260	31	260	30	260	32
30,000	240	43	250	47	240	51	250	47
35,000	260	60	260	55	260	60	260	69
40,000	260	69	250	71	260	68	260	73
45,000	240	58	250	74	260	71	260	75
50,000	240	70	240	71	250	69	240	64
55,000	280	33	250	44	270	32	290	36
60,000	130	09	150	08	180	06	190	13
65,000	130	15	210	05	170	07	140	07
70,000	080	12	090	06	090	13	080	12
75,000	110	32	090	25	110	38	090	37
80,000	090	48	110	47	110	51	100	49
85,000	100	64	090	64	090	62	090	56
90,000	100	72	110	69	100	71	100	61
94,000	100	65	---	--	---	--	---	--
95,000	---	--	100	64	100	57	100	62
98,000	---	--	---	--	---	--	100	63
100,000	---	--	100	65	100	63	---	--
102,000	---	--	---	--	100	63	---	--
105,000	---	--	100	67	---	--	---	--
106,000	---	--	100	67	---	--	---	--

## NOTES:

1. Numbers in parentheses are estimated values.
2. Tropopause height was 52,300 ft MSL. (Reference 149).
3. Wind data was obtained by the weather station on Eniwetok Island.
4. At the surface the air pressure was 14.62 psi, the temperature 27.2°C, the dew point 25.0°C, and the relative humidity 84%.

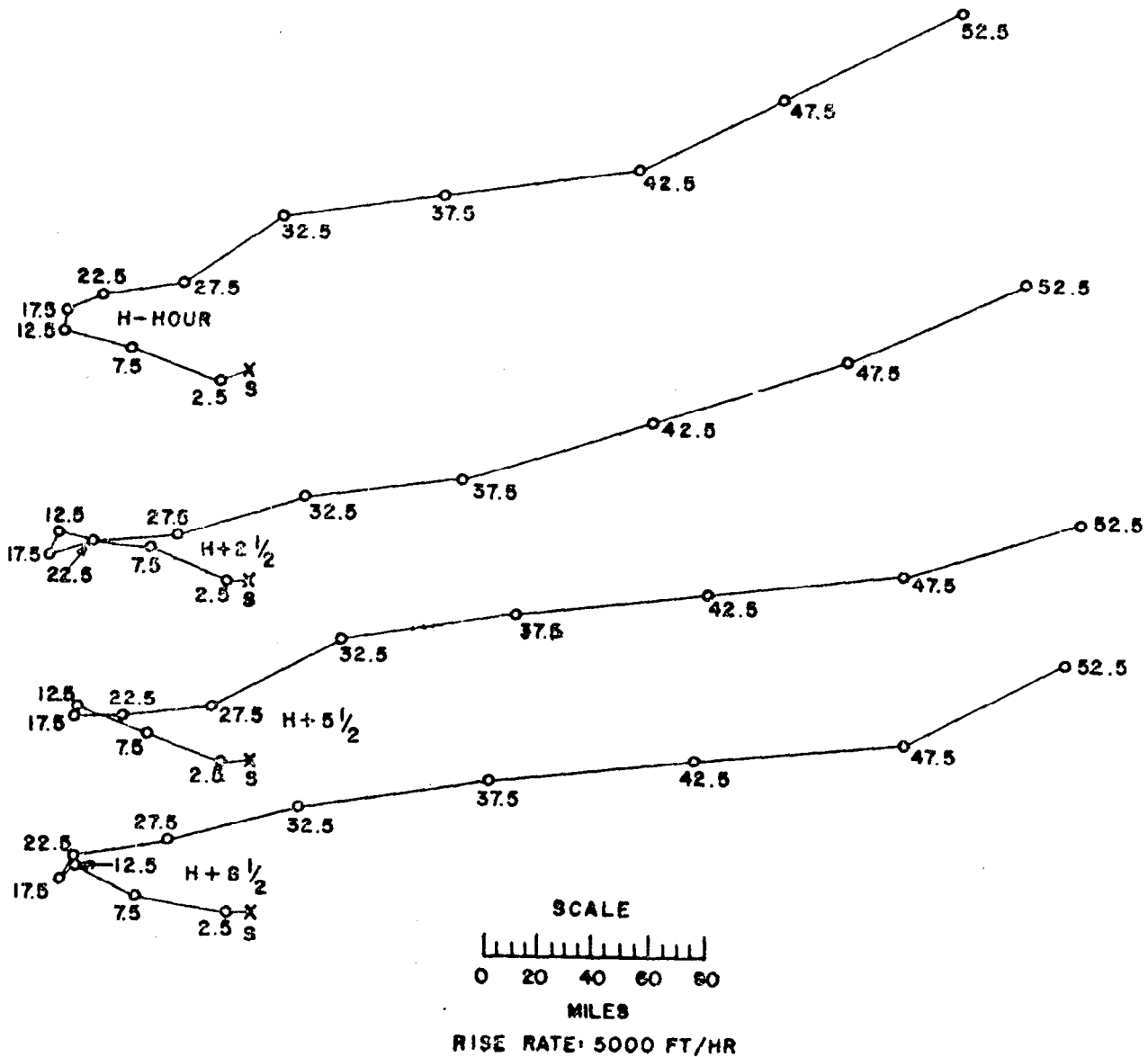


Figure 68. Hodographs for Operation REDWING - Lacrosse.

OPERATION REDWING -

Cherokee

	<u>PPG time</u>	<u>GMT</u>
<u>DATE:</u>	21 May 1956	20 May 1956
<u>TIME:</u>	0551	1751

Sponsor: IASL

SITE: PPG - Bikini - 16,000 ft NE  
of Charlie  
11° 40' 06" N  
165° 23' 39" E  
Site elevation: Sea level

HEIGHT OF BURST: 4,350 ± 150 ft

TYPE OF BURST AND PLACEMENT:

Air burst over water

CLOUD TOP HEIGHT: 94,000 ft MSL

CLOUD BOTTOM HEIGHT: 44,000 ft MSL

REMARKS:

No fallout was observed on the islands. Very light fallout was observed North of GZ. Gamma dose-rate readings on Charlie were at background levels.

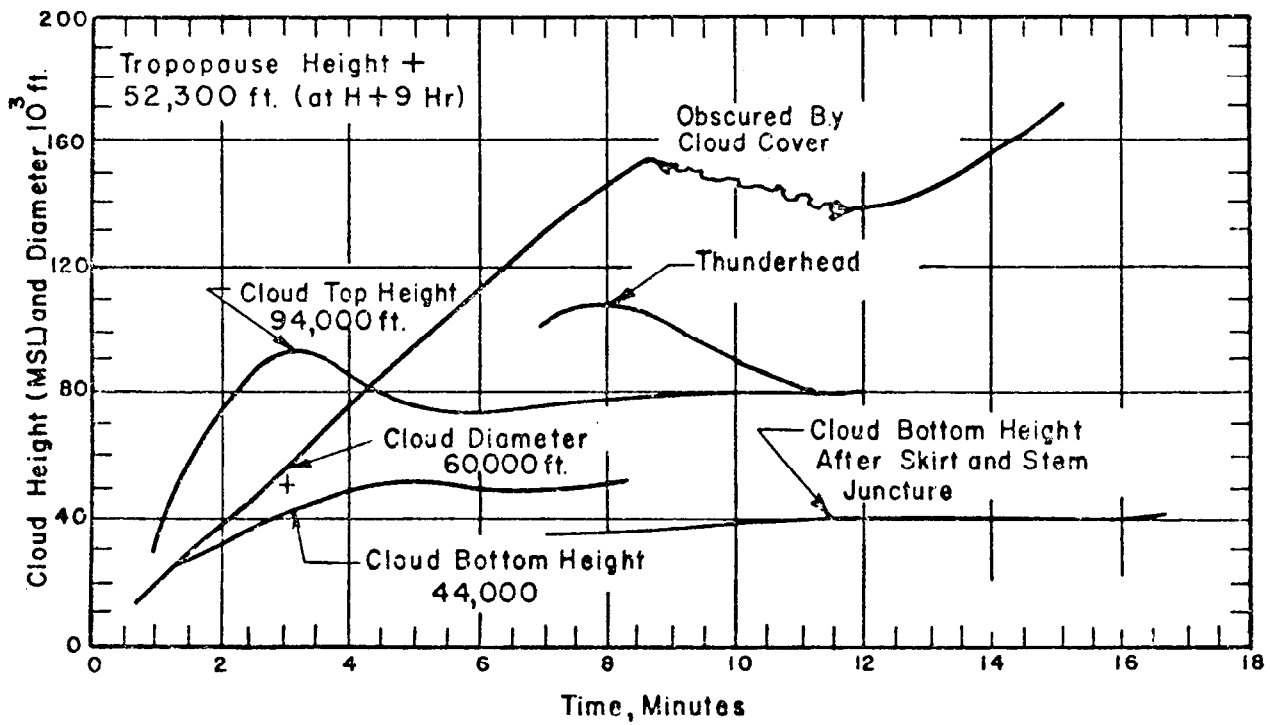


Figure 69. Cloud Dimensions: Operation REDWING - Cherokee.



TABLE 19 BIKINI WIND DATA FOR OPERATION REDWING -

CHEROKEE

Altitude (MSL) feet	H-hour		H+3 hours		H+6 hours	
	Dir degrees	Speed mph	Dir degrees	Speed mph	Dir degrees	Speed mph
Surface	090	06	120	18	120	17
1,000	100	20	090	18	090	22
2,000	090	23	100	18	100	25
3,000	090	23	110	23	100	26
4,000	090	24	110	24	100	26
5,000	090	21	110	22	100	22
6,000	090	16	110	17	090	21
7,000	090	16	110	17	090	23
8,000	090	15	100	18	090	22
9,000	100	13	100	15	090	17
10,000	120	13	090	18	120	13
12,000	120	14	110	17	120	16
14,000	140	16	130	18	110	15
15,000	(140)	(16)	(140)	(17)	(130)	(15)
16,000	140	17	150	17	150	15
18,000	130	17	160	16	170	23
20,000	140	21	170	15	150	15
25,000	150	10	090	20	160	20
30,000	140	07	150	14	150	10
35,000	260	07	220	12	220	09
40,000	230	17	250	23	230	25
45,000	240	18	250	37	250	38
50,000	250	37	250	39	240	25
55,000	210	01	180	07	230	14
60,000	100	20	100	12	150	09
65,000	030	23	090	30	090	23
70,000	100	25	090	40	090	31
75,000	090	55	090	45	080	53
78,000	---	--	---	--	080	60
80,000	090	58	090	53	---	--
85,000	080	63	090	35	---	--
87,000	---	--	090	39	---	--
90,000	080	70	---	--	---	--
95,000	090	85	---	--	---	--
100,000	090	93	---	--	---	--

## NOTES:

1. Numbers in parentheses are estimated values.
2. Tropopause height was 52,500 ft MSL.
3. Wind data was obtained on board the U. S. S. Curtiss.
4. At H-hour the sea level pressure was 1009.0 mb, the temperature 81°F, the dew point 73°F, and the relative humidity 76%.

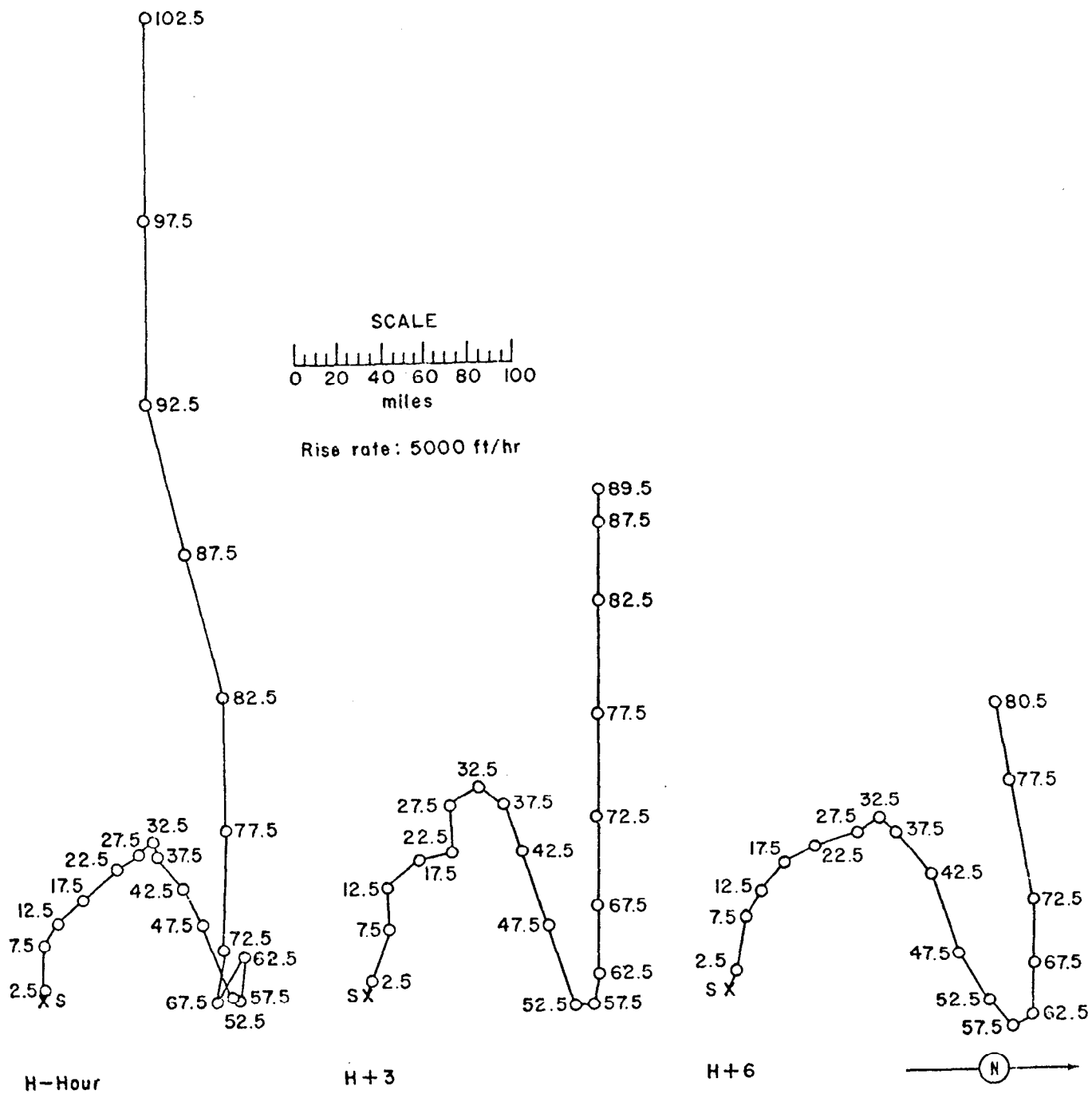


Figure 70 . Hodographs for Operation REDWING -

Cherokee.

OPERATION REDWING - Zuni

	<u>PPG Time</u>	<u>GMP</u>
<u>DATE:</u>	28 May 1956	27 May 1956
<u>TIME:</u>	0556	1756

Sponsor: UCRL

SITE: PPG - Bikini - Tare  
11° 29' 48" N  
165° 22' 09" E  
Site elevation: Sea Level

TOTAL YIELD: 3.5 mt

HEIGHT OF BURST: 9 ft

FIREBALL DATA:

Time to 1st minimum: 160 ± 184 msec  
Time to 2nd maximum: 1.705 ± 2.15 sec  
Radius at 2nd maximum: 5,248 ft

TYPE OF BURST AND PLACEMENT:

Surface burst from platform  
on coral soil and over water

CRATER DATA: Diameter: 2,310 ft  
Depth: 103 ft  
Lip: No apparent lip

CLOUD TOP HEIGHT: 79,000 ft MSL  
CLOUD BOTTOM HEIGHT: 49,000 ft MSL

REMARKS:

The on-site fallout pattern was drawn from island readings taken by scientific project 2.65 supplemented by fallout sample collection on rafts and barges in the lagoon. The measured field decay exponent was used to extrapolate the dose-rate readings to H+1 hour. It was observed that the water adjacent to the beaches of the northern islands of the atoll was generally much more highly contaminated than the islands.

The off-site fallout pattern was drawn from oceanographic surveys. The oceanographic surveys used detector probes for measuring the dose-rate at the surface, plus the allied equipment necessary for measuring the dose-rate at depths to and below the thermocline (water-sampling equipment for the taking of surface samples and for the collection of samples from any desired depth). The dose-rate readings were extrapolated to H+1 hour by using the decay measurements of the samples collected. The portion of fallout that penetrated below the thermocline is unknown. Rather than attempt to estimate the percentage, the results for the dose rates assume no penetration beyond the depth of mixing.

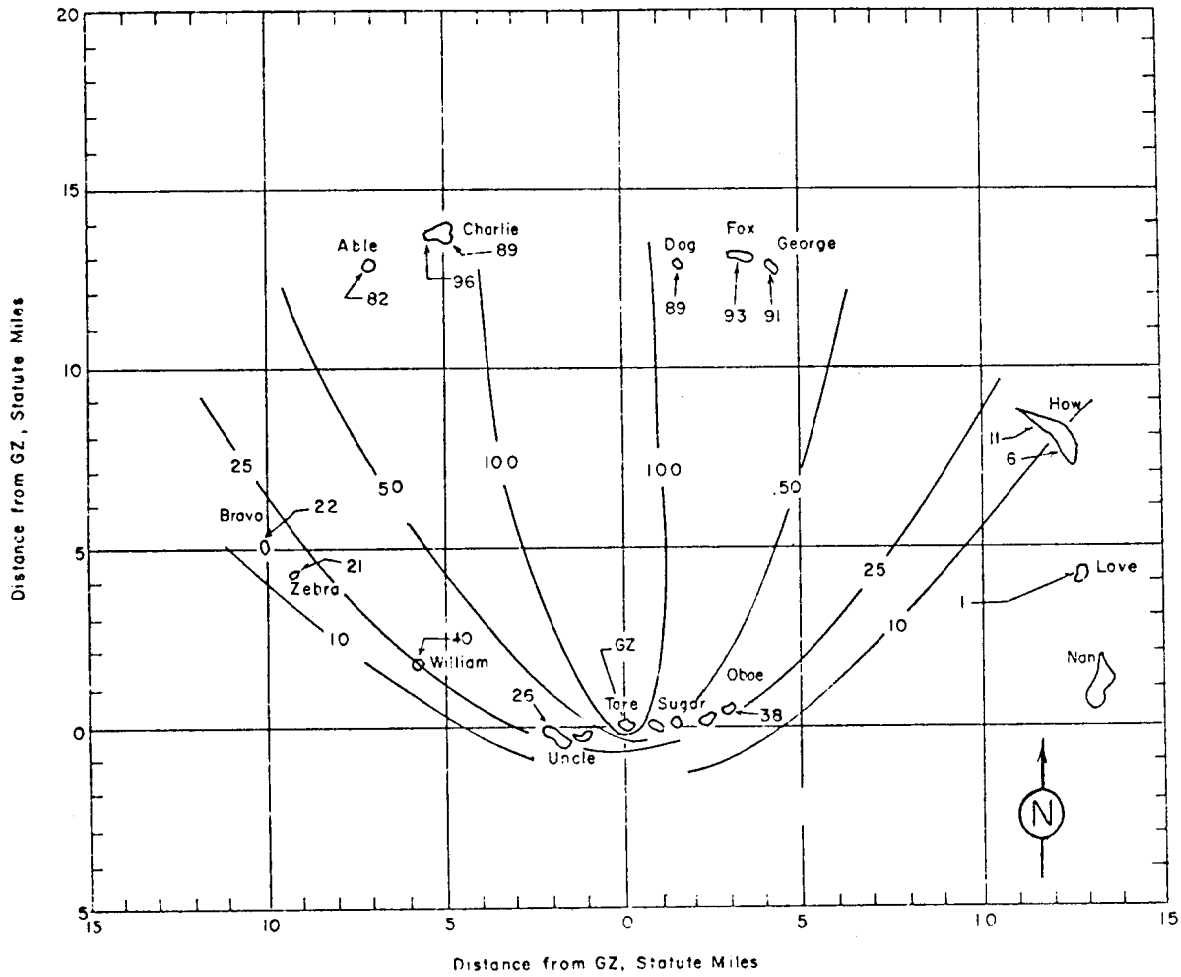


Figure 71. Operation REDWING -  
in r/hr at H+1 hour.

Zuni. On-site dose rate contours

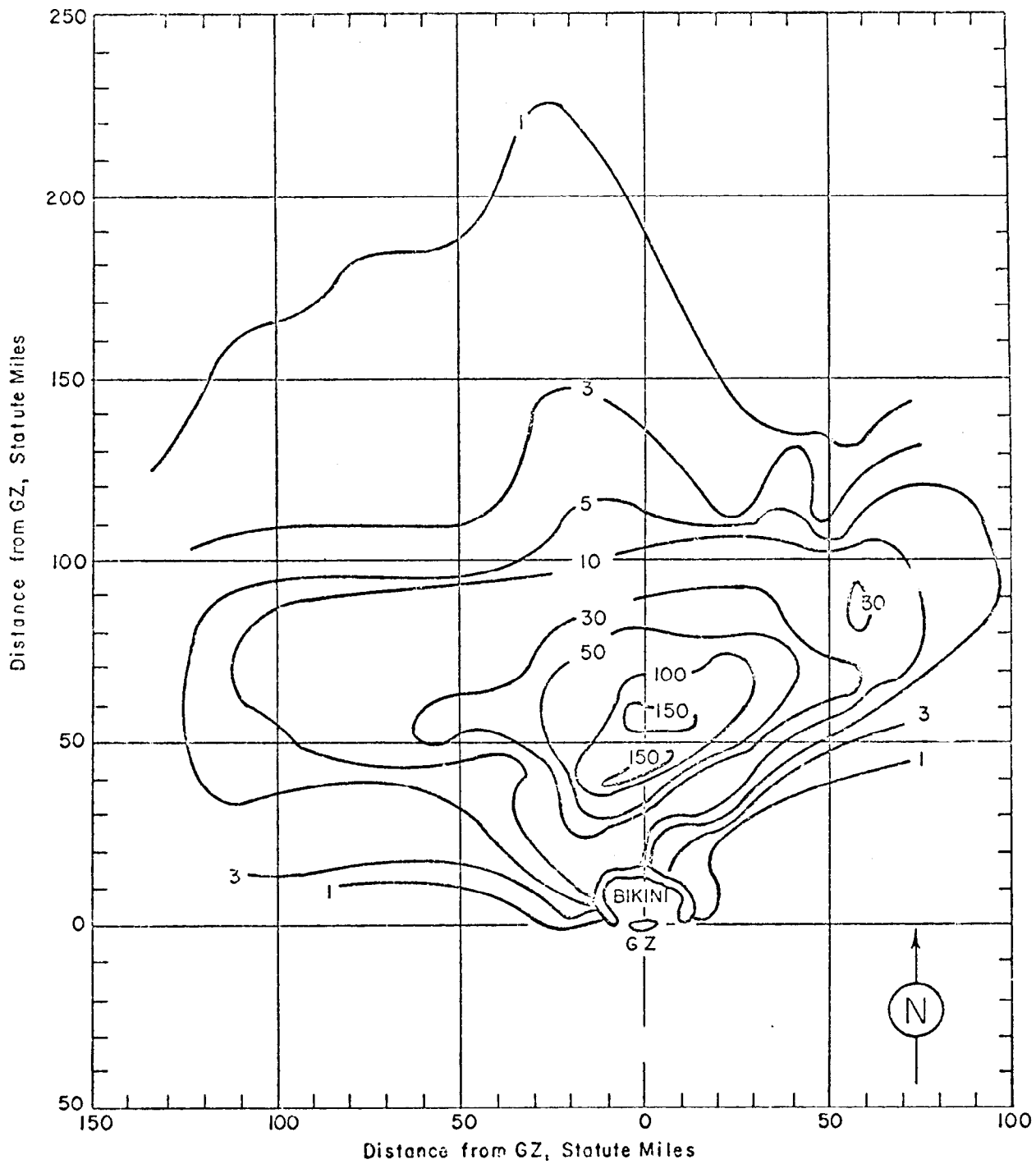


Figure 72. Operation REDWING - Zuni. Off-site dose rate contours in r/hr at H+1 hour.

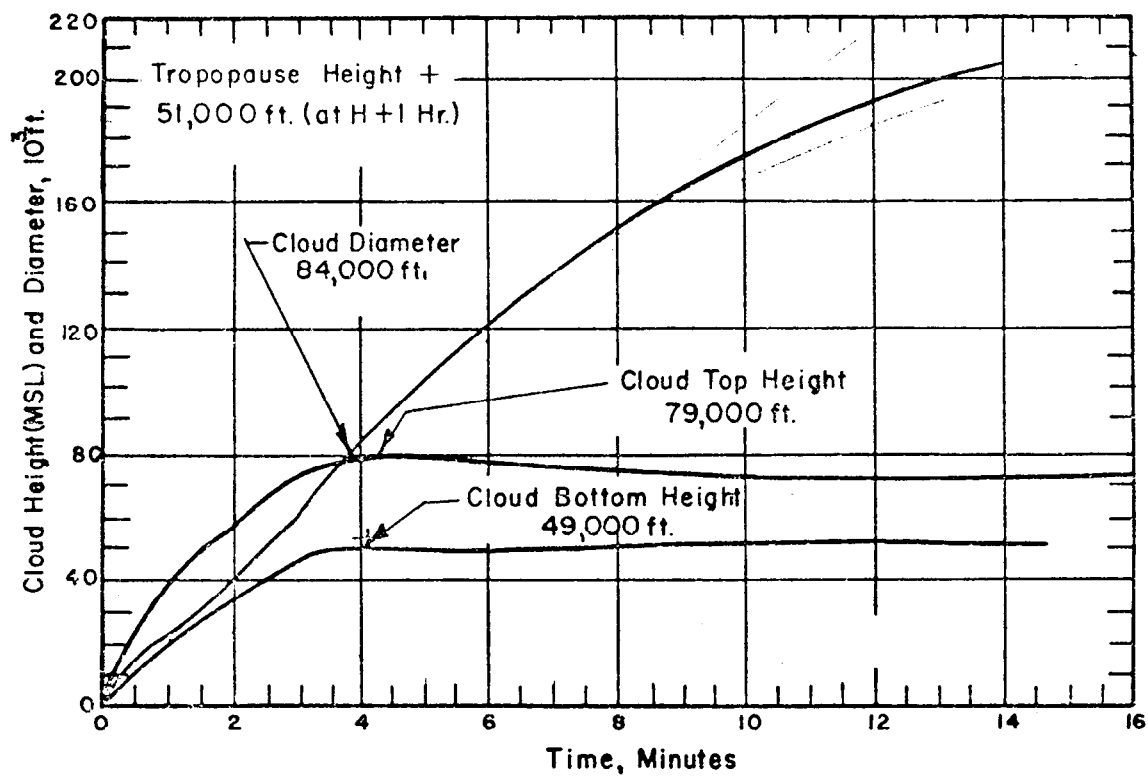


Figure 73. Cloud Dimensions: Operation REDWING - Zuni.

TABLE 20 BIKINI WIND DATA FOR OPERATION REDWING - ZUNI

Altitude (MSL) feet	H-4 hours		H-hour		H+3 hours		H+6 hours	
	Dir degrees	Speed mph	Dir degrees	Speed mph	Dir degrees	Speed mph	Dir degrees	Speed mph
Surface	070	22	050	22	060	30	090	24
1,000	090	26	080	26	060	26	070	28
2,000	090	24	070	25	060	26	080	35
3,000	090	24	070	28	070	30	090	31
4,000	090	25	090	28	070	31	100	30
5,000	080	26	090	24	090	29	100	28
6,000	080	23	100	22	090	29	100	30
7,000	090	23	100	22	100	23	100	31
8,000	080	24	100	22	120	23	090	29
9,000	090	24	100	22	110	24	100	30
10,000	090	24	100	23	100	22	100	30
12,000	100	22	090	24	090	17	090	26
14,000	080	17	090	17	080	16	090	24
15,000	---	--	(100)	(15)	(080)	(15)	(090)	(24)
16,000	110	15	110	12	070	14	090	25
18,000	110	17	100	12	090	13	090	17
20,000	110	14	140	12	110	10	090	17
25,000	170	18	160	18	170	20	260	02
30,000	240	26	170	14	160	18	180	13
35,000	250	36	220	29	200	35	230	35
40,000	260	34	220	46	210	50	260	50
45,000	230	54	210	40	220	43	230	61
50,000	240	37	240	29	250	31	240	32
51,000	---	--	250	29	---	--	---	--
55,000	220	26	240	3	250	21	240	20
60,000	060	18	080	17	090	16	080	22
65,000	090	28	090	30	090	31	090	32
70,000	090	32	090	30	090	37	090	30
75,000	080	44	090	40	090	38	090	35
77,000	---	--	---	--	---	--	100	41
80,000	100	47	100	48	100	48	---	--
85,000	090	51	100	48	100	46	---	--
86,000	---	--	---	--	100	43	---	--
90,000	090	52	100	48	---	--	---	--

NOTES:

1. Numbers in parentheses are estimated values.
2. Tropopause height was 51,200 ft MSL.
3. Wind data was obtained on board the U. S. S. Curtiss.
4. H-hour data for altitudes over 51,000 ft were determined by interpolating from measurements taken between H-4 and H+3 hours.
5. At H-hour the sea level pressure was 1010.5 mb, the temperature 81°F, the dew point 76°F, and the relative humidity 80%.

TABLE 20 WIND DATA FOR OPERATION REDWING -

ZUNI (CONTD)

Altitude (MSL) feet	Bikini				Rongerik	
	H+9 hours		H+15 hours		H+21 hours	
	Dir degrees	Speed mph	Dir degrees	Speed mph	Dir degrees	Speed mph
Surface	080	24	090	23	070	15
1,000	090	28	080	24	080	24
2,000	100	31	080	23	080	24
3,000	100	31	090	20	080	21
4,000	100	28	090	18	080	16
5,000	100	29	090	18	080	13
6,000	100	25	090	20	090	12
7,000	100	26	100	21	090	12
8,000	100	31	100	21	090	14
9,000	090	30	090	21	090	14
10,000	090	26	100	21	090	12
12,000	100	25	100	22	090	14
14,000	080	31	090	21	100	12
15,000	(080)	(26)	(090)	(18)	(100)	(14)
16,000	070	22	090	17	090	18
18,000	090	18	100	24	090	24
20,000	070	24	090	23	080	21
25,000	050	25	070	20	060	23
30,000	230	21	200	13	020	26
35,000	230	31	200	13	220	15
40,000	210	46	210	26	230	24
45,000	220	47	220	38	230	28
50,000	250	31	230	32	310	25
53,000	---	--	240	31	---	--
55,000	290	16	---	--	010	07
60,000	110	23	---	--	150	14
65,000	090	26	---	--	090	24
70,000	090	31	---	--	080	23
75,000	090	37	---	--	090	40
80,000	090	36	---	--	080	47
85,000	090	44	---	--	090	52
90,000	090	56	---	--	080	56
95,000	100	65	---	--	080	69
96,000	100	65	---	--	---	--
99,000	---	--	---	--	080	81

## NOTES:

1. Numbers in parentheses are estimated values.
2. Wind data for H+9 hours and H+15 hours were obtained on board the U. S. S. Curtiss. Wind data for H+21 hours was obtained by weather station on Eniwetok Island (Rongerik Atoll).



TABLE 20 RONGERIK WIND DATA FOR OPERATION REDWING -

ZUNI (Contd)

Altitude (MSL) feet	H+27 hours		H+33 hours		H+39 hours	
	Dir degrees	Speed mph	Dir degrees	Speed mph	Dir degrees	Speed mph
Surface	090	18	090	10	070	18
1,000	080	21	080	16	070	23
2,000	080	22	070	17	070	25
3,000	080	21	070	16	070	29
4,000	080	18	080	13	070	22
5,000	080	16	100	09	070	12
6,000	070	14	090	06	080	07
7,000	080	13	080	06	080	07
8,000	090	13	090	08	070	07
9,000	090	13	090	10	080	07
10,000	090	13	080	13	080	10
12,000	080	12	060	13	090	12
14,000	110	08	060	13	060	14
15,000	(090)	(13)	(080)	(12)	(060)	(15)
16,000	070	17	090	10	060	17
18,000	090	17	090	12	040	16
20,000	070	15	080	07	030	12
25,000	060	22	080	22	090	14
30,000	050	24	070	22	050	13
35,000	330	08	330	17	310	18
40,000	190	10	200	16	180	21
45,000	230	10	190	06	290	09
50,000	230	14	320	17	270	08
55,000	180	14	200	09	220	17
60,000	110	16	360	05	080	17
65,000	090	22	100	15	090	23
70,000	080	29	040	08	080	26
75,000	100	38	100	32	080	38
80,000	090	36	090	41	080	47
85,000	090	55	090	56	100	57
90,000	090	60	090	61	090	67
92,000	---	--	---	--	080	75
95,000	090	74	090	69	---	--
100,000	090	81	090	81	---	--
105,000	090	04	080	89	---	--
110,000	090	69	080	102	---	--
114,000	090	69	080	102	---	--

NOTES:

1. Numbers in parentheses are estimated values.
2. Wind data was obtained by the weather station on Eniwetok Island (Rongerik Atoll).

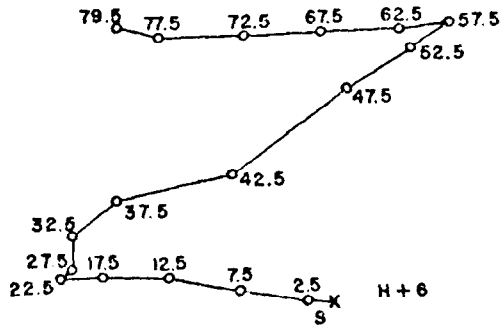
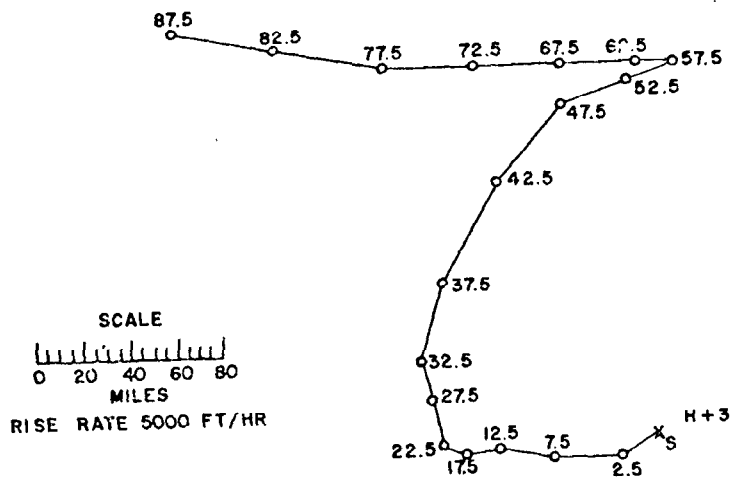
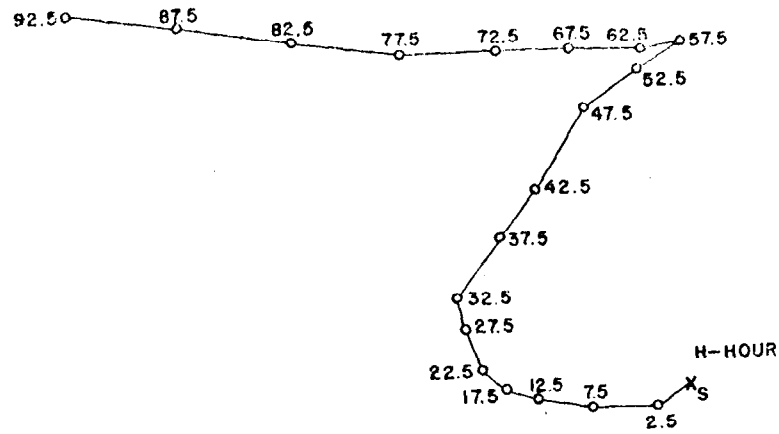


Figure 74 . Hodographs for Operation REDWING - Zuni.

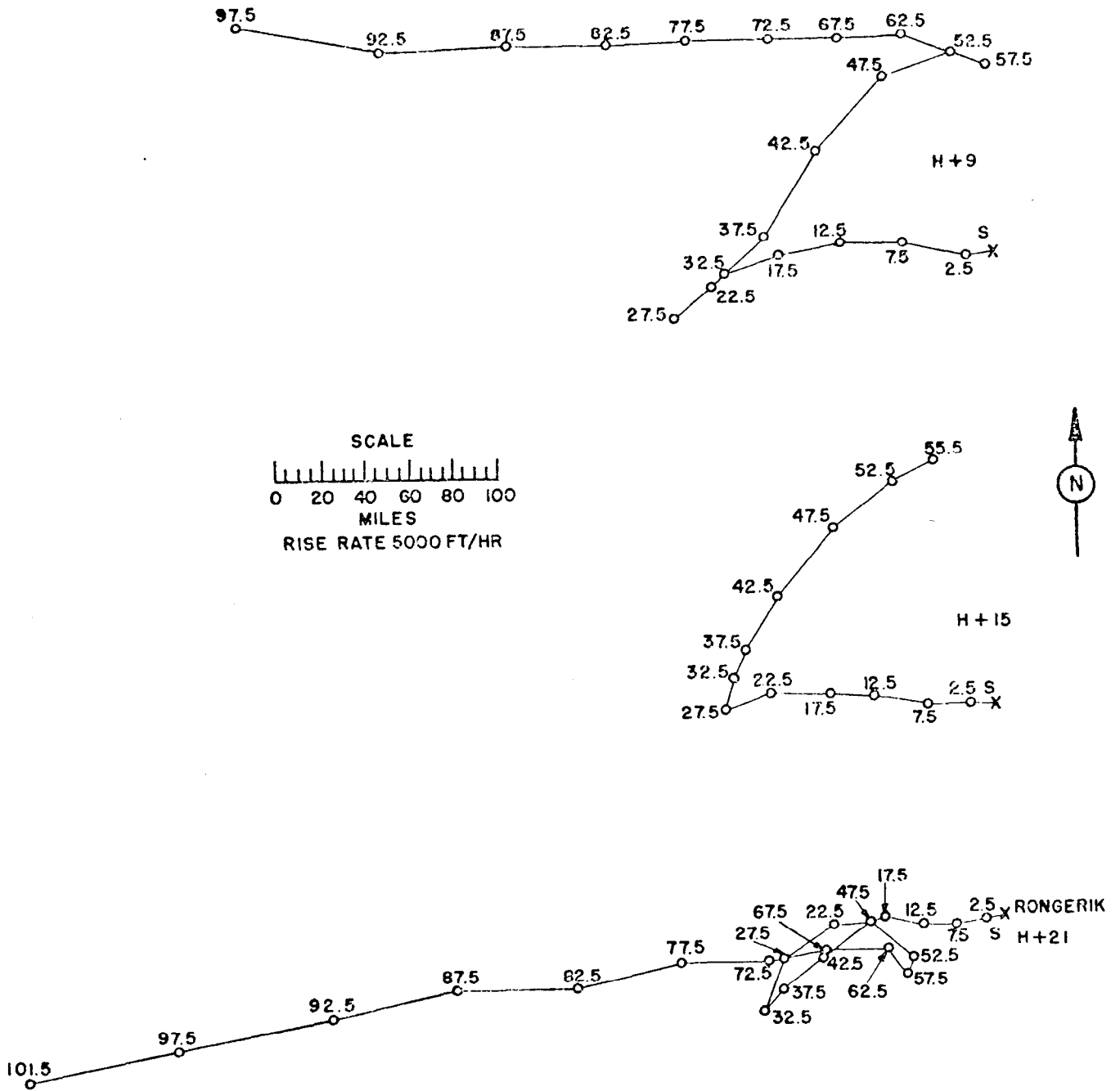


Figure 75. Hodographs for Operation REDWING - Zuni.

OPERATION REDWING: - Yuma

	<u>PPG time</u>	<u>GMT</u>
<u>DATE:</u>	28 May 1956	27 May 1956
<u>TIME:</u>	0756	1956

Sponsor: UCRL

SITE: PPG - Eniwetok - Sally  
11° 30' 33" N  
162° 18' 55" E  
Site elevation: Sea Level

HEIGHT OF BURST: - 205 ft

CLOUD TOP HEIGHT: 8,000 ft MSL  
CLOUD BOTTOM HEIGHT: 1,000 ft MSL

TYPE OF BURST AND PLACEMENT:  
Tower burst over coral soil

REMARKS:

Only island dose rate readings are available. These were taken from the aerial and ground surveys made by the Radiological Safety organization. The  $t^{-1.2}$  decay approximation was used to extrapolate the dose rate readings to H+1 hour. Significant amounts of alpha (plutonium) contamination were found on the shot island.

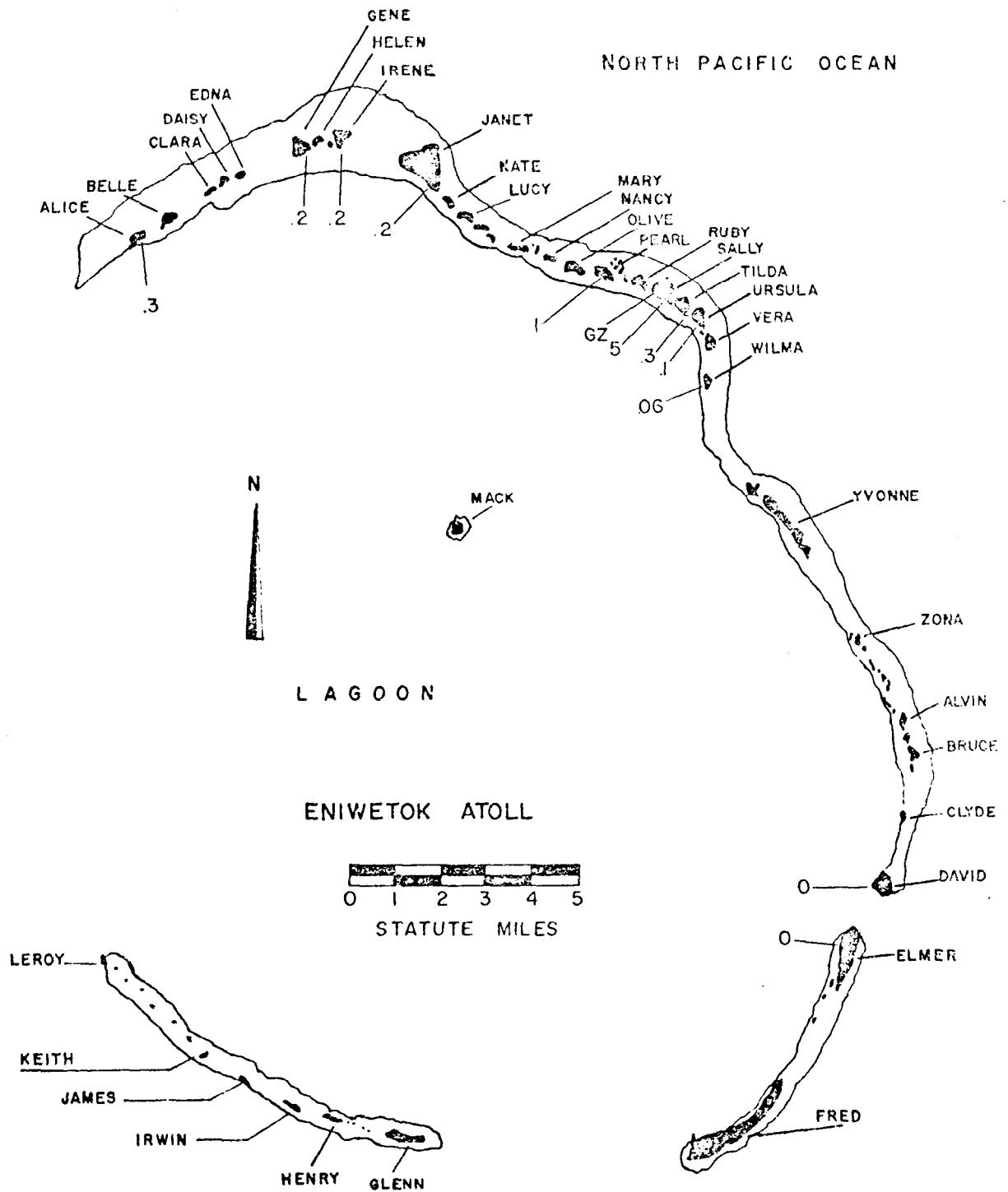


Figure 76. Operation REDWING - Yuma.  
Island dose rates in r/hr at H+1 hour.

TABLE 21 ENIWETOK WIND DATA FOR OPERATION REDWING - YUMA

Altitude (MSL) feet	H-2 hours		H hour		H+4 hours		H+7 hours	
	Dir	Speed	Dir	Speed	Dir	Speed	Dir	Speed
	degrees	mph	degrees	mph	degrees	mph	degrees	mph
Surface	080	21	080	21	090	17	090	14
1,000	080	24	090	33	090	26	090	26
2,000	080	31	090	33	100	33	090	30
3,000	080	35	090	35	100	38	100	33
4,000	080	35	090	36	100	45	100	36
5,000	080	32	090	33	100	36	110	30
6,000	090	28	080	33	100	35	120	28
7,000	090	28	080	36	090	30	110	30
8,000	090	29	080	38	090	37	110	35
9,000	090	30	080	37	090	39	110	36
10,000	090	30	080	31	090	43	120	35
12,000	090	25	080	24	090	40	100	32
14,000	110	23	090	15	090	14	090	28
16,000	140	22	140	16	110	16	100	14
18,000	140	17	150	14	120	18	120	15
20,000	180	05	100	12	100	14	100	12
25,000	170	26	160	21	180	12	270	08
30,000	260	21	190	22	160	21	220	23
35,000	230	35	220	35	190	41	220	47
40,000	220	55	210	44	200	55	200	52
45,000	---	--	230	51	240	35	230	40
50,000	---	--	270	45	250	32	230	24
55,000	---	--	210	29	240	38	240	28
60,000	---	--	060	14	060	10	100	15
65,000	---	--	080	37	100	39	100	32
70,000	---	--	110	38	100	38	100	31
75,000	---	--	090	37	100	40	090	37
80,000	---	--	100	47	100	39	100	45
85,000	---	--	090	47	090	53	100	54
90,000	---	--	110	60	100	55	100	60
95,000	---	--	100	68	090	67	100	71
98,000	---	--	---	--	100	85	---	--
100,000	---	--	100	89	---	--	100	68
102,000	---	--	100	92	---	--	---	--

NOTES:

1. Tropopause height was 55,500 ft MSL.
2. Wind data was obtained by the weather station on Eniwetok Island.
3. H hour values were interpolated from data taken at H-2 hours and H+1 hour.
4. At the surface the air pressure was 14.64 psi, the temperature 27.5°C, the dew point 23.9°C and the relative humidity 80%.

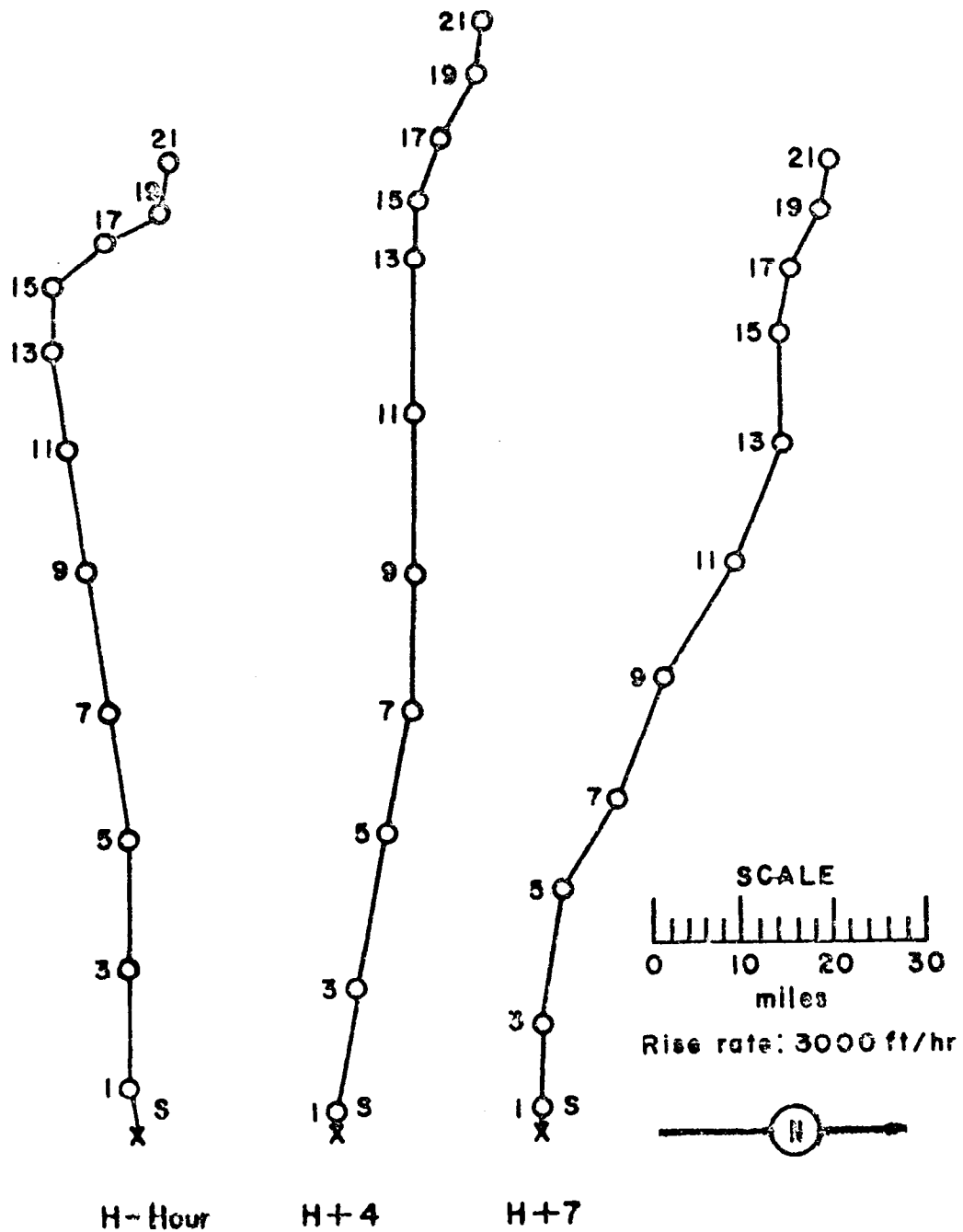


Figure 77. Hodographs for Operation REDWING -

Yuma.

OPERATION REDWING - Erie

	<u>PPG Time</u>	<u>GMT</u>
<u>DATE:</u>	31 May 1956	30 May 1956
<u>TIME:</u>	0615	1815

Sponsor: LASL

SITE: PPG - Eniwetok - Yvonne  
11° 32' 40" N  
162° 21' 52" E  
Site elevation: Sea level

HEIGHT OF BURST: 300 ft

TOWER OF BURST AND PLACEMENT:  
Tower burst over coral soil

CLOUD TOP HEIGHT: 32,000 ft MSL  
CLOUD BOTTOM HEIGHT: 10,000 ft MSL

REMARKS:

Only island dose-rate readings are available. These were obtained from aerial and ground surveys made by the Radiological Safety organization at H+4 hours. The  $t^{-1.2}$  decay approximation was used to extrapolate the dose-rate readings to H+1 hour. Islands north of Yvonne in the atoll were only slightly contaminated.



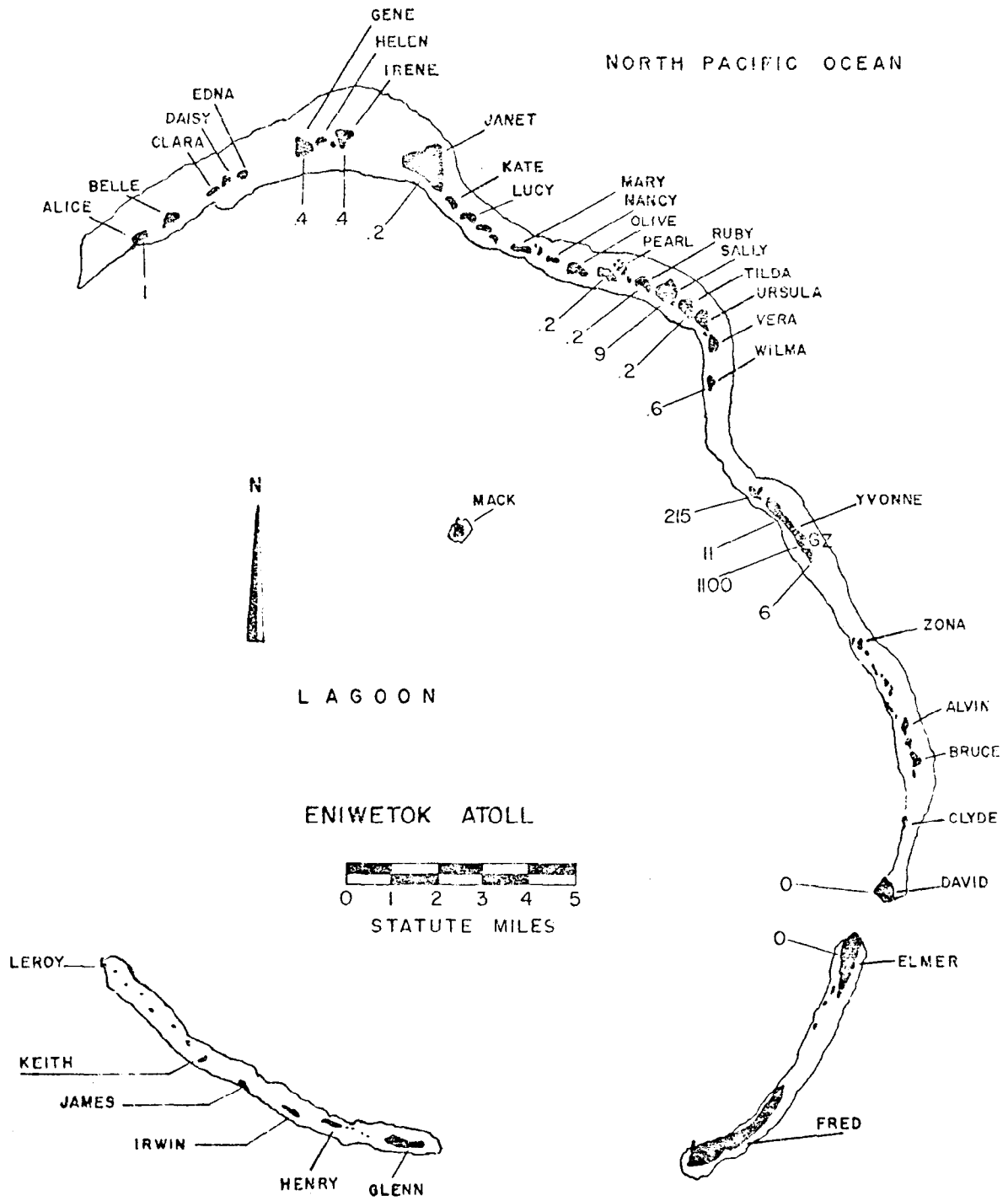


Figure 78 . Operation REDWING - Erie.  
Island dose rates in r/hr at 11:1 hour.

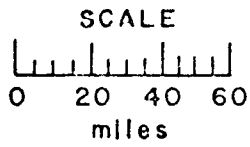
TABLE 22 ENIWETOK WIND DATA FOR OPERATION REDWING -

ERIE

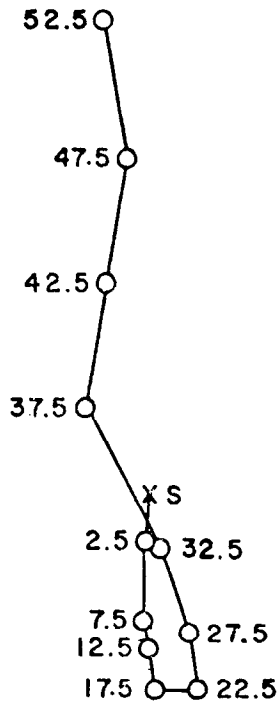
Altitude (MSL) feet	H-hour		H+3 hours		H+6 hours	
	Dir degrees	Speed mph	Dir degrees	Speed mph	Dir degrees	Speed mph
Surface	100	16	130	16	090	12
1,000	100	28	100	20	090	23
2,000	100	28	100	21	090	23
3,000	100	23	100	22	090	22
4,000	100	21	100	22	090	20
5,000	090	20	100	18	090	16
6,000	090	16	100	12	100	17
7,000	080	10	110	07	100	16
8,000	100	08	110	06	100	16
9,000	100	17	090	07	110	16
10,000	080	05	090	08	120	14
12,000	100	06	100	06	120	05
14,000	090	09	090	07	120	09
15,000	(080)	(10)	(090)	(09)	(100)	(07)
16,000	080	10	090	13	080	06
18,000	070	14	090	13	080	12
20,000	360	07	110	07	080	07
25,000	260	15	200	20	280	09
30,000	250	22	250	24	230	17
35,000	240	44	270	28	240	30
40,000	280	37	270	41	280	38
45,000	280	36	270	40	260	38
50,000	260	38	250	41	240	39
55,000	320	18	300	12	270	24
60,000	080	12	090	13	140	07
65,000	090	26	080	24	080	24
70,000	100	33	110	32	110	32
75,000	100	40	100	44	100	44
80,000	100	72	090	68	120	62
85,000	090	79	090	98	120	72
90,000	090	74	110	83	100	78
94,000	090	77	---	--	---	--
95,000	---	--	100	77	100	80
96,000	---	--	100	78	---	--
100,000	---	--	---	--	120	88
102,000	---	--	---	--	120	93

## NOTES:

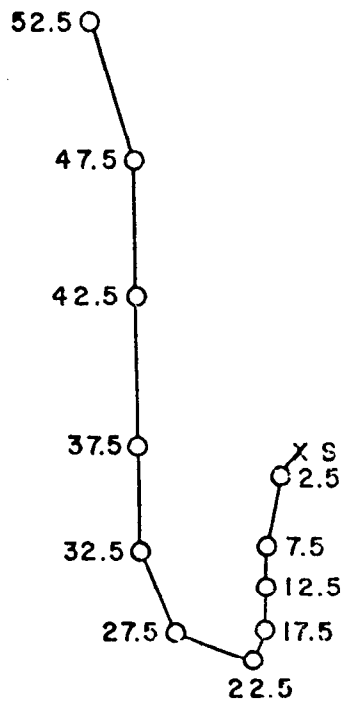
1. Numbers in parentheses are estimated values.
2. Tropopause height was 54,100 ft MSL. (Reference 149).
3. Wind data was obtained by the weather station on Eniwetok Island.
4. At H-hour the sea level pressure was 1009.1 mb, the temperature 80.3°F, the dew point 73.5°F, and the relative humidity 80.2%.



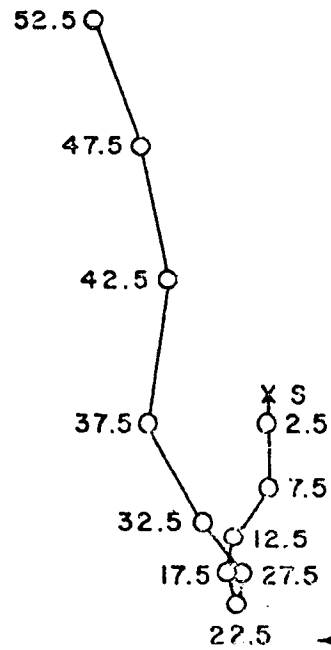
Rise rate: 5000 ft/hr



H - Hour



H + 3



H + 6

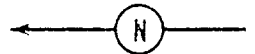


Figure 79 . Hodographs for Operation REDWING -

Erie.

OPERATION REDWING - - Seminole

	<u>PTG time</u>	<u>GMT</u>
<u>DATE:</u>	6 June 1956	6 June 1956
<u>TIME:</u>	1255	0055

Sponsor: IASL

SITE: PPG - Eniwetok - Irene  
11° 40' 35" N  
162° 13' 02" E

HEIGHT OF BURST: 4.5 ft

TYPE OF BURST AND PLACEMENT:  
Surface burst in water tank  
over coral soil

CLOUD TOP HEIGHT: 16,000 ft MSL  
CLOUD BOTTOM HEIGHT: 9,000 ft MSL

REMARKS:

Only island dose-rate readings are available. These were obtained from aerial and ground surveys made by the Radiological Safety organization. The  $t^{-1.2}$  decay approximation was used to extrapolate the dose-rate readings to H+1 hour.

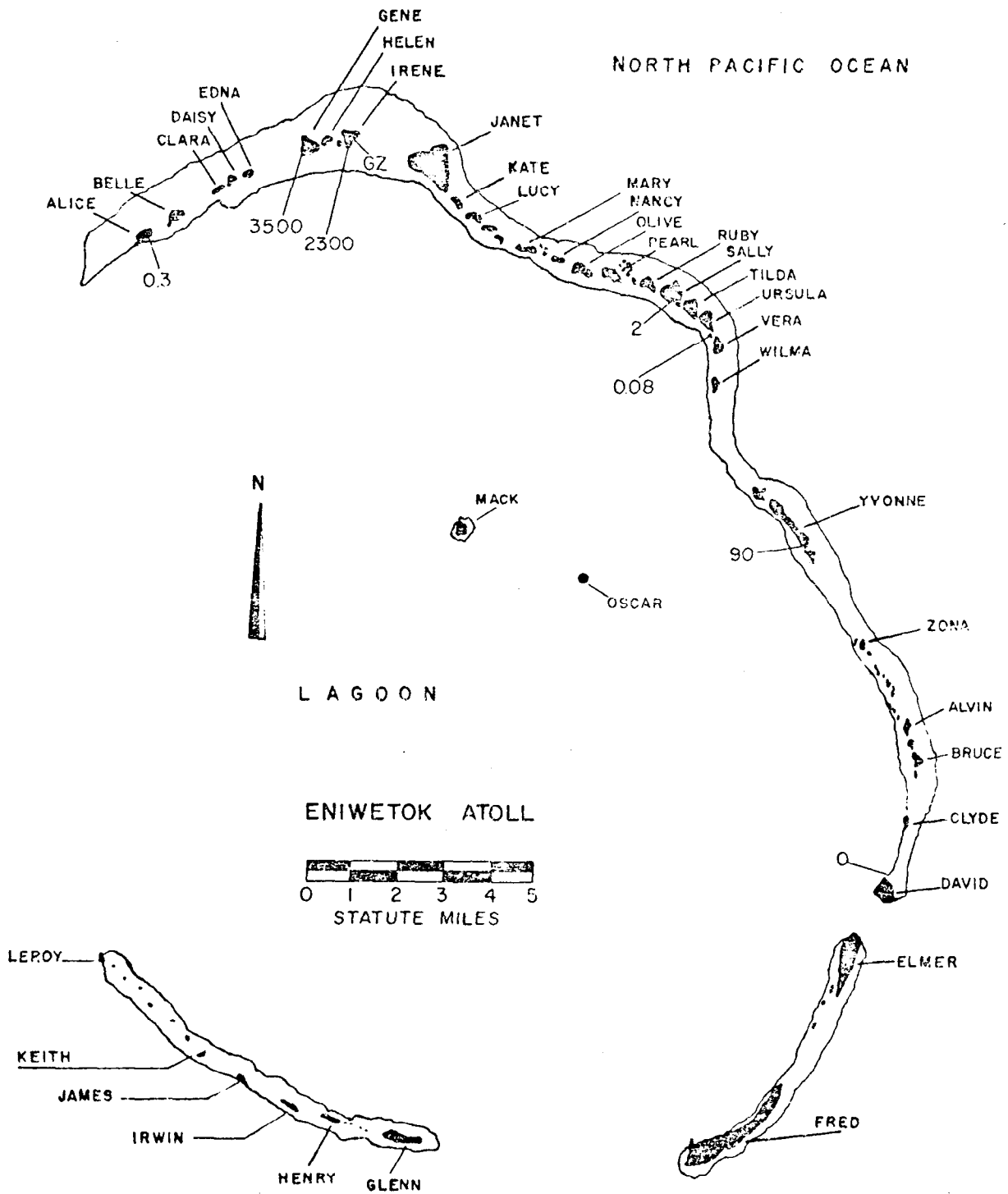


Figure 80. Operation REDWING - Seminole.  
Island dose rates in r/hr at H+1 hour.

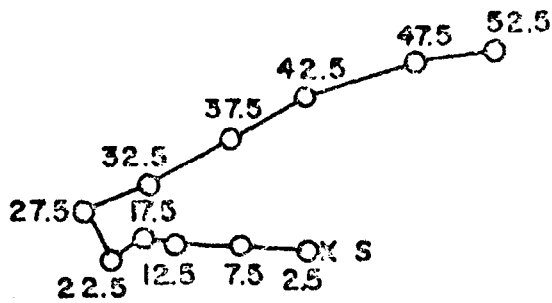
TABLE 23 ENIWETOK WIND DATA FOR OPERATION REDWING -

SEMINOLE

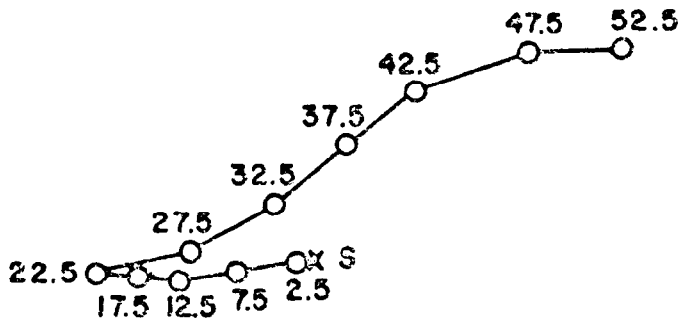
Altitude (MSL) feet	H-1 hour		H-hour		H+2 hours		H+5 hour	
	Dir degrees	Speed mph	Dir degrees	Speed mph	Dir degrees	Speed mph	Dir degrees	Speed mph
Surface	100	13	100	12	090	09	080	12
1,000	090	16	090	15	080	14	070	20
2,000	090	16	090	17	090	20	070	20
3,000	090	18	090	18	090	17	100	20
4,000	090	18	090	17	080	14	100	20
5,000	090	18	090	17	080	14	090	17
6,000	100	15	090	15	080	14	080	16
7,000	100	10	100	12	100	14	080	09
8,000	100	10	110	12	120	14	100	08
9,000	090	13	090	13	100	14	110	08
10,000	090	14	090	14	080	14	090	08
12,000	090	12	080	10	070	08	100	07
14,000	090	05	090	06	100	09	140	02
15,000	---	--	(100)	(06)	(100)	(09)	(Calm)	(Calm)
16,000	100	05	100	06	100	09	Calm	Calm
18,000	110	02	110	03	110	05	Calm	Calm
20,000	040	08	060	09	090	10	160	07
25,000	030	09	110	13	260	21	240	05
30,000	250	14	250	17	240	23	240	14
35,000	250	23	240	23	230	23	220	17
40,000	240	20	240	20	230	21	230	16
45,000	250	27	250	30	260	23	250	25
50,000	260	18	260	20	270	21	270	13
55,000	360	05	340	05	300	05	290	09
60,000	090	13	080	12	060	10	120	05
65,000	090	26	100	26	110	28	110	23
70,000	070	45	080	47	090	49	090	52
75,000	090	60	090	60	100	61	100	56
80,000	090	63	090	63	090	76	100	64
85,000	100	75	100	76	090	79	100	74
90,000	100	77	100	79	090	84	090	71
93,000	---	--	---	--	090	84	090	71
95,000	100	81	100	80	---	--	---	--
100,000	100	68	100	68	---	--	---	--

## NOTES:

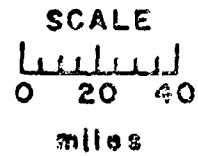
1. Numbers in parentheses are estimated values.
2. Tropopause height was 52,200 ft MSL. (Reference 149).
3. Wind data was obtained by the weather station on Eniwetok Island.
4. H-hour values were interpolated from data taken at H-1 hour and H+2 hours.
5. At the surface the air pressure was 14.64 psi, the temperature 30.5°C, the dew point 24.7°C and the relative humidity 71%.



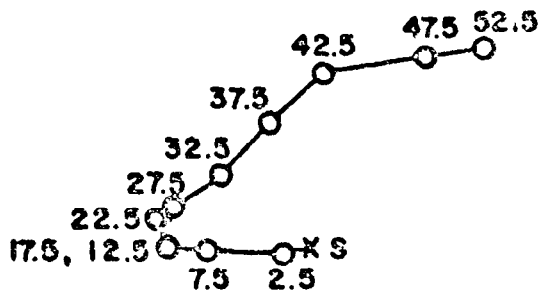
H-Hour



H+2



Rise rate: 5000 ft/hr



H+5



Figure 81. Hodographs for Operation REDWING -

Seminole.

OPERATION REDWING -

Flathcad

	<u>PPG Time</u>	<u>GMF</u>
<u>DATE:</u>	12 Jun 1956	11 Jun 1956
<u>TIME:</u>	0626	1826

Sponsor: LASL

SITE: PPG - Bikini - 5,000 ft south  
of Dog  
11° 36' 00" N  
165° 27' 05" E  
Site elevation: Sea Level

HEIGHT OF BURST: 15 ft

TYPE OF BURST AND PLACEMENT:

Surface burst from barge on  
water; center of gravity  
approx. 15 ft above surface  
of water; water depth 114 ft

CLOUD TOP HEIGHT: 65,700 ft MSL

CLOUD BOTTOM HEIGHT: 38,600 ft MSL

REMARKS:

The on-site fallout pattern was drawn from island readings taken by scientific projects supplemented by fallout sample collection on rafts and barges in the lagoon. Actual field decay measurements, which indicated a decay exponent were used to extrapolate the dose-rate readings to H+1 hour.

The off-site fallout pattern was drawn from oceanographic surveys. The oceanographic surveys used detector probes for measuring the dose-rate at depths to and below the thermocline. Water-sampling equipment was used for the taking of surface samples and for the collection of samples from any desired depth. The dose-rate readings were extrapolated to H+1 hour by using the decay measurements of the samples collected. Very little of the fallout should have been associated with solid particles large enough to penetrate below the thermocline.



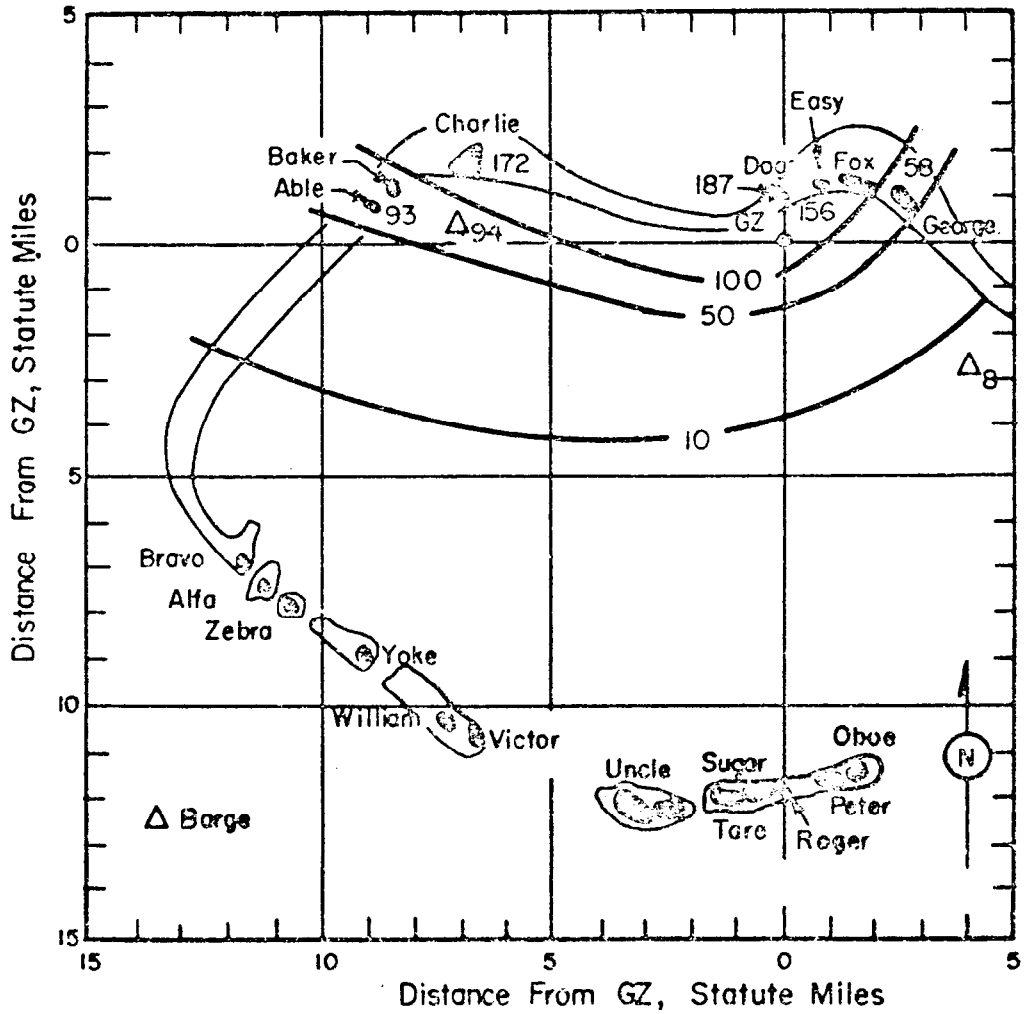


Figure 82. Operation REDWING - Flathead. On-site dose rate contours in r/hr at H+1 hour.

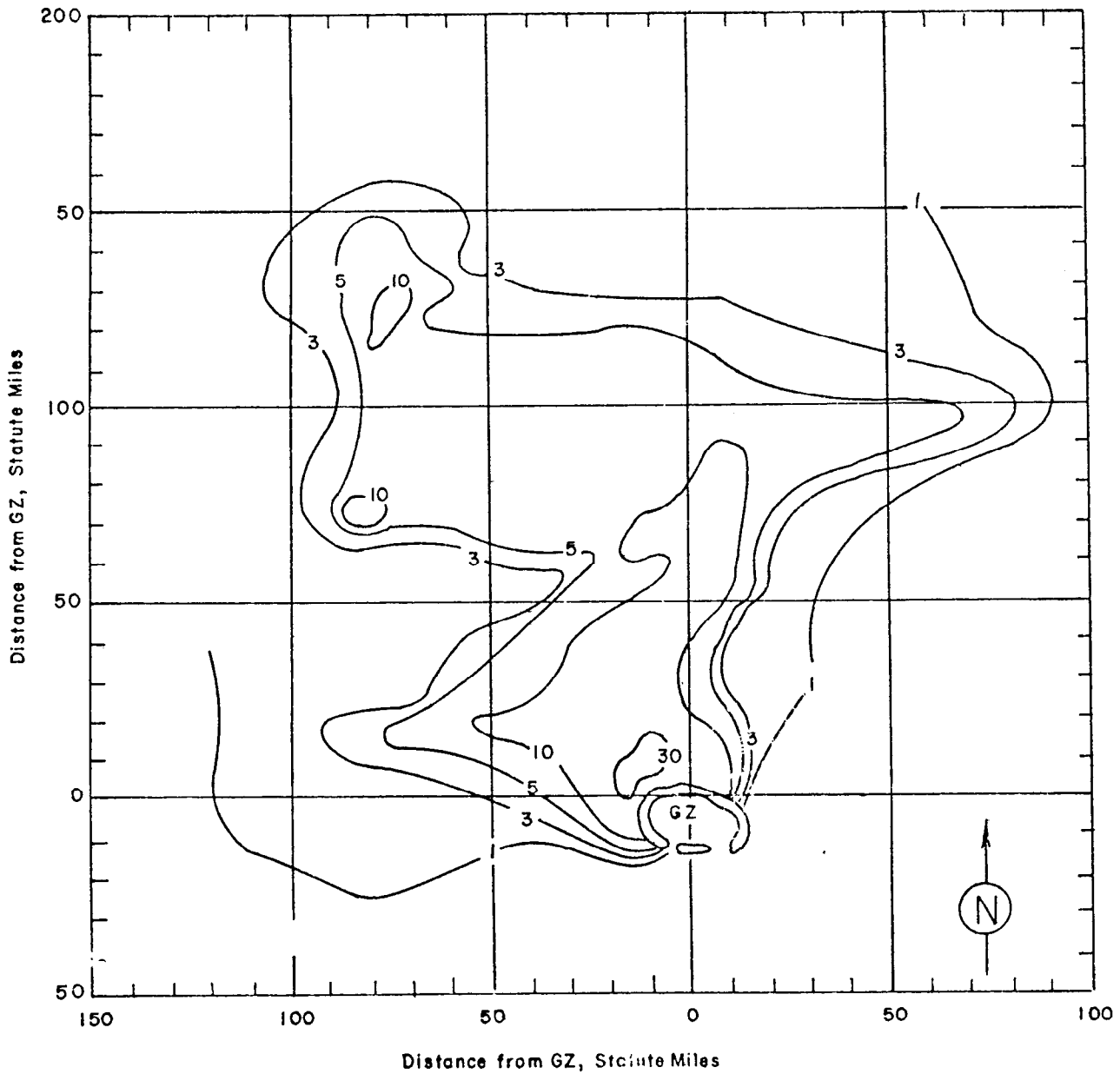


Figure 83. Operation REDWING - Flathead.  
Off-site dose rate contours in r/hr at H+1 hour.

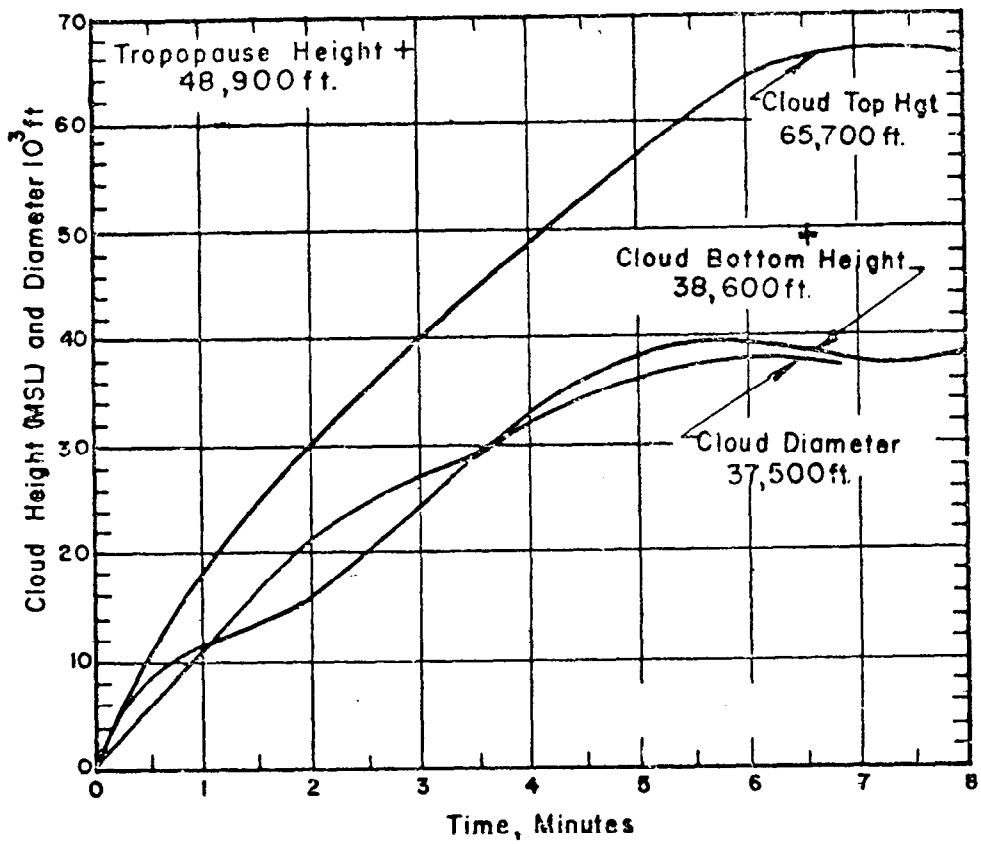


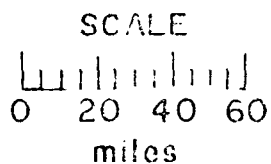
Figure 84 . Cloud Dimensions: Operation REDWING - Flathead.

TABLE 24 BIKINI WIND DATA FOR OPERATION REDWING - FLATHEAD

Altitude (MSL) feet	H-2½ hours		H-hour		H+½ hours		H+3½ hours		H+5½ hours	
	Dir degrees	Speed mph	Dir degrees	Speed mph	Dir degrees	Speed mph	Dir degrees	Speed mph	Dir degrees	Speed mph
Surface	080	18	080	22	080	24	060	21	050	15
1,000	060	17	070	21	070	23	060	20	050	22
2,000	070	14	080	17	080	20	070	20	050	21
3,000	080	14	090	15	090	15	070	18	060	24
4,000	080	16	090	14	100	13	070	18	070	15
5,000	090	17	100	15	100	13	070	18	080	16
6,000	090	15	100	14	100	14	070	16	080	15
7,000	090	14	090	14	090	14	060	09	090	14
8,000	080	12	090	10	090	10	060	08	090	09
9,000	080	10	090	09	100	08	090	07	060	06
10,000	090	09	100	08	100	07	050	06	050	05
12,000	090	08	090	07	090	05	090	08	100	06
14,000	110	03	120	05	130	06	Calm	Calm	Calm	Calm
16,000	020	02	110	06	160	08	080	03	170	05
18,000	110	06	130	10	150	14	100	06	070	04
20,000	160	09	160	12	160	13	150	07	180	07
25,000	050	14	120	17	170	20	170	14	180	12
30,000	210	12	200	17	200	21	200	15	200	16
35,000	240	14	250	14	250	14	250	15	260	21
40,000	260	22	240	21	230	21	240	22	270	21
45,000	220	22	230	21	240	20	270	18	310	18
50,000	300	15	340	15	360	15	330	14	030	15
55,000	070	14	090	17	100	20	070	21	100	20
60,000	090	28	090	28	---	---	100	23	090	16
65,000	100	28	100	28	---	---	080	24	080	25
70,000	100	33	100	33	---	---	090	40	080	37
75,000	090	46	090	46	---	---	080	46	080	57
80,000	---	---	---	---	---	---	080	63	090	64
85,000	---	---	---	---	---	---	090	64	080	68
90,000	---	---	---	---	---	---	090	54	080	59
91,000	---	---	---	---	---	---	---	---	080	69
93,000	---	---	---	---	---	---	090	56	---	---

NOTES:

1. Tropopause height was 48,900 ft MSL at H-hour.
2. Wind data was obtained on board the U. S. S. Curtiss.
3. H-hour values were interpolated from data taken at H-2½ hours and H+1½ hours.
4. At H-hour the sea level pressure was 1012.9 mb, the temperature 82.0°F, the dew point 76.0°F and the relative humidity 82.0%.



Rise rate: 5000 ft/hr

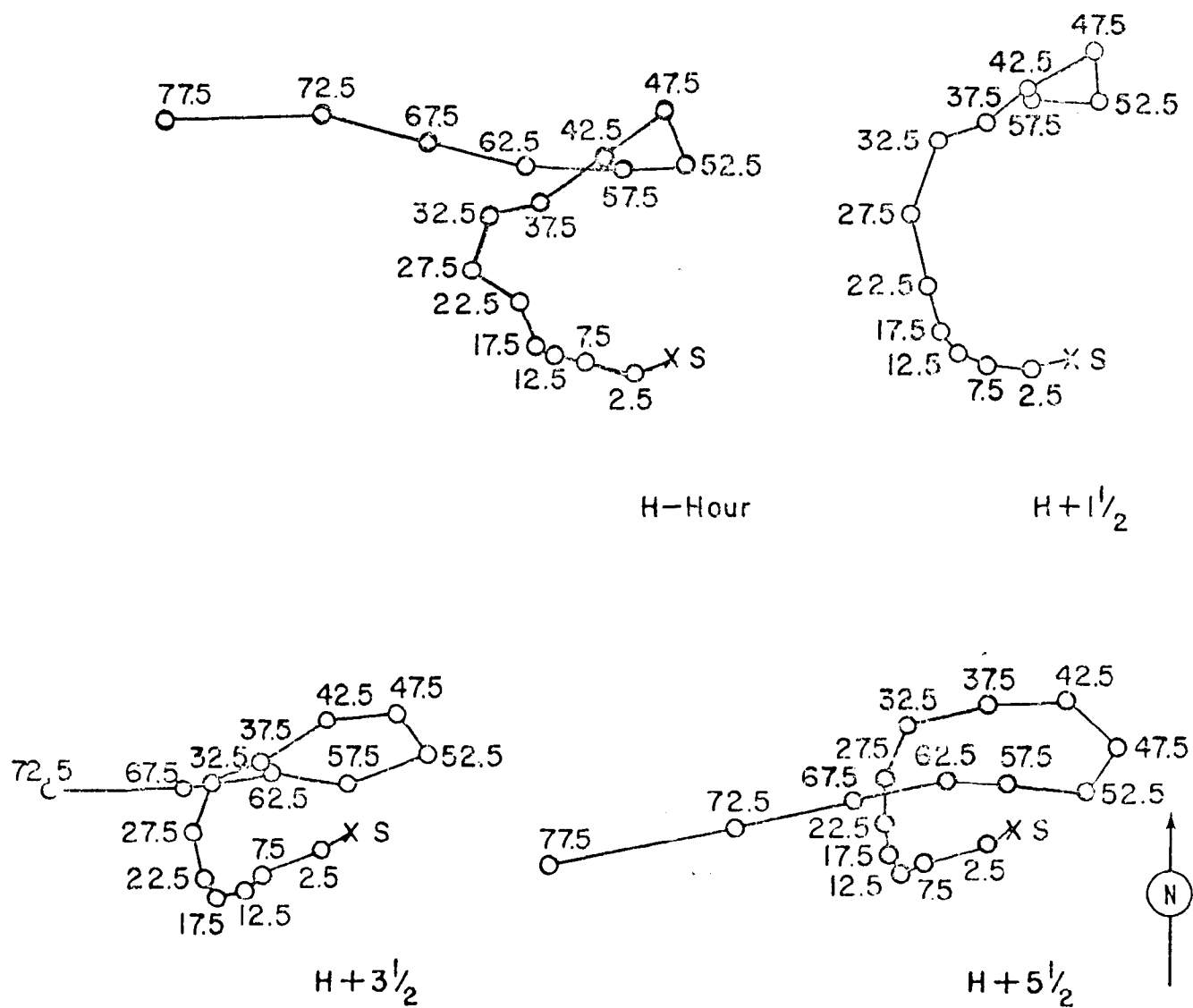


Figure 85 . Hodographs for Operation REDWING -

Flathead.

OPERATION RELWING -

Blackfoot

	<u>PPG Time</u>	<u>GMT</u>
<u>DATE:</u>	12 June 1956	11 June 1956
<u>TIME:</u>	0626	1826

Sponsor: IASI.

SITE: PPG - Eniwetok - Yvonne  
11° 33' 04" N  
162° 21' 31" E  
Site elevation: Sea level

HEIGHT OF BURST: 200 ft

TYPE OF BURST AND PLACEMENT:  
Tower burst over coral soil

CLOUD TOP HEIGHT: 25,000 ft MSL  
CLOUD BOTTOM HEIGHT: 14,000 ft MSL

REMARKS:

Only island dose-rate readings are available. These were obtained from aerial and ground surveys made by the Radiological Safety organization. The  $t^{-1.2}$  decay approximation was used to extrapolate the dose-rate readings to H+1 hour. Heavy contamination from this shot, fired on central Yvonne, was limited primarily to the shot island. However, the photo tower on Mack was highly contaminated from the fallout.

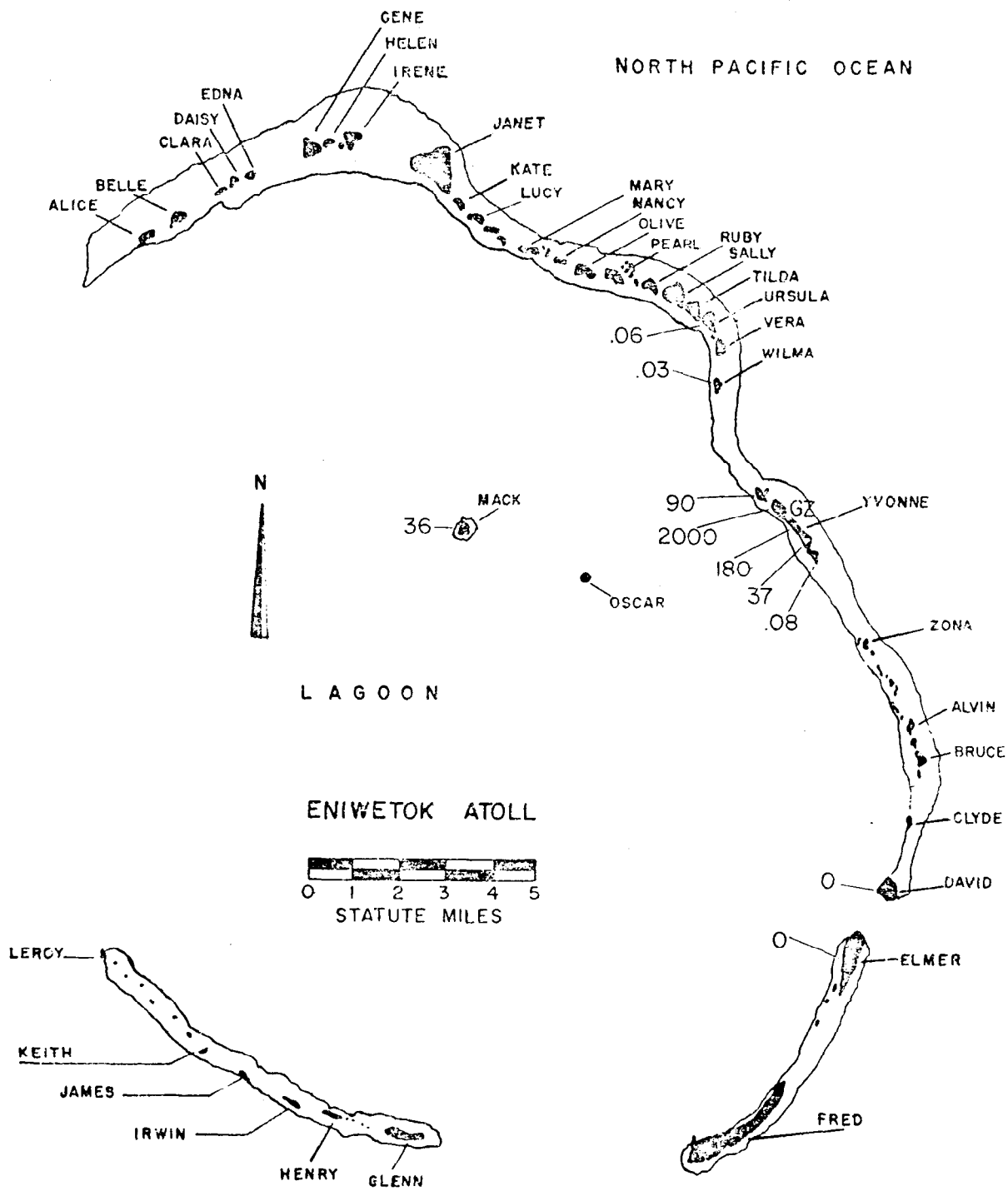


Figure 86. Operation REDWING - Blackfoot.  
Island dose rates in r/hr at H+1 hour.

TABLE 25 ENIWETOK WIND DATA FOR OPERATION REDWING

BLACKFOOT

Altitude (MSL.) feet	H-1 hour		H+2½ hours		H+5½ hours		H+8½ hours	
	Dir degrees	Speed mph	Dir degrees	Speed mph	Dir degrees	Speed mph	Dir degrees	Speed mph
Surface	090	14	130	14	110	15	050	14
1,000	090	14	070	08	080	18	080	18
2,000	090	15	080	16	080	16	070	17
3,000	100	24	090	15	090	16	080	14
4,000	100	18	100	15	090	16	080	12
5,000	100	15	100	14	090	13	080	13
6,000	100	13	090	15	100	12	080	12
7,000	100	12	090	14	100	12	080	12
8,000	100	12	090	13	100	13	100	13
9,000	090	09	090	12	100	13	100	13
10,000	070	09	090	07	090	10	100	14
12,000	080	09	090	07	100	09	100	08
14,000	090	08	110	10	100	09	100	09
15,000	(090)	(09)	(100)	(10)	(100)	(08)	(120)	(06)
16,000	090	09	090	12	110	07	110	07
18,000	070	16	080	09	090	12	120	06
20,000	070	09	070	09	090	12	100	13
25,000	090	10	120	21	180	12	150	09
30,000	050	08	080	07	140	12	170	10
35,000	280	14	240	32	230	26	220	28
40,000	240	35	240	28	240	23	230	23
45,000	240	23	250	17	030	09	290	23
50,000	310	22	010	13	090	16	020	12
52,000	---	--	---	--	---	--	---	--
53,000	---	--	030	20	---	--	020	23
55,000	090	20	---	--	100	18	---	--
60,000	120	26	---	--	100	20	---	--
65,000	060	17	---	--	080	17	---	--
70,000	090	36	---	--	090	50	---	--
71,000	090	36	---	--	---	--	---	--
75,000	---	--	---	--	090	59	---	--
80,000	---	--	---	--	090	59	---	--
82,000	---	--	---	--	090	61	---	--

## NOTES:

1. Numbers in parentheses are estimated values.
2. Tropopause height was 52,500 ft MSL.
3. Wind data was obtained by the weather station on Eniwetok Island.
4. At H-hour the sea level pressure was 1012.5 mb, the temperature 81.1°F, the dew point 75.8°F and the relative humidity 84.0%.



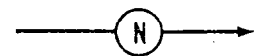
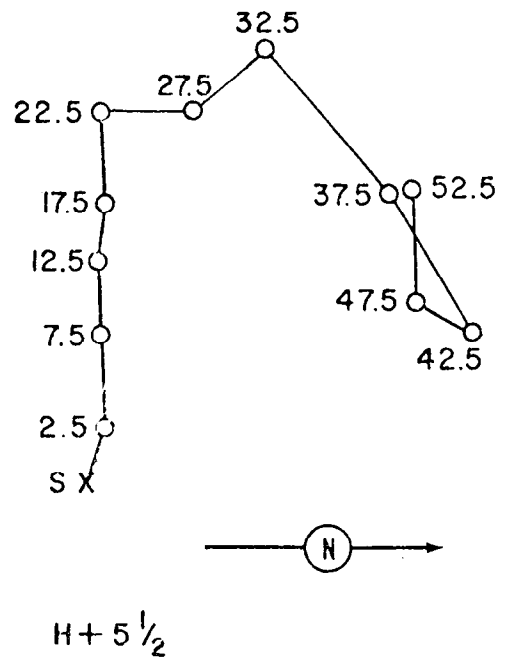
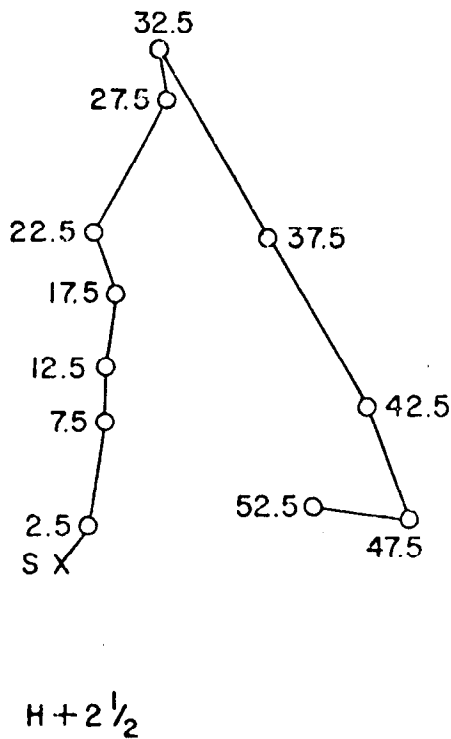
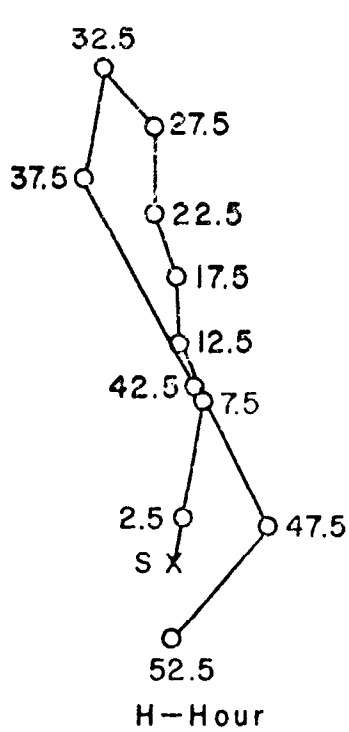
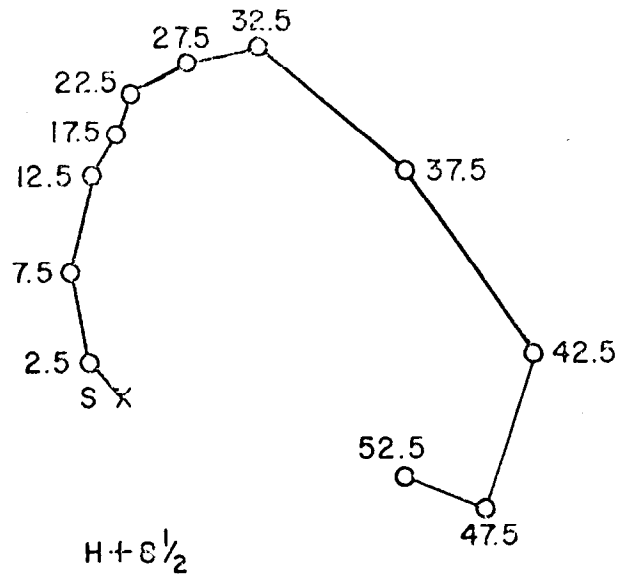
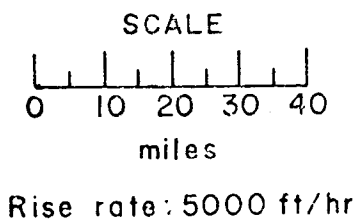


Figure 87. Hodographs for Operation REDWING - Blackfoot.

OPERATION REDWING

Kickapoo

	<u>PPG Time</u>	<u>GMP</u>
<u>DATE:</u>	14 June 1956	13 June 1956
<u>TIME:</u>	1126	2326

Sponsor: UCRL

SITE: PPG - Eniwetok - Sally  
11° 30' 38" N  
162° 19' 11" E  
Site elevation: Sea Level

HEIGHT OF BURST: 300 ft

TYPE OF BURST AND PLACEMENT:  
Tower burst over coral scil

CLOUD TOP HEIGHT: 16,000 ft MSL  
CLOUD BOTTOM HEIGHT: 11,000 ft MSL

REMARKS: Only island dose-rate readings are available. These were obtained from aerial and ground surveys made by the Radiological Safety Organization. The  $t^{-1.2}$  decay approximation was used to extrapolate the dose-rate readings to H+1 hour. Heavy contamination was encountered only on Sally, the shot island. Significant alpha (plutonium) contamination was also found on the shot island.

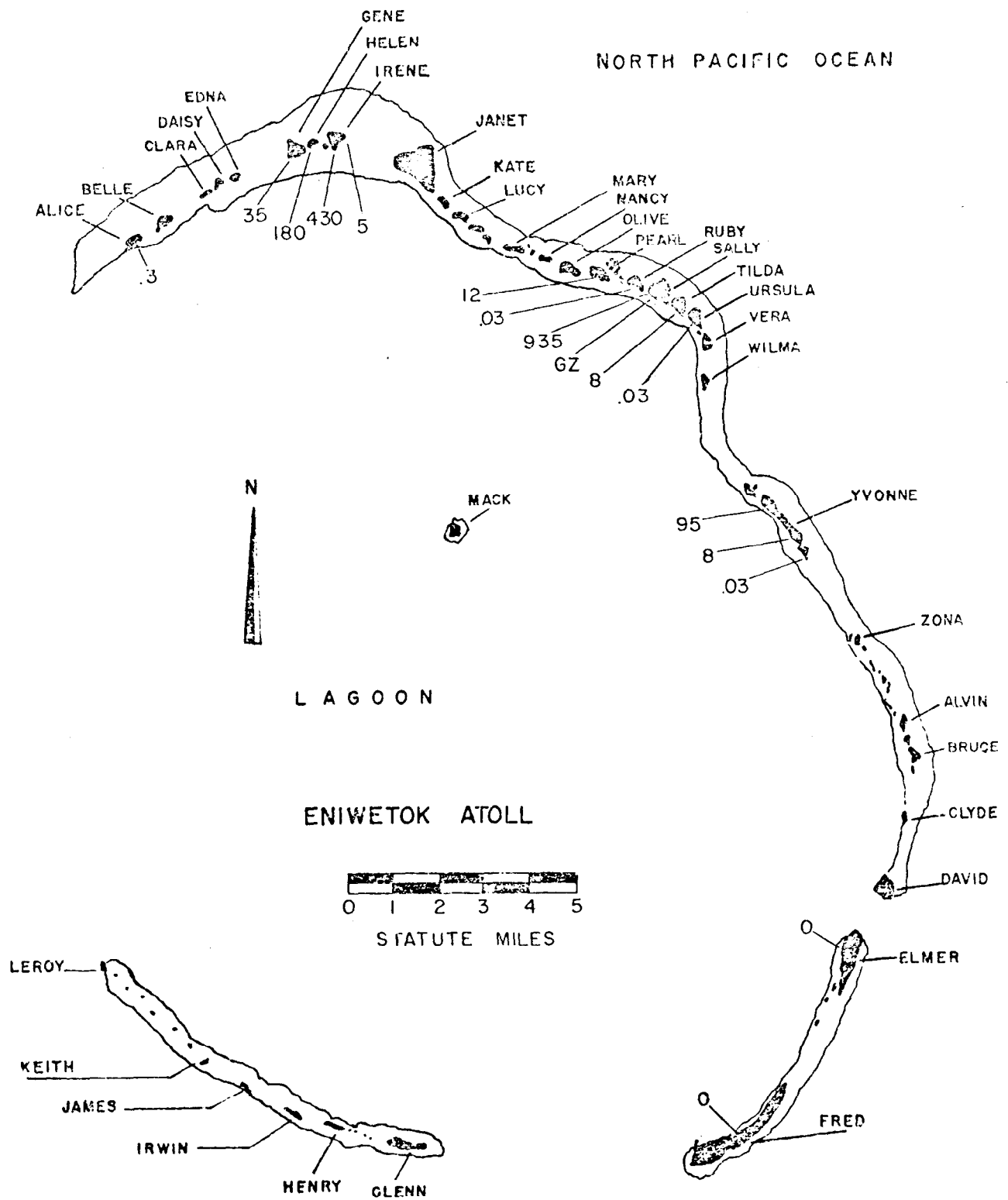


Figure 88. Operation REDWING -  
Island dose rates in r/hr at H+1 hour.

Kickapoo.

TABLE 26 ENIWETOK WIND DATA FOR OPERATION REDWING

KICKAPOO

Altitude (MSL) feet	H-hour		H+3 $\frac{1}{2}$ hours		H+9 $\frac{1}{2}$ hours	
	Dir	Speed	Dir	Speed	Dir	Speed
	degrees	mph	degrees	mph	degrees	mph
Surface	080	12	050	12	080	12
1,000	090	12	090	12	090	14
2,000	090	14	090	14	090	14
3,000	090	17	090	17	100	14
4,000	090	16	100	15	090	13
5,000	100	14	100	13	090	10
6,000	120	12	120	12	070	08
7,000	100	07	120	12	080	07
8,000	080	06	100	12	080	07
9,000	060	09	100	12	070	08
10,000	030	10	070	03	060	09
12,000	030	13	040	05	060	05
14,000	030	10	020	07	050	05
15,000	(030)	(08)	(020)	(09)	(050)	(06)
16,000	020	06	020	13	040	07
18,000	020	12	020	09	040	12
20,000	070	12	050	07	020	14
25,000	030	10	040	15	030	23
30,000	360	09	350	17	010	15
35,000	350	12	350	18	040	15
40,000	360	20	020	18	030	15
45,000	350	22	020	24	340	23
50,000	340	24	250	26	350	29
55,000	060	26	050	32	060	30
60,000	080	24	090	16	070	25
65,000	100	31	110	37	100	39
70,000	090	46	090	51	090	51
75,000	090	77	100	61	100	56
80,000	100	74	100	69	090	65
81,000	---	--	---	--	090	65
85,000	100	71	090	79	---	--
90,000	090	83	090	80	---	--
95,000	100	90	090	86	---	--
98,000	100	90	---	--	---	--
100,000	---	--	090	68	---	--
102,000	---	--	090	68	---	--

## NOTES:

1. Numbers in parentheses are estimated values.
2. Tropopause height was 53,100 ft MSL.
3. Wind data was obtained by weather station on Eniwetok Island.
4. At the surface the air pressure was 14.65 psi, the temperature 29.8°C, the relative humidity 71%.

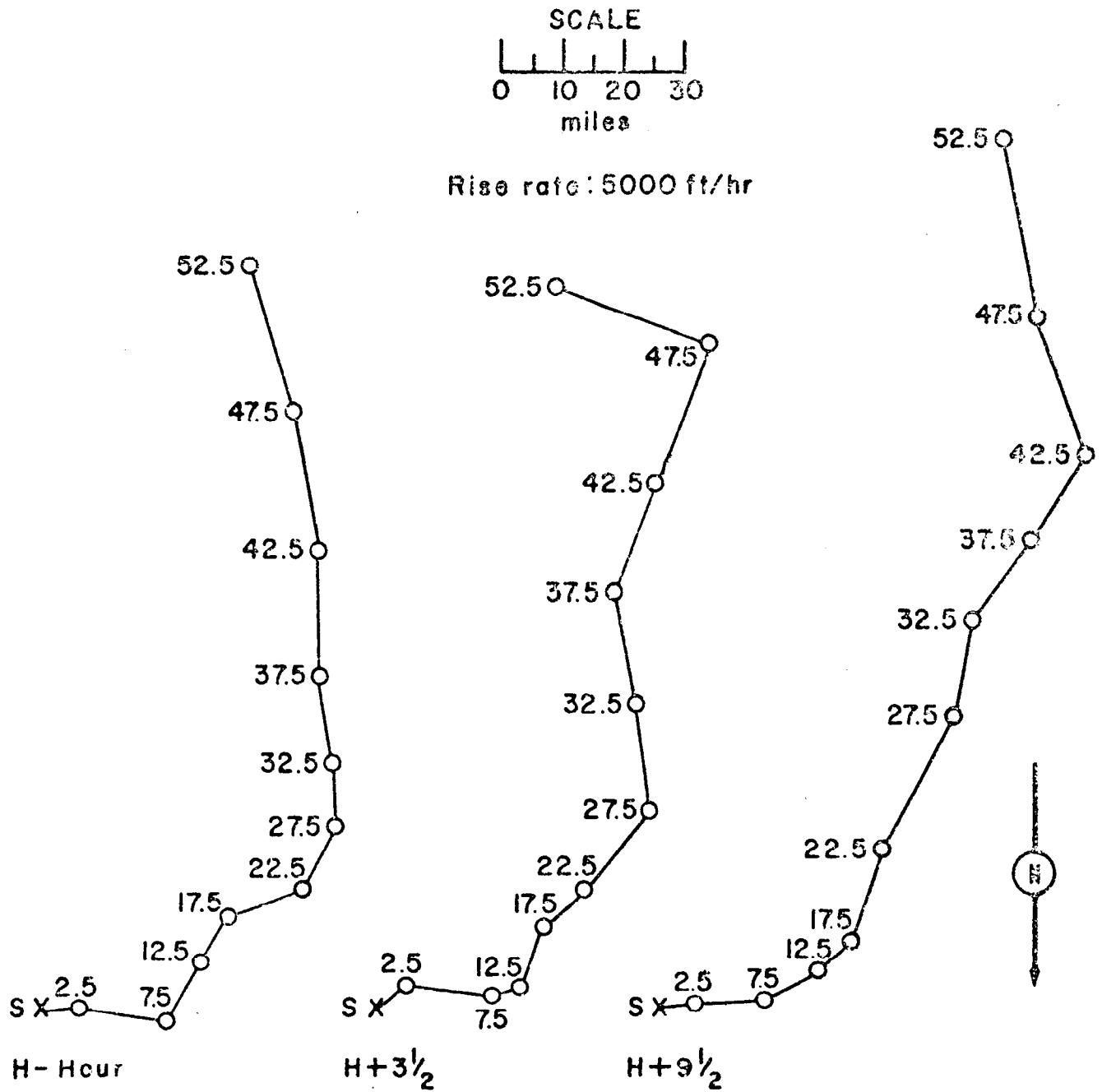


Figure 89. Hodographs for Operation REDWING - Kickapoo

OPERATION REDWING -

Osage

	<u>PPG Time</u>	<u>GMT</u>
<u>DATE:</u>	16 Jun 1956	16 Jun 1956
<u>TIME:</u>	1314	0114

Sponsor: LASL

SITE: PFG - Eniwetok - Yvonne  
11° 32' 48" N  
162° 21' 39" E  
Site elevation: Sea Level

HEIGHT OF BURST: 670 ± 35 ft

TYPE OF BURST AND PLACEMENT:  
Air burst over coral soil

CLOUD TOP HEIGHT: 21,000 ft MSL  
CLOUD BOTTOM HEIGHT: 17,000 ft MSL

REMARKS: No significant contamination was observed.

TABLE 27 ENIWETOK WIND DATA FOR OPERATION REDWING -

OSAGE

Altitude (MSL) feet	H- $\frac{3}{4}$ hours		H-hour		H+7 $\frac{1}{2}$ hours		H+10 $\frac{1}{4}$ hours	
	Dir degrees	Speed mph	Dir degrees	Speed mph	Dir degrees	Speed mph	Dir degrees	Speed mph
Surface	150	14	150	14	160	16	180	15
1,000	130	16	130	16	---	--	160	12
2,000	130	18	140	17	---	--	190	12
3,000	130	18	140	17	---	--	190	12
4,000	140	18	150	17	---	--	190	09
5,000	150	17	150	16	---	--	190	10
6,000	160	16	160	16	---	--	190	13
7,000	170	14	170	14	---	--	190	13
8,000	180	09	180	09	---	--	190	10
9,000	180	09	180	09	---	--	190	05
10,000	170	12	170	10	---	--	170	07
12,000	220	13	220	12	---	--	180	07
14,000	230	14	230	14	---	--	210	09
15,000	---	--	(220)	(14)	---	--	---	--
16,000	210	15	210	13	---	--	200	07
18,000	200	12	200	12	---	--	200	07
20,000	200	07	200	07	---	--	180	05
25,000	230	05	230	05	---	--	180	02
30,000	020	05	030	05	080	06	180	02
35,000	030	15	040	15	090	14	360	05
40,000	050	26	050	25	040	18	010	12
45,000	160	07	150	09	050	30	---	--
50,000	110	14	120	14	230	12	---	--
55,000	140	07	140	07	120	07	---	--
60,000	140	07	130	12	090	40	---	--

## NOTES:

1. Numbers in parentheses are estimated values.
2. Tropopause height was 51,500 ft MSL.
3. Wind data was obtained by the weather station on Eniwetok Island.
4. H-hour values above 30,000 ft were interpolated from data taken at H-2 $\frac{1}{2}$  hours and H+1 $\frac{1}{2}$  hours.
5. At the surface the air pressure was 14.63 psi, the temperature 29.9°C, and the relative humidity 74%.

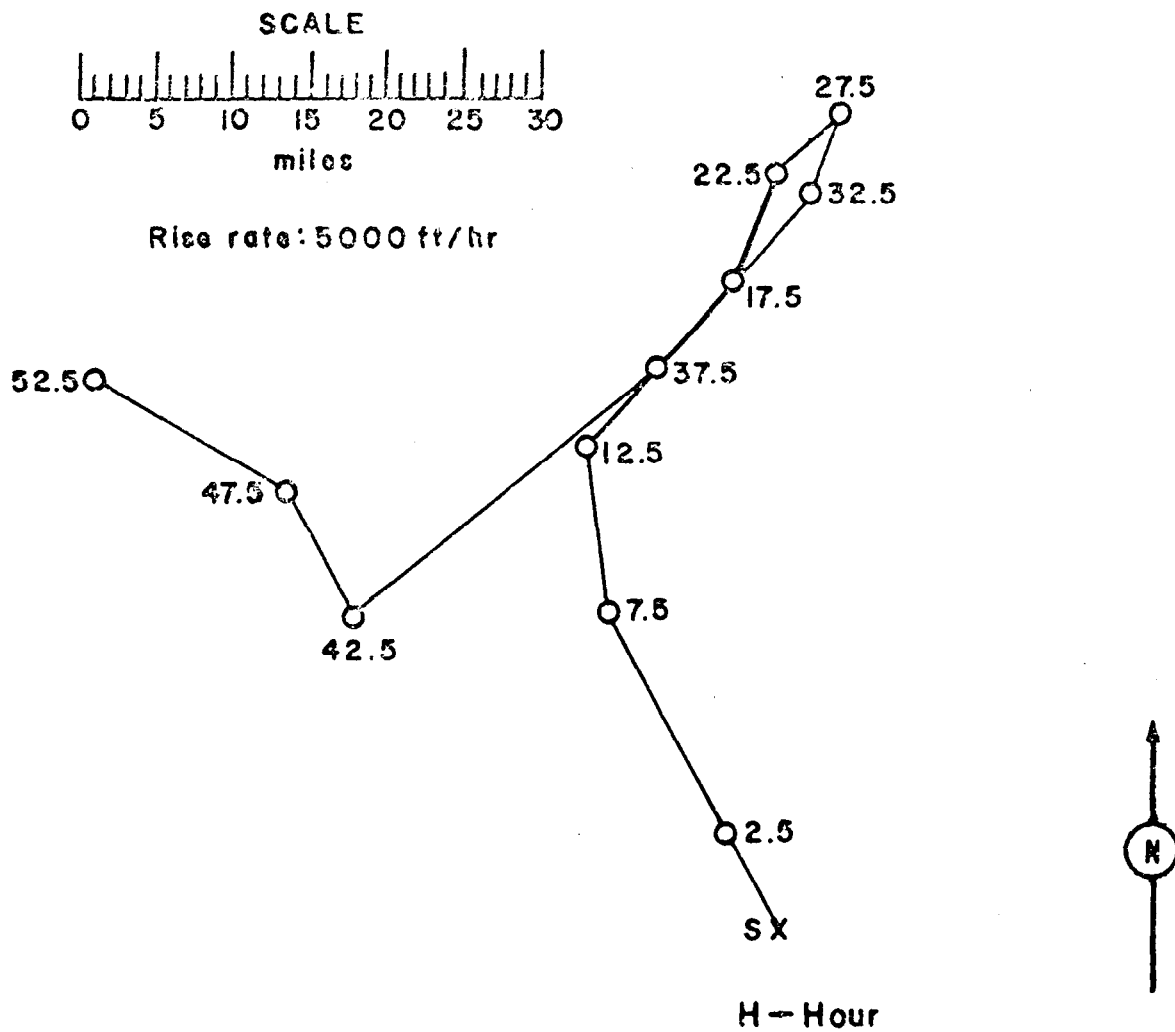


Figure 90. Hodograph for Operation REDWING -

Osage



OPERATION REDWING -

Inca

	<u>PPG Time</u>	<u>GMT</u>
<u>DATE:</u>	22 June 1956	21 June 1956
<u>TIME:</u>	0956	2156

Sponsor: UCRL

SITE: PPG - Eniwetok - Pearl  
11° 37' 53" N  
162° 17' 50" E  
Site elevation: Sea Level

HEIGHT OF BURST: 200 ft

TYPE OF BURST AND PLACEMENT:  
Tower burst over coral soil

CLOUD TOP HEIGHT: 42,000 ft MSL  
CLOUD BOTTOM HEIGHT: 30,000 ft MSL

REMARKS: Only island dose-rate readings are available. These were obtained from aerial and ground surveys made by the Radiological Safety Organization. The  $t^{-1.2}$  decay approximation was used to extrapolate the dose rate readings to H+1 hour. Heavy contamination resulted only on the shot island.

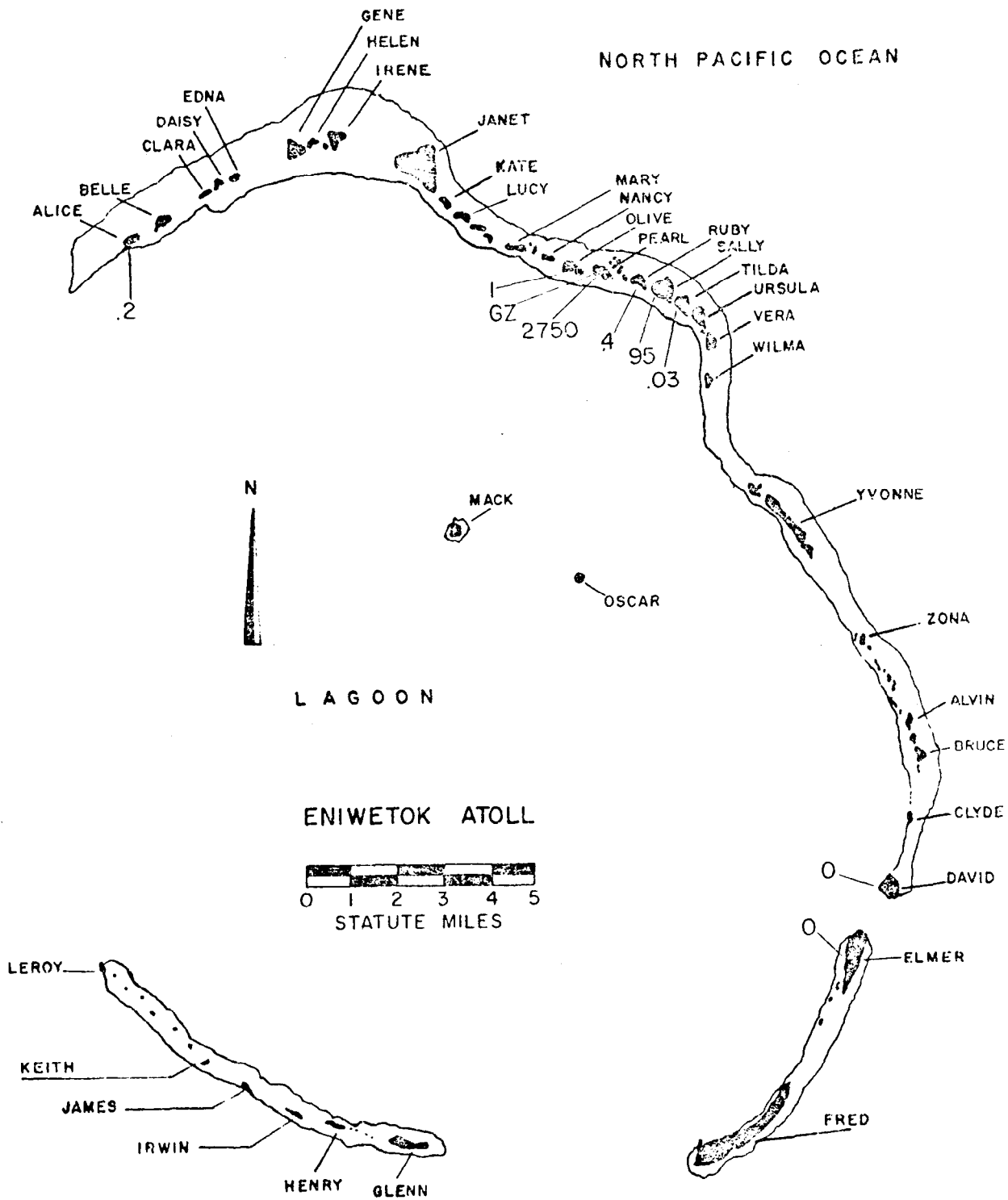


Figure 91. Operation REDWING - Island dose rates in r/hr at H+1 hour.

Inca.

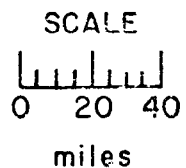
TABLE 28 ENIWETOK WIND DATA FOR OPERATION REDWING-

INCA

Altitude (MSL) feet	H-1 hour		H-hour		H+2 hours		H+5 hours		H+8 hours	
	Dir degrees	Speed mph	Dir degrees	Speed mph	Dir degrees	Speed mph	Dir degrees	Speed mph	Dir degrees	Speed mph
Surface	150	12	140	14	110	18	090	12	090	18
1,000	100	20	100	20	090	21	080	21	080	16
2,000	100	22	100	23	090	24	090	23	080	20
3,000	110	26	100	26	090	28	100	29	080	26
4,000	110	29	100	29	090	28	100	29	080	26
5,000	110	29	100	29	090	29	100	29	080	23
6,000	110	29	110	29	100	30	100	28	090	20
7,000	100	29	100	29	100	30	100	24	090	17
8,000	100	29	100	30	100	31	100	24	110	23
9,000	090	29	090	29	100	29	100	24	110	24
10,000	090	29	090	28	100	24	100	24	100	24
12,000	090	29	090	28	100	24	090	20	090	21
14,000	100	29	100	26	100	23	090	22	100	23
15,000	(100)	(28)	(100)	(26)	(100)	(23)	(100)	(21)	(100)	(22)
16,000	100	28	100	26	100	23	100	21	100	22
18,000	080	24	080	24	090	23	110	20	090	22
20,000	080	22	080	23	090	26	100	22	090	20
25,000	010	25	020	22	040	16	010	13	040	09
30,000	240	18	220	16	170	12	180	14	150	13
35,000	210	25	200	23	170	17	170	14	210	10
40,000	210	30	210	29	200	26	270	17	260	30
45,000	230	36	240	36	260	35	270	31	300	26
50,000	---	--	300	23	320	24	020	17	100	13
55,000	---	--	350	22	330	21	110	21	110	14
60,000	---	--	---	--	---	--	100	25	090	24
65,000	---	--	---	--	---	--	100	29	080	24
70,000	---	--	---	--	---	--	090	49	100	54
75,000	---	--	---	--	---	--	100	53	100	42
80,000	---	--	---	--	---	--	110	49	100	43
85,000	---	--	---	--	---	--	100	54	090	56
90,000	---	--	---	--	---	--	090	83	090	74
95,000	---	--	---	--	---	--	090	97	090	44
97,000	---	--	---	--	---	--	---	--	100	43
100,000	---	--	---	--	---	--	100	85	---	--

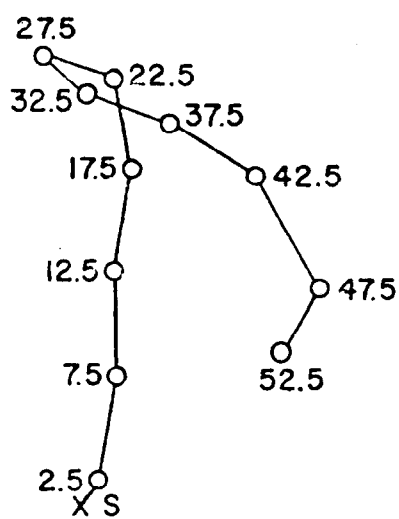
## NOTES:

1. Numbers in parentheses are estimated values.
2. Tropopause height was 54,400 ft MSL at H+5 hours.
3. Wind data was obtained by the weather station on Eniwetok Island.
4. H-hour values were interpolated from data taken at H-1 hour and H+2 hours.
5. At the surface the air pressure was 14.63 psi, the temperature 28.6°C and the relative humidity 81%.

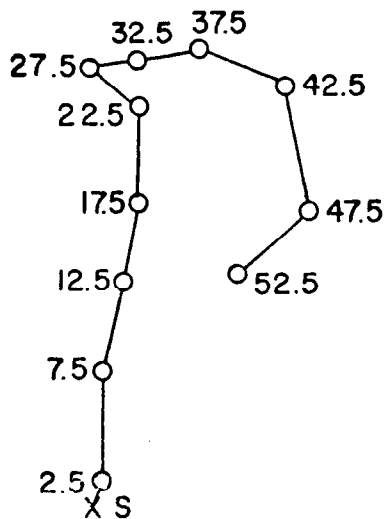


Rise rate: 5000 ft/hr

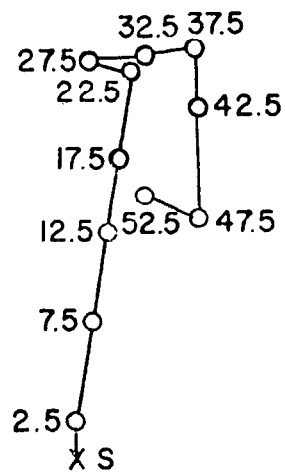
152



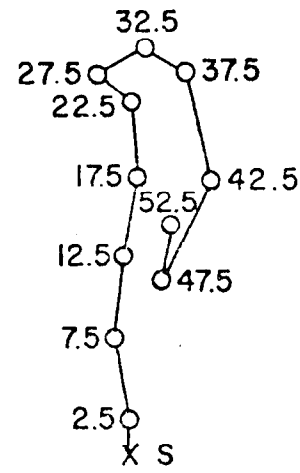
H - Hour



H + 2



H + 5



H + 8

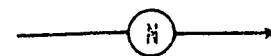


Figure 92. Hodographs for Operation REDWING -

Inca

OPERATION REDWING -

Dakota

	<u>PTG Time</u>	<u>GMT</u>
<u>DATE:</u>	26 June 1956	25 June 1956
<u>TIME:</u>	0606	1806

Sponsor: IAGI.

SITE: PPC - Bikini - 5,000 ft  
south of Dog  
11° 36' 10" N  
165° 27' 05" E  
Site elevation: Sea level

HEIGHT OF BURST: Surface

HEIGHT OF BURST AND PLACEMENT:

Surface burst from barge on water

CLOUD TOP HEIGHT: 75,000 ft MSL

CLOUD BOTTOM HEIGHT: 55,000 ft MSL

REMARKS:

Only island dose-rate readings are available. They were obtained from aerial and ground surveys made by the Radiological Safety Organization. The  $t^{-1.2}$  decay approximation was used to extrapolate the dose rate readings to H+1 hour. This shot produced less contamination on the islands than expected. However, the water adjacent to the northern islands was heavily contaminated.

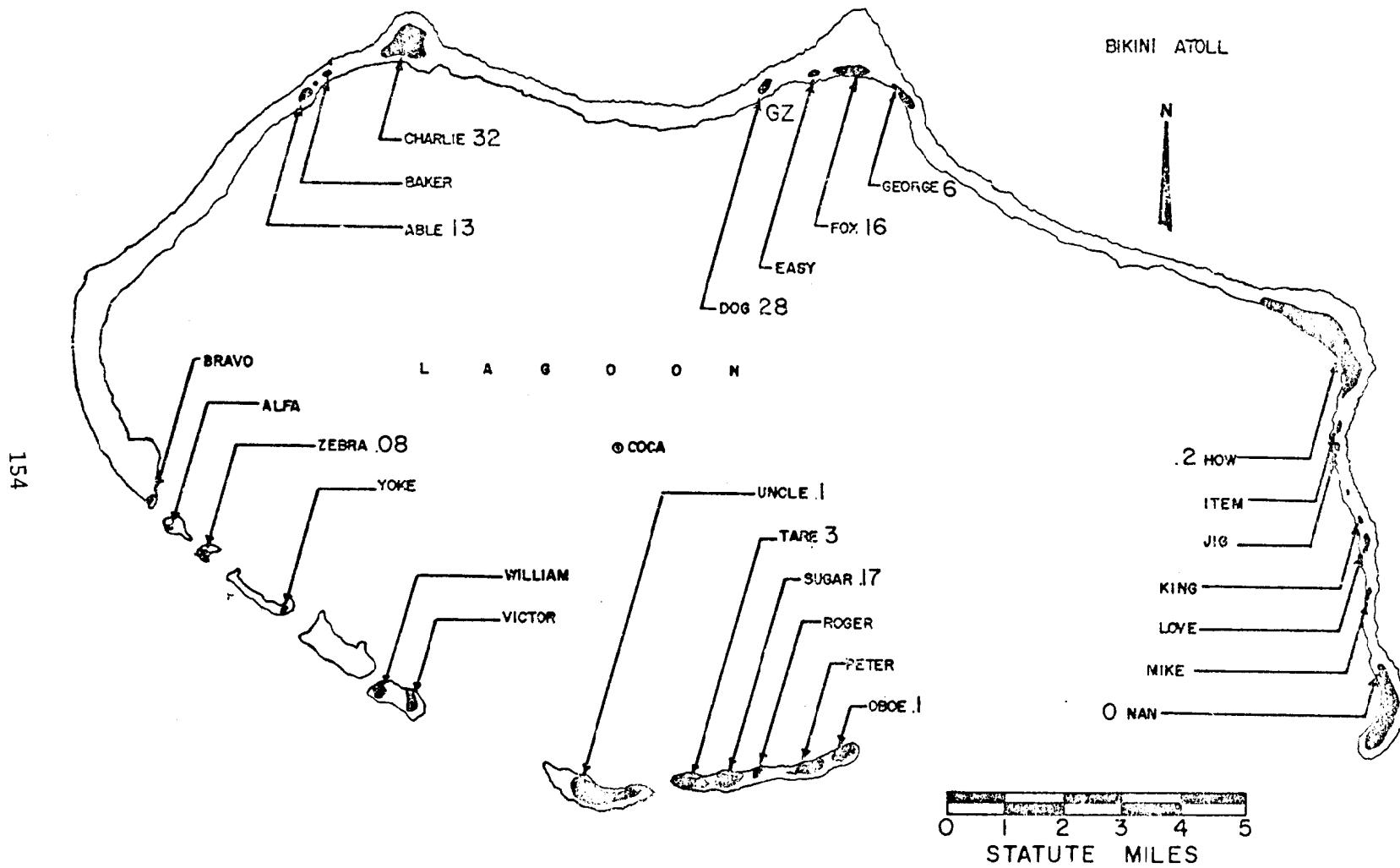


Figure 93. Operation REDWING -

Dakota. Island dose rates in r/hr at H+1 hour.

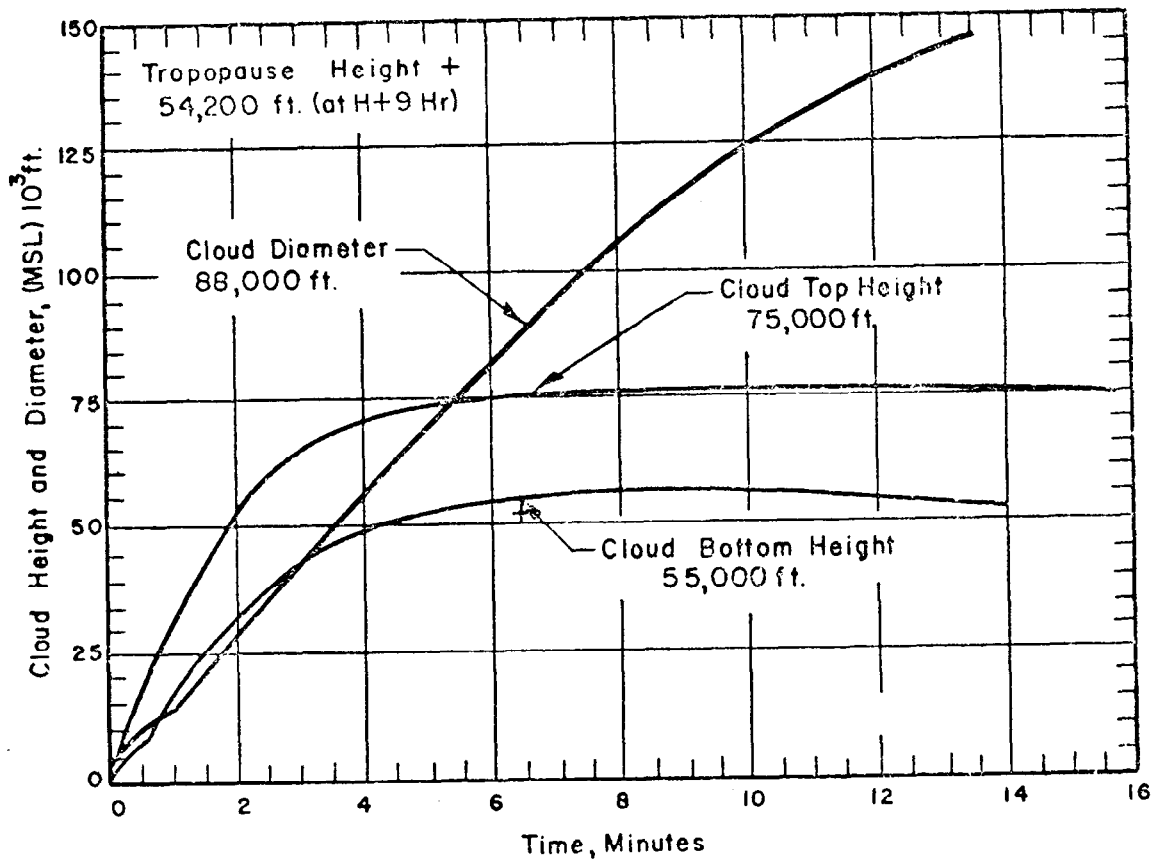


Figure 94. Cloud Dimensions: Operation REDWING - Dakota

TABLE 29 BIKINI WIND DATA FOR OPERATION REDWING--

DAKOTA

Altitude (MSL) feet	H-4 hrs		H-1 hr		H hr		H+3 hrs		H+6 hrs	
	Dir deg	Speed mph	Dir deg	Speed mph	Dir deg	Speed mph	Dir deg	Speed mph	Dir deg	Speed mph
Surface	070	17	080	21	090	17	080	15	090	18
1,000	070	17	080	21	---	--	070	18	090	17
2,000	060	13	080	18	---	--	080	21	100	21
3,000	080	17	080	17	110	21	090	23	100	25
4,000	080	16	070	17	110	17	100	22	090	26
5,000	120	15	070	17	100	15	100	17	090	22
6,000	120	18	090	15	100	16	110	13	080	17
7,000	110	18	080	13	100	14	110	15	100	16
8,000	120	15	100	17	120	16	110	17	110	18
9,000	130	13	110	18	120	16	100	18	100	20
10,000	130	14	100	14	120	16	100	17	100	16
12,000	120	12	110	15	110	15	120	10	090	16
14,000	060	06	100	13	130	15	080	12	080	10
16,000	310	05	080	07	160	09	090	07	100	07
18,000	190	06	210	10	190	09	240	07	210	05
20,000	250	08	210	07	210	14	200	09	210	09
25,000	270	08	240	25	230	18	250	17	250	23
30,000	230	14	240	33	240	25	260	27	260	26
35,000	250	25	250	32	240	51	240	45	230	48
40,000	250	41	240	45	250	51	240	54	230	54
45,000	250	58	250	35	250	57	260	60	260	48
50,000	270	35	250	54	280	35	270	53	250	22
55,000	080	09	---	--	090	08	---	--	130	10
60,000	100	22	---	--	100	16	---	--	080	28
65,000	080	33	---	--	080	39	---	--	090	28
70,000	100	45	---	--	080	39	---	--	090	40
75,000	080	58	---	--	080	62	---	--	100	58
80,000	090	63	---	--	100	74	---	--	090	71
85,000	090	81	---	--	090	85	---	--	090	87
90,000	100	89	---	--	---	--	---	--	090	77

## NOTES:

1. Tropopause height was 54,200 ft MSL at H+9 hours.
2. Wind data was obtained on board the U.S.S. Curtiss.
3. At H-hour the sea level pressure was 1009.1 mb, the temperature 82.0°F, the dew point 75.0°F and the relative humidity 80.0%.



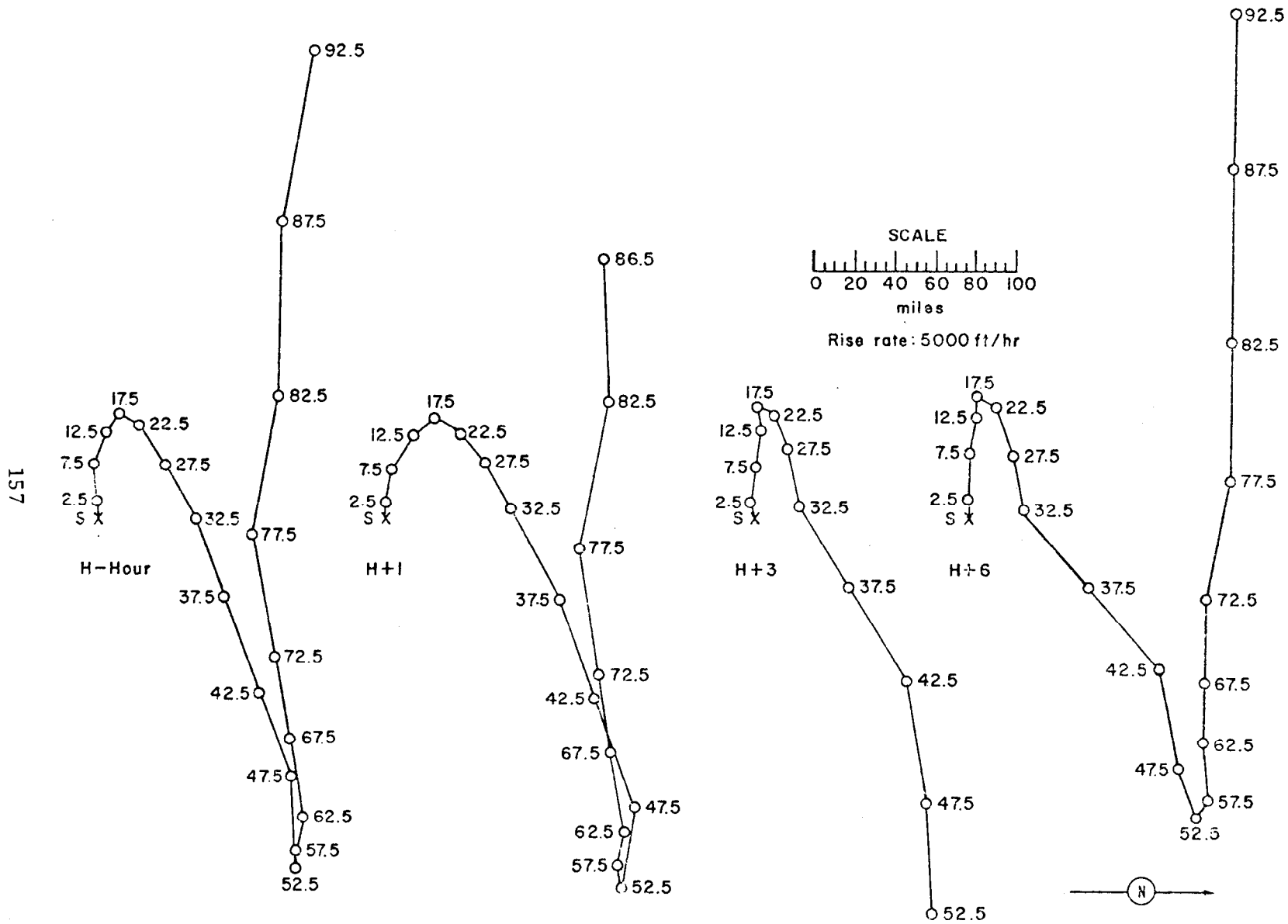


Figure 95. Hodographs for Operation REDWING -

Dakota

OPERATION REDWING -

Mohawk

	<u>PPG Time</u>	<u>GMT</u>
<u>DATE:</u>	3 Jul 1956	2 Jul 1956
<u>TIME:</u>	0606	1806

Sponsor: UCRL

SITE: PPG - Eniwetok - Ruby  
11° 30' 38" N  
162° 18' 39" E  
Site elevation: Sea level

HEIGHT OF BURST: 300 ft

TYPE OF BURST AND PLACEMENT:  
Tower burst over coral soil

CLOUD TOP HEIGHT: 65,000 ft MSL  
CLOUD BOTTOM HEIGHT: 42,000 ft MSL

REMARKS: The dose-rate readings on the islands of the atoll were taken by aerial and ground surveys of scientific projects between H+9 hours and H+56 hours. The experimentally determined gamma field decay exponent was used to extrapolate the dose rate readings to H+1 hour. Extremely heavy local contamination resulted on Ruby. In addition, significant amounts of contamination were deposited on the northern islands of the atoll. The readings taken between sites, Janet and Olive, were corrected for the small dose rates observed there before the shot. No such corrections were applied to sites, Pearl and Sally, because the contamination from shot Mohawk was so heavy that the pre-shot dose rates could be neglected. The readings in the vicinity of the crater were taken between H+32 hours and H+56 hours. The average field decay exponent was used to extrapolate the readings to H+1 hour. Approximately 2 hours after detonation, light fallout started on Elmer and continued for one hour. Peak intensity was 22 mr/hr.

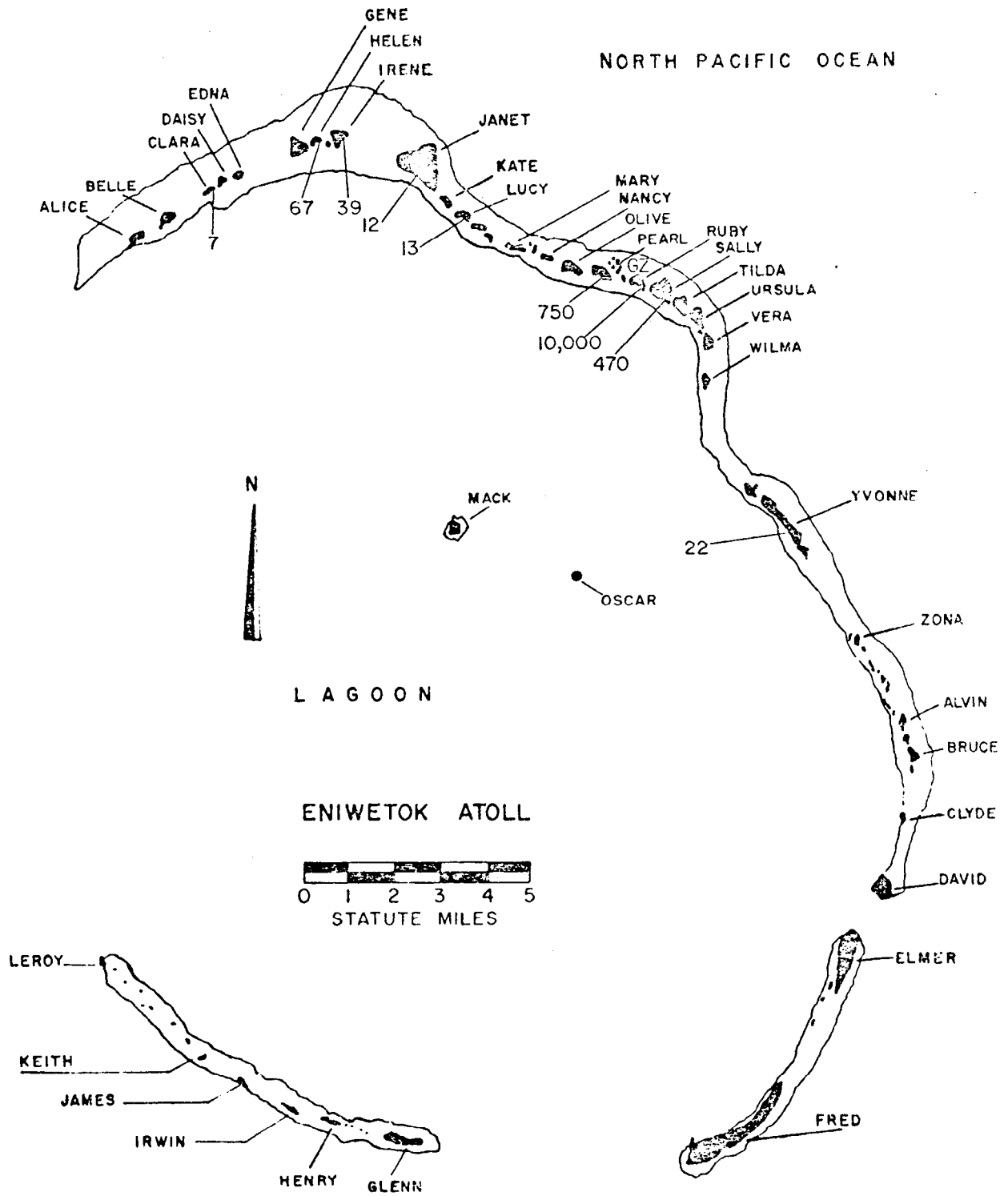


Figure 96. Operation REDWING -  
Island dose rates in r/hr at H+1 hour.

Mohawk.

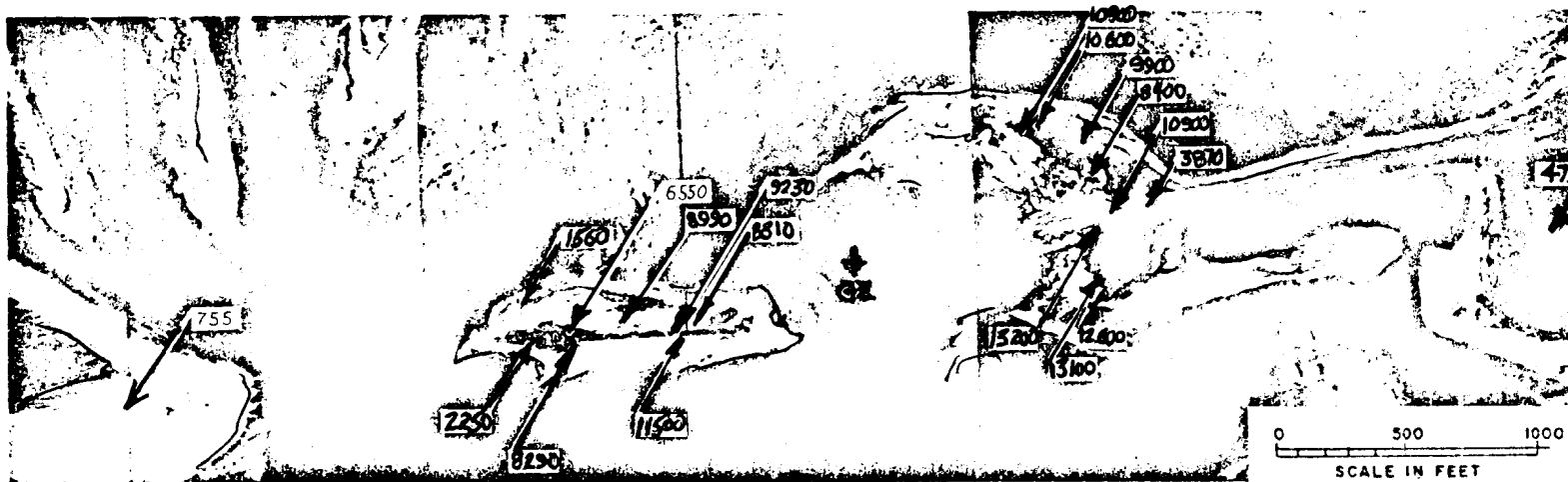


Figure 97. Dose rate readings near the Mohawk crater in r/hr at H+1 hour

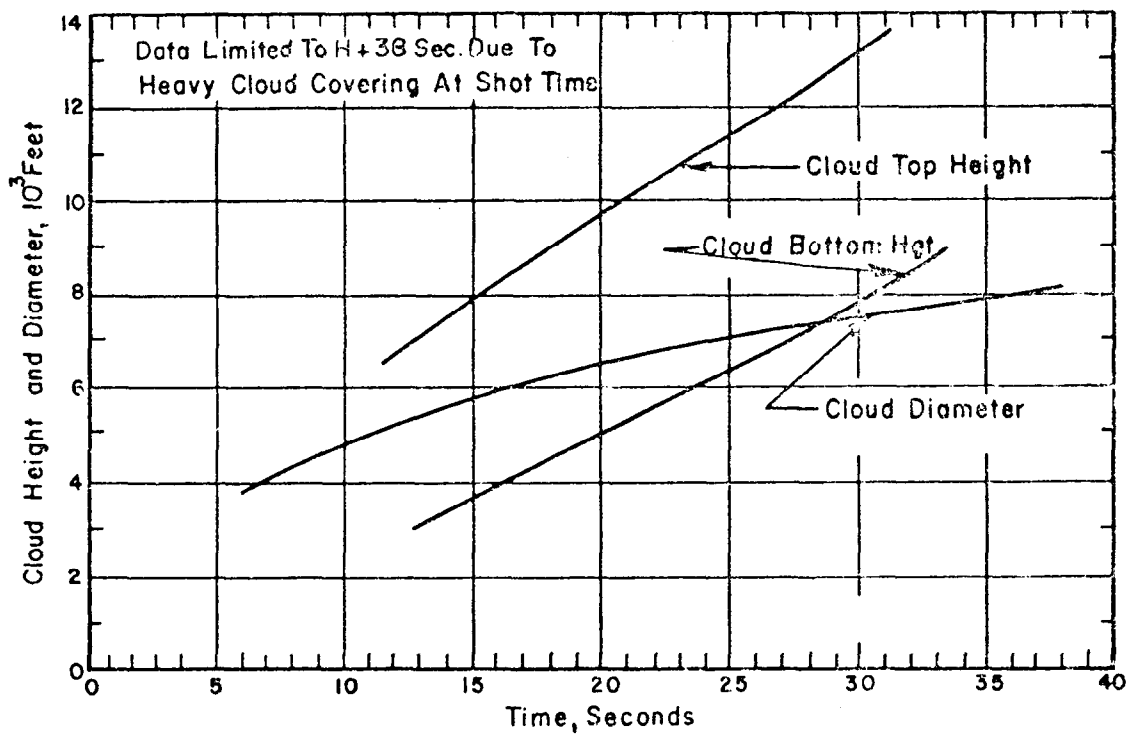


Figure 98. Cloud Dimensions: Operation REDWING - Mohawk

TABLE 30 ENIWETOK WIND DATA FOR OPERATION REDWING -

MOJAWK

Altitude (MSL) feet	H-3 hours		H-hour		H+3 hours		H+6 hours	
	Dir degrees	Speed mph	Dir degrees	Speed mph	Dir degrees	Speed mph	Dir degrees	Speed mph
Surface	130	28	130	21	140	18	130	18
1,000	110	24	110	18	090	18	090	20
2,000	110	24	120	23	100	23	090	21
3,000	100	26	110	26	120	25	090	23
4,000	100	22	110	30	120	25	090	23
5,000	110	20	110	37	120	26	100	23
6,000	110	23	120	35	120	21	110	23
7,000	090	22	120	29	110	16	130	24
8,000	090	20	120	22	100	18	120	26
9,000	090	16	100	16	100	18	120	26
10,000	080	15	060	15	090	16	100	25
12,000	070	12	070	18	060	18	070	16
14,000	040	07	050	18	030	17	050	14
15,000	---	--	(020)	(16)	(010)	(17)	(020)	(13)
16,000	090	09	350	14	350	17	360	13
18,000	120	10	280	09	070	08	020	09
20,000	140	20	210	03	090	12	070	10
25,000	270	10	160	06	130	07	220	14
30,000	260	29	150	14	190	20	210	22
35,000	240	36	180	24	200	32	220	32
40,000	240	54	230	32	220	44	220	38
45,000	250	51	250	45	240	40	230	35
50,000	270	32	270	32	260	32	250	25
55,000	170	09	160	08	150	07	150	18
60,000	100	10	100	20	110	29	090	24
65,000	---	--	---	--	090	35	100	38
70,000	---	--	---	--	100	48	100	45
75,000	---	--	---	--	100	54	100	52
80,000	---	--	---	--	100	65	100	56
82,000	---	--	---	--	---	--	100	56
85,000	---	--	---	--	100	61	---	--
90,000	---	--	---	--	090	74	---	--
95,000	---	--	---	--	090	79	---	--
100,000	---	--	---	--	090	88	---	--
102,000	---	--	---	--	090	88	---	--

## NOTES:

1. Numbers in parentheses are estimated values.
2. Tropopause height was 56,800 ft MSL.
3. Wind data was obtained by the weather station on Eniwetok Island.
4. H-hour values interpolated for 45,000 ft and above from H-3 hours and H+3 hours data.
5. At the surface the air pressure was 14.64 psi, the temperature 26.5°C, the dew point 22.8°C and the relative humidity 81%.

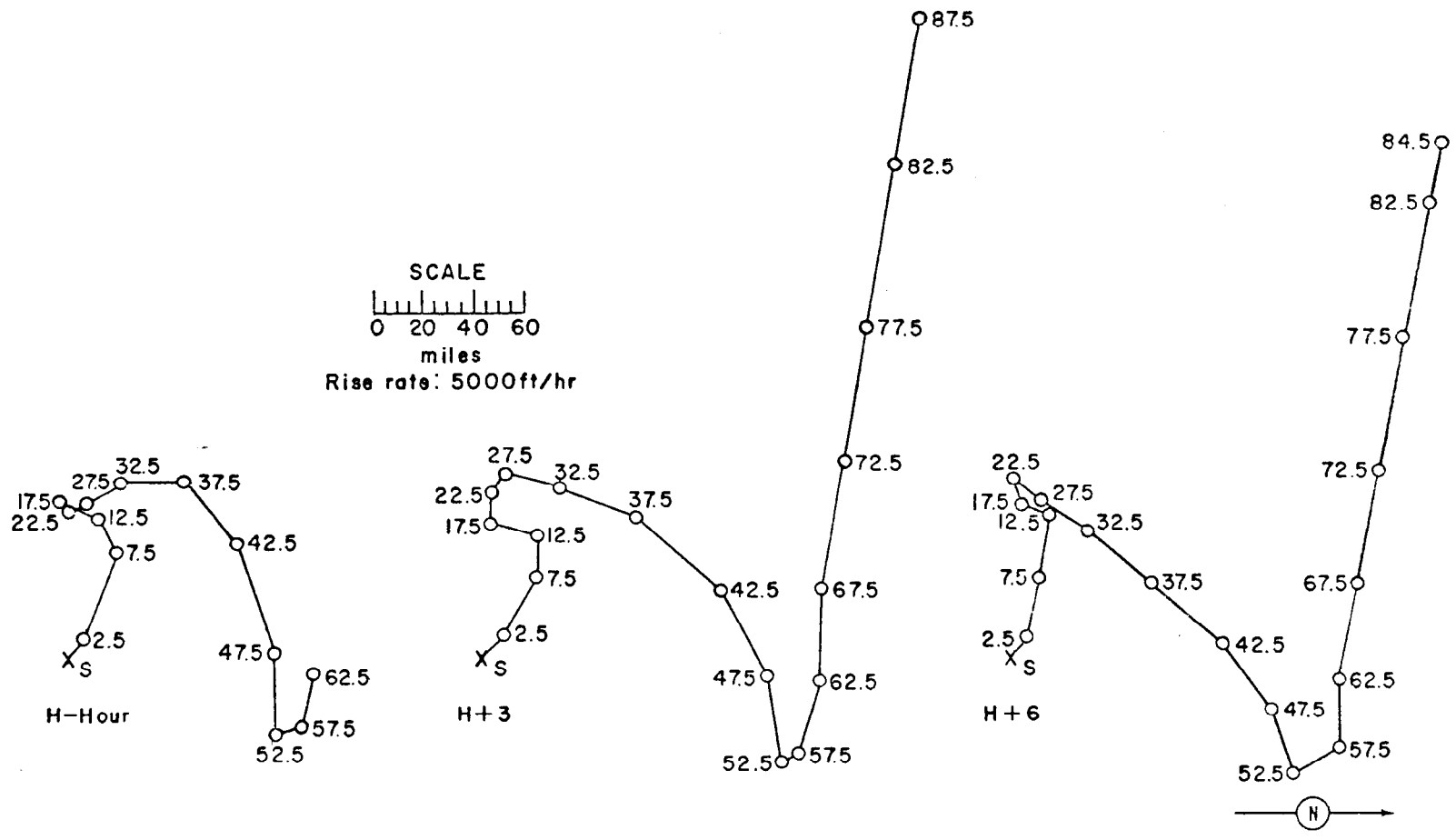


Figure 99. Hodographs for Operation REDWING -

Mohawk.

OPERATION REDWING -

Apache

	<u>PPG Time</u>	<u>GMT</u>
<u>DATE:</u>	9 Jul 1956	8 Jul 1956
<u>TIME:</u>	0606	1806

Sponsor: UCRJ

SITE: PPG - Eniwetok - Flora  
11° 40' 17" N  
162° 12' 01" E  
Site elevation: Sea level

HEIGHT OF BURST: Surface

TYPE OF BURST AND PLACEMENT:  
Surface burst from barge on  
water over the Mike crater

CLOUD TOP HEIGHT: 66,700 ft MSL  
CLOUD BOTTOM HEIGHT: 36,000 ft MSL

REMARKS:

Only island dose rate readings are available. These were taken by aerial and ground surveys made by the Radiological Safety organization. The  $t^{-1.2}$  decay approximation was used to extrapolate the dose rate readings to H+1 hour. This shot produced exceptionally heavy contamination throughout the upper islands of the atoll. Water in the north end of the lagoon was highly contaminated for a considerable distance from the shot island, and as the silt and debris were moved out by lagoon currents, the contamination spread widely.



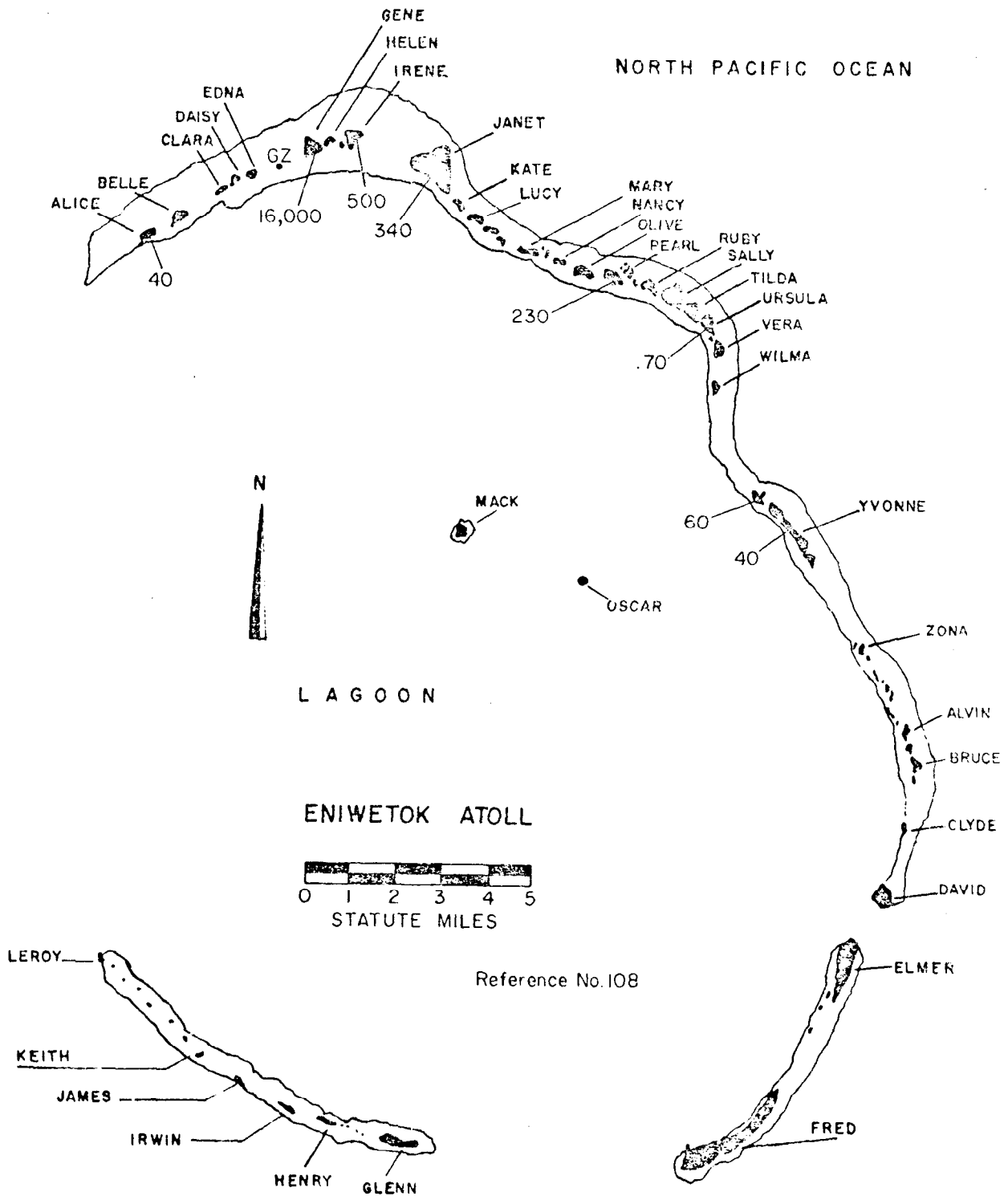


Figure 100 . Operation REDWING - Apache.  
Island dose rates in r/hr at H+1 hour.

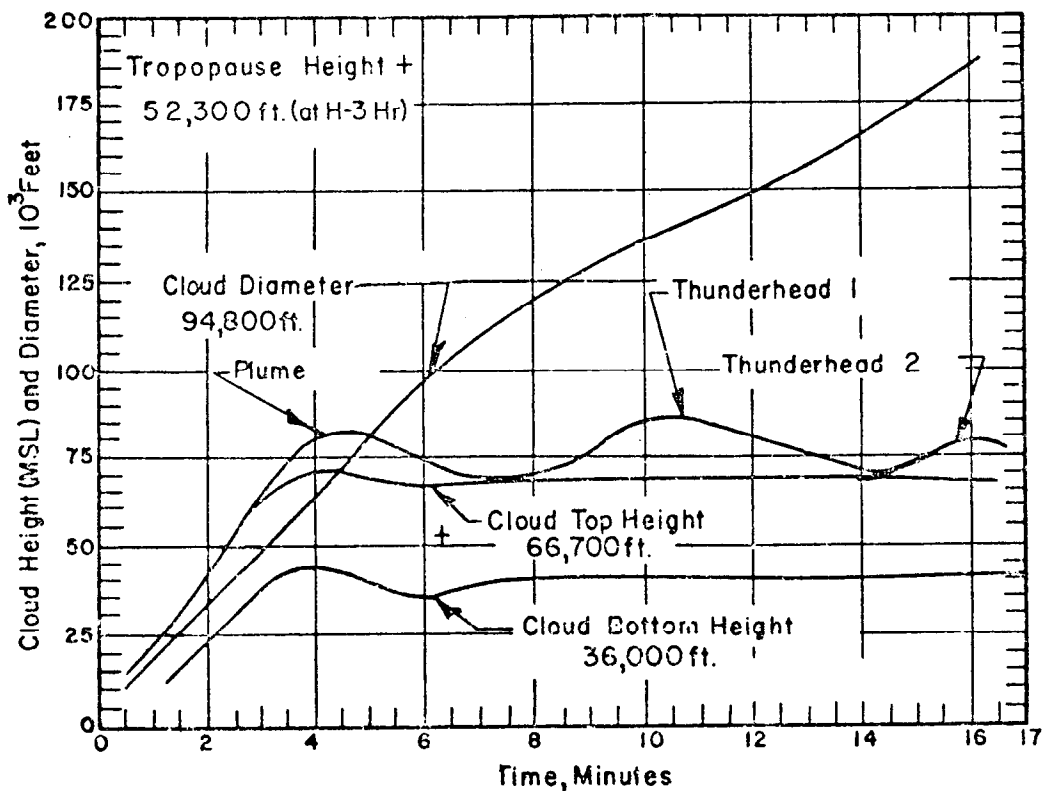


Figure 101. Cloud Dimensions: Operation REDWING - Apache.

TABLE 31 ENIWETOK WIND DATA FOR OPERATION RMDMUNC -

APACHE

Altitude (MSL) feet	H-1 hour		H-hour		H+1 hour		H+4½ hours		H+9 hours	
	Dir degrees	Speed mph	Dir degrees	Speed mph	Dir degrees	Speed mph	Dir degrees	Speed mph	Dir degrees	Speed mph
Surface	070	12	070	12	070	12	070	15	090	14
1,000	070	14	070	16	060	20	080	21	080	16
2,000	070	14	070	18	070	23	080	23	090	17
3,000	080	12	080	17	070	24	090	23	090	24
4,000	100	15	090	20	080	26	090	23	100	28
5,000	100	15	100	23	100	31	090	23	100	25
6,000	110	15	110	18	110	22	090	21	100	24
7,000	110	17	110	18	120	21	090	21	100	21
8,000	130	16	120	22	100	21	100	21	100	21
9,000	130	18	130	21	130	23	110	21	110	20
10,000	140	18	140	21	140	23	110	21	110	20
12,000	150	09	150	10	140	13	110	15	110	18
14,000	120	02	120	03	110	06	160	02	100	12
16,000	060	07	060	06	060	05	230	07	130	12
18,000	040	05	020	05	350	05	310	02	300	09
20,000	050	02	030	05	020	07	020	05	360	09
25,000	230	07	190	08	160	09	230	07	320	12
30,000	300	10	270	10	250	09	180	09	210	13
35,000	110	24	200	14	210	15	210	14	210	20
40,000	310	10	290	09	280	07	220	07	210	15
45,000	280	16	270	16	260	17	250	28	230	28
50,000	220	17	220	26	230	37	220	35	230	31
55,000	180	28	160	23	---	--	090	04	160	36
60,000	100	30	100	30	---	--	090	32	080	41
65,000	080	39	080	39	---	--	090	41	100	46
70,000	---	--	---	--	---	--	100	44	100	55
75,000	---	--	---	--	---	--	100	54	090	54
80,000	---	--	---	--	---	--	090	72	090	71
89,000	---	--	---	--	---	--	090	108	---	--
90,000	---	--	---	--	---	--	---	--	110	106
93,000	---	--	---	--	---	--	---	--	110	96

## NOTES:

1. Numbers in parentheses are estimated values.
2. Tropopause height was 52,300 ft MSL at H-3 hours.
3. Wind data was obtained by the weather station on Eniwetok Island.
4. H-hour values interpolated; H-1 hour and H+1 hour data was used for surface through 50,000 ft; H-1 hour and H+4½ hours data was used for 55,000 ft and above.
5. At the surface the air pressure was 14.63 psi, the temperature 26.8°C, the dew point 23.9°C, and the relative humidity 84%.

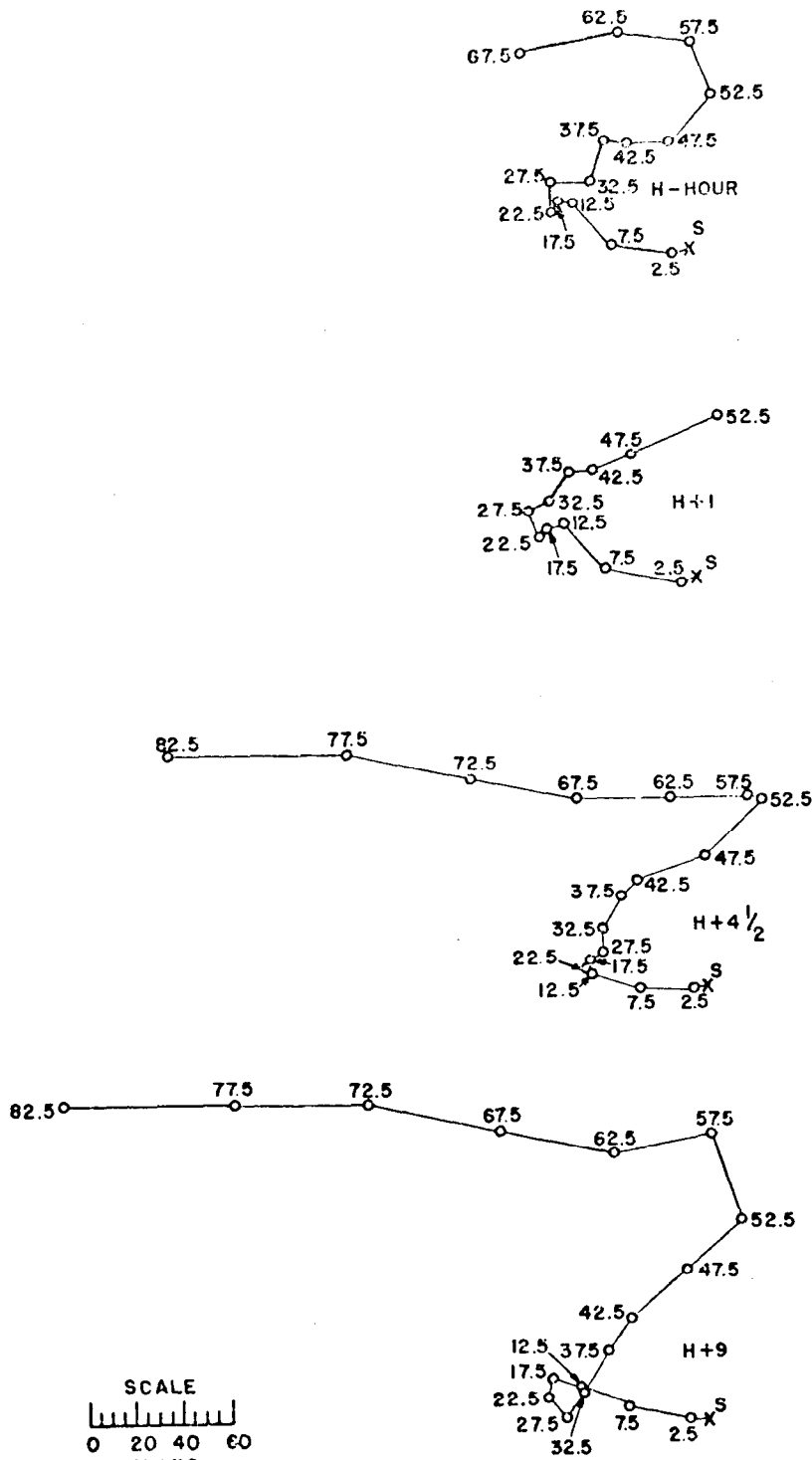


Figure 102. Hodographs for Operation REDWING -

Apache.

OPERATION REDWING -

Navajo

	<u>PPG Time</u>	<u>GMT</u>
<u>DATE:</u>	11 Jul 1956	10 Jul 1956
<u>TIME:</u>	0556	1756

Sponsor: LASL

SITE: PPG - Bikini - South of Dog  
11° 39' 48" N  
165° 23' 14" E  
Site elevation: Sea level

HEIGHT OF BURST: 15 ft

TYPE OF BURST AND PLACEMENT:  
Surface burst from barge on  
water; center of gravity  
approx. 15 ft above surface  
of water; depth to bottom-215 ft

CLOUD TOP HEIGHT: 85,000 ft MSL  
CLOUD BOTTOM HEIGHT: 51,200 ft MSL

REMARKS:

The on-site fallout pattern was drawn from island readings taken by scientific projects supplemented by fallout sample collections on rafts and barges in the lagoon. The survey readings were obtained on D-day. A gamma decay exponent determined from laboratory gamma decay measurements, was used to convert the D-day readings to H+1 hour values. Light fallout occurred on Nan approximately 18 hours after detonation, with peak gamma intensities of 22 mr/hr.

The off-site fallout pattern was drawn from aerial and oceanographic surveys. The oceanographic surveys used detector probes for measuring the dose rate at depths to and below the thermocline. Water sampling equipment was used for taking of surface samples and for the collection of samples from any desired depth. The dose rate readings were extrapolated to H+1 hour by using the decay measurements of the samples collected.

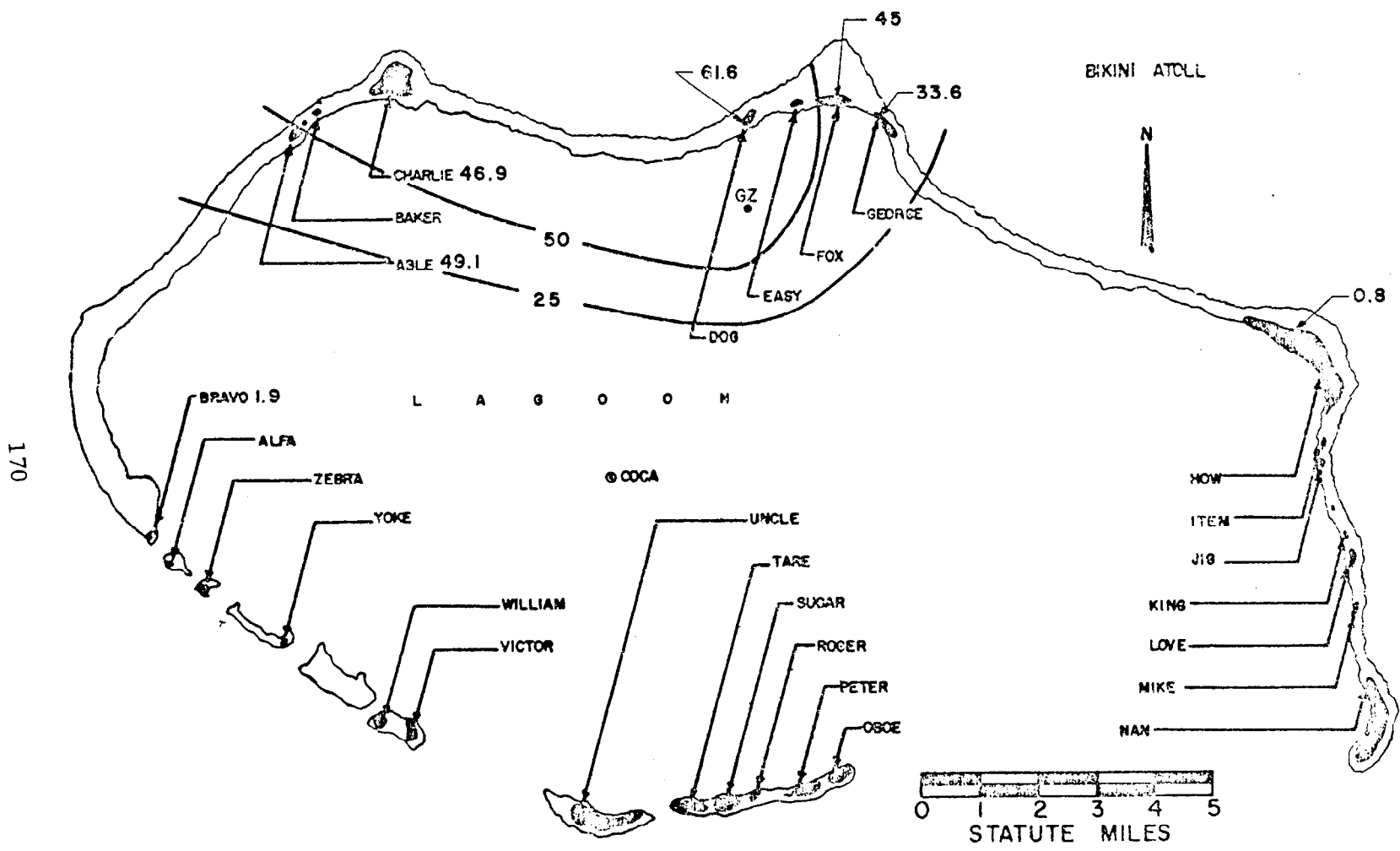


Figure 103. Operation REDWING - Navajo. Atoll rate contours in r/hr at H+1 hour.

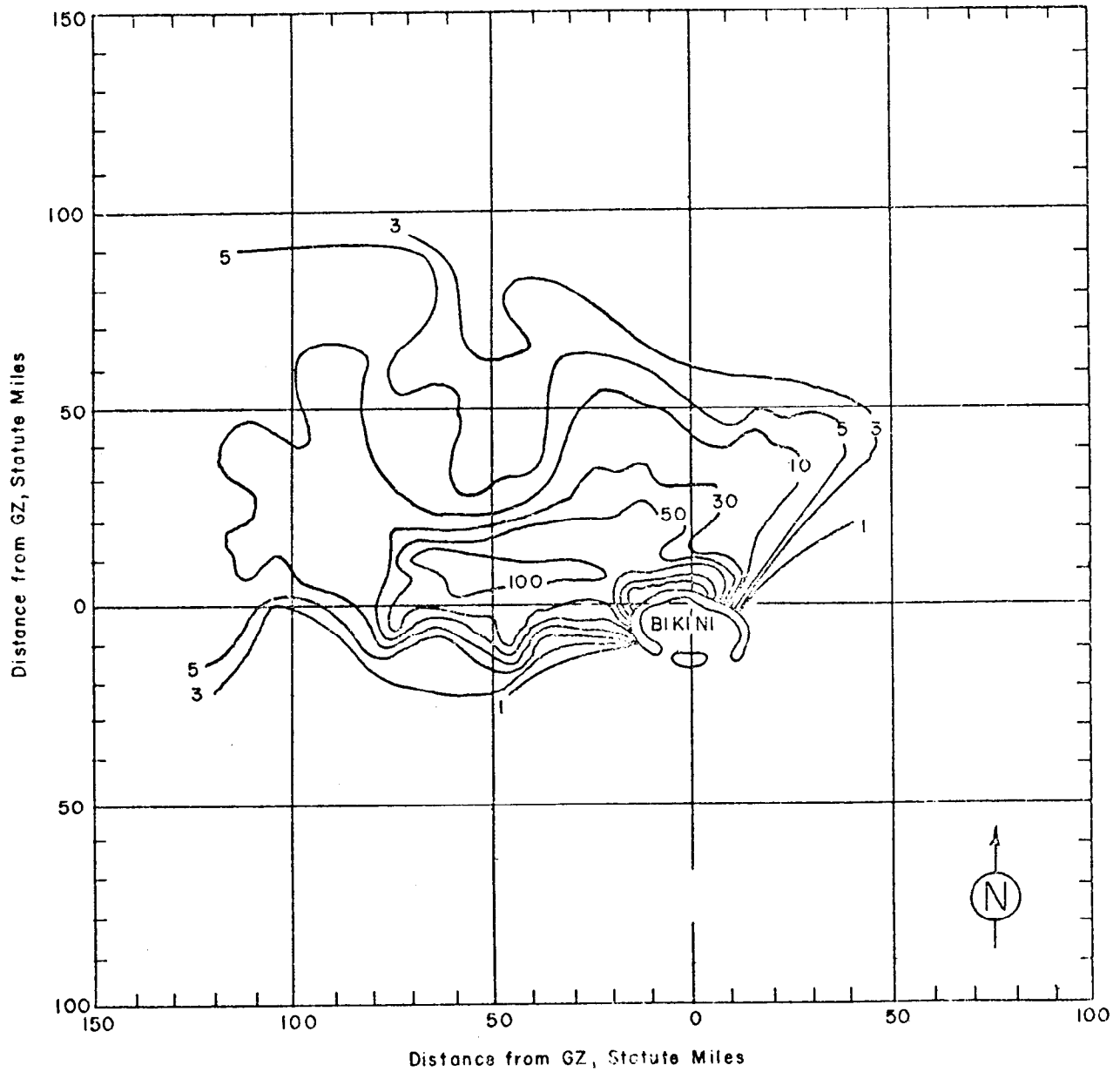


Figure 104. Operation REDWING - Navajo. Off-site dose rate contours in r/hr at H+1 hour.

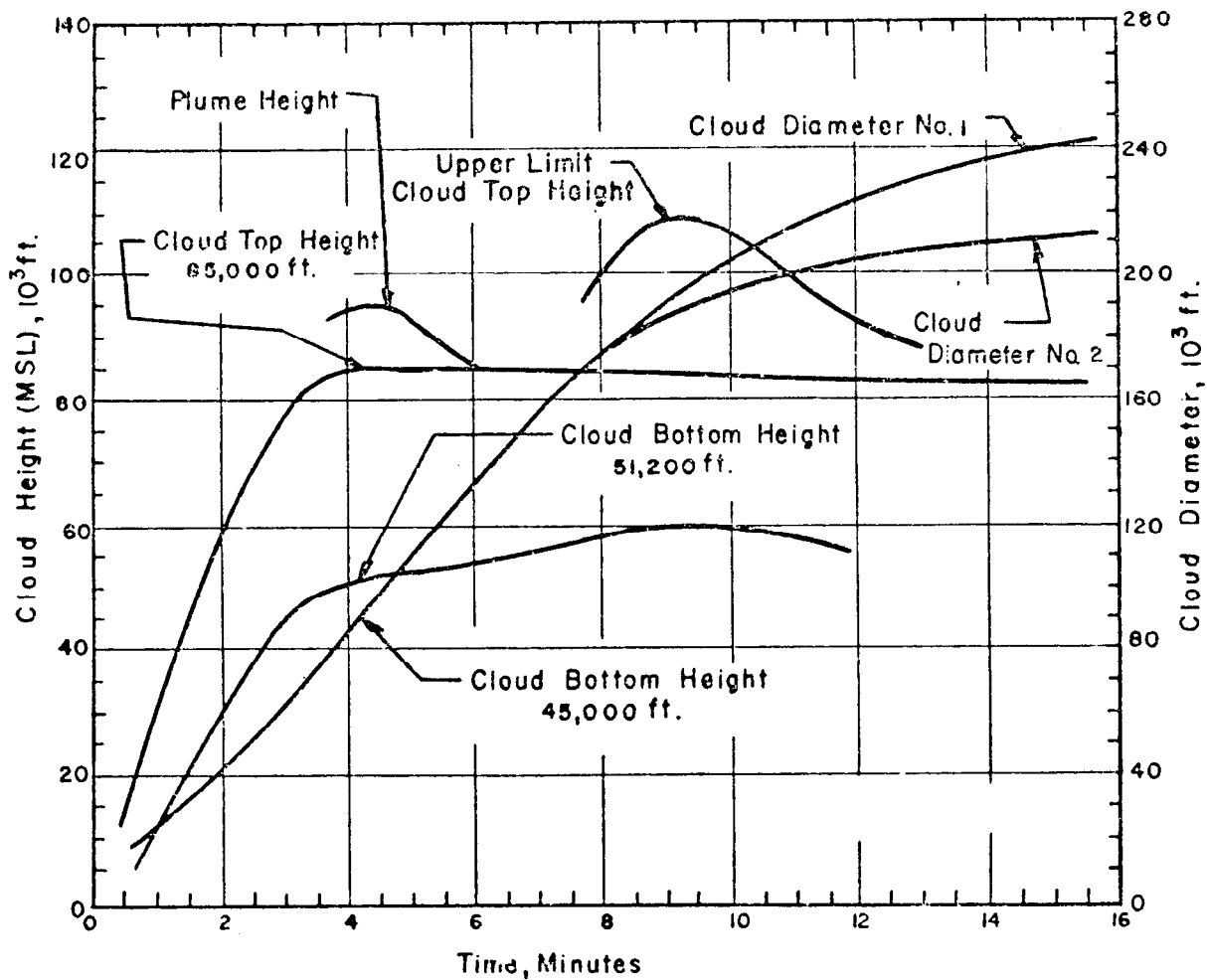


Figure 105. Cloud Dimensions: Operation REDWING - Navajo.



TABLE 32 BIKINI WIND DATA FOR OPERATION REDWING -

NAVAJO

Altitude (MSL) feet	H-hour		H+3 hours		H+6 hours		H+9 hours	
	Dir degrees	Speed mph	Dir degrees	Speed mph	Dir degrees	Speed mph	Dir degrees	Speed mph
Surface	090	12	090	20	090	21	080	14
1,000	080	24	080	24	100	20	080	14
2,000	080	26	080	25	100	24	090	15
3,000	080	25	080	29	090	26	100	20
4,000	080	25	080	26	090	26	110	21
5,000	080	23	080	24	090	22	110	21
6,000	080	21	080	24	100	21	100	21
7,000	080	22	080	24	100	21	100	21
8,000	080	23	090	23	100	21	100	23
9,000	080	22	080	24	090	24	100	23
10,000	080	21	080	22	080	24	090	23
12,000	070	15	080	22	070	23	070	21
14,000	060	14	070	13	050	17	060	15
15,000	(080)	(12)	(070)	(13)	(050)	(15)	(060)	(15)
16,000	100	10	070	13	060	14	050	16
18,000	100	10	080	10	060	13	070	13
20,000	140	09	090	08	100	07	090	08
25,000	180	08	170	09	270	03	070	05
30,000	210	17	240	13	260	14	290	15
35,000	220	24	270	17	240	16	270	22
40,000	270	18	260	29	240	32	240	34
45,000	240	35	250	37	230	42	220	38
50,000	240	33	240	21	240	30	250	34
52,000	230	37	---	--	---	--	---	--
55,000	---	--	120	14	300	06	050	18
60,000	---	--	080	25	110	30	110	25
65,000	---	--	090	40	090	35	080	35
70,000	---	--	080	52	090	47	090	44
72,000	---	--	---	--	090	48	---	--
74,000	---	--	---	--	---	--	090	59

## NOTES:

1. Numbers in parentheses are estimated values.
2. Wind data was obtained on board the U. S. S. Curtiss.
3. Tropopause height was 50,000 ft MSL.
4. At H-hour the sea level pressure was 1010.2 mb, the temperature 81.2°F, the dew point 74.0°F and the relative humidity 80.0%.

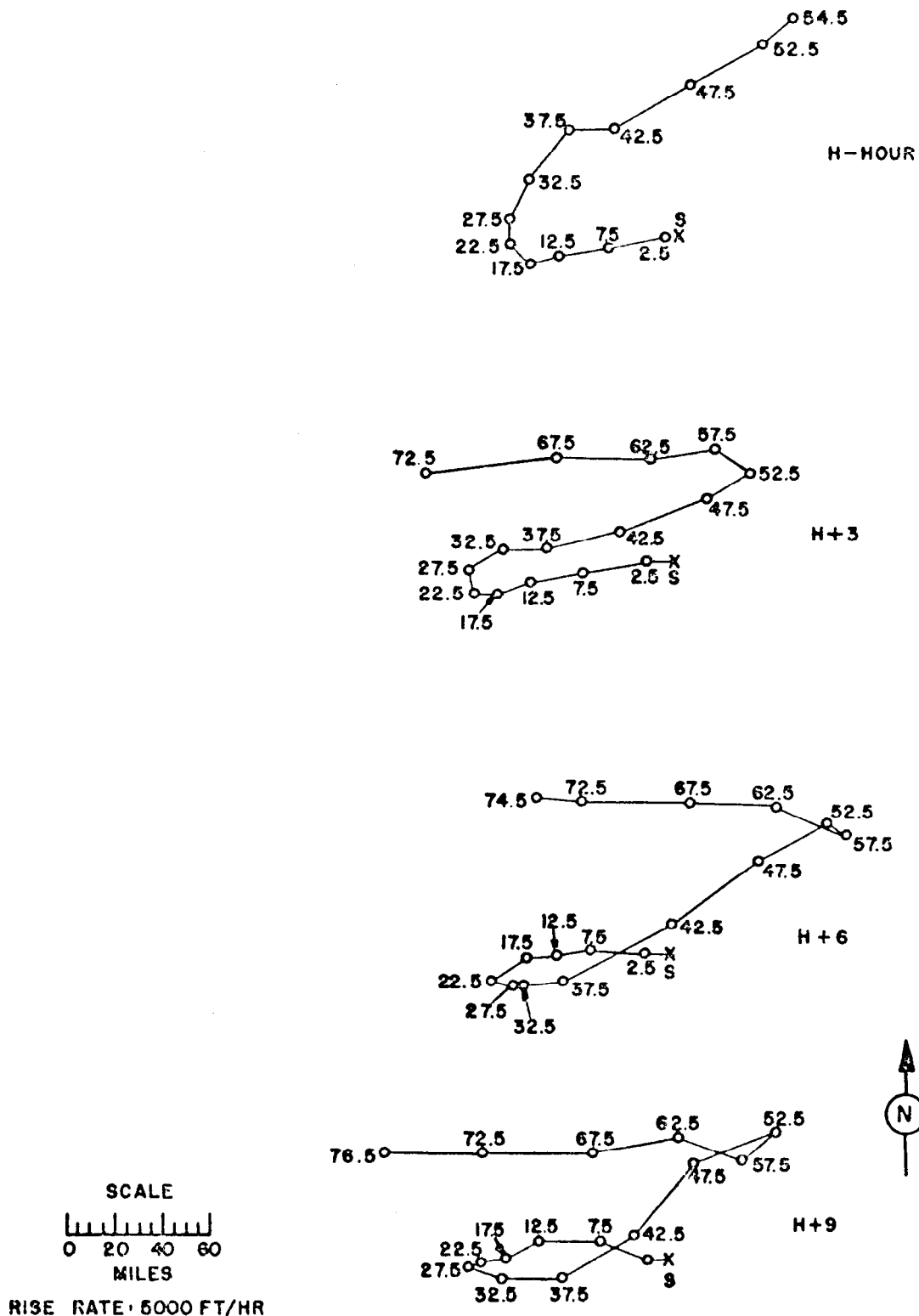


Figure 106. Hodographs for Operation REDWING -

Navajo.

OPERATION REDWING -

Tewa

DATE: 21 Jul 1956 20 Jul 1956  
TIME: 0546 1746

TOTAL YIELD: 5 Mt

FIREBALL DATA:

Time to 1st minimum: 185 to 240 msec  
Time to 2nd maximum: 2.08 sec  
Radius at 2nd maximum: 5,904 ft

CRATER DATA:

Diameter: 4,000 ft  
Depth: 129 ft

Sponsor: UCRL

SITE: PPG - Bikini - Charlie -  
Dog Reef  
11° 40' 26" N  
165° 20' 22" E  
Site elevation: Sea level

HEIGHT OF BURST: 15 ft

TYPE OF BURST AND PLACEMENT:

Surface burst from barge on  
water; center of gravity 15  
ft above surface of water;  
depth to bottom 25 ft.

CLOUD TOP HEIGHT: 99,000 ft MSL

CLOUD BOTTOM HEIGHT: NM

REMARKS:

The on-site fallout pattern was drawn from island readings taken by scientific projects, supplemented by fallout sample collection on rafts and barges in the lagoon. Actual field decay measurements indicated a decay exponent. This decay exponent was used to extrapolate the dose rate readings to H+1 hour. The extremely heavy rains which followed this shot had no observable effect on the decay rates. On all islands the contamination remaining from previous shots was negligible in comparison with the high radiation levels produced by this shot. Very slight fallout occurring approximately 18 hours after firing increased the background on Nan by approximately 4 mr/hr. In contrast to the other barge shots, contamination was also experienced on the atoll's southwestern islands.

The off-site fallout pattern was drawn from oceanographic surveys. The oceanographic surveys used detector probes for measuring the dose rate at depths to and below the thermocline. Water-sampling equipment was used for the taking of surface samples and for the collection of samples from any desired depth. The dose rate readings were extrapolated to H+1 hour by using the decay measurements of the samples collected. Fallout from the firing of this device contaminated Eniwetok atoll. The fallout on Eniwetok commenced approximately 9 hours after the device was fired with a peak of 100 to 120 mr/hr.

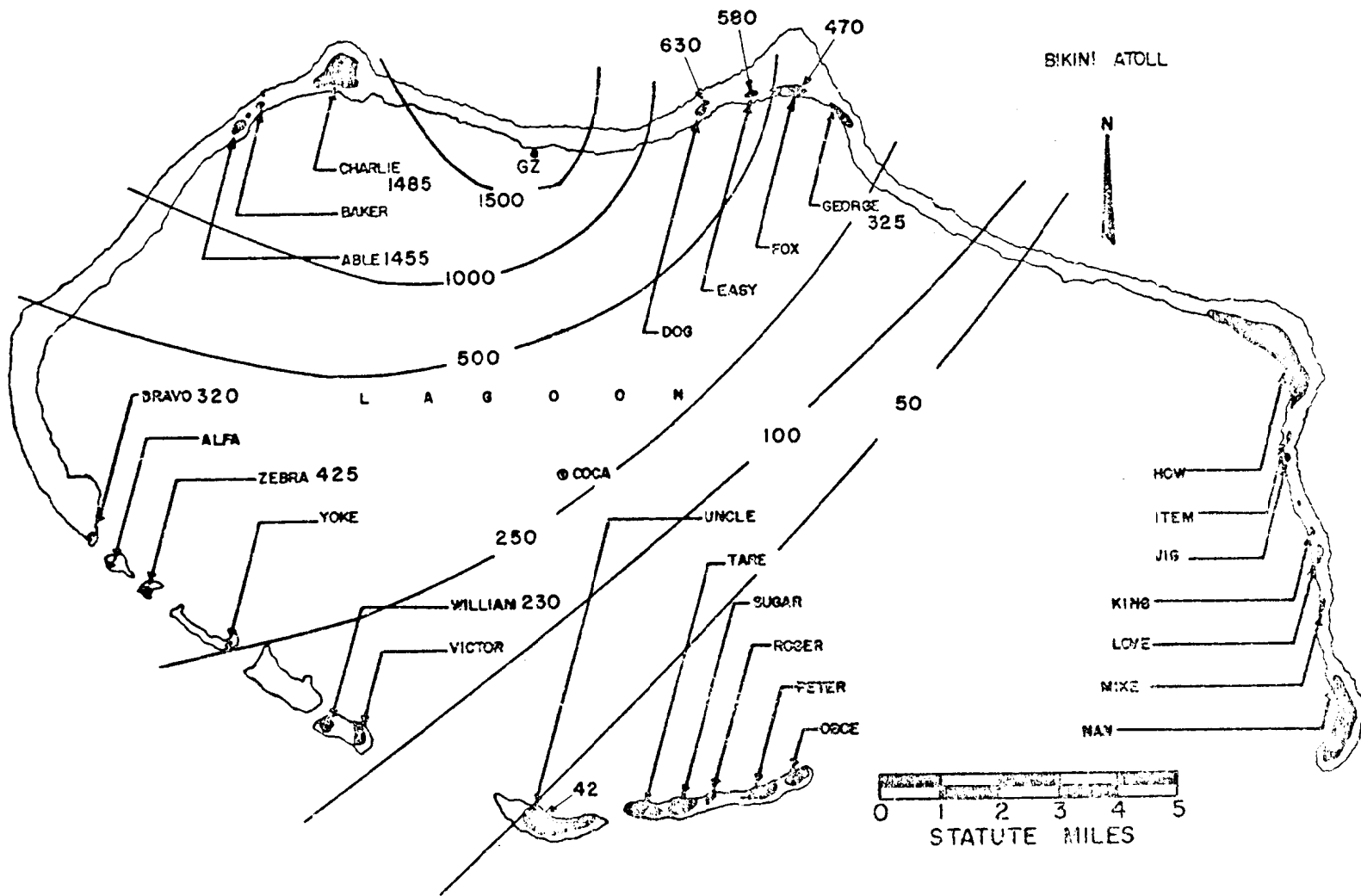


Figure 107. Operation REDWING -

Tewa. Atoll dose rate contours in r/hr at H+1 hour.

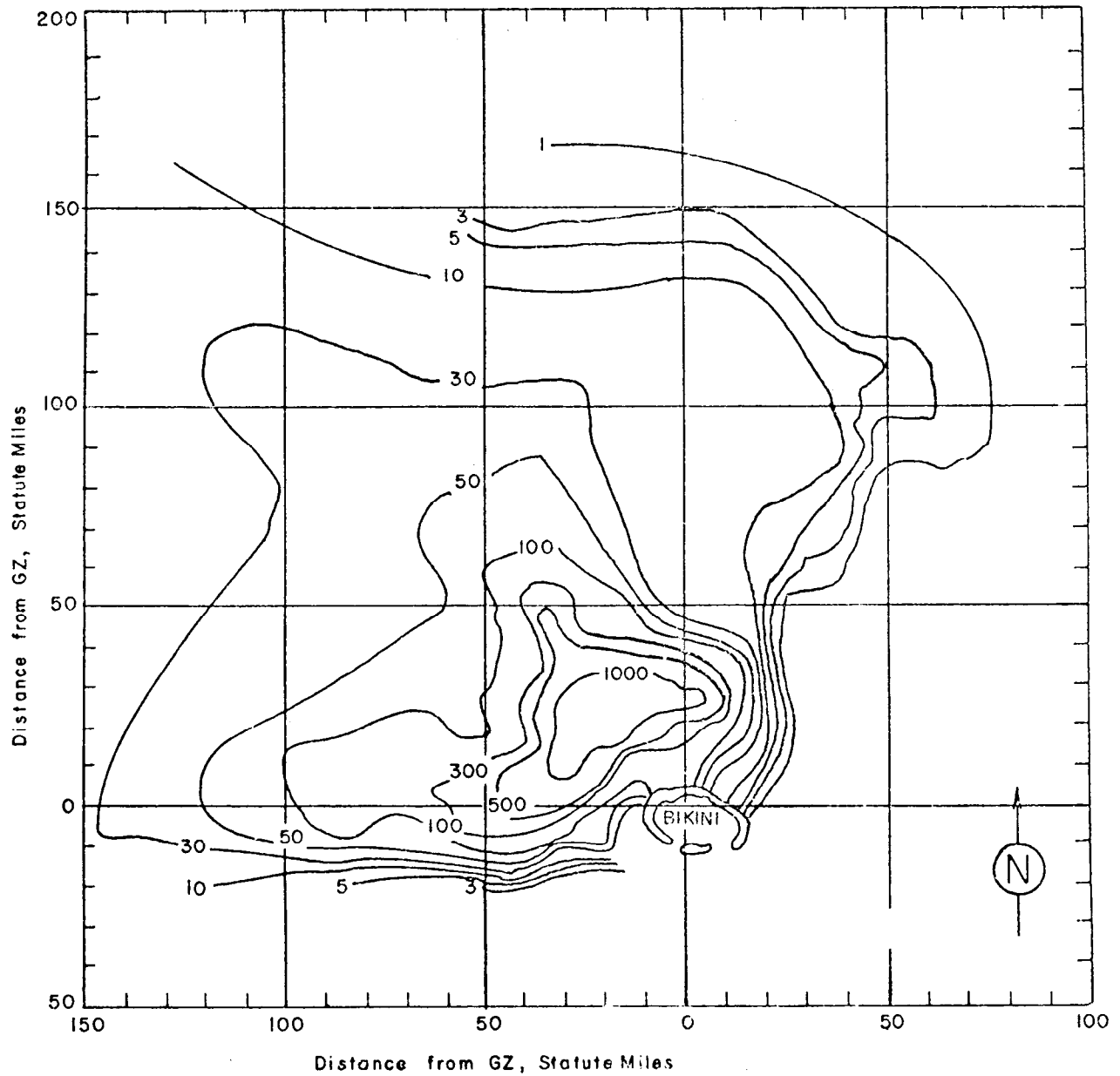


Figure 108. Operation REDWING - Tewa.  
Off-site dose rate contours in r/hr at H+1 hour.

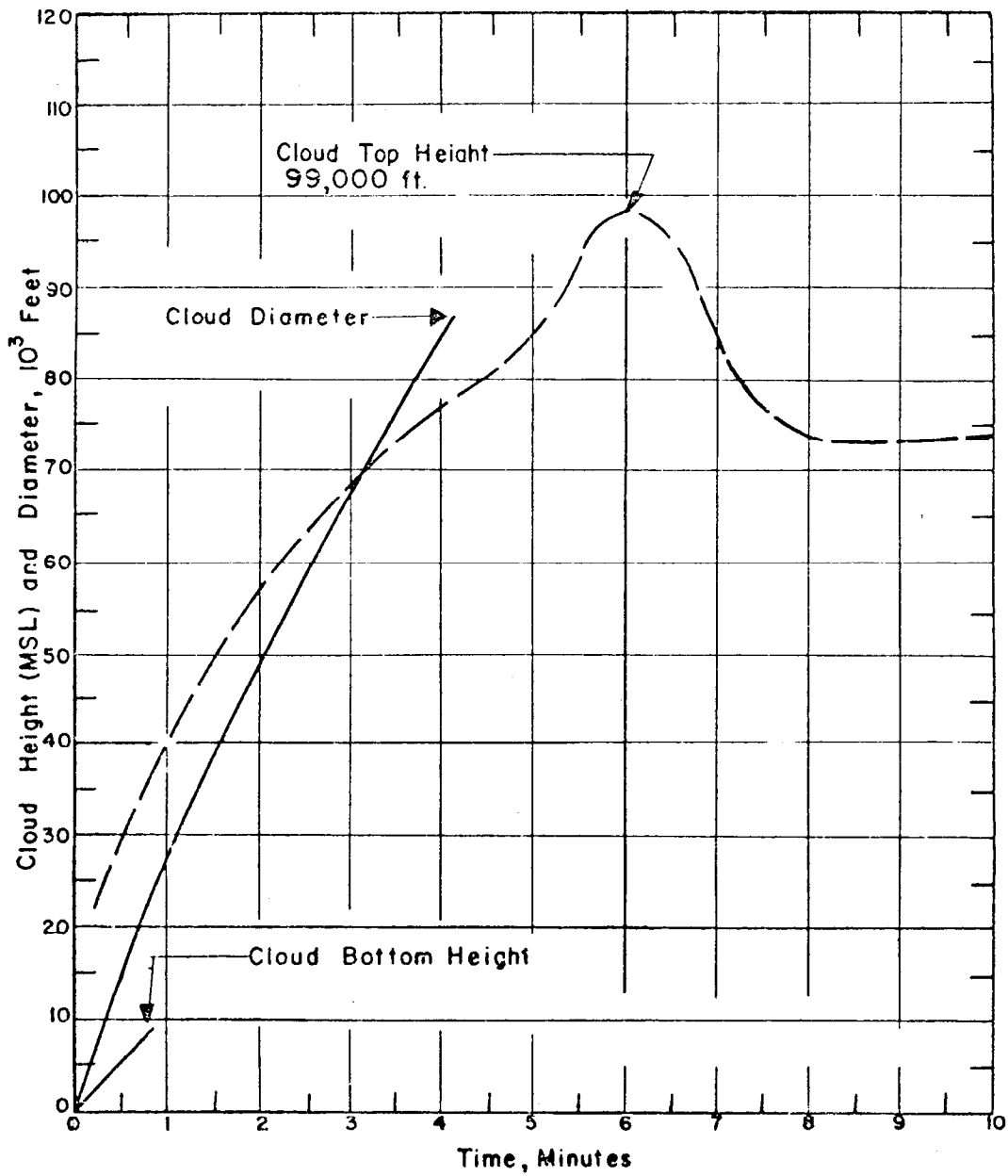


Figure 109. Cloud Dimensions: Operation REDWING - Tewa.

TABLE 33 HIKINI WIND DATA FOR OBSERVATION RECORDING -

TBWA

Altitude (MSL) feet	H-hour		H+3 hours		H+7 hours		H+9 hours	
	Dir degrees	Speed mph	Dir degrees	Speed mph	Dir degrees	Speed mph	Dir degrees	Speed mph
Surface	090	15	090	16	100	15	080	22
1,000	080	17	090	16	100	16	080	13
2,000	090	17	100	17	090	17	090	16
3,000	110	18	100	20	100	24	090	14
4,000	110	18	100	21	100	24	090	18
5,000	110	18	100	20	090	22	100	23
6,000	100	20	110	20	090	22	100	23
7,000	100	22	110	23	090	20	100	22
8,000	090	23	100	24	100	18	090	21
9,000	090	21	110	22	090	21	090	15
10,000	070	20	100	17	090	18	090	15
12,000	080	17	100	15	090	16	080	13
14,000	080	16	100	10	080	10	060	09
15,000	(100)	(12)	(100)	(13)	(090)	(11)	(080)	(12)
16,000	120	07	100	15	090	13	090	14
18,000	090	13	110	15	120	13	160	03
20,000	130	13	120	13	140	12	180	07
25,000	290	09	130	07	180	06	220	15
30,000	320	06	210	13	170	05	260	07
35,000	190	09	260	13	150	05	270	14
40,000	260	23	270	28	270	20	320	18
45,000	250	37	290	21	340	13	040	31
50,000	270	25	260	21	080	20	310	12
55,000	110	06	070	05	080	16	100	17
60,000	070	33	080	37	080	21	090	28
65,000	090	52	100	50	100	54	100	44
70,000	090	48	110	40	090	55	090	40
72,000	---	--	110	37	---	--	---	--
75,000	080	61	---	--	090	60	090	63
80,000	100	55	---	--	090	67	090	69
85,000	100	56	---	--	090	78	---	--
90,000	---	--	---	--	090	108	---	--

## NOTES:

1. Numbers in parentheses are estimated values.
2. Wind data was obtained on board the U. S. S. Curtiss.
3. Tropopause height was 52,000 ft MSL.
4. At H-hour the sea level pressure was 1009.3 mb, the temperature 82°F, the dew point 77°F and the relative humidity 85%.

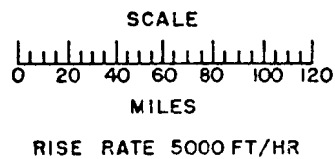
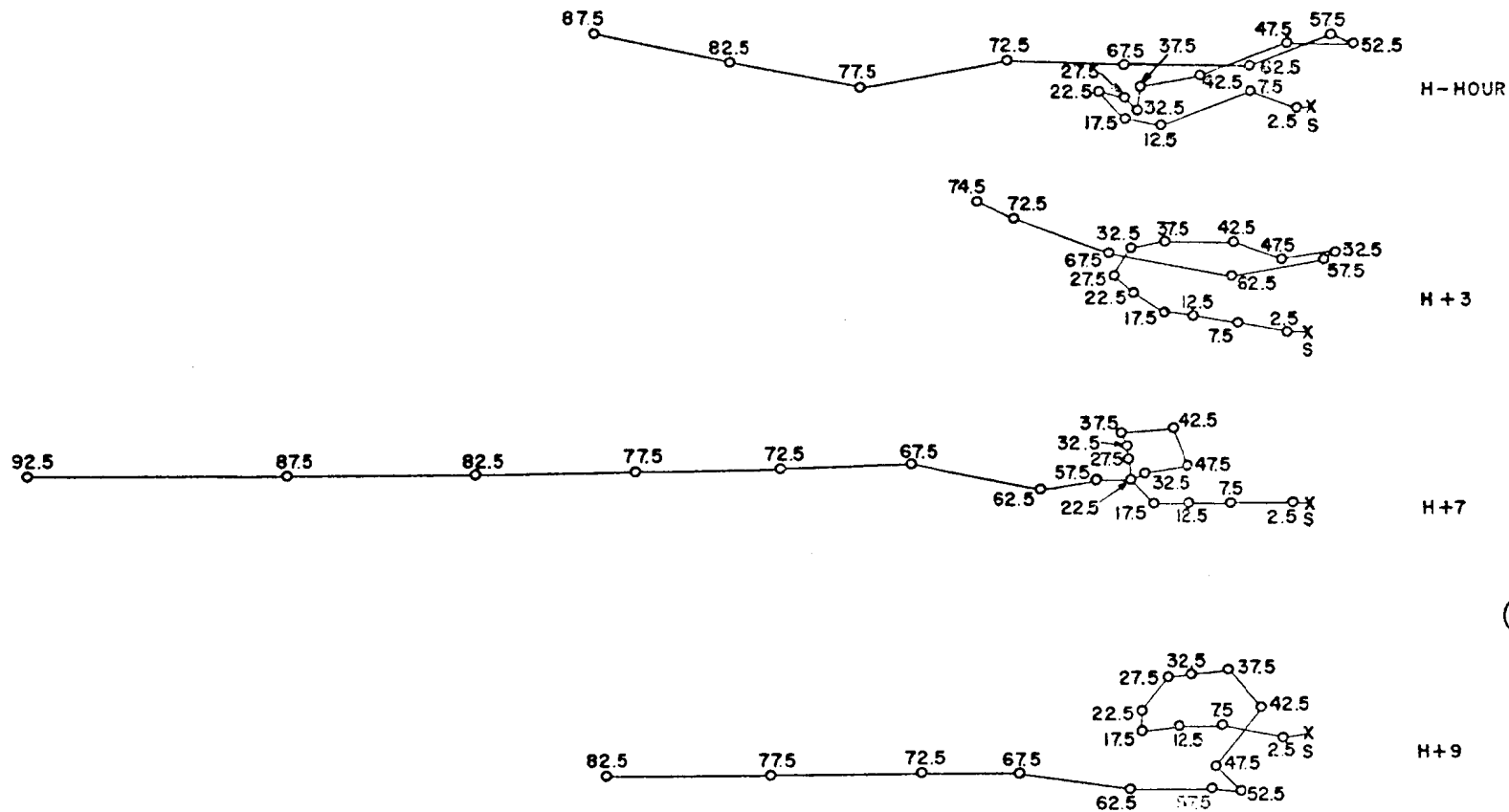


Figure 110. Hodographs for Operation REDWING - Tewa.



OPERATION REMDWING -

Huron

	<u>PPG Time</u>	<u>GMP</u>
<u>DATE:</u>	22 July 1956	21 July 1956
<u>TIME:</u>	0616	1816

Sponsor: LASL

SITE: PPG - Eniwetok - Off Flora  
11° 40' 19" N  
162° 22' 09" E  
Site elevation: Sea level

HEIGHT OF BURST: Surface

TYPE OF BURST AND PLACEMENT:  
Surface burst from barge on  
water

CLOUD TOP HEIGHT: 54,000 ft MSL  
CLOUD BOTTOM HEIGHT: 27,000 ft MSL

REMARKS:

Only island dose-rate readings are available. These were obtained from aerial and ground surveys made by the Radiological Safety organization. The  $t^{-1.2}$  decay approximation was used to extrapolate the dose rate readings to H+1 hour.

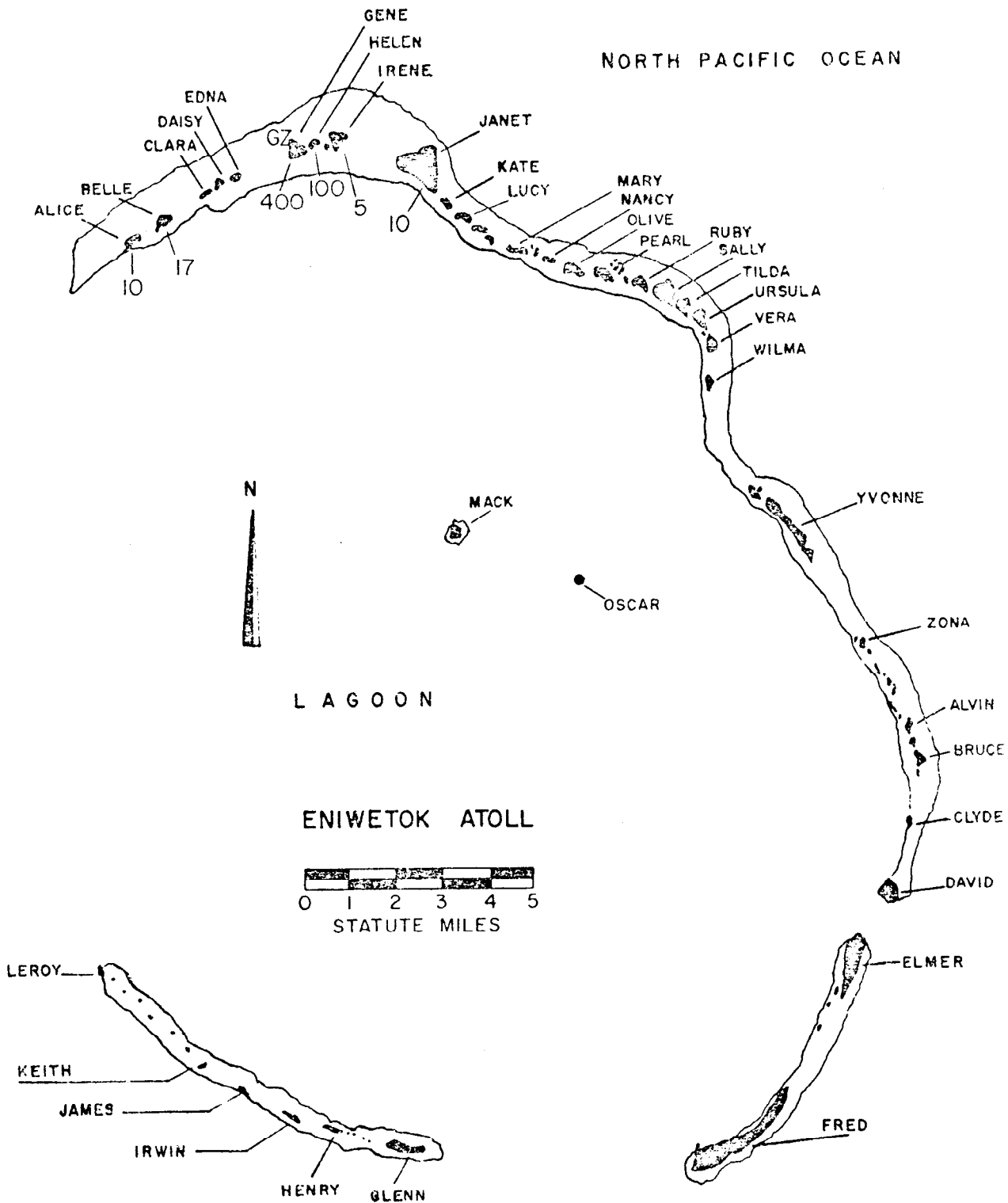


Figure 111. Operation REDWING - Huron.  
Island dose rates in r/hr at H+1 hour.

TABLE 34 ENIWETOK WIND DATA FOR OPERATION REDWING -

HURON

Altitude (MSL) feet	H-hour		H+3 hours		H+6 hours		H+9 hours	
	Dir degrees	Speed mph	Dir degrees	Speed mph	Dir degrees	Speed mph	Dir degrees	Speed mph
Surface	120	14	090	18	130	16	140	23
1,000	100	18	110	20	110	14	120	29
2,000	100	18	110	24	090	14	110	28
3,000	100	18	110	29	100	16	110	32
4,000	100	18	100	30	060	15	110	35
5,000	110	22	100	29	120	14	110	37
6,000	110	22	100	28	120	16	110	38
7,000	120	18	100	25	110	16	110	38
8,000	120	22	090	23	110	14	110	35
9,000	110	23	090	25	110	14	100	35
10,000	110	18	100	28	110	14	100	35
12,000	110	12	110	21	110	14	090	28
14,000	120	14	100	23	080	18	080	23
15,000	(140)	(13)	(090)	(23)	(110)	(13)	(080)	(16)
16,000	160	12	080	23	130	07	080	09
18,000	160	12	070	10	090	15	090	12
20,000	150	12	060	09	060	18	080	07
25,000	170	09	030	05	360	07	010	07
30,000	080	16	040	10	110	06	120	09
35,000	060	32	050	37	060	14	090	24
40,000	060	40	050	39	100	09	060	25
44,000	---	--	050	39	---	--	---	--
45,000	070	52	---	--	070	08	050	09
50,000	070	08	---	--	080	15	260	10
55,000	070	23	---	--	120	13	080	14
60,000	100	38	---	--	120	20	090	40
65,000	110	51	---	--	100	22	090	52
70,000	090	56	---	--	110	35	100	53
75,000	100	71	---	--	090	37	100	63
80,000	100	79	---	--	070	23	100	75
85,000	100	87	---	--	090	23	090	82
90,000	100	107	---	--	---	--	---	--
99,000	---	--	---	--	---	--	090	117

## NOTES:

1. Numbers in parentheses are estimated values.
2. Tropopause height was 50,000 ft MSL at H-hour.
3. Wind data was obtained by the weather station on Eniwetok Island.
4. At the surface the air pressure was 14.62 psi, the temperature 27.4°C, the dew point 24.5°C and the relative humidity 84%.

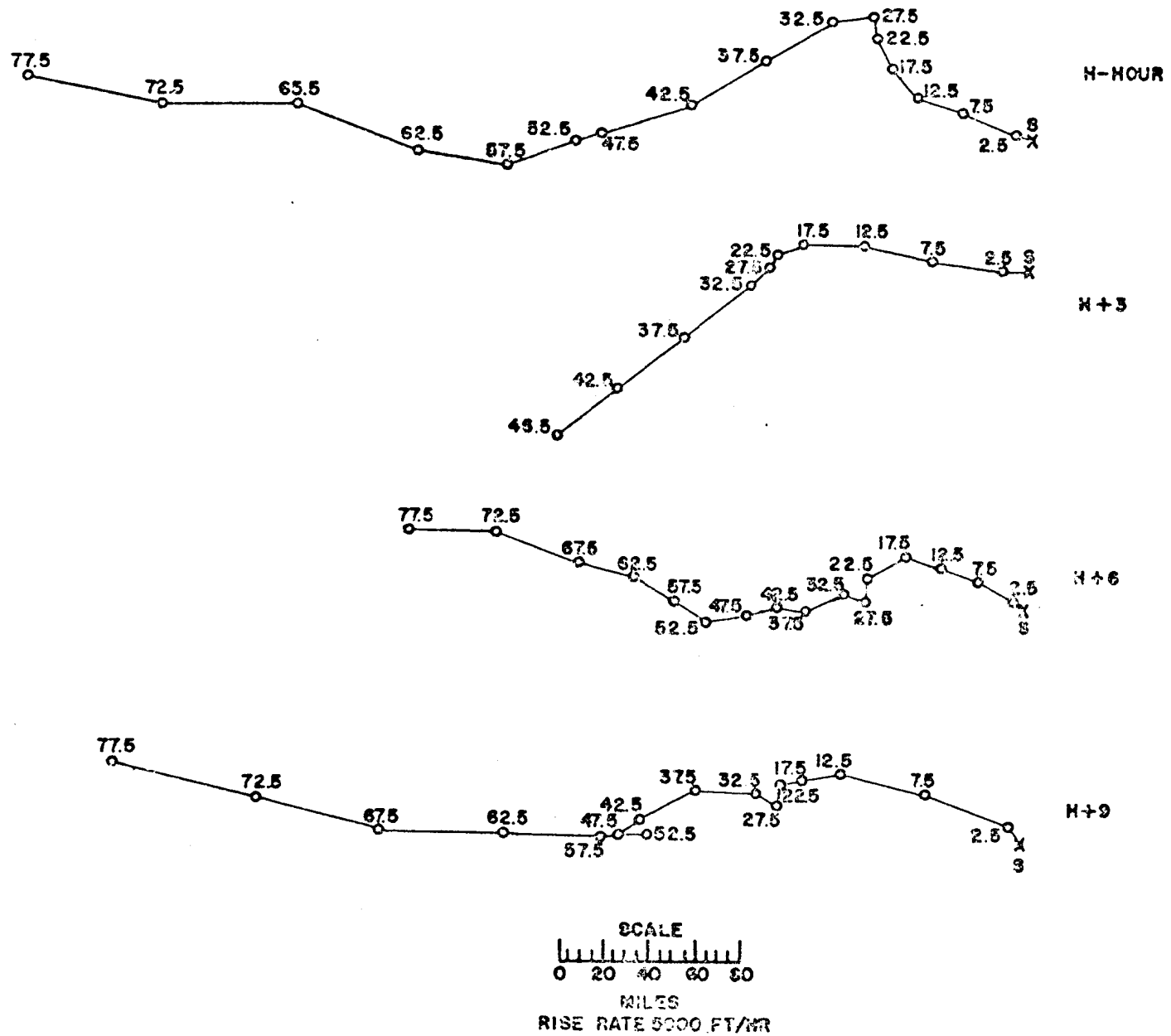


Figure 112. Hodographs for Operation REDWING - Huron.

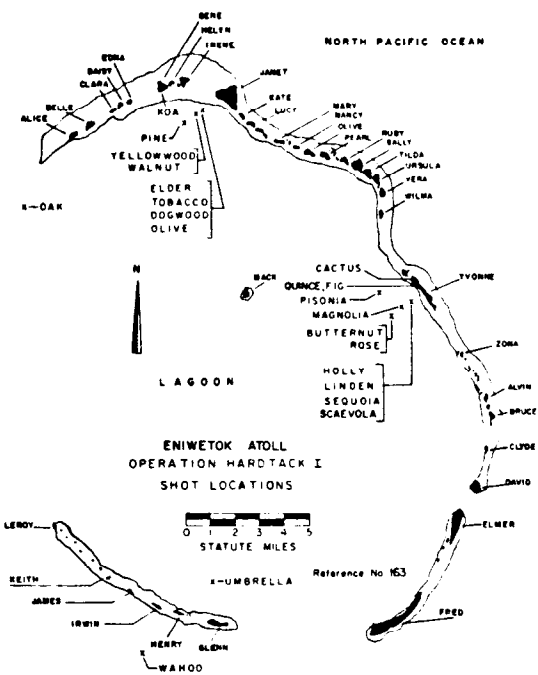
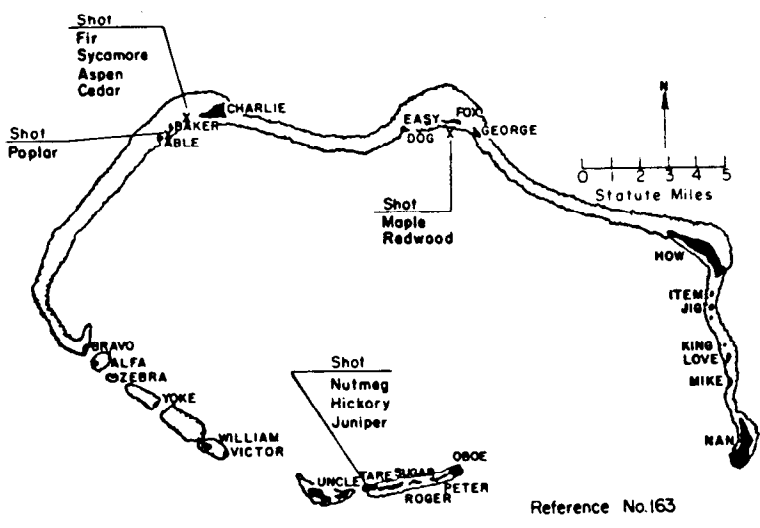


Figure 113. Operation HARDTACK I, Shot Locations, Eniwetok Atoll



BIKINI ATOLL  
 OPERATION HARDTACK I  
 SHOT LOCATIONS  
 Yucca(High Altitude) Detonated 60 Miles West of Bikini

Figure 114. Operation HARDTACK I, Shot Locations, Bikini Atoll

OPERATION HARDTACK I -

Yucca

	<u>PPG Time</u>	<u>GMT</u>
<u>DATE:</u>	28 Apr 1958	28 Apr 1958
<u>TIME:</u>	1440	0240

Sponsor: DOD

SITE: PPG - USS Boxer 60 mi  
west of Bikini  
12° 37' 00" N  
163° 01' 30" E  
Site elevation: Sea level

HEIGHT OF BURST: 86,000 ft

TYPE OF BURST AND PLACEMENT:  
Air burst from free balloon  
over water

CLOUD TOP HEIGHT: NM  
CLOUD BOTTOM HEIGHT: NM

REMARKS: No fallout

TABLE 35 BIKINI WIND DATA FOR OPERATION HARDTACK I -

YUCCA

Altitude (MSL) feet	H-hour	
	Dir degrees	Speed mph
Surface	040	16
1,000	050	29
2,000	050	35
3,000	070	36
4,000	130	09
5,000	350	12
6,000	360	14
7,000	150	15
8,000	190	12
9,000	210	09
10,000	230	06
12,000	350	12
14,000	320	15
15,000	(320)	(15)
16,000	330	16
18,000	300	15
20,000	260	07
23,000	210	15
25,000	240	18
30,000	200	13
35,000	210	32
40,000	270	44
45,000	270	51
50,000	270	40
55,000	270	38
60,000	280	38
65,000	250	18
70,000	070	15
75,000	180	09

NOTES:

1. Numbers in parentheses are estimated values.
2. Wind data was taken on board ship located within 30 nautical miles of the Tower at Nan Island, Bikini Atoll.
3. Tropopause height was 53,000 ft MSL.
4. At H-hour the surface air pressure was 14.67 psi, the temperature 25.7°C, the dew point 69.6°F, and the relative humidity 75%.

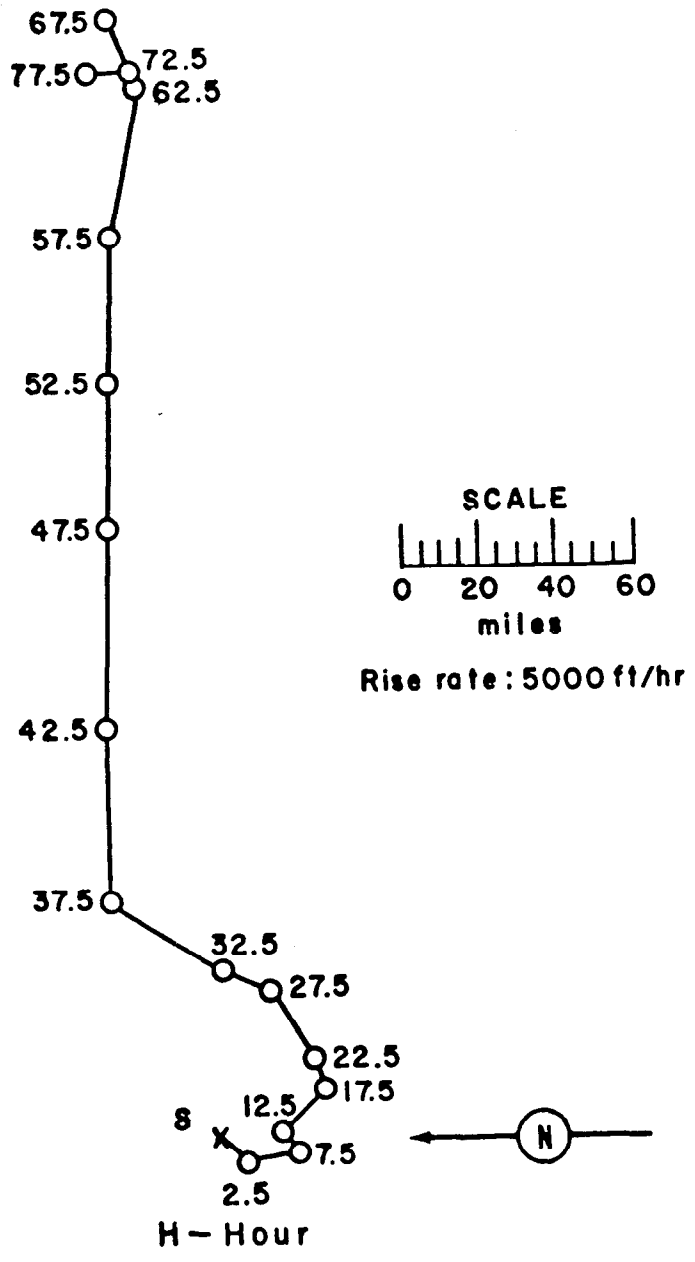


Figure 115. Hodograph for Operation HARDTACK I -

Yucca.



OPERATION HARDTACK I -

Cactus

	<u>PPG Time</u>	<u>GMT</u>
<u>DATE:</u>	6 May 1958	5 May 1958
<u>TIME:</u>	0615	1815

TOTAL YIELD: 18 kt

FIREBALL DATA:

Time to 1st minimum: 12 msec  
Time to 2nd maximum: 130 msec  
Radius at 2nd maximum: 656 ft

CRATER DATA:

Diameter: 340 ft  
Depth: 34.5 ft  
Lip Height: 8 to 14 ft  
Lip Width: 115 to 170 ft

Sponsor: LASL

SITE: PPG - Eniwetok - Yvonne  
11° 33' 23" N  
162° 21' 15" E  
Site elevation: Sea level

HEIGHT OF BURST: 3 ft

TYPE OF BURST AND PLACEMENT:

Surface burst - Platform on coral soil

CLOUD TOP HEIGHT: 19,000 ft MSL

CLOUD BOTTOM HEIGHT: NM

REMARKS:

Only individual island dose rates are available. These were obtained from helicopter surveys at H+4 hours made by the Radiological Safety organization. The helicopter survey technique called for the pilot either to land the aircraft at the desired spot, so that a ground reading could be obtained, or to make a slow pass over the desired spot at an elevation of 25 feet. Readings taken at 25 feet were multiplied by a factor of 2 in order to obtain a reasonable approximation of the true ground reading. The basic instrument used in the aerial surveys was the AN/PDR-39 survey meter modified to read up to 500 r/hr. The  $t^{-1.2}$  decay approximation was used to extrapolate the H+4 hour dose-rate readings to H+1 hour.

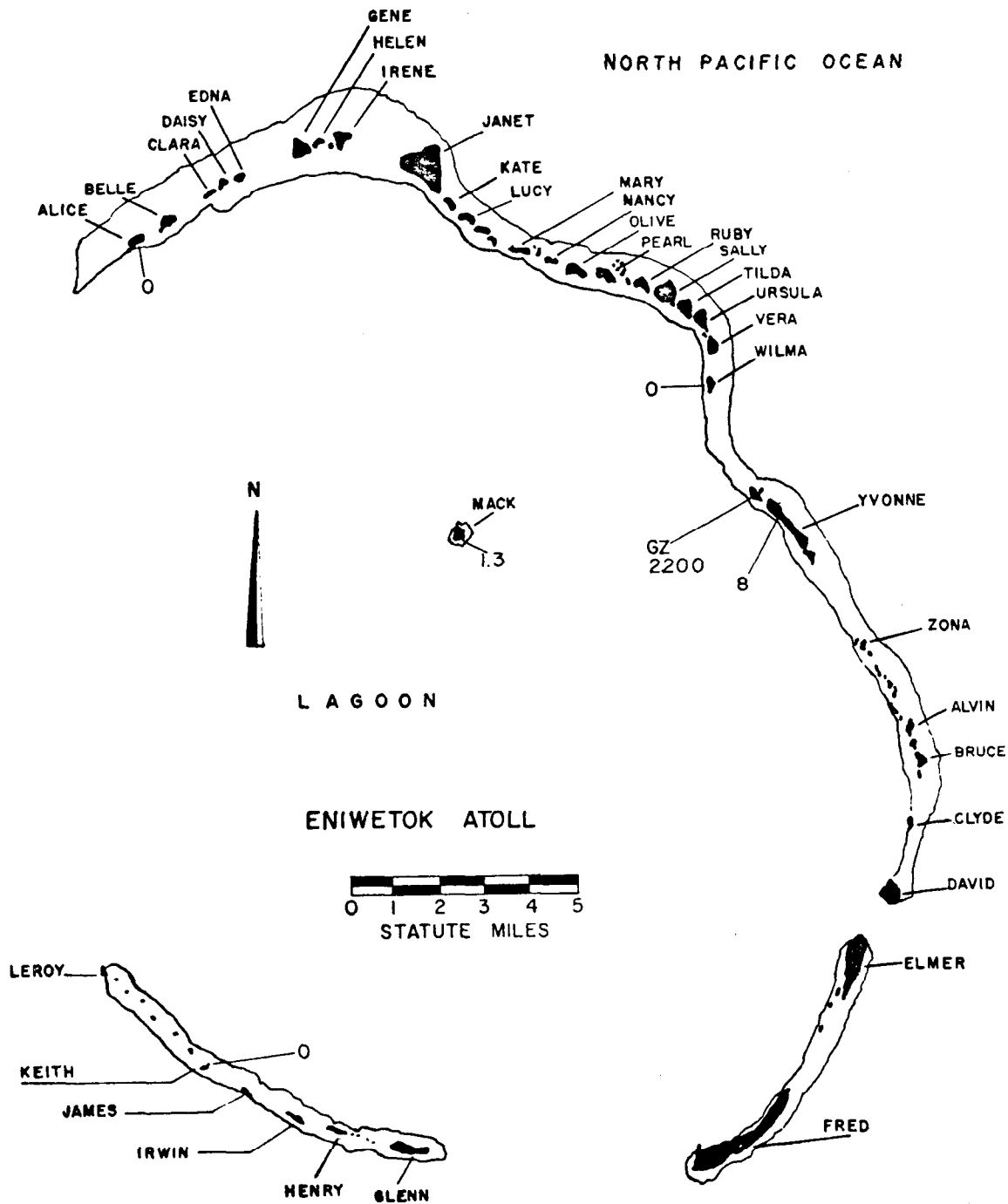


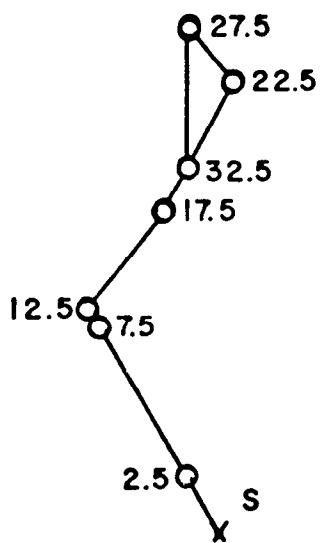
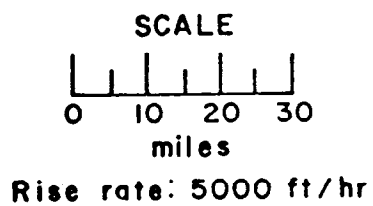
Figure 116. Operation HARDTACK I - Cactus.  
Island dose rates in r/hr at H+1 hour.

TABLE 36 ENIWETOK WIND DATA FOR OPERATION HARDTACK I - CACTUS

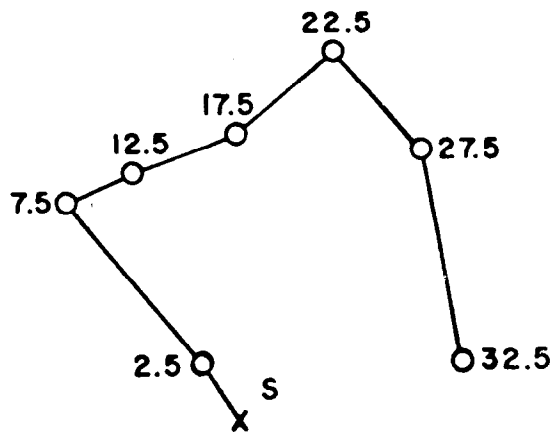
Altitude (MSL) feet	H+ $\frac{3}{4}$ hour		H+5 $\frac{1}{4}$ hours	
	Dir	Speed	Dir	Speed
	degrees	mph	degrees	mph
Surface	060	16	060	16
1,000	070	24	060	29
2,000	070	25	060	24
3,000	060	26	060	26
4,000	060	24	060	28
5,000	060	23	050	25
6,000	060	23	040	24
7,000	080	15	030	17
8,000	090	10	010	08
9,000	110	05	040	05
10,000	060	03	160	08
12,000	200	02	220	10
14,000	150	12	180	13
15,000	(130)	(15)	(160)	(13)
16,000	100	18	130	14
18,000	100	18	140	15
20,000	120	18	140	15
23,000	090	13	150	18
25,000	050	09	230	15
30,000	270	17	260	26
35,000	---	--	230	32
40,000	220	37	230	39
45,000	290	35	270	33
50,000	310	39	270	23
55,000	230	07	250	18
60,000	260	17	240	17
65,000	---	--	250	12
67,000	210	07	---	--
70,000	120	08	090	05
75,000	070	13	080	12
80,000	080	31	090	23
85,000	080	52	100	33
90,000	090	60	100	40
95,000	---	--	100	62
96,000	100	57	---	--
100,000	---	--	090	49
105,000	---	--	090	51
110,000	---	--	090	59
112,000	---	--	090	61

NOTES:

1. Number in parentheses are estimated values.
2. Wind data was taken by the Eniwetok weather station.
3. Tropopause height was 51,000 ft MSL.
4. The surface air pressure was 14.66 psi, the temperature 26.7°C, the dew point 72°F and the relative humidity 76%.



$H + \frac{3}{4}$  Hour



$H + 5\frac{3}{4}$



Figure 117. Hodographs for Operation HARDTACK I - Cactus.

OPERATION HARDTACK I -

Fir

	<u>PPG Time</u>	<u>GMT</u>
<u>DATE:</u>	12 May 1958	11 May 1958
<u>TIME:</u>	0550	1750

Sponsor: UCRL

SITE: PPG - Bikini - SW of  
Charlie 4,000 ft from  
nearest edge of the island  
11° 41' 27" N  
165° 16' 25" E  
Site elevation: Sea level

HEIGHT OF BURST: 9.88 ft

CLOUD TOP HEIGHT: 90,000 ft MSL  
CLOUD BOTTOM HEIGHT: NM

TYPE OF BURST AND PLACEMENT:  
Surface burst from barge on  
water

REMARKS:

Only individual island dose rates are available. These were obtained from Radiological Safety organization helicopter surveys at H+4 hours. The helicopter survey technique called for the pilot either to land the aircraft at the desired spot, so that a ground reading could be obtained, or to make a slow pass over the desired spot at an elevation of 25 feet. Readings taken at 25 feet were multiplied by a factor of 2 in order to obtain a reasonable approximation of the true ground reading. The basic instrument used in the aerial surveys was the AN/PDR-39 survey meter modified to read up to 500 r/hr. The  $t^{-1.2}$  decay approximation was used to extrapolate the H+4 hour dose rate readings to H+1 hour.

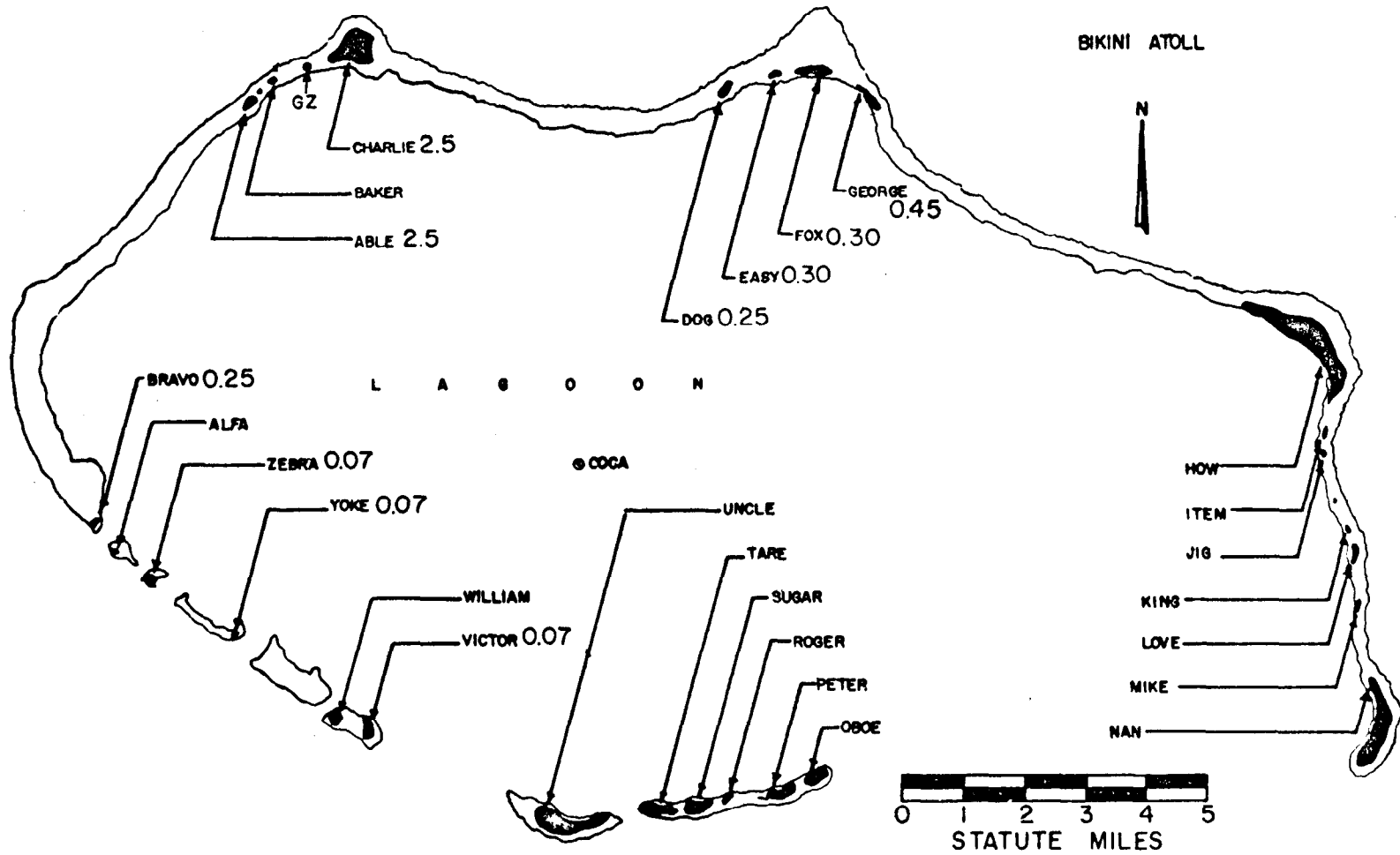


Figure 118. Operation HARDTACK I - Fir. Island dose rates in r/hr at H+1 hour.

TABLE 37 BIKINI WIND DATA FOR OPERATION HARDTACK I - FIR

Altitude (MSL) feet	H- $\frac{3}{4}$ hour		H+7 $\frac{1}{2}$ hours		H+12 $\frac{1}{4}$ hours	
	Dir degrees	Speed mph	Dir degrees	Speed mph	Dir degrees	Speed mph
Surface	070	25	070	25	060	28
1,000	070	26	060	26	060	26
2,000	080	26	070	26	070	29
3,000	080	22	080	26	080	29
4,000	090	26	090	29	090	25
5,000	090	36	100	30	110	22
6,000	110	26	100	29	110	23
7,000	130	23	110	24	110	31
8,000	130	17	110	18	120	29
9,000	150	17	130	18	130	18
10,000	170	15	150	16	150	13
12,000	120	08	190	07	200	13
14,000	110	08	220	14	250	10
15,000	(090)	(12)	(170)	(10)	(210)	(08)
16,000	070	14	120	07	180	06
18,000	060	07	140	06	190	02
20,000	050	07	160	03	280	01
23,000	090	05	200	03	240	06
25,000	130	06	220	06	250	10
30,000	280	20	280	17	270	17
35,000	(255)	(34)	(250)	(28)	(235)	(32)
40,000	230	48	220	40	200	48
45,000	240	56	(250)	(39)	220	55
50,000	260	45	280	39	260	33
54,000	280	26	---	--	---	--
55,000	(270)	(23)	(200)	(25)	(250)	(21)
56,000	---	--	180	12	250	18
60,000	210	05	290	08	360	05
64,000	---	--	080	09	---	--
65,000	(120)	(12)	(190)	(13)	(110)	(12)
67,000	360	06	---	--	---	--
70,000	040	20	090	17	090	13
75,000	080	26	(090)	(22)	(090)	(16)
80,000	120	26	090	26	090	20
85,000	110	40	---	--	---	--
88,000	---	--	---	--	100	53

NOTES:

1. Numbers in parentheses are estimated values.
2. Wind data was taken on board ship located within 30 nautical miles of the Tower at Nan Island, Bikini Atoll.
3. Tropopause height was 54,000 ft MSL.
4. The surface air pressure was 14.64 psi, the temperature 26.7°C, the dew point 73.0°F, and the relative humidity 80%.

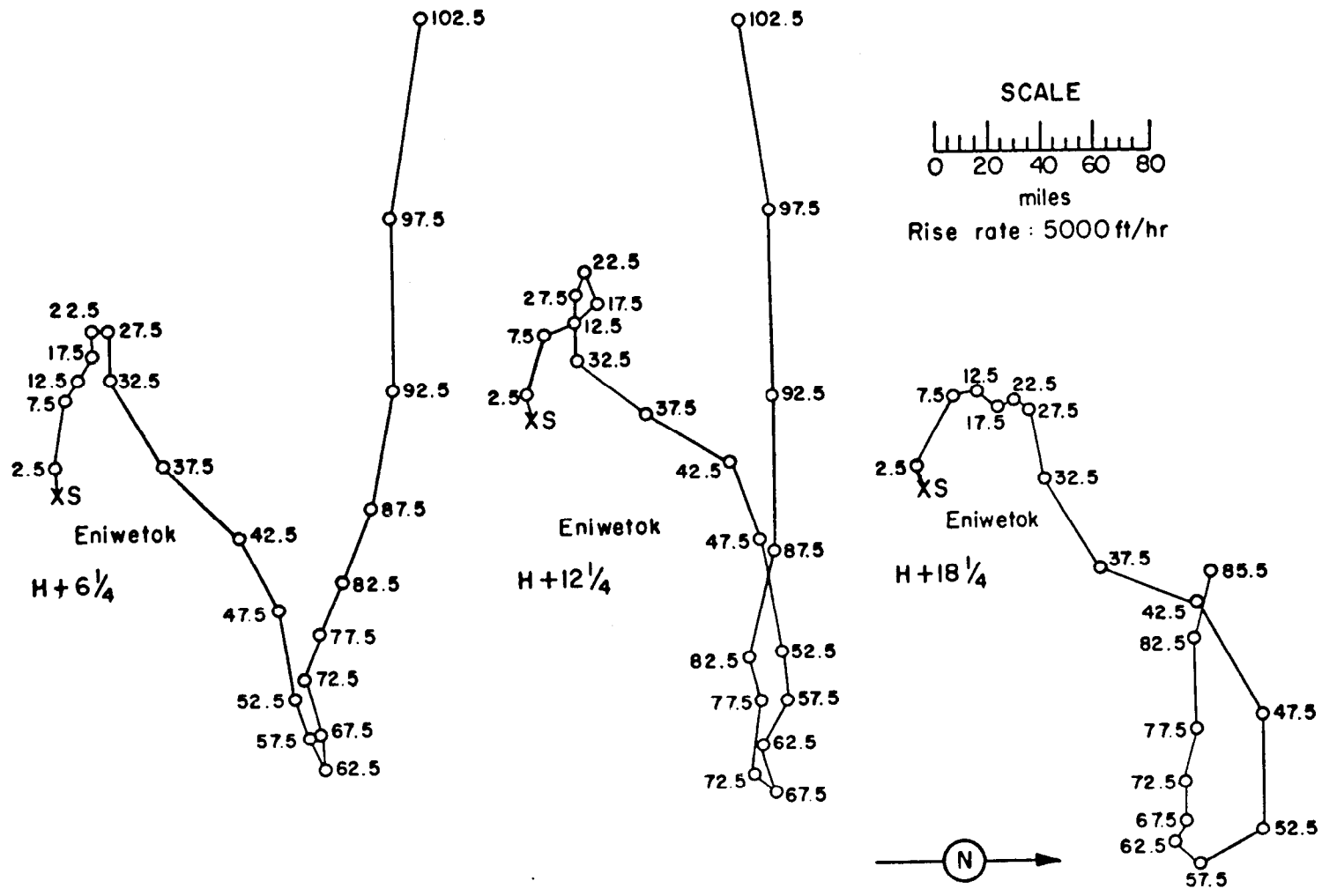


Figure 119. Hodographs for Operation HARDTACK I - Fir.



OPERATION HARDTACK I - Butternut

	<u>PPG Time</u>	<u>GMT</u>
<u>DATE:</u>	12 May 1958	11 May 1958
<u>TIME:</u>	0615	1815

Sponsor: IASL

SITE: PPG - Eniwetok - SW of  
Yvonne  
4,000 ft from the nearest  
edge of the island  
11° 20' 41" N  
162° 21' 02" E  
Site elevation: Sea level

HEIGHT OF BURST: 10.13 ft

TYPE OF BURST AND PLACEMENT:  
Surface burst from barge on  
water  
Water depth: 65 ft

CLOUD TOP HEIGHT: 35,000 ft MSL  
CLOUD BOTTOM HEIGHT: NM

REMARKS:

Only individual island dose rates are available. These were obtained from helicopter surveys at H+4 hours made by the Radiological Safety Organization. The helicopter survey technique called for the pilot either to land the aircraft at the desired spot, so that a ground reading could be obtained, or to make a slow pass over the desired spot at an elevation of 25 feet. Readings taken at 25 feet were multiplied by a factor of 2 in order to obtain a reasonable approximation of the true ground reading. The basic instrument used in the aerial surveys was the AN/PDR-39 survey meter modified to read up to 500 r/hr. The  $t^{-1.2}$  decay approximation was used to extrapolate the H+4 hour dose-rate readings to H+1 hour.

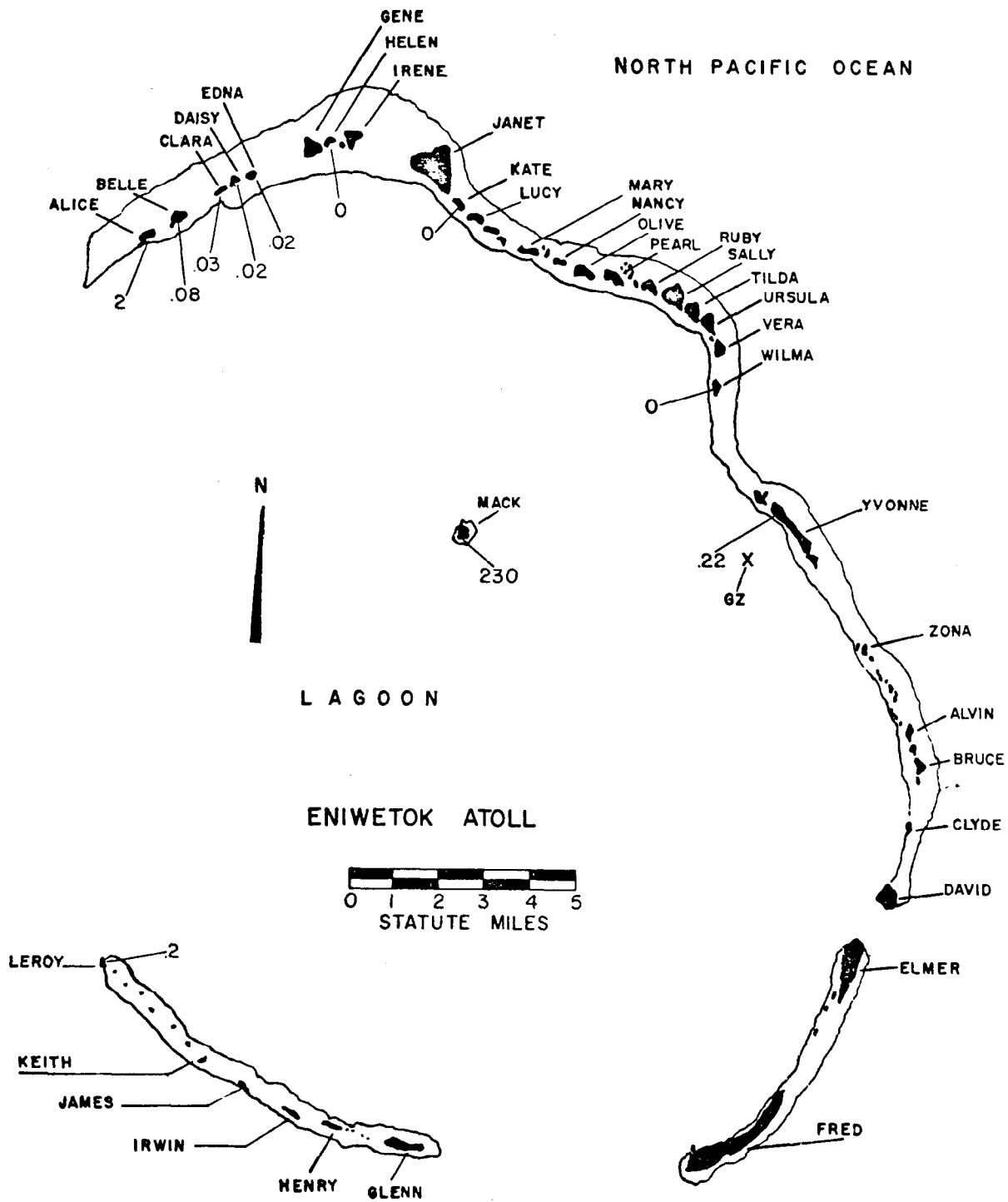


Figure 120 . Operation HARDTACK I - Butternut.  
Island dose rates in r/hr at H+1 hour.

TABLE 38 ENIWETOK WIND DATA FOR OPERATION HARDTACK I - BUTTERNUT

Altitude (MSL) feet	H- $\frac{1}{2}$ hour		H+5 $\frac{1}{4}$ hours		H+11 $\frac{1}{4}$ hours	
	Dir degrees	Speed mph	Dir degrees	Speed mph	Dir degrees	Speed mph
Surface	080	12	080	17	070	16
1,000	090	24	080	24	080	28
2,000	090	25	080	24	080	29
3,000	090	25	090	29	090	29
4,000	100	21	090	28	100	26
5,000	120	18	100	24	110	24
6,000	120	18	120	24	130	21
7,000	150	16	150	21	130	17
8,000	150	13	170	16	150	13
9,000	130	09	170	15	170	15
10,000	100	10	120	08	160	10
12,000	090	09	190	07	230	09
14,000	080	09	150	09	200	09
15,000	(080)	(14)	(120)	(09)	(140)	(09)
16,000	070	18	090	09	080	08
18,000	100	12	110	09	070	07
20,000	100	09	090	07	070	05
23,000	110	07	160	02	340	05
25,000	Calm	Calm	200	03	300	08
30,000	280	22	270	17	270	24
35,000	(230)	(41)	240	36	220	33
37,000	210	49	---	---	---	---
40,000	230	43	220	39	210	37
45,000	260	47	240	28	250	35
50,000	250	40	260	33	260	40
54,000	280	21	---	---	---	---
55,000	---	---	250	16	260	17
60,000	200	05	250	09	300	12
65,000	---	---	080	12	250	15
66,000	070	12	---	---	---	---
70,000	080	16	070	18	050	10
72,000	100	25	---	---	---	---
75,000	---	---	110	16	100	17
80,000	090	37	110	20	080	20
84,000	100	36	---	---	---	---
85,000	---	---	110	29	100	38

NOTES:

1. Numbers in parentheses are estimated values.
2. Wind data was taken by the Eniwetok weather station.
3. Tropopause height was 53,000 ft MSL.
4. The surface air pressure was 14.63 psi, the temperature 27°C, the dew point 74°F, and the relative humidity 80%.

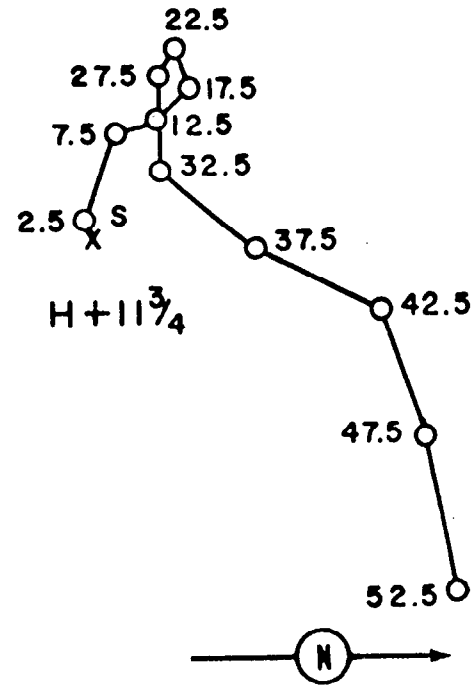
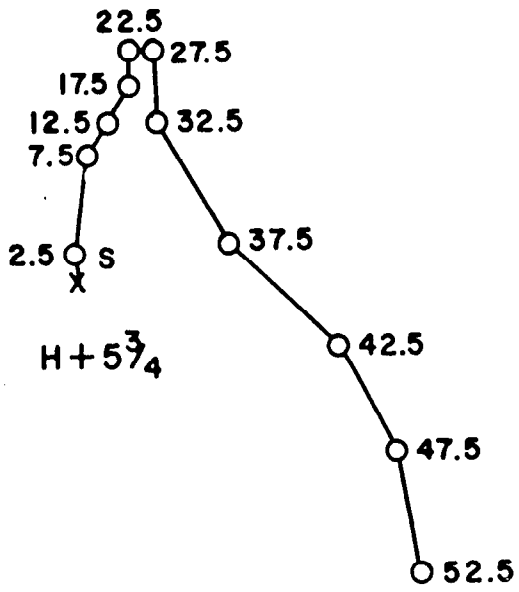
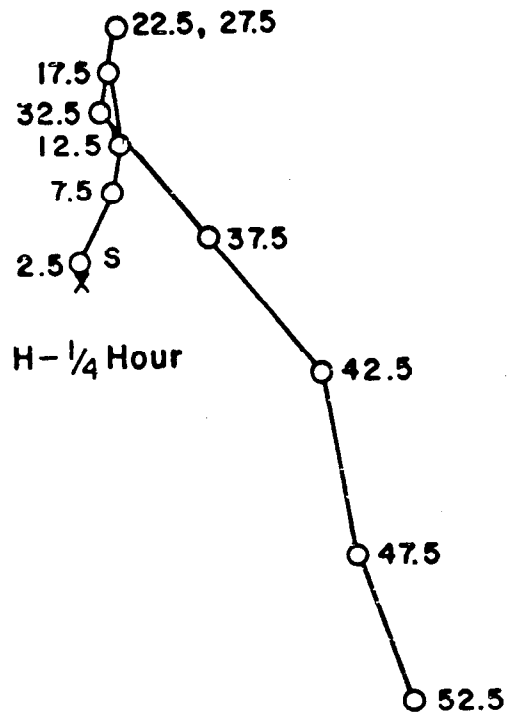
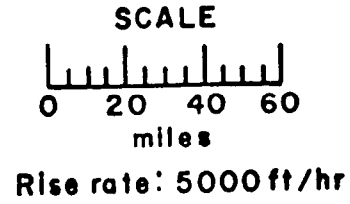


Figure 121 . Hodographs for Operation HARDTACK I -

Butternut.

OPERATION HARDTACK I - Koa

	<u>PPG Time</u>	<u>GMT</u>
<u>DATE:</u>	13 May 1958	12 May 1958
<u>TIME:</u>	0630	1830

TOTAL YIELD: 1.37 Mt

FIREBALL DATA:

Time to 1st minimum: 100 msec  
Time to 2nd maximum: 0.94 to 1.35 sec  
Radius at 2nd maximum: 3,641 ft

CRATER DATA:

Diameter: 4,000 ft  
Depth: 171 ft  
Lip: Apparently washed away

Sponsor: IASL

SITE: PPG - Eniwetok - West  
end of Gene  
11° 40' 30" N  
162° 12' 20" E  
Site elevation: Sea level

HEIGHT OF BURST: 3 ft

TYPE OF BURST AND PLACEMENT:

Surface burst from 10 ft deep  
tank of water sitting on coral  
soil

CLOUD TOP HEIGHT: 72,200 ft MSL  
CLOUD BOTTOM HEIGHT: NM

REMARKS:

Only individual island dose rates are available. These were obtained from Radiological Safety organization helicopter surveys at H+4 hours. The helicopter survey technique called for the pilot either to land the aircraft at the desired spot, so that a ground reading could be obtained, or to make a slow pass over the desired spot at an elevation of 25 feet. Readings taken at 25 feet were multiplied by a factor of 2 in order to obtain a reasonable approximation of the true ground reading. The basic instrument used in the aerial surveys was the AN/PDR-39 survey meter modified to read up to 500 r/hr. The  $t^{-1.2}$  decay approximation was used to extrapolate the H+4 hour dose rate readings to H+1 hour.

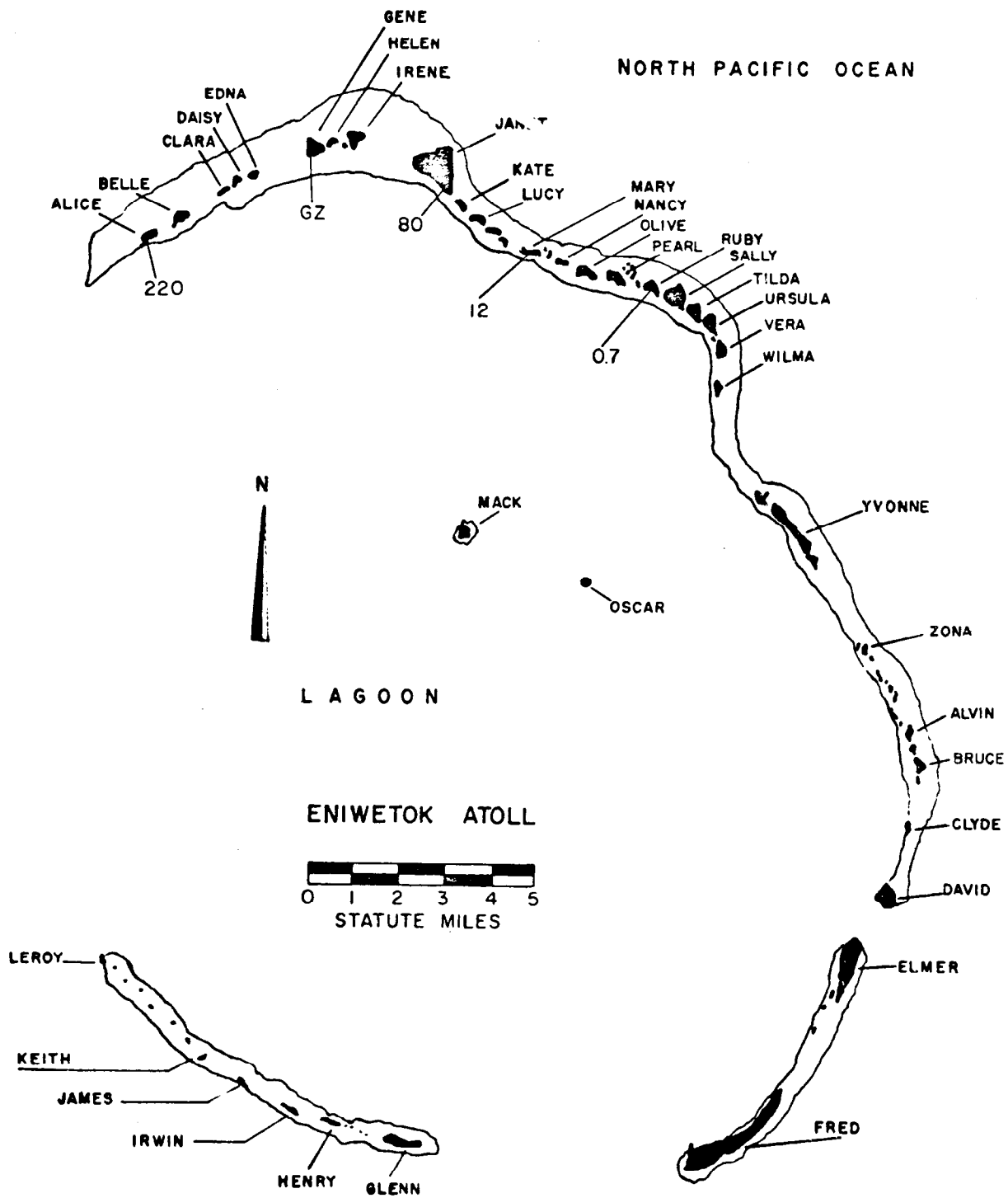


Figure 122. Operation HARDTACK I - Koa.  
Island dose rates in r/hr at H+1 hour.

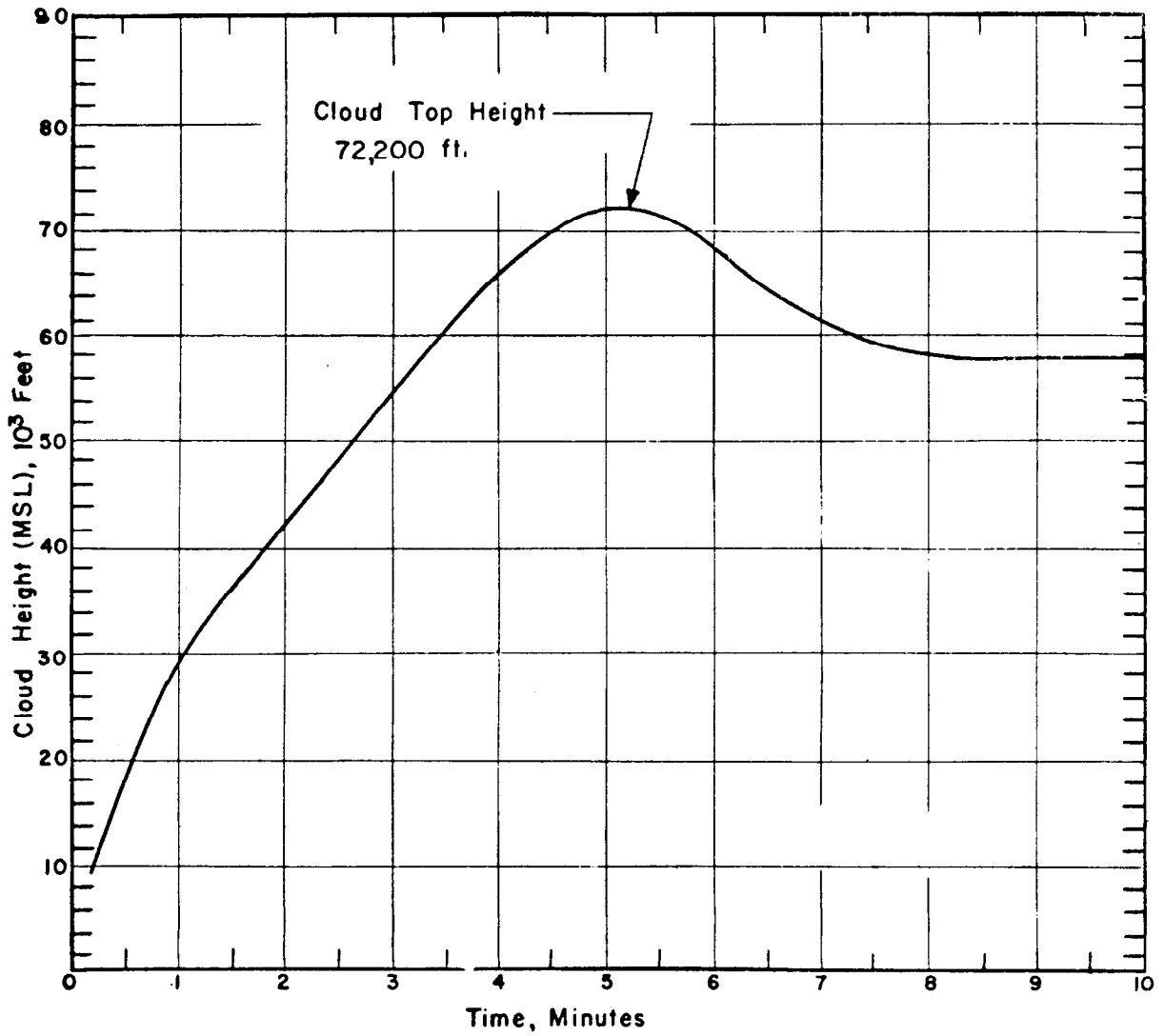


Figure 123. Cloud Dimensions: Operation HARDTACK I - Koa.

TABLE 39 ENIWETOK WIND DATA FOR OPERATION HARDTACK I-

KOA

Altitude (MSL) feet	H-4 hour		H+5 hours		H+11 hours	
	Dir degrees	Speed mph	Dir degrees	Speed mph	Dir degrees	Speed mph
Surface	050	18	060	18	060	18
1,000	070	29	080	32	080	26
2,000	070	31	070	38	080	29
3,000	080	32	070	37	080	29
4,000	080	36	080	29	090	31
5,000	090	33	080	29	100	26
6,000	100	29	090	23	110	26
7,000	100	31	100	18	100	26
8,000	100	31	100	20	080	23
9,000	090	25	100	20	070	20
10,000	090	25	120	18	090	14
12,000	100	29	130	20	120	13
14,000	110	25	150	14	120	03
15,000	(110)	(20)	(150)	(14)	(160)	(07)
16,000	120	14	140	14	190	12
18,000	110	12	140	14	180	05
20,000	070	08	130	05	220	09
23,000	200	09	180	18	180	16
25,000	270	14	160	18	170	14
30,000	250	24	240	21	250	21
35,000	190	31	170	31	180	21
40,000	220	29	190	29	230	31
45,000	240	40	260	52	(255)	(32)
50,000	290	36	280	35	280	33
55,000	280	13	230	14	200	33
60,000	140	17	210	07	270	12
65,000	090	07	060	08	(210)	(09)
70,000	100	16	130	09	150	07
74,000	---	---	---	---	070	16
75,000	100	23	070	20	080	18
80,000	100	31	090	36	100	30
85,000	090	41	100	53	---	---
90,000	090	59	110	71	100	61
92,000	090	66	---	---	---	---
95,000	---	---	100	77	---	---
100,000	---	---	100	83	100	68
105,000	---	---	100	85	---	---
110,000	---	---	100	126	100	75
118,000	---	---	---	---	100	101

## NOTES:

1. Numbers in parentheses are estimated values.
2. Wind data was taken by the Eniwetok weather station.
3. Tropopause height was 57,000 ft MSL.
4. The surface air pressure was 14.66 psi, the temperature 27.2°C, the dew point 74°F, and the relative humidity 79%.



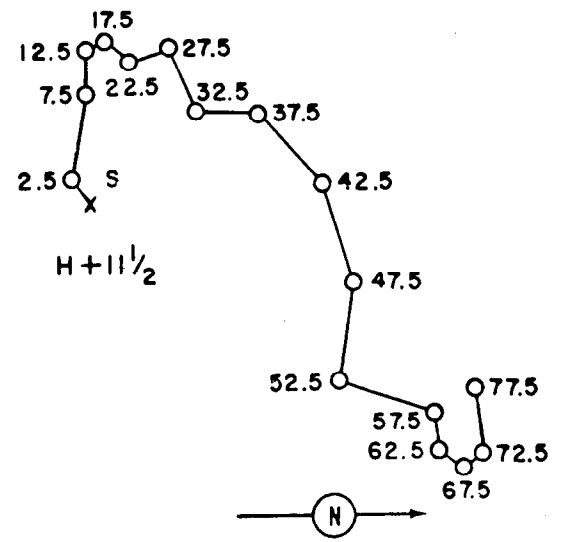
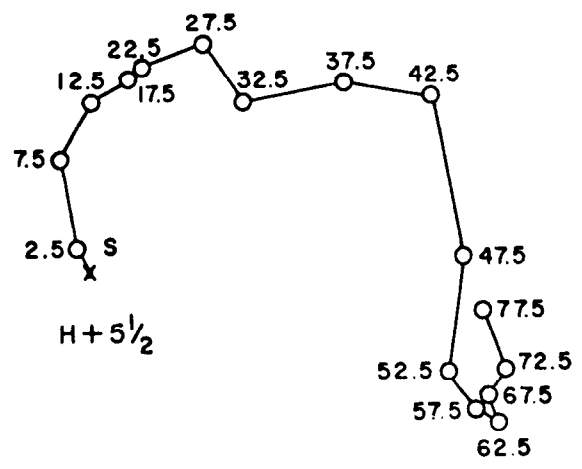
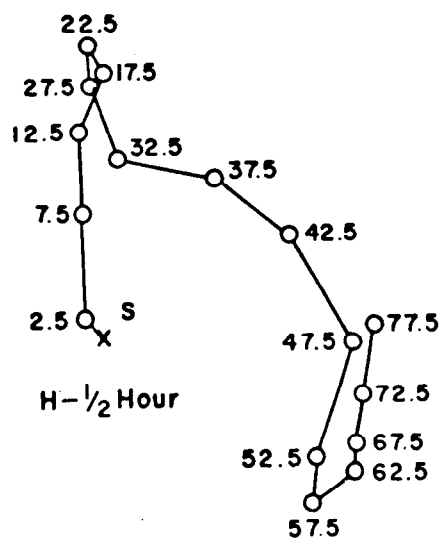
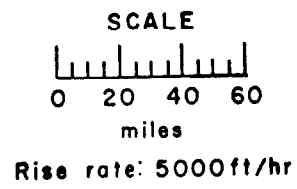


Figure 124. Hodographs for Operation HARDTACK I - Koa.

OPERATION HARDTACK I -

Wahoo

	<u>PPG Time</u>	<u>GMT</u>
<u>DATE:</u>	16 May 1958	16 May 1958
<u>TIME:</u>	1330	0130

Sponsor: IASL/DOD

SITE: PPG - Eniwetok -south by  
SSW of Irwin about 8,000  
ft from the island  
11° 20' 41" N  
162° 10' 44" E  
Site elevation: Sea level

HEIGHT OF BURST: -500 ft under  
water

TYPE OF BURST AND PLACEMENT:  
Underwater - Device suspended  
by a cable. Water depth  
3,200 ft

PLUME TOP HEIGHT: 1,760 ft MSL  
at 15½ sec

PLUME DIAMETER: 3,400 ft MSL  
at 15½ sec

REMARKS:

"Nearly all of the total gamma dose occurred within 25 minutes after zero time and was due to the passage of airborne radioactive material. Gamma doses in excess of 100r occurred within the first 15 minutes at downwind distances less than 16,000 feet. In both instances the residual field due to deposited radioactive material was relatively insignificant, although radioactive foam may represent a radiological hazard."

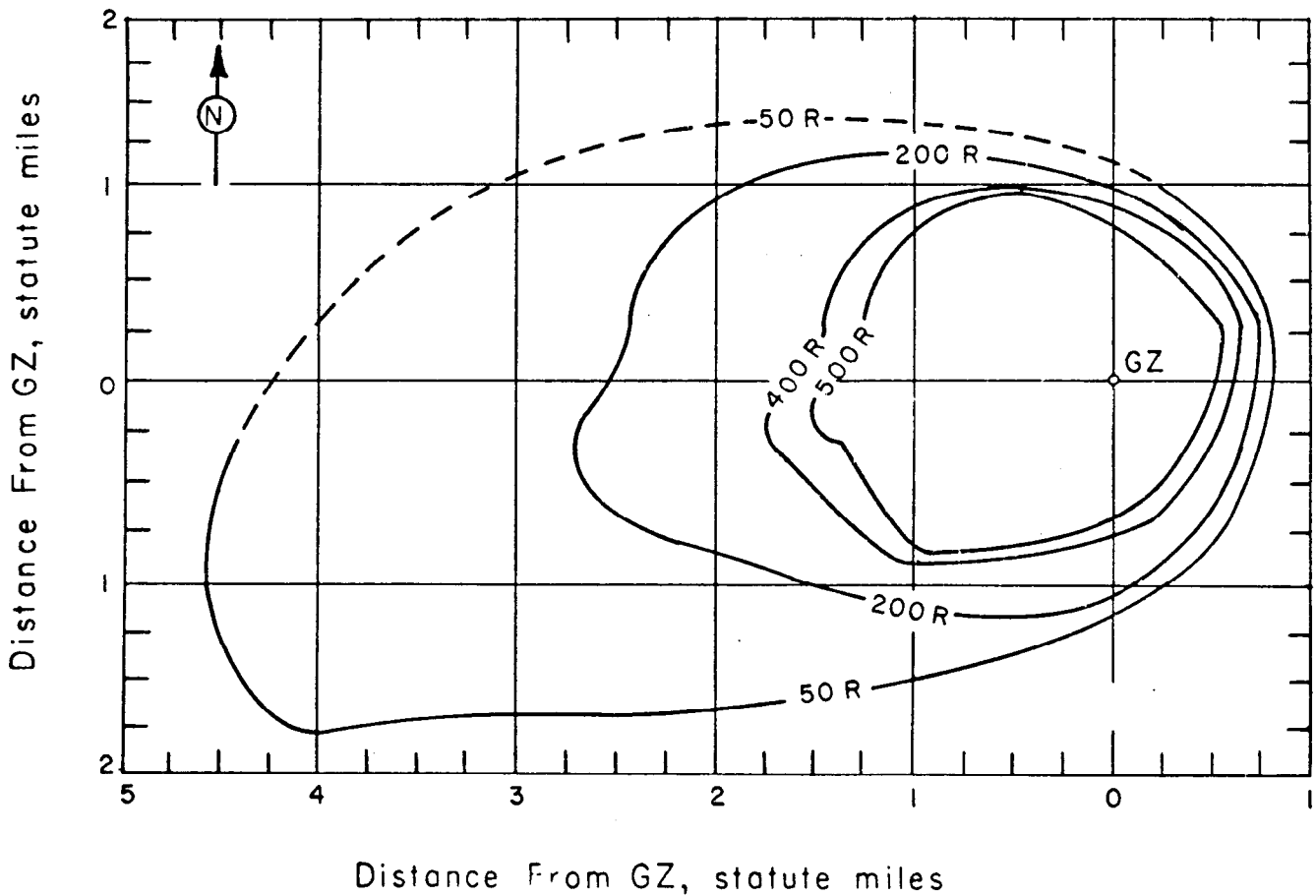


Figure 125. Operation HARDTACK I - Wahoo.  
 On-site cumulative dose to 6 hours in roentgens.

TABLE 40 ENIWETOK WIND DATA FOR OPERATION HARDTACK I -

WAHOO

Altitude (MSL) feet	H-1½ hours		H+4½ hours	
	Dir degrees	Speed mph	Dir degrees	Speed mph
Surface	090	17	080	16
1,000	090	22	080	18
2,000	090	22	080	20
3,000	090	20	080	21
4,000	090	17	080	20
5,000	070	13	060	14
6,000	040	08	050	12
7,000	330	07	350	07
8,000	280	12	300	14
9,000	290	17	300	20
10,000	280	21	300	22
12,000	310	16	290	14
14,000	290	09	310	12
16,000	020	07	340	09
18,000	240	14	020	09
20,000	040	08	040	13
23,000	060	05	010	07
25,000	240	02	360	07
30,000	300	15	260	10
35,000	260	35	---	--
40,000	270	25	270	30
45,000	280	29	---	--
50,000	340	15	310	24
52,000	---	--	270	09
55,000	070	06	---	--
60,000	060	15	020	20
65,000	090	17	---	--
69,000	---	--	120	10
70,000	090	12	100	07
73,000	090	57	060	13
75,000	---	--	---	--
80,000	100	60	090	40
85,000	090	57	---	--
90,000	090	57	090	72
95,000	---	--	---	--
100,000	---	--	090	79
110,000	---	--	100	93
114,000	---	--	100	100

NOTES:

1. Wind data was taken by the Eniwetok weather station.
2. Tropopause height was 59,000 ft MSL.
3. The surface air pressure was 14.69 psi, the temperature 30.8°C, the dew point 73°F, and the relative humidity 63%.

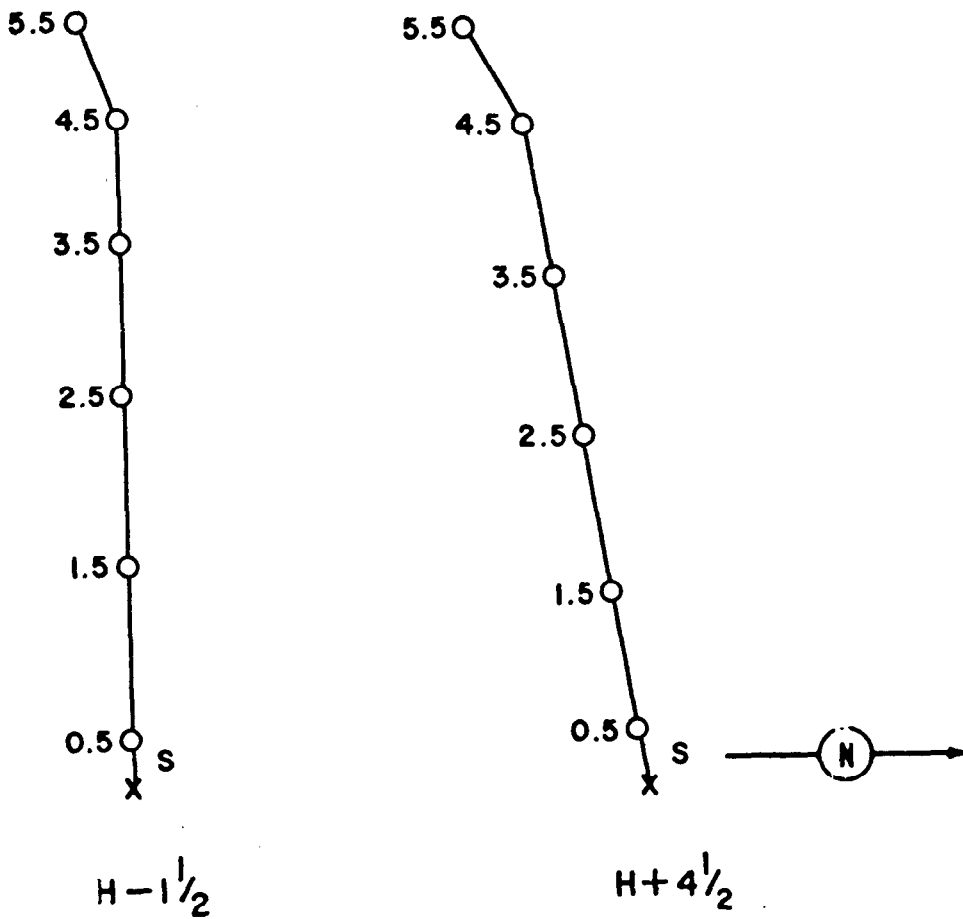
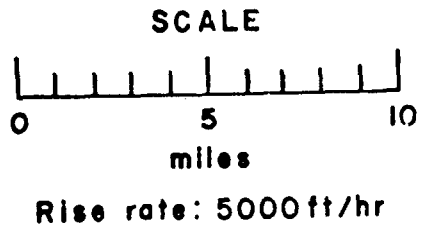


Figure 126. Hodographs for Operation HARDTACK I - Wahoo

OPERATION HARDTACK I -

Holly

	<u>PPG Time</u>	<u>GMT</u>
<u>DATE:</u>	21 May 1958	20 May 1958
<u>TIME:</u>	0630	1830

Sponsor: LASL

SITE: PPG - Eniwetok - West  
of Yvonne, 4,000 ft  
from the nearest edge  
of the island  
11° 32' 38" N  
162° 21' 22" E

Site elevation: Sea level

HEIGHT OF BURST: 13.06 ft

TYPE OF BURST AND PLACEMENT:

Surface burst from barge on  
water

Water depth: 40 ft

CLOUD TOP HEIGHT: 15,000 ft MSL

CLOUD BOTTOM HEIGHT: 7,000 ft MSL

REMARKS:

Only individual island dose rates are available. These were obtained from helicopter surveys made by the Radiological Safety organization at H+4 hours. The helicopter survey technique called for the pilot either to land the aircraft at the desired spot, so that a ground reading could be obtained, or to make a slow pass over the desired spot at an elevation of 25 feet. Readings taken at 25 feet were multiplied by a factor of 2 in order to obtain a reasonable approximation of the true ground reading. The basic instrument used in the aerial surveys was the AN/PDR-39 survey meter modified to read up to 500 r/hr. The  $t^{-1.2}$  decay approximation was used to extrapolate the H+4 hour dose rate readings to H+1 hour.

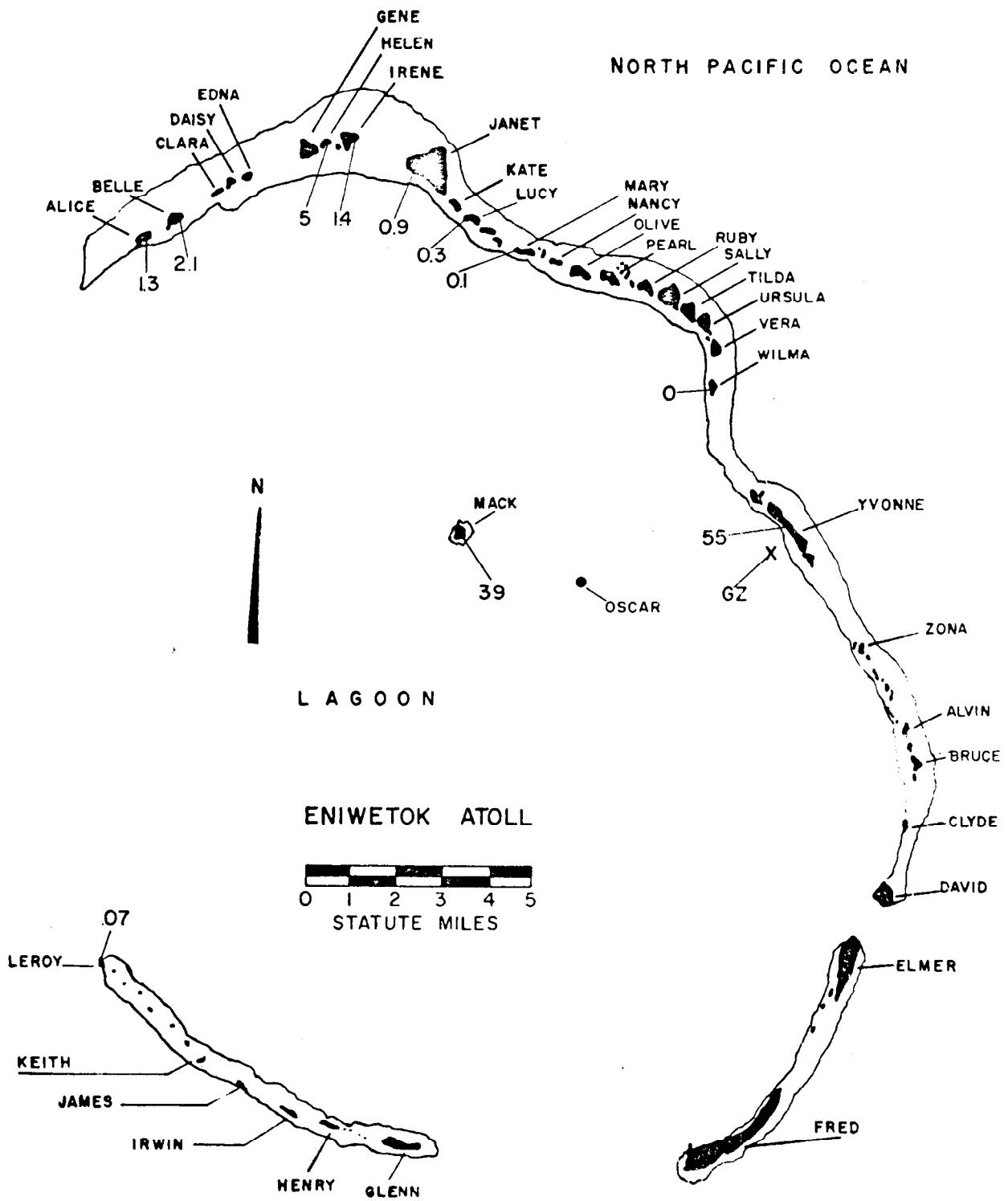


Figure 127. Operation HARDTACK I - Holly. Island dose rates in r/hr at H+1 hour.

TABLE 41 ENIWETOK WIND DATA FOR OPERATION HARDTACK I -

HOLLY

Altitude (MSL) feet	H- $\frac{1}{2}$ hour		H+ $5\frac{1}{2}$ hours		H+10 $\frac{1}{2}$ hours	
	Dir degrees	Speed mph	Dir degrees	Speed mph	Dir degrees	Speed mph
Surface	080	16	090	23	080	23
1,000	080	24	080	26	070	26
2,000	080	26	080	26	070	24
3,000	080	26	080	24	080	24
4,000	080	24	070	22	080	26
5,000	080	23	070	17	080	24
6,000	090	14	080	17	070	20
7,000	100	10	100	17	080	16
8,000	120	12	120	14	110	17
9,000	150	12	140	14	120	14
10,000	180	12	150	10	150	09
12,000	210	05	210	10	210	05
14,000	280	10	240	05	270	02
15,000	(270)	(07)	(200)	(05)	(300)	(05)
16,000	250	05	150	05	320	07
18,000	220	05	120	02	280	09
20,000	220	09	220	10	240	12
23,000	250	12	260	09	210	10
25,000	270	13	290	05	240	10
30,000	280	24	280	09	240	21
35,000	---	--	280	22	270	20
36,000	270	24	---	--	---	--
40,000	220	22	200	30	190	39
45,000	210	38	210	43	210	32
50,000	230	20	270	17	270	18

## NOTES:

1. Numbers in parentheses are estimated values.
2. Wind data was taken by the Eniwetok weather station.
3. Tropopause height was 52,000 ft MSL.
4. The surface air pressure was 14.65 psi, the temperature 27°C, the dew point 75°F, and the relative humidity 75%.



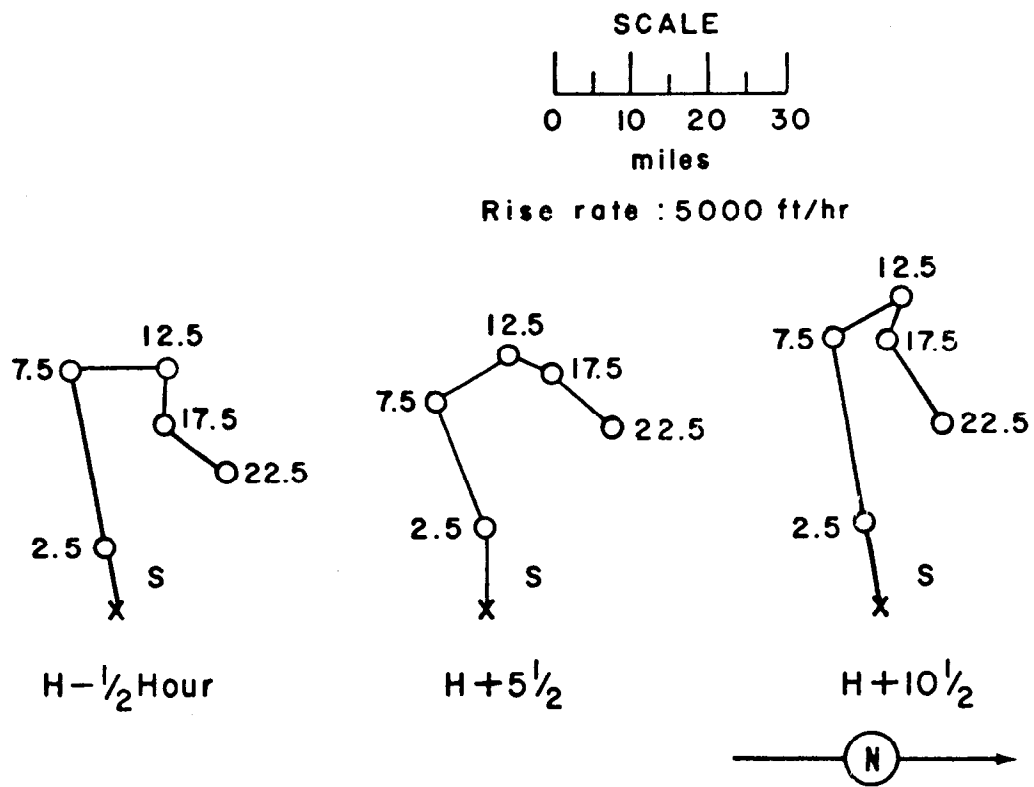


Figure 128. Hodographs for Operation HARDTACK I - Holly.

OPERATION HARDTACK I -

Nutmeg

	<u>PPG Time</u>	<u>GMT</u>
<u>DATE:</u>	22 May 1958	21 May 1958
<u>TIME:</u>	0920	2120

Sponsor: UCRL

SITE: PPG - Bikini - West end Tare  
11° 29' 46" N  
165° 22' 15" E  
Site elevation: Sea level

HEIGHT OF BURST: 12.11 ft

TYPE OF BURST AND PLACEMENT:  
Surface burst from barge on  
water

CLOUD TOP HEIGHT: 20,000 ft MSL  
CLOUD BOTTOM HEIGHT: NM

REMARKS:

Only individual island dose rates are available. These were obtained from helicopter surveys made by the Radiological Safety organization at H+4 hours. The helicopter survey technique called for the pilot either to land the aircraft at the desired spot, so that a ground reading could be obtained, or to make a slow pass over the desired spot at an elevation of 25 feet. Readings taken at 25 feet were multiplied by a factor of 2 in order to obtain a reasonable approximation of the true ground reading. The basic instrument used in the aerial surveys was the AN/PDR-39 survey meter modified to read up to 500 r/hr. The  $t^{-1.2}$  decay approximation was used to correct the H+4 hour dose-rate readings to H+1 hour.

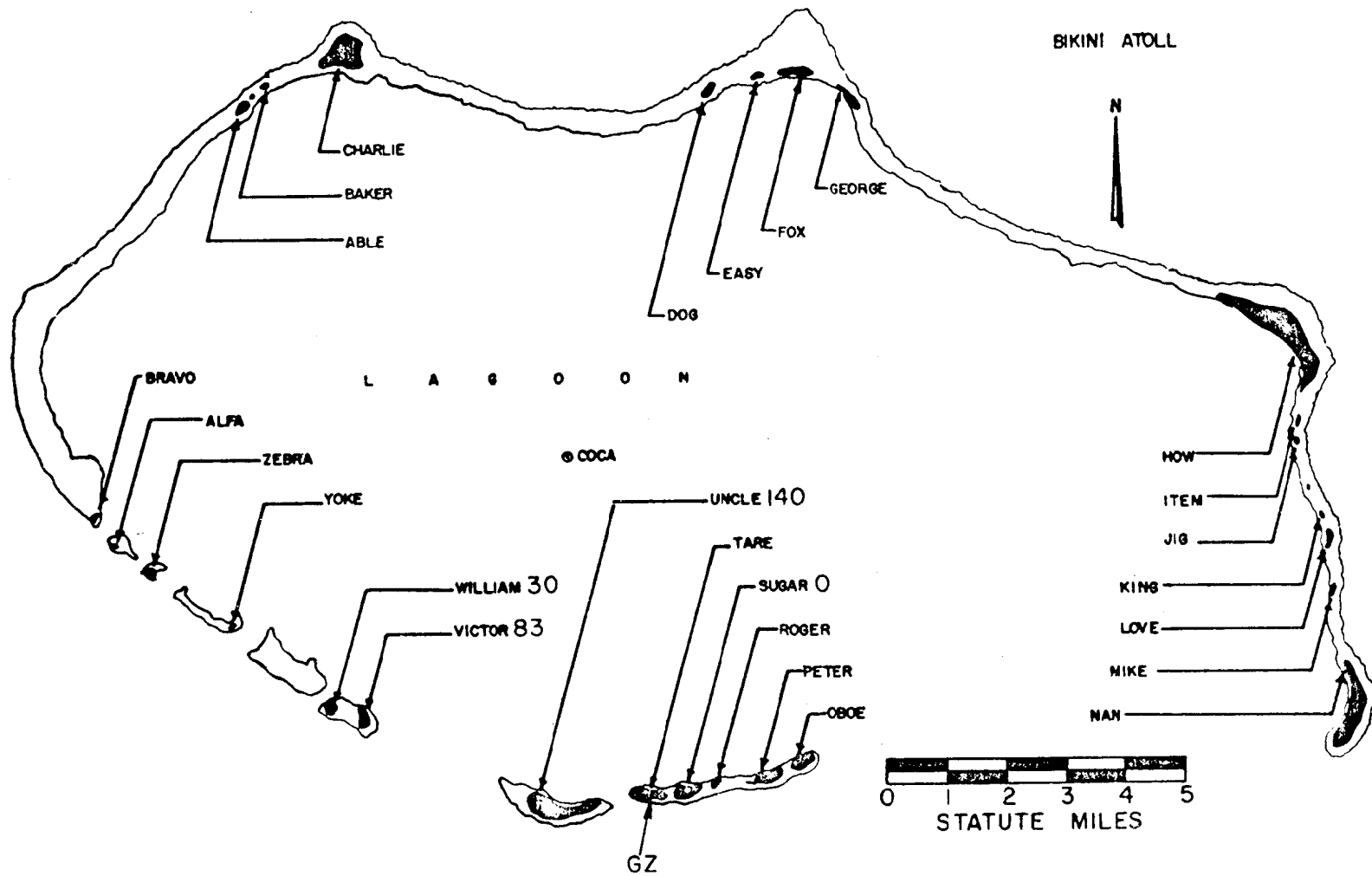


Figure 129. Operation HARDTACK I - Nutmeg.  
Island dose rates in r/hr at H+1 hour.

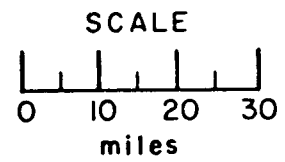
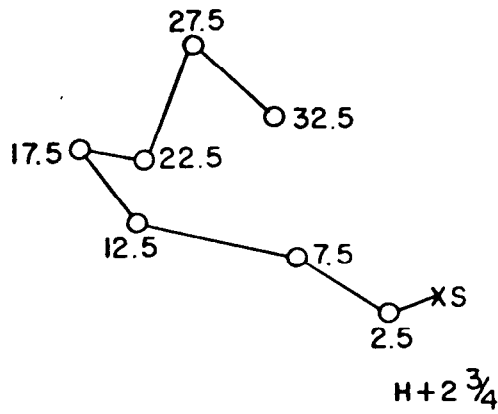
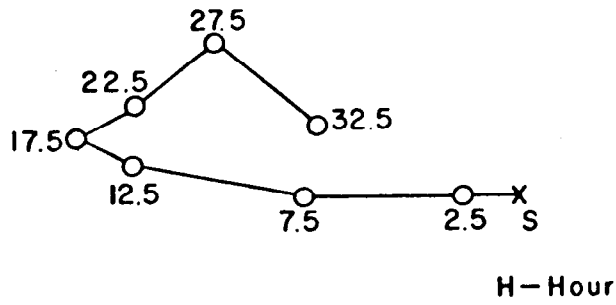
TABLE 42 BIKINI WIND DATA FOR OPERATION HARDTACK I -

NUTMEG

Altitude (MSL) feet	H-hour		H+2 $\frac{1}{2}$ hours		H+8 $\frac{1}{2}$ hours	
	Dir degrees	Speed mph	Dir degrees	Speed mph	Dir degrees	Speed mph
Surface	090	16	080	16	080	14
1,000	090	16	070	18	070	14
2,000	090	15	070	16	080	15
3,000	090	18	080	18	080	14
4,000	090	18	090	15	090	09
5,000	090	16	120	14	090	12
6,000	100	17	110	17	110	09
7,000	090	18	100	20	110	14
8,000	070	18	080	20	080	14
9,000	090	18	090	23	090	14
10,000	100	17	100	20	110	14
12,000	080	10	130	16	120	14
14,000	120	10	150	12	140	14
15,000	(110)	(12)	(140)	(12)	(130)	(09)
16,000	110	12	120	10	120	06
18,000	220	12	340	10	070	07
20,000	240	03	280	08	310	05
23,000	210	09	190	07	320	07
25,000	230	06	200	15	270	12
30,000	310	24	310	14	250	09
33,000	---	--	---	--	220	16
34,000	300	21	---	--	---	--
35,000	---	--	260	16	---	--
40,000	200	35	200	24	240	14
45,000	250	23	---	--	290	14
50,000	320	10	310	07	200	02
55,000	---	--	080	07	040	02
57,000	080	07	---	--	---	--
60,000	200	06	160	06	250	07
64,000	---	--	---	--	080	07
65,000	090	09	120	08	---	--
70,000	110	12	110	08	080	08
72,000	---	--	---	--	050	08
75,000	080	25	---	--	---	--
80,000	090	36	090	35	090	37
82,000	---	--	090	38	---	--
83,000	---	--	---	--	090	22
85,000	090	52	---	--	---	--

## NOTES:

1. Numbers in parentheses are estimated values.
2. Wind data was taken on board ship located within 30 nautical miles of the Tower at Nan Island, Bikini Atoll.
3. Tropopause height was 54,000 ft MSL.
4. The surface air pressure was 14.68 psi, the temperature 27.4°C, the dew point 72.5°F, and the relative humidity 76%.



Rise rate : 5000 ft/hr

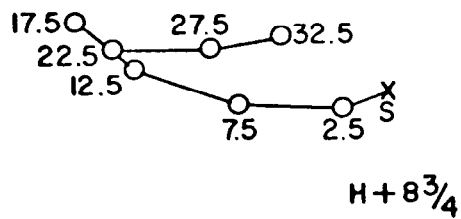


Figure 130 . Hodographs for Operation HARDTACK I -

Nutmeg.

OPERATION HARDTACK I -

Yellowwood

DATE: 26 May 1958 26 May 1958  
TIME: 1400 0200

Sponsor: LASL

SITE: PPG - Eniwetok - SW of  
Janet 5,000 ft  
11° 39' 37" N  
162° 13' 31" E  
Site elevation: Sea level  
Water depth: 75 ft

HEIGHT OF BURST: 10.52 ft

TYPE OF BURST AND PLACEMENT:  
Surface burst from barge on water

CLOUD TOP HEIGHT: 50,000 ft MSL  
CLOUD BOTTOM HEIGHT: 30,000 ft MSL

REMARKS:

Only individual island dose rates are available. These were obtained from Radiological Safety organization helicopter surveys at H+4 hours. The helicopter survey technique called for the pilot either to land the aircraft at the desired spot, so that a ground reading could be obtained, or to make a slow pass over the desired spot at an elevation of 25 feet. Readings taken at 25 feet were multiplied by a factor of 2 in order to obtain a reasonable approximation of the true ground reading. The basic instrument used in the aerial surveys was the AN/PDR-39 survey meter modified to read up to 500 r/hr. The  $t^{-1.2}$  decay approximation was used to extrapolate the H+4 hour dose-rate readings to H+1 hour.

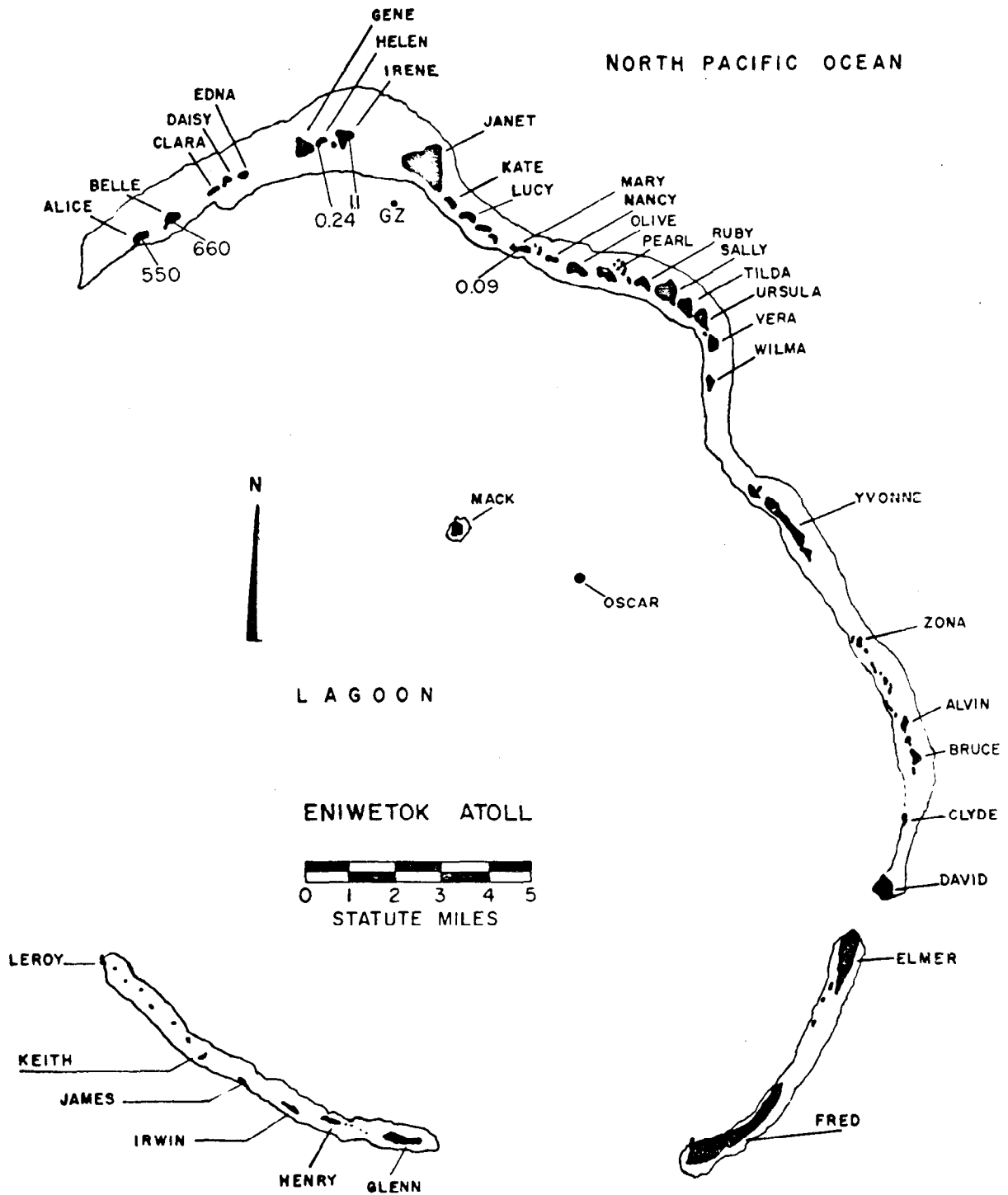


Figure 131. Operation HARDTACK I - Yellowwood.  
Island dose rates in r/hr at H+1 hour.

TABLE 43 ENIWETOK WIND DATA FOR OPERATION HARDTACK I -- YELLOWWOOD

Altitude (MSL) feet	H-hour		H+4 hours		H+10 hours	
	Dir degrees	Speed mph	Dir degrees	Speed mph	Dir degrees	Speed mph
Surface	090	14	070	18	080	15
1,000	090	16	080	20	080	18
2,000	090	16	080	17	080	18
3,000	090	18	080	17	090	18
4,000	080	17	090	15	100	16
5,000	080	16	090	12	100	12
6,000	070	13	080	09	100	12
7,000	060	13	070	09	090	12
8,000	050	09	070	12	090	15
9,000	050	10	070	12	090	15
10,000	050	08	060	13	090	09
12,000	040	12	050	14	030	12
14,000	050	07	020	09	360	12
15,000	(060)	(07)	(030)	(08)	(360)	(08)
16,000	070	07	040	07	350	06
18,000	060	20	060	12	100	06
20,000	070	30	060	14	090	09
23,000	090	18	080	18	080	20
25,000	100	22	090	18	090	16
30,000	080	29	070	23	070	29
35,000	110	30	090	23	050	23
40,000	070	31	080	36	090	30
45,000	080	32	090	29	080	32
50,000	090	24	090	17	090	23
55,000	050	24	050	32	050	24
60,000	070	23	060	20	030	24
65,000	060	09	050	16	080	21
70,000	090	07	100	23	080	21
75,000	080	43	100	38	110	35
80,000	100	49	100	48	090	55
85,000	100	51	080	59	090	60
90,000	100	57	090	54	090	61
95,000	100	63	090	53	---	--
100,000	090	76	090	79	---	--
1.5,000	080	86	090	94	---	--
110,000	080	79	090	109	---	--
115,000	100	105	090	105	---	--
120,000	110	112	100	92	---	--
122,000	---	--	100	90	---	--
123,000	110	114	---	--	---	--

NOTES:

1. Numbers in parentheses are estimated values.
2. Wind data was taken by the Eniwetok weather station.
3. Tropopause height was 55,000 ft MSL.
4. The surface air pressure was 14.66 psi, the temperature 30.6°C, the dew point 73°F, and the relative humidity 63%.



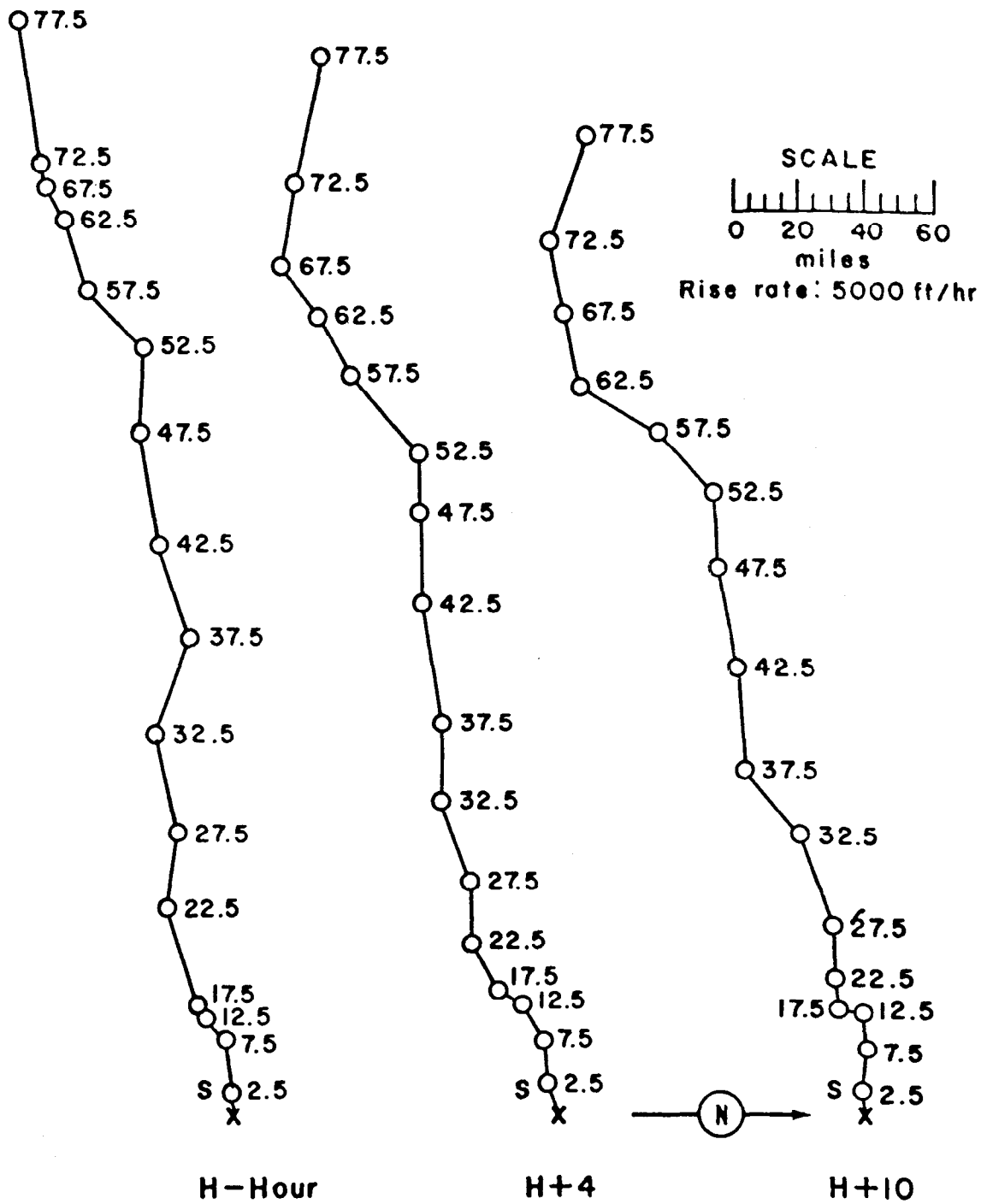


Figure 132. Hodographs for Operation HARDTACK I - Yellowwood.

OPERATION HARDTACK I -

Magnolia

	<u>PPG Time</u>	<u>GMT</u>
<u>DATE:</u>	27 May 1958	26 May 1958
<u>TIME:</u>	0600	1800

Sponsor: LASL

SITE: PPG - Eniwetok - SW of  
Yvonne, 3,000 ft from  
the nearest edge of the  
island

11° 32' 34" N

162° 21' 14" E

Site elevation: Sea level

HEIGHT OF BURST: 13.88 ft

TYPE OF BURST AND PLACEMENT:

Surface burst from barge on  
water

CLOUD TOP HEIGHT: 44,000 ft MSL

CLOUD BOTTOM HEIGHT: 15,000 ft MSL

REMARKS:

Only individual island dose rates are available. These were obtained from helicopter surveys made by the Radiological Safety organization at H+4 hours. The helicopter survey technique called for the pilot either to land the aircraft at the desired spot, so that a ground reading could be obtained, or to make a slow pass over the desired spot at an elevation of 25 feet. Readings taken at 25 feet were multiplied by a factor of 2 in order to obtain a reasonable approximation of the true ground reading. The basic instrument used in the aerial surveys was the AN/PDR-39 survey meter modified to read up to 500 r/hr. The  $t^{-1.2}$  decay approximation was used to extrapolate the H+4 hour dose-rate readings to H+1 hour.

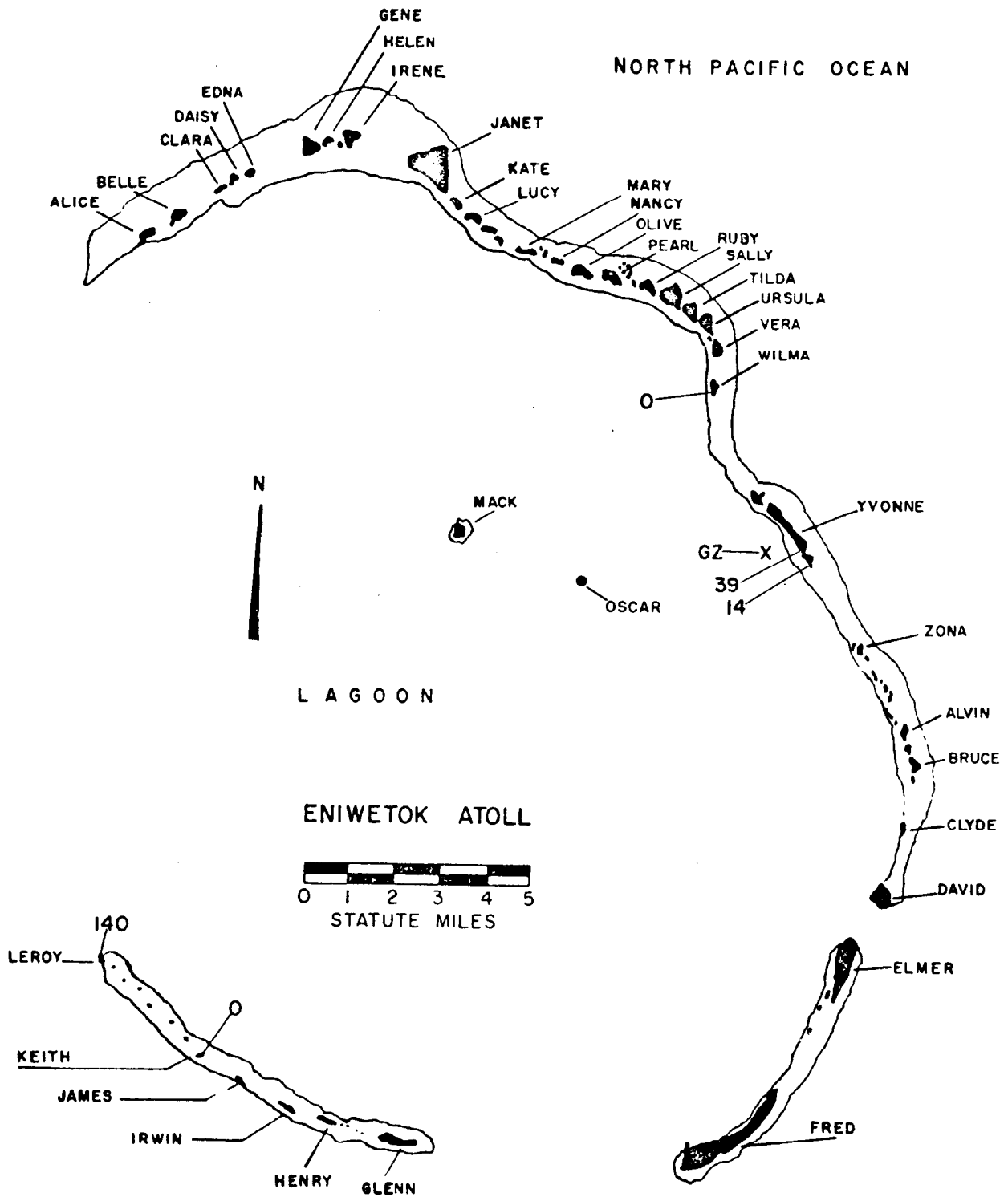


Figure 133. Operation HARDTACK I - Magnolia.  
Island dose rates in r/hr at H+1 hour.

TABLE 44 ENIWETOK WIND DATA FOR OPERATION HARDPACK I --

MAGNOLIA

Altitude (MSL) feet	H-hour		H+6 hours		H+11 hours	
	Dir degrees	Speed mph	Dir degrees	Speed mph	Dir degrees	Speed mph
Surface	090	16	110	16	090	12
1,000	080	14	100	16	080	14
2,000	080	14	100	14	100	09
3,000	090	14	100	10	080	09
4,000	100	15	100	09	090	07
5,000	120	10	090	09	090	08
6,000	120	07	070	07	090	06
7,000	080	05	070	07	060	03
8,000	070	08	070	09	020	06
9,000	070	09	060	09	040	06
10,000	070	09	060	09	030	03
12,000	060	09	140	03	260	03
14,000	040	12	110	06	150	05
15,000	(040)	(14)	(110)	(07)	(110)	(05)
16,000	050	05	100	09	080	05
18,000	100	09	190	09	080	09
20,000	130	09	090	12	070	12
23,000	090	16	070	14	050	15
25,000	080	12	060	14	020	13
30,000	060	31	060	31	030	21
35,000	060	25	040	20	030	23
40,000	080	24	060	30	050	25
45,000	090	39	060	22	020	18
50,000	040	24	020	30	350	16
55,000	050	23	050	35	050	28
60,000	050	31	050	25	080	20
65,000	100	15	070	23	100	16
70,000	080	18	110	22	090	21
75,000	090	37	110	32	090	24
80,000	090	49	100	52	100	48
85,000	090	71	100	64	090	61
90,000	090	78	100	64	090	69
91,000	090	78	---	--	---	--
95,000	---	--	100	68	080	71
100,000	---	--	100	69	080	64
105,000	---	--	100	80	---	--
110,000	---	--	100	99	---	--
113,000	---	--	100	101	---	--

NOTES:

1. Numbers in parentheses are estimated values.
2. Wind data was taken by the Eniwetok weather station.
3. Tropopause height was 54,000 ft MSL.
4. The surface air pressure was 14.66 psi, the temperature 26.8°C, the dew point 72°F, and the relative humidity 76%.

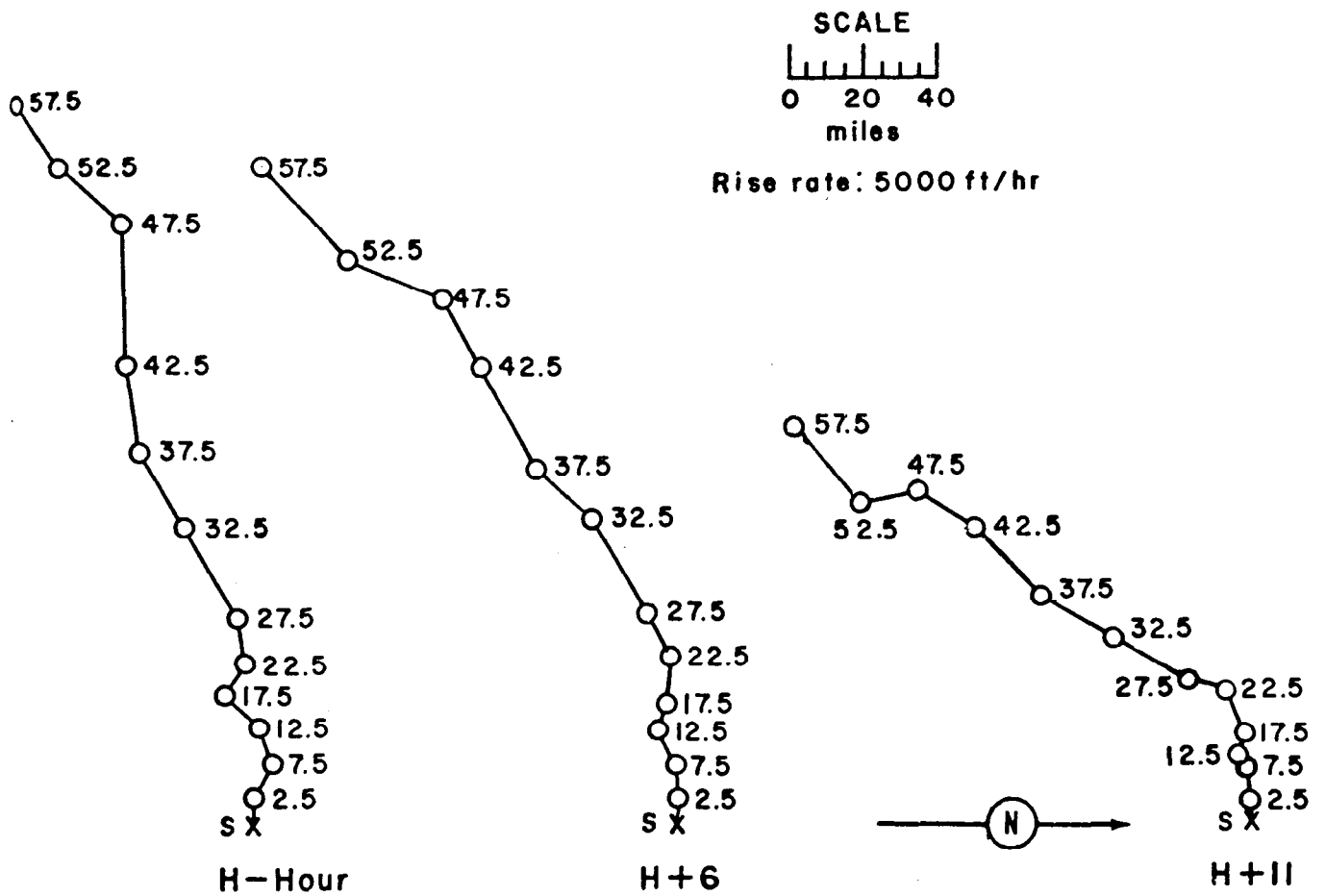


Figure 134. Hodographs for Operation HARDTACK I -

Magnolia.

OPERATION HARDTACK I -

Tobacco

	<u>PPG Time</u>	<u>GMT</u>
<u>DATE:</u>	30 May 1958	30 May 1958
<u>TIME:</u>	1415	0215

Sponsor: IASL

SITE: PPG - Eniwetok - 3,000 ft  
NW of Janet  
11° 39' 48" N  
162° 13' 48" E  
Site elevation: Sea level

TYPE OF BURST AND PLACEMENT:  
Surface burst from barge on  
water

CLOUD TOP HEIGHT: 18,000 ft MSL  
CLOUD BOTTOM HEIGHT: NM

REMARKS:

Only individual island dose rates are available. These were obtained from helicopter surveys made by the Radiological Safety organization at H+4 hours. The helicopter survey technique called for the pilot either to land the aircraft at the desired spot, so that a ground reading could be obtained, or to make a slow pass over the desired spot at an elevation of 25 feet. Readings taken at 25 feet were multiplied by a factor of 2 in order to obtain a reasonable approximation of the true ground reading. The basic instrument used in the aerial surveys was the AN/PDR-39 survey meter modified to read up to 500 r/hr. The  $t^{-1.2}$  decay approximation was used to extrapolate the H+4 hour dose rate readings to H+1 hour.

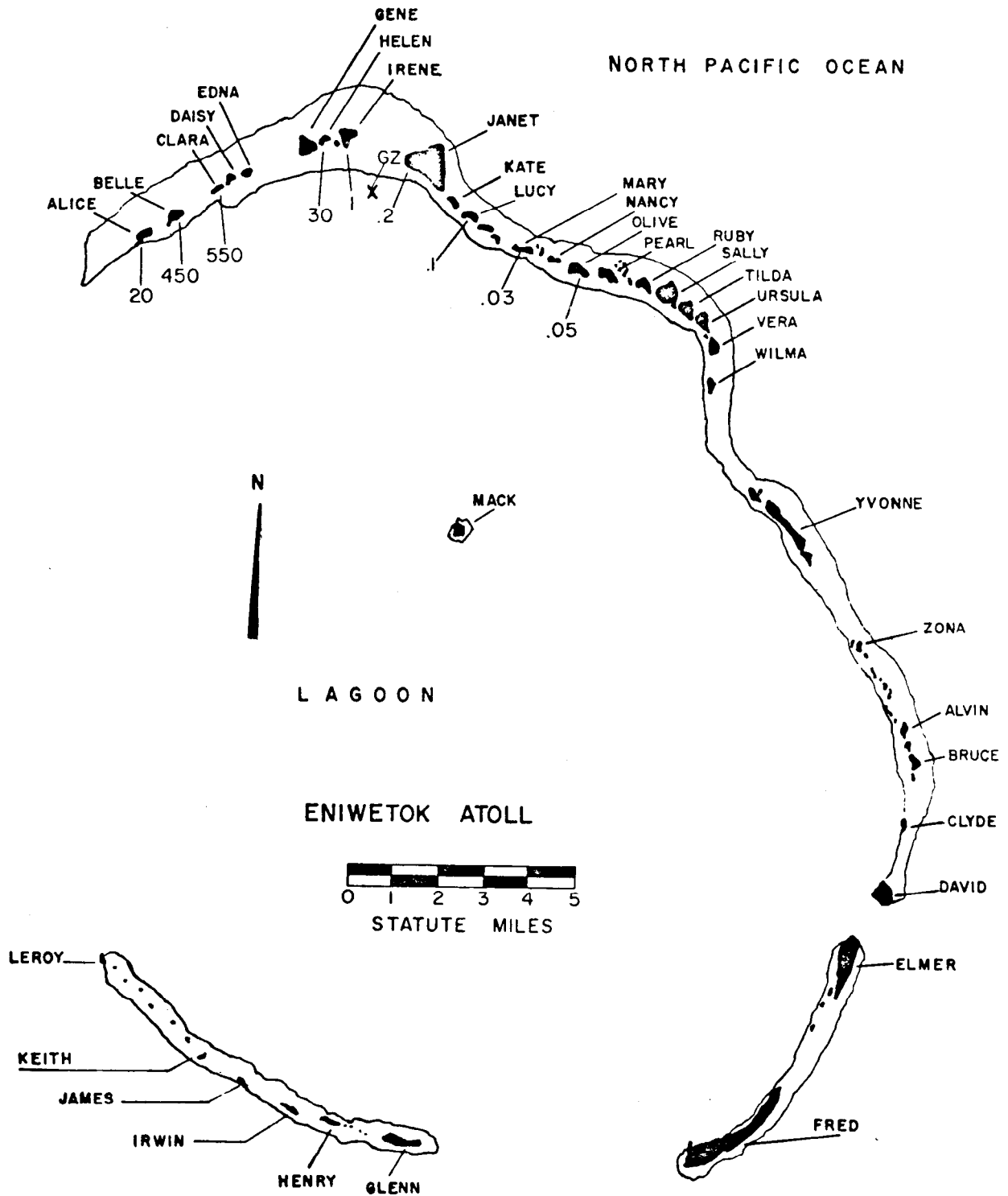


Figure 135. Operation HARDIACK I - Tobacco.  
Island dose rates in r/hr at H+1 hour.

TABLE 45 ENIWETOK WIND DATA FOR OPERATION HARDTACK I -

TOBACCO

Altitude (MSL) feet	H- $\frac{1}{2}$ hour		H+3 $\frac{1}{2}$ hours		H+9 hours	
	Dir degrees	Speed mph	Dir degrees	Speed mph	Dir degrees	Speed mph
Surface	080	14	080	23	120	28
1,000	080	24	080	26	090	24
2,000	080	36	080	29	100	28
3,000	090	21	090	29	110	30
4,000	090	16	090	26	120	25
5,000	090	14	100	22	130	22
6,000	090	17	100	22	140	22
7,000	090	22	110	21	140	26
8,000	100	21	110	16	130	29
9,000	110	18	110	16	120	32
10,000	130	20	110	20	110	33
12,000	140	14	120	09	100	29
14,000	130	10	130	07	120	19
15,000	(130)	(11)	(130)	(06)	(120)	(13)
16,000	140	13	130	05	120	09
18,000	120	12	140	02	110	10
20,000	120	12	110	02	110	17
23,000	130	14	140	05	120	18
25,000	120	12	130	07	150	16
30,000	190	07	200	08	210	07
35,000	240	15	230	12	210	09
40,000	200	17	220	14	210	26
45,000	200	17	220	25	230	26
50,000	230	17	230	18	270	12
55,000	290	07	220	05	240	08
60,000	070	08	070	13	100	18
65,000	130	24	140	18	160	12
70,000	110	17	070	23	070	24
75,000	090	35	090	37	090	38
80,000	090	48	100	55	090	57
85,000	100	68	100	68	090	69
90,000	100	69	100	69	090	71
94,000	---	--	---	--	090	71
95,000	100	71	090	69	---	--
100,000	100	77	090	69	---	--
105,000	100	72	100	76	---	--
110,000	090	77	---	--	---	--
118,000	090	95	---	--	---	--

NOTES:

1. Numbers in parentheses are estimated values.
2. Wind data was taken by the Eniwetok weather station.
3. Tropopause height was 55,000 ft MSL.
4. The surface air pressure was 14.65 psi, the temperature 28.9°C, the dew point 75°F, and the relative humidity 74%.



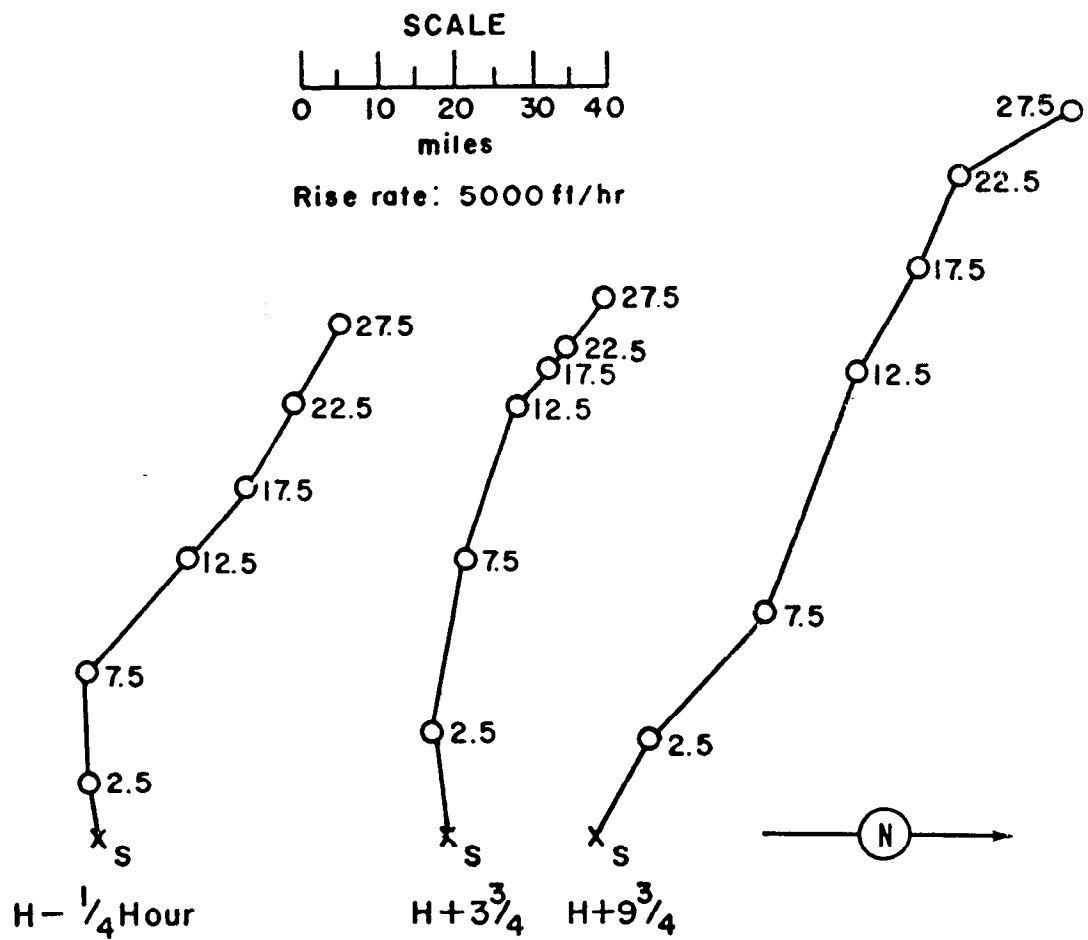


Figure 136. Hodographs for Operation HARDTACK I -

Tobacco.

OPERATION HARDTACK I -

Sycamore

	<u>PPG Time</u>	<u>GMT</u>
<u>DATE:</u>	31 May 1958	31 May 1958
<u>TIME:</u>	1500	0300

Sponsor: UCRL

SITE: PPG - Bikini - SW of  
Charlie 4,000 ft from  
the nearest edge of the  
island  
11° 41' 27" N  
165° 16' 25" E  
Site elevation: Sea level

HEIGHT OF BURST: 11.64 ft

TYPE OF BURST AND PLACEMENT:

Surface burst from barge on  
water

CLOUD TOP HEIGHT: 46,000 ft MSL

CLOUD BOTTOM HEIGHT: NM

REMARKS:

Only individual island dose rates are available. These were obtained from helicopter surveys made by the Radiological Safety organization at H+4 hours. The helicopter survey technique called for the pilot either to land the aircraft at the desired spot, so that a ground reading could be obtained, or to make a slow pass over the desired spot at an elevation of 25 feet. Readings taken at 25 feet were multiplied by a factor of 2 in order to obtain a reasonable approximation of the true ground reading. The basic instrument used in the aerial surveys was the AN/PDR-39 survey meter modified to read up to 500 r/hr. The  $t^{-1.2}$  decay approximation was used to extrapolate the H+4 hour dose rate readings to H+1 hour.

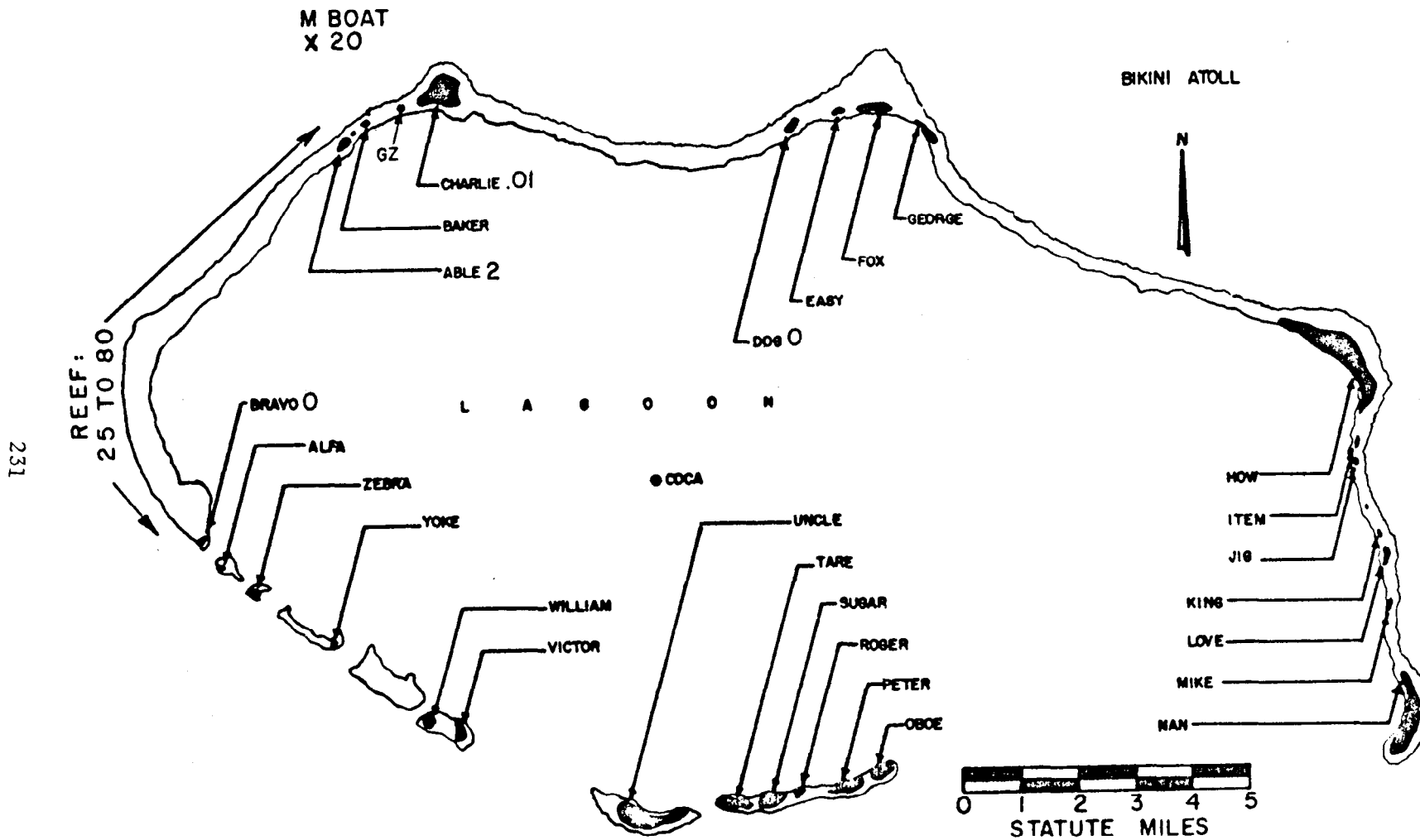


Figure 137. Operation HARDTACK I - Sycamore.  
Island dose rates in r/hr at H+1 hour.

TABLE 46 BIKINI WIND DATA FOR OPERATION HARDTACK I -

SYCAMORE

Altitude (MSL) feet	H-hour		H+3 hours		H+9 hours	
	Dir degrees	Speed mph	Dir degrees	Speed mph	Dir degrees	Speed mph
Surface	090	12	100	17	070	21
1,000	110	22	090	21	080	22
2,000	100	23	090	22	080	24
3,000	110	28	090	24	080	25
4,000	110	24	100	23	090	23
5,000	110	18	110	22	080	18
6,000	110	14	110	18	090	15
7,000	100	17	110	18	100	15
8,000	100	07	100	18	100	15
9,000	110	14	100	17	090	20
10,000	120	14	110	16	110	14
12,000	120	16	110	16	130	16
14,000	080	15	090	13	100	17
15,000	(080)	(13)	(070)	(13)	(090)	(15)
16,000	090	12	050	12	080	14
18,000	120	13	100	09	120	07
20,000	130	18	140	12	100	02
23,000	160	10	130	17	090	08
25,000	140	23	100	14	010	16
30,000	010	09	040	13	060	13
33,000	270	06	---	---	---	---
34,000	---	---	---	---	120	10
35,000	(260)	(12)	280	17	(140)	(13)
40,000	220	26	230	23	230	23
45,000	230	24	(255)	(17)	300	25
50,000	280	18	280	12	270	08
53,000	---	---	080	06	---	---
55,000	(150)	(30)	(080)	(10)	060	16
57,000	100	35	---	---	---	---
60,000	120	26	120	22	100	20
65,000	080	16	---	---	---	---
66,000	---	---	060	30	---	---
70,000	100	24	090	31	090	29
75,000	090	38	---	---	---	---
80,000	100	55	100	53	090	53
81,000	100	58	---	---	---	---
85,000	---	---	---	---	090	41
90,000	---	---	090	59	080	75
91,000	---	---	090	59	---	---
94,000	---	---	---	---	080	68

## NOTES:

1. Numbers in parentheses are estimated values.
2. Wind data was taken on board ship located within 30 nautical miles of the Tower on Nan Island, Bikini Atoll.
3. Tropopause height was 55,000 ft MSL.
4. The surface air pressure was 14.62 psi, the temperature 28.6°C, the dew point 74°F and the relative humidity 73%.

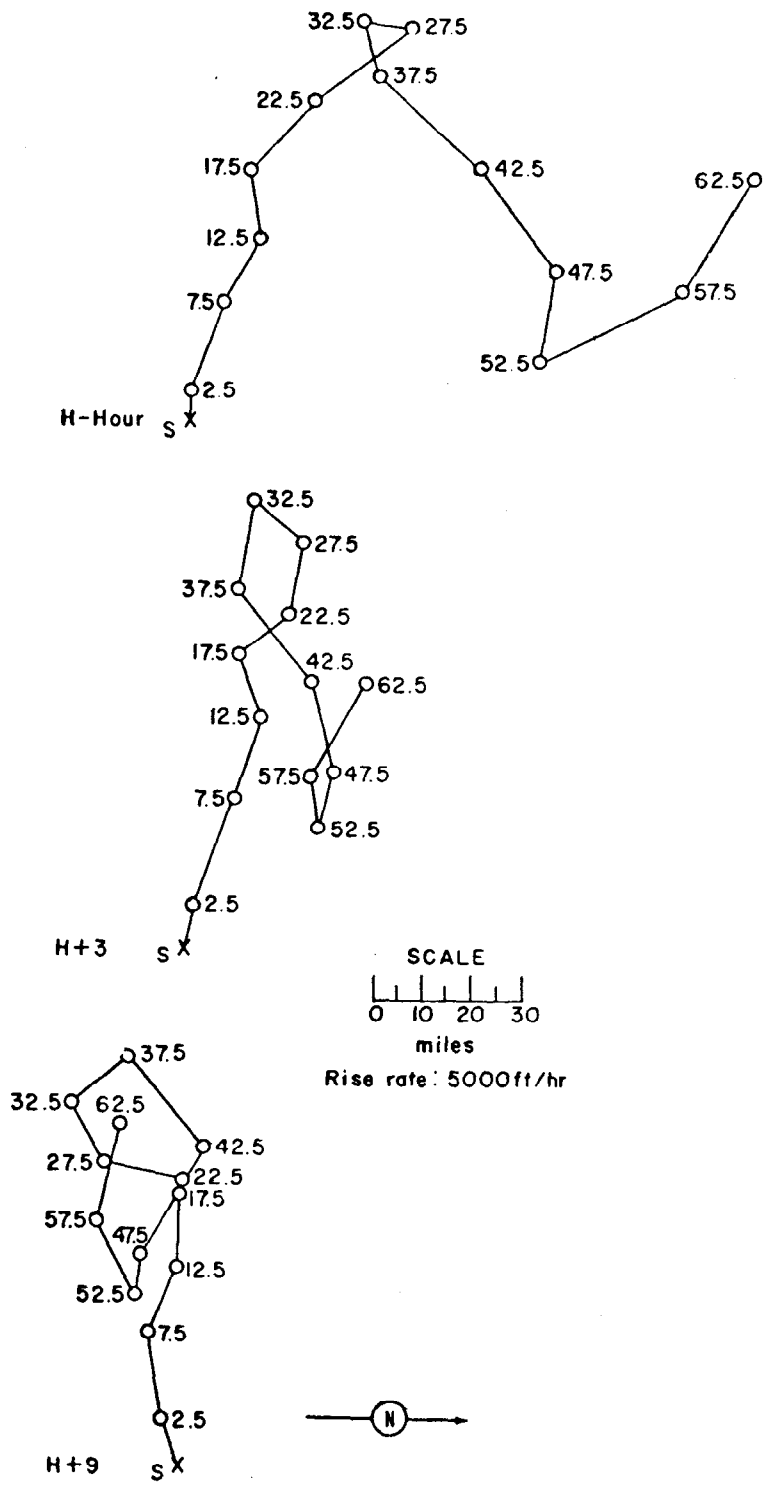


Figure 138. Hodographs for Operation HARDTACK I - Sycamore.

OPERATION HARDTACK I -

Rose

	<u>PPG Time</u>	<u>GMT</u>
<u>DATE:</u>	3 June 1958	2 June 1958
<u>TIME:</u>	0645	1845

Sponsor: LASL

SITE: PPG - Eniwetok - SW of  
Yvonne 4,000 ft from the  
nearest edge of the island  
Site elevation: Sea level

HEIGHT OF BURST: 15.43 ft

TYPE OF BURST AND PLACEMENT:  
Surface burst from barge on  
water

CLOUD TOP HEIGHT: 17,000 ft MSL  
CLOUD BOTTOM HEIGHT: 5,000 ft MSL

REMARKS:

Only individual island dose rates are available. These were obtained from helicopter surveys made by the Radiological Safety organization at H+4 hours. The helicopter survey technique called for the pilot either to land the aircraft at the desired spot, so that a ground reading could be obtained, or to make a slow pass over the desired spot at an elevation of 25 feet. Readings taken at 25 feet were multiplied by a factor of 2 in order to obtain a reasonable approximation of the true ground reading. The basic instrument used in the aerial surveys was the AN/PDR-39 survey meter modified to read up to 500 r/hr. The  $t^{-1.2}$  decay approximation was used to extrapolate the H+4 hour dose-rate readings to H+1 hour.

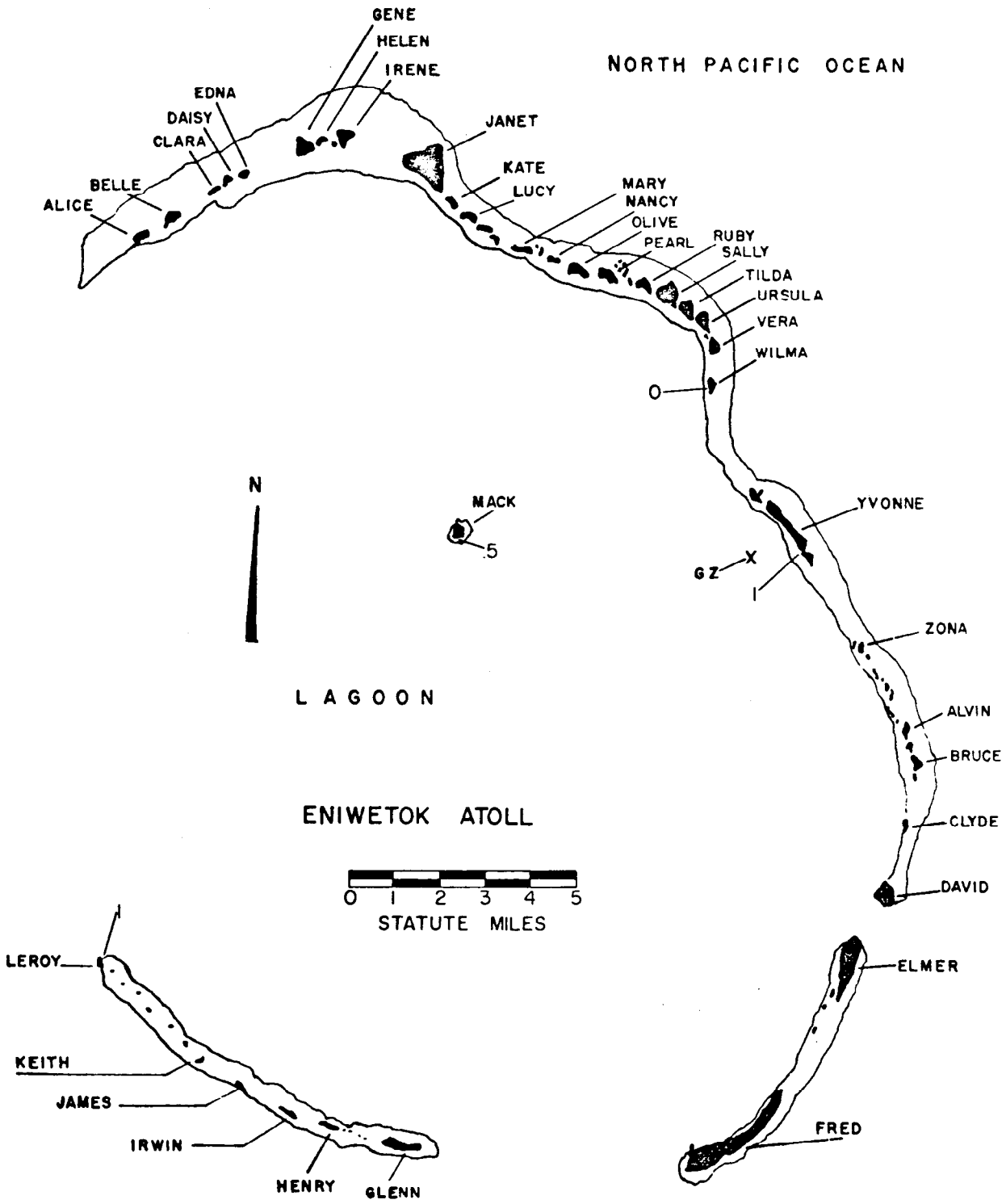


Figure 139. Operation HARDTACK I - Rose. Island dose rates in r/hr at H+1 hour.

TABLE 47 ENIWETOK WIND DATA FOR OPERATION HARDTACK I -

ROSE

Altitude (MSL) feet	H- $\frac{1}{4}$ hour		H+ $\frac{1}{4}$ hours	
	Dir degrees	Speed mph	Dir degrees	Speed mph
Surface	080	25	070	23
1,000	070	26	060	22
2,000	080	26	070	24
3,000	060	24	070	25
4,000	080	21	080	20
5,000	080	20	090	17
6,000	090	22	080	21
7,000	080	28	070	24
8,000	070	29	060	22
9,000	070	25	060	18
10,000	070	23	080	14
12,000	070	10	130	12
14,000	060	02	110	09
15,000	(070)	(05)	(110)	(08)
16,000	080	07	120	07
18,000	110	12	120	13
20,000	130	09	130	17
23,000	100	22	100	15
25,000	100	24	100	23
30,000	090	15	090	21
35,000	140	09	090	15
40,000	180	29	130	24
45,000	160	21	160	31
50,000	240	07	090	09
55,000	060	24	090	21
60,000	100	28	120	20
65,000	050	22	060	23
70,000	090	33	100	38
75,000	---	--	110	35
77,000	110	45	---	--
80,000	---	--	110	43
85,000	---	--	090	42
90,000	---	--	090	54
95,000	---	--	100	65
100,000	---	--	100	76
105,000	---	--	100	84
110,000	---	--	080	70
114,000	---	--	110	76

NOTES:

1. Numbers in parentheses are estimated values.
2. Wind data was taken by the Eniwetok weather station.
3. Tropopause height was 57,000 ft MSL.
4. The surface air pressure was 14.62 psi, the temperature 27.2°C, the dew point 74°F, and the relative humidity 79%.



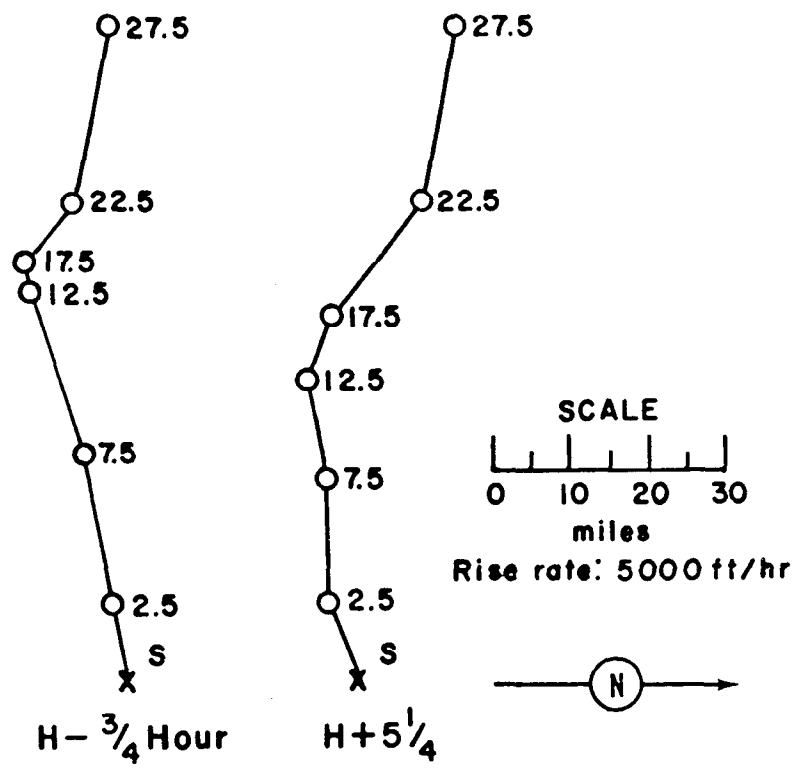


Figure 140 . Hodographs for Operation HARDTACK I -

Rose.

OPERATION HARDTACK I

- Umbrella

	<u>PPG Time</u>	<u>GMT</u>
DATE:	9 June 1958	8 June 1958
TIME:	1115	2315

Sponsor: DOD

SITE: PPG - Eniwetok - NNE of  
Henry  
11° 22' 51" N  
162° 13' 09" E  
Site elevation: Sea level  
Water depth: 150 ft

HEIGHT OF BURST: 150 ft underwater

TYPE OF BURST AND PLACEMENT:  
Sub-surface burst on lagoon  
bottom

REMARKS:

The pattern was obtained from a total of about 80 points which is really too few to place much reliance on the rather pronounced lobing of the downwind contours. "Nearly all of the total gamma dose occurred within 25 minutes after zero time and was due to the passage of air-borne radioactive material. Gamma doses in excess of 100r occurred within the first 15 minutes at downwind distances less than 14,000 feet. The residual field due to deposited radioactive material was relatively insignificant, although radioactive foam may represent a radiological hazard."

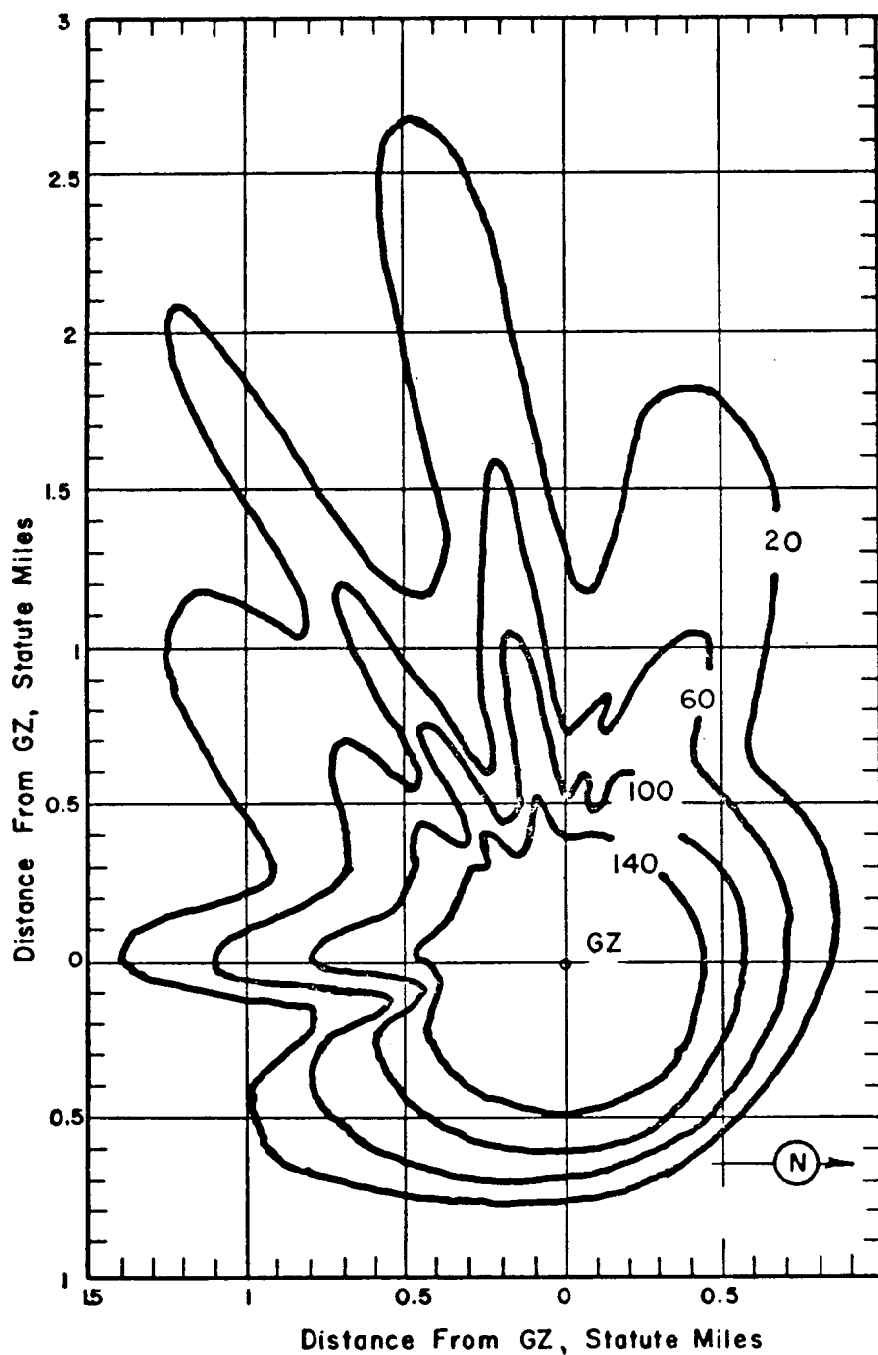


Figure 141. Operation HARDTACK I - Umbrella. Idealized rate contours in r. (Contours represent cumulative dose to 6 hours.)

TABLE 48 ENIWETOK WIND DATA FOR OPERATION HARDTACK I -

UMBRELLA

Altitude (MSL) feet	H+ <sub>1</sub> hour		H+6 <sub>1</sub> hours	
	Dir degrees	Speed mph	Dir degrees	Speed mph
Surface	060	23	070	23
1,000	050	26	---	--
2,000	060	24	---	--
3,000	070	24	---	--
4,000	080	25	---	--
5,000	080	28	---	--
6,000	090	28	---	--
7,000	100	21	---	--
8,000	100	17	---	--
9,000	100	20	---	--
10,000	100	24	---	--
12,000	110	18	---	--
14,000	120	15	070	09
16,000	100	09	060	15
18,000	160	05	080	07
20,000	070	07	190	05
23,000	090	02	030	09
25,000	080	06	360	05
30,000	050	06	350	17
35,000	330	14	250	15
40,000	260	14	270	15
45,000	270	15	200	29
50,000	280	10	200	20
55,000	160	08	150	06
60,000	140	07	040	08
65,000	090	24	120	22
70,000	100	20	080	16
75,000	100	45	---	--
80,000	100	57	090	57
85,000	090	57	---	--
90,000	090	62	090	63
95,000	090	63	---	--
99,000	---	--	090	56
100,000	090	60	---	--
105,000	090	58	---	--

**NOTES:**

1. Wind data was taken by the Eniwetok weather station.
2. Tropopause height was 54,000 ft MSL.
3. The surface air pressure was 14.66 psi, the temperature 30°C, the dew point 72°F, and the relative humidity 63%.

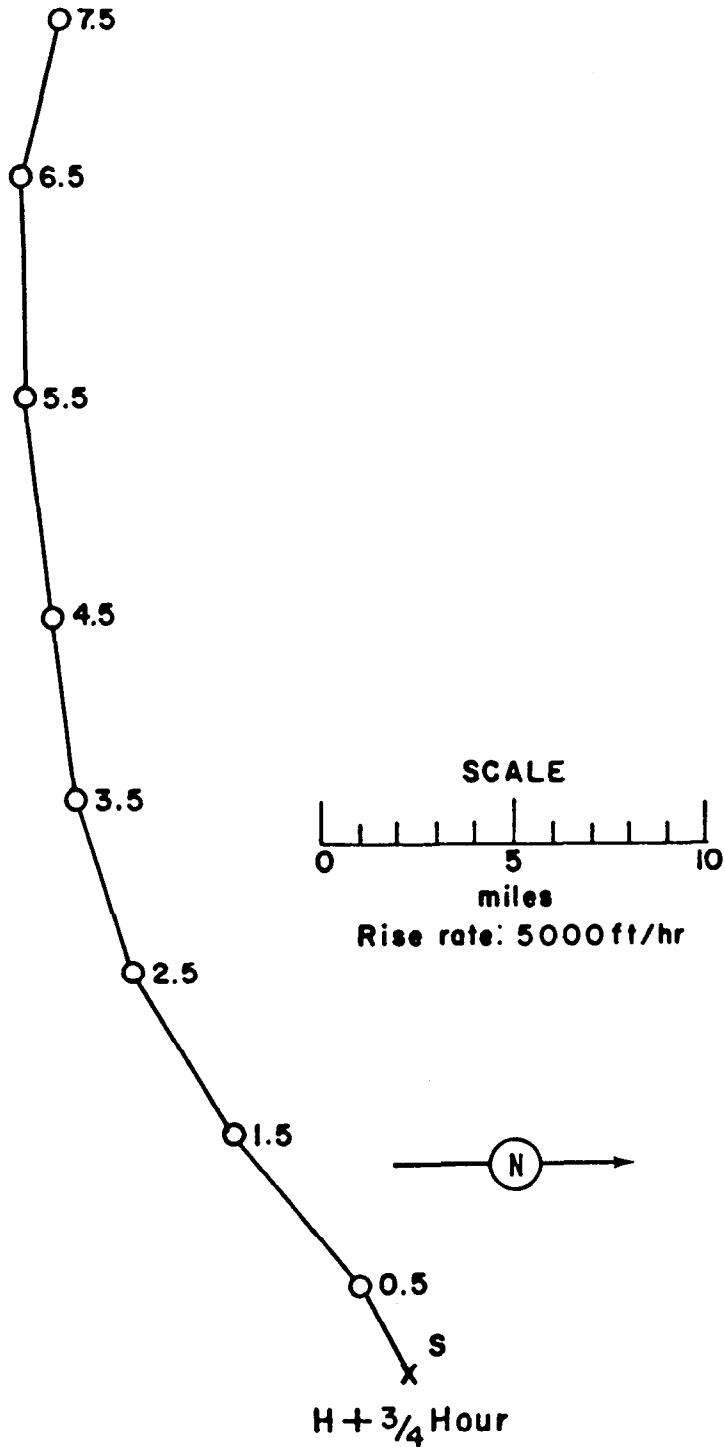


Figure 142 . Hodograph for Operation HARDTACK I -

Umbrella.

OPERATION HARDTACK I -

Maple

	<u>PPG Time</u>	<u>GMT</u>
<u>DATE:</u>	11 June 1958	10 June 1958
<u>TIME:</u>	0530	1730

Sponsor: UCRL

SITE: PPG - Bikini - South of  
Fox  
11° 41' 14" N  
165° 24' 54" E  
Site elevation: Sea level

HEIGHT OF BURST: 11.58 ft

TYPE OF BURST AND PLACEMENT:  
Surface burst from barge on  
water

CLOUD TOP HEIGHT: 40,000 ft MSL

CLOUD BOTTOM HEIGHT: NM

REMARKS:

Only individual island dose rates are available. These were obtained from Radiological Safety organization helicopter surveys at H+4 hours. The helicopter survey technique called for the pilot either to land the aircraft at the desired spot, so that a ground reading could be obtained, or to make a slow pass over the desired spot at an elevation of 25 feet. Readings taken at 25 feet were multiplied by a factor of 2 in order to obtain a reasonable approximation of the true ground reading. The basic instrument used in the aerial surveys was the AN/PDR-39 survey meter modified to read up to 500 r/hr. The  $t^{-1.2}$  decay approximation was used to extrapolate the H+4 hour dose-rate readings to H+1 hour.

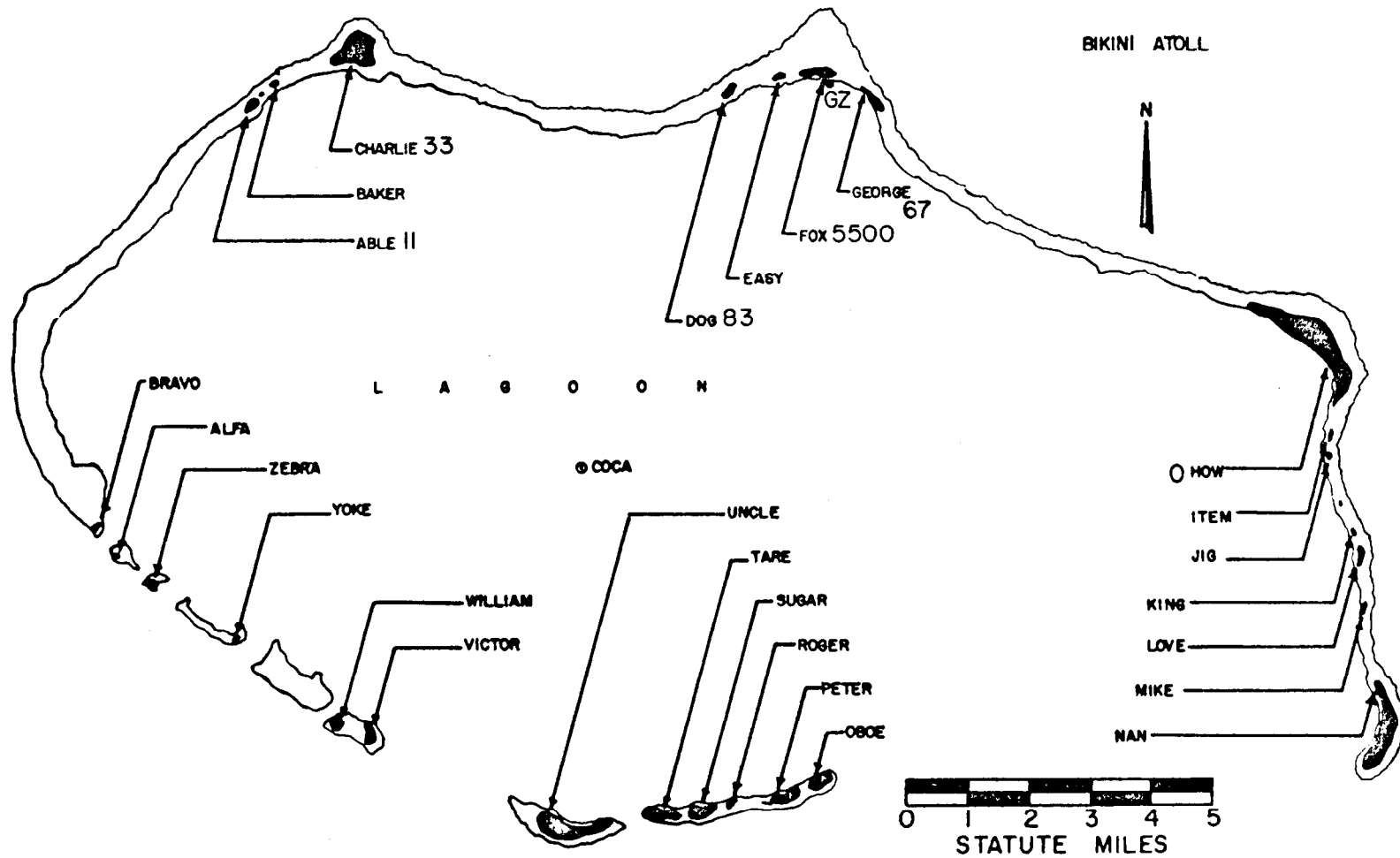


Figure 143. Operation HARDTACK I - in r/hr at H+1 hour.

Maple. Island dose rates

TABLE 49 BIKINI WIND DATA FOR OPERATION HARDTACK I -

MAPLE

Altitude (MSL) feet	H+ $\frac{1}{2}$ hour		H+6 $\frac{1}{2}$ hours		H+12 $\frac{1}{2}$ hours	
	Dir degrees	Speed mph	Dir degrees	Speed mph	Dir degrees	Speed mph
Surface	080	25	040	25	050	21
1,000	080	23	070	22	070	23
2,000	080	24	070	20	070	23
3,000	080	23	080	17	080	21
4,000	100	22	090	14	090	20
5,000	110	22	120	17	100	20
6,000	120	22	140	20	110	16
7,000	130	18	150	18	100	13
8,000	140	20	150	18	110	09
9,000	130	20	140	16	110	12
10,000	130	18	130	20	110	14
12,000	100	24	120	20	120	13
14,000	080	21	140	24	120	18
15,000	(080)	(22)	(140)	(21)	(130)	(20)
16,000	080	24	140	18	130	20
18,000	140	29	120	24	150	13
20,000	140	28	130	26	130	15
23,000	130	21	140	15	120	20
25,000	190	10	190	08	330	18
30,000	270	20	280	09	280	18
35,000	250	38	(285)	(17)	(285)	(17)
40,000	270	33	290	25	290	17
45,000	310	24	(315)	(24)	350	26
50,000	330	20	340	23	350	24
54,000	070	03	---	--	---	--
55,000	(080)	(06)	(350)	(06)	(250)	(07)
56,000	---	--	350	02	230	07
60,000	100	14	130	13	360	08
63,000	---	--	---	--	100	22
65,000	070	33	---	--	---	--
70,000	090	21	090	25	080	24
75,000	090	32	---	--	---	--
80,000	090	58	090	56	090	60
83,000	---	--	---	--	100	61
84,000	---	--	090	56	---	--
85,000	090	69	---	--	---	--
90,000	090	79	---	--	---	--

**NOTES:**

1. Numbers in parentheses are estimated values.
2. Wind data was taken on board ship located within 30 nautical miles of the Tower at Nan, Bikini Atoll.
3. Tropopause height was 53,000 ft MSL.
4. The surface air pressure was 14.66 psi, the temperature 27.0°C, the dew point 74°F, and the relative humidity 81%.



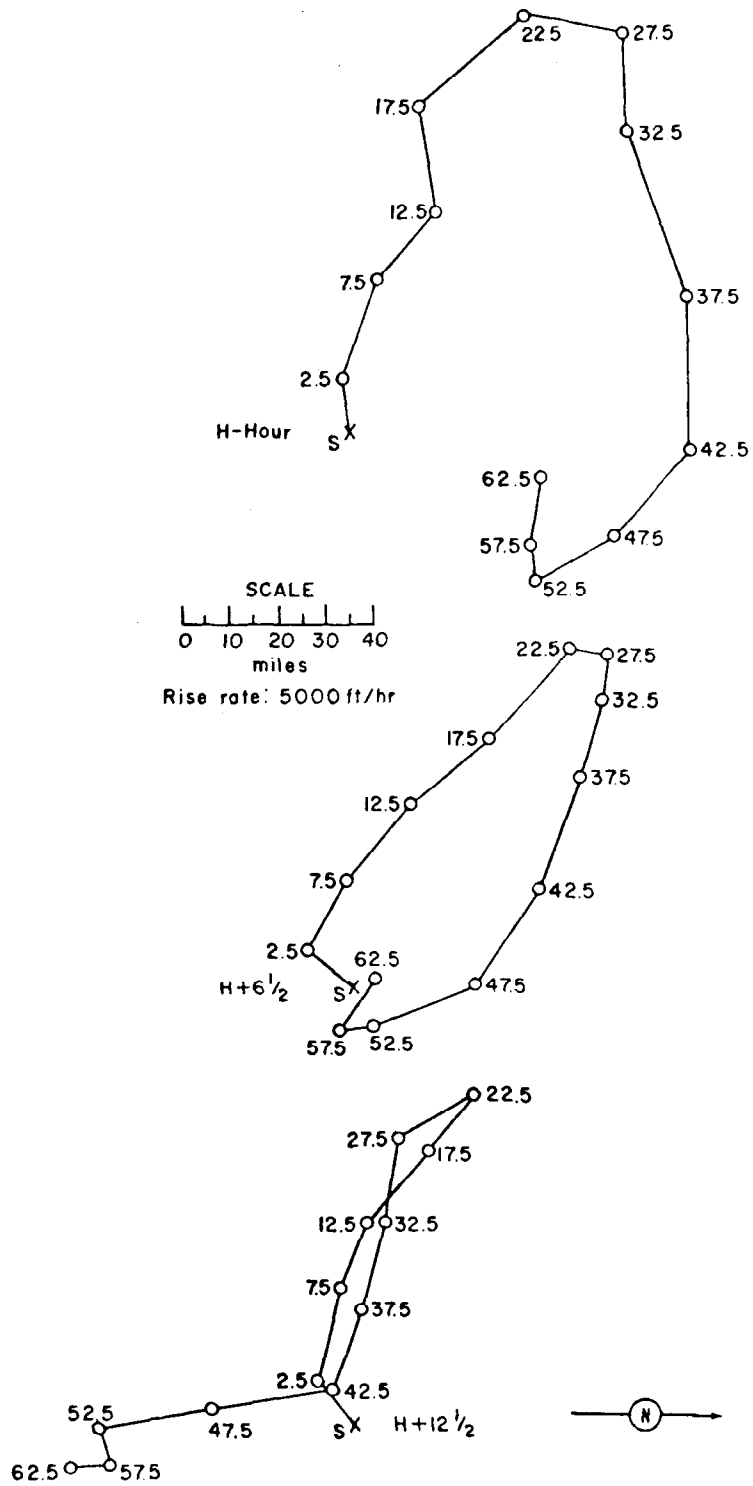


Figure 144. Hodographs for Operation HARDTACK I -

Maple.

OPERATION HARDTACK I -

Aspen

	<u>PPG Time</u>	<u>GMT</u>
<u>DATE:</u>	15 June 1958	14 June 1958
<u>TIME:</u>	0530	1730

Sponsor: UCRL

SITE: PPG - Bikini - SW of  
Charlie 4,000 ft from  
the island  
11° 41' 27" N  
165° 16' 24" E  
Site elevation: Sea level

HEIGHT OF BURST: 10.82 ft

TYPE OF BURST AND PLACEMENT:  
Surface burst from barge on  
water

CLOUD TOP HEIGHT: 48,600 ft  
CLOUD BOTTOM HEIGHT: NM

REMARKS:

Only individual island dose rates are available. These were obtained from Radiological Safety organization helicopter surveys at H+4 hours. The helicopter survey technique called for the pilot either to land the aircraft at the desired spot, so that a ground reading could be obtained, or to make a slow pass over the desired spot at an elevation of 25 feet. Readings taken at 25 feet were multiplied by a factor of 2 in order to obtain a reasonable approximation of the true ground reading. The basic instrument used in the aerial surveys was the AN/PDR-39 survey meter modified to read up to 500 r/hr. The  $t^{-1.2}$  decay approximation was used to extrapolate the H+4 hour dose rate readings to H+1 hour.

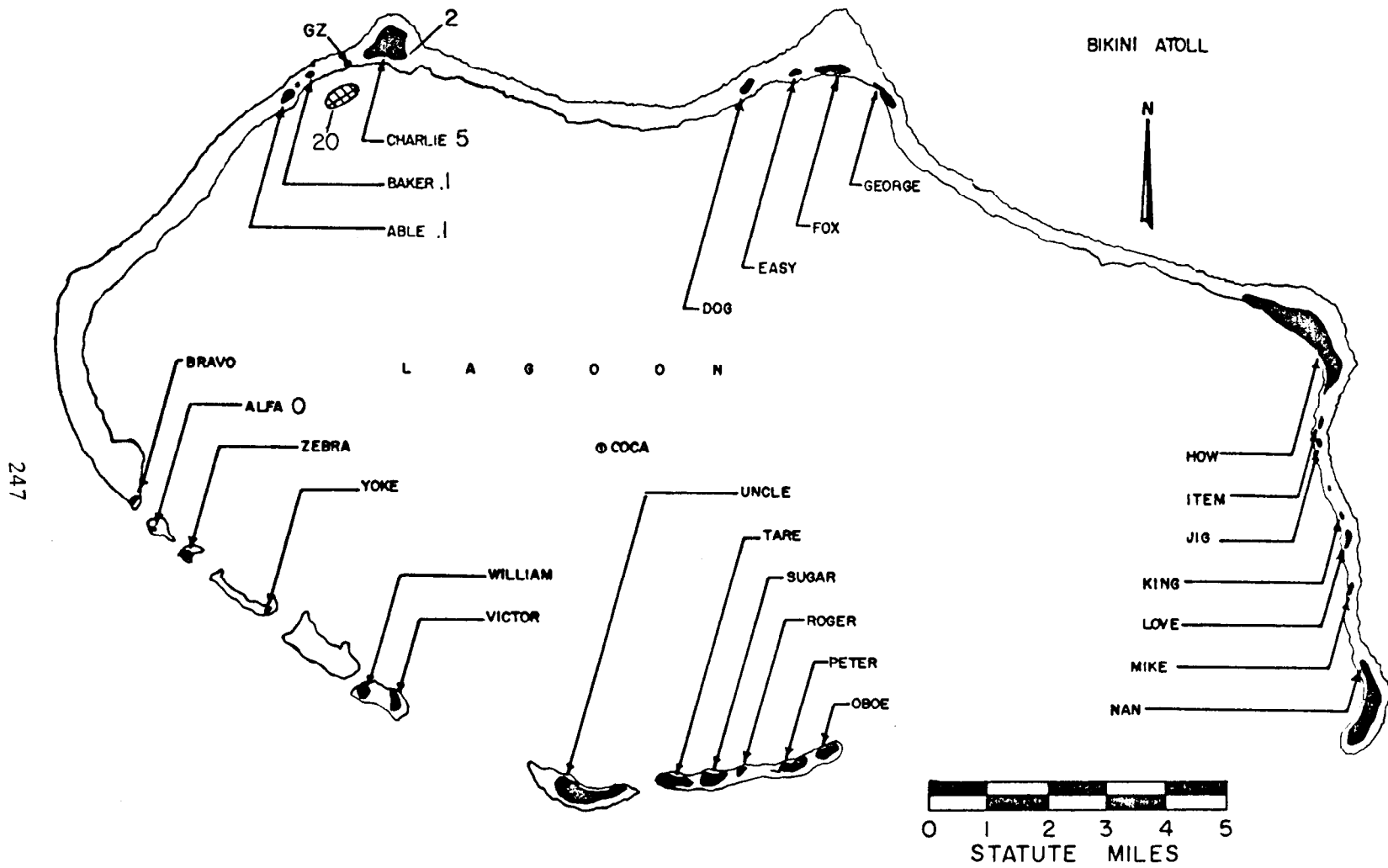


Figure 145. Operation HARDTACK - Aspen.  
Island dose rates in r/hr at H+1 hour.

TABLE 50 BIKINI WIND DATA FOR OPERATION HARDTACK I -

ASPEN

Altitude (MSL) feet	H+ $\frac{1}{2}$ hour		H+ $9\frac{1}{2}$ hours		H+12 $\frac{1}{2}$ hours	
	Dir degrees	Speed mph	Dir degrees	Speed mph	Dir degrees	Speed mph
Surface	050	21	060	21	060	23
1,000	070	22	060	22	070	24
2,000	080	21	060	22	070	24
3,000	090	21	070	22	070	22
4,000	090	21	090	24	070	24
5,000	090	20	090	25	070	24
6,000	100	22	---	--	090	22
7,000	110	22	---	--	090	12
8,000	110	22	---	--	080	23
9,000	120	23	100	22	080	21
10,000	110	14	100	22	080	17
12,000	110	16	100	13	090	17
14,000	120	10	110	15	090	15
15,000	(110)	(12)	(110)	(16)	(090)	(16)
16,000	110	13	110	17	090	18
18,000	120	13	110	15	090	17
20,000	120	13	120	18	090	17
23,000	140	21	120	17	100	15
25,000	150	23	130	21	120	18
30,000	160	26	140	23	130	23
35,000	170	29	(140)	(26)	(150)	(24)
37,000	---	--	140	28	---	--
40,000	150	26	200	33	170	25
44,000	---	--	---	--	180	46
45,000	160	23	---	--	---	--
50,000	190	30	190	28	200	20
54,000	100	14	---	--	---	--
55,000	(110)	(13)	(110)	(18)	(150)	(12)
56,000	---	--	---	--	110	10
57,000	---	--	070	15	---	--
60,000	150	08	060	17	100	20
62,000	060	20	---	--	---	--
64,000	---	--	---	--	110	08
66,000	---	--	120	38	---	--
70,000	090	29	090	23	060	23
73,000	---	--	060	45	---	--
78,000	---	--	---	--	080	48
89,000	---	--	---	--	110	57

**NOTES:**

1. Numbers in parentheses are estimated values.
2. Wind data was taken on board ship located within 30 nautical miles of the Tower at Nan, Bikini Atoll.
3. Tropopause height was 52,000 ft MSL.
4. The surface air pressure was 14.66 psi, the temperature 27.4°C, the dew point 74°F, and the relative humidity 78%.

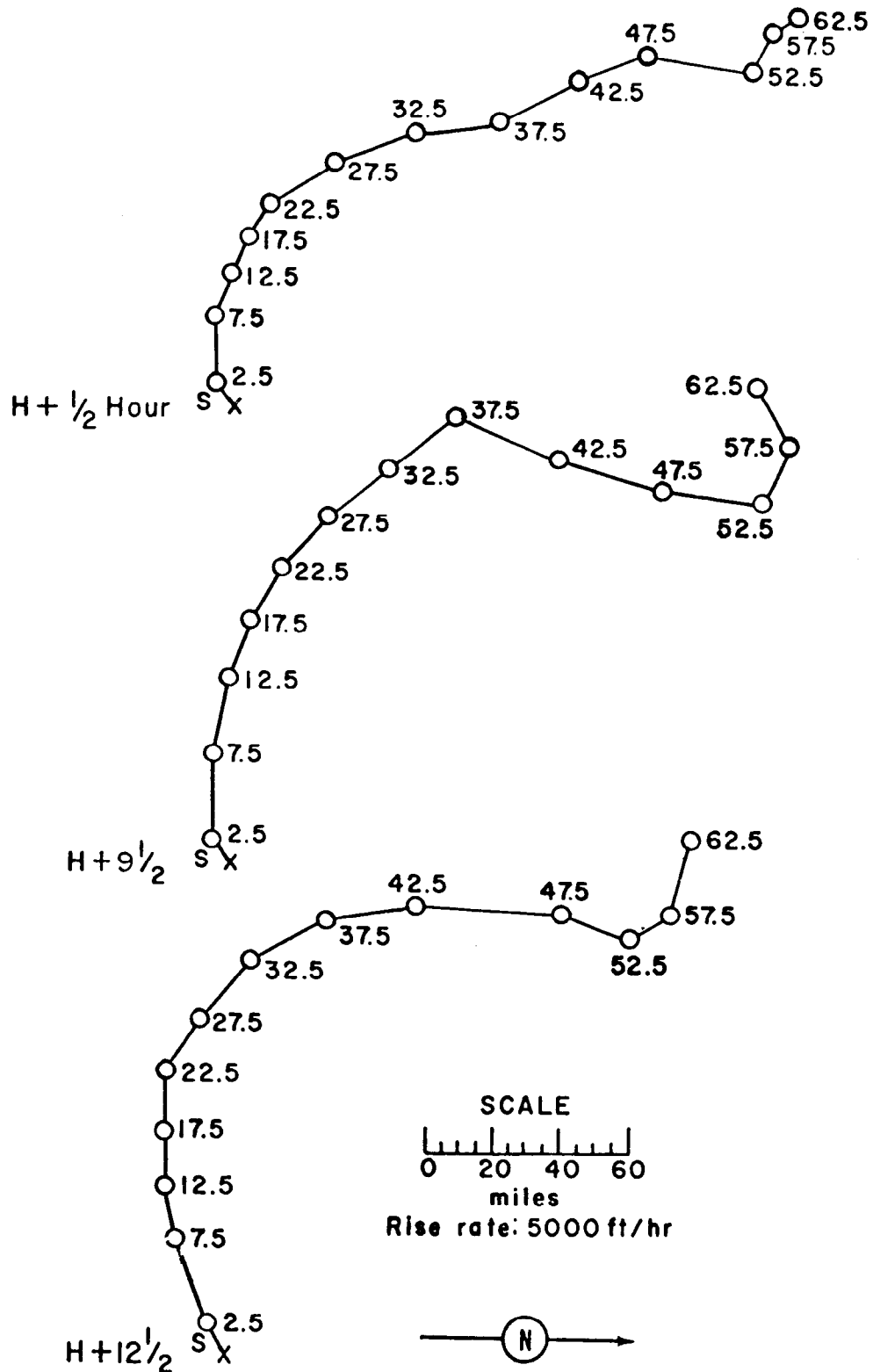


Figure 146. Hodographs for Operation HARDTACK I -

Aspen.

OPERATION HARDTACK I -

Walnut

	<u>PPG Time</u>	<u>GMT</u>
<u>DATE:</u>	15 Jun 1958	14 Jun 1958
<u>TIME:</u>	0630	1830

Sponsor: LASL

SITE: PPG - Eniwetok - 5,000 ft  
SW of Janet  
11° 39' 37" N  
162° 13' 31" E  
Site elevation: Sea level

HEIGHT OF BURST: 7.21 ft

TYPE OF BURST AND PLACEMENT:  
Surface burst from barge  
on water

CLOUD TOP HEIGHT: 61,000 ft MSL  
CLOUD BOTTOM HEIGHT: NM

REMARKS:

Only individual island dose rates are available. These were obtained from Radiological Safety organization helicopter surveys at H+4 hours. The helicopter survey technique called for the pilot either to land the aircraft at the desired spot, so that a ground reading could be obtained, or to make a slow pass over the desired spot at an elevation of 25 feet. Readings taken at 25 feet were multiplied by a factor of 2 in order to obtain a reasonable approximation of the true ground reading. The basic instrument used in the aerial surveys was the AN/PDR-39 survey meter modified to read up to 500 r/hr. The  $t^{-1.2}$  decay approximation was used to extrapolate the H+4 hour dose-rate readings to H+1 hour.

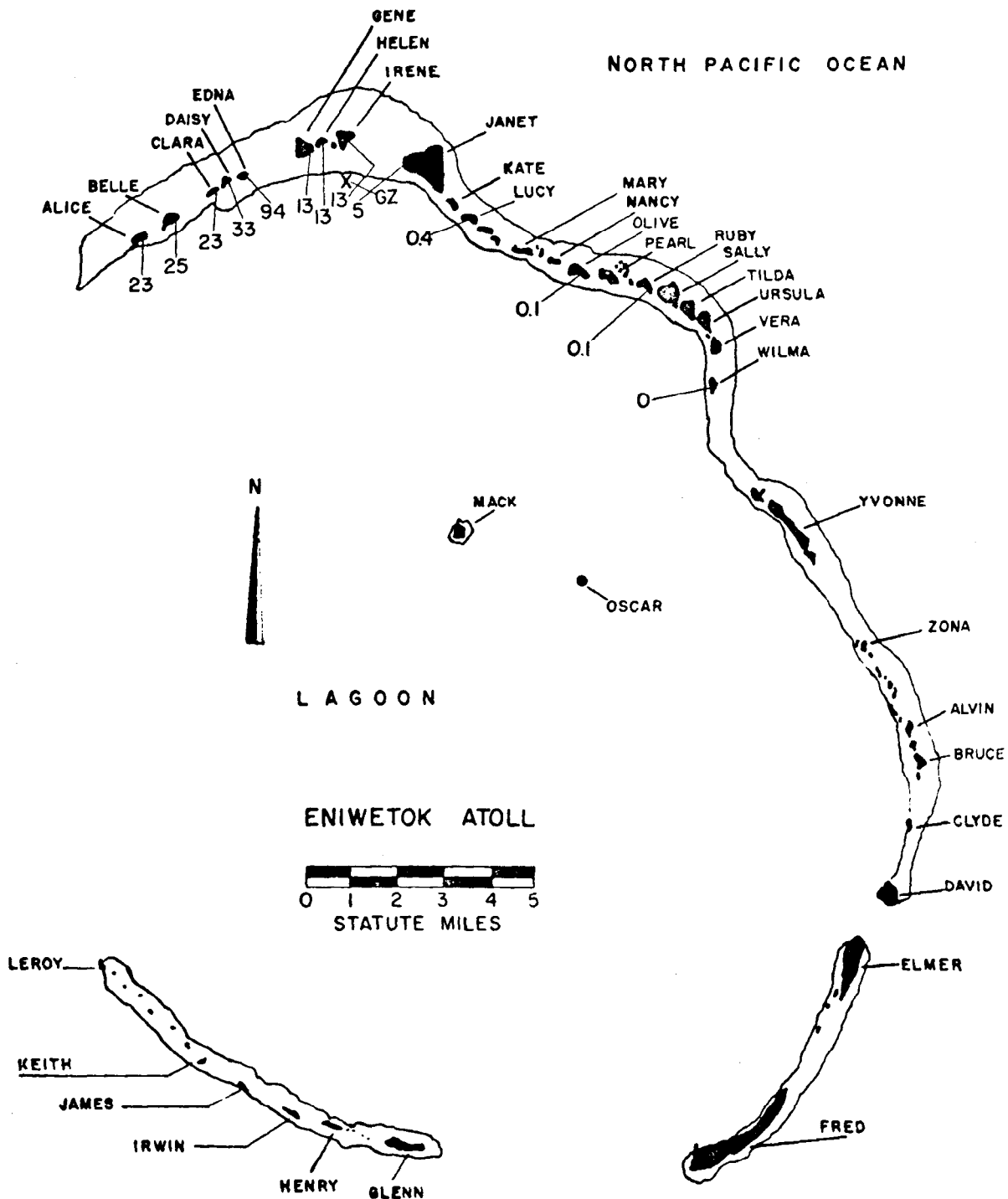


Figure 147. Operation HARDTACK I - Walnut.  
Island dose rates in r/hr at H+1 hour.

TABLE 51 ENIWETOK WIND DATA FOR HARDTACK I-

WALNUT

Altitude (MSL) feet	H- $\frac{1}{2}$ hour		H+ $5\frac{1}{2}$ hours		H+10 $\frac{1}{2}$ hours	
	Dir degrees	Speed mph	Dir degrees	Speed mph	Dir degrees	Speed mph
Surface	070	16	100	17	080	17
1,000	070	22	070	25	060	17
2,000	080	22	080	20	070	21
3,000	090	22	100	20	080	21
4,000	090	22	100	20	090	21
5,000	090	20	100	18	090	24
6,000	090	17	110	21	090	26
7,000	090	15	110	21	090	24
8,000	090	15	110	17	100	20
9,000	100	15	110	14	100	16
10,000	100	15	100	15	120	17
12,000	090	15	120	10	090	12
14,000	110	17	110	08	110	07
15,000	(110)	(20)	(120)	(09)	(110)	(08)
16,000	110	23	130	12	110	09
18,000	110	23	120	22	120	15
20,000	110	21	130	20	120	14
23,000	150	14	110	07	130	14
25,000	200	13	130	07	140	18
30,000	180	29	160	14	170	24
35,000	190	24	160	29	(170)	(26)
40,000	210	26	160	28	170	28
45,000	150	16	160	26	170	45
50,000	140	16	180	30	210	28
55,000	110	09	170	06	---	--
57,000	---	--	---	--	050	15
60,000	080	20	080	17	090	20
65,000	100	26	110	30	(090)	(23)
70,000	090	29	090	28	080	28
75,000	090	48	090	39	(080)	(38)
80,000	090	57	090	53	090	59
85,000	090	69	090	69	---	--
90,000	090	73	100	76	080	54
94,000	090	73	---	--	---	--
95,000	---	--	100	77	---	--
100,000	---	--	100	90	090	83
105,000	---	--	090	94	090	78

**NOTES:**

1. Numbers in parentheses are estimated values.
2. Wind data was taken by the Eniwetok weather station.
3. Tropopause height was 54,000 ft MSL.
4. The surface air pressure was 14.66 psi, the temperature 27.1°C, the dew point 76°F, and the relative humidity 84%.



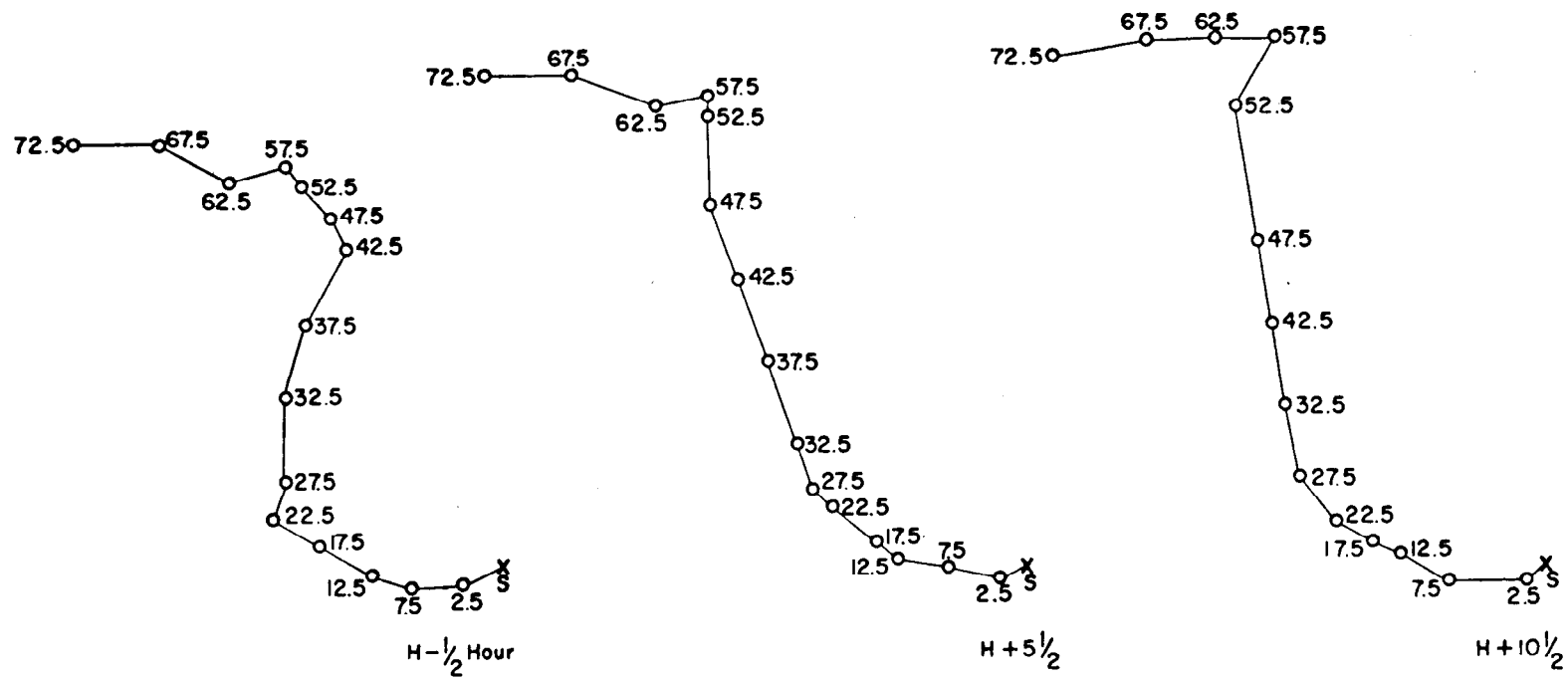


Figure 148. Hodographs for Operation HARDTACK I -

Walnut.

OPERATION HARDTACK I -

Linden

	<u>PPG Time</u>	<u>GMT</u>
<u>DATE:</u>	18 Jun 1958	18 Jun 1958
<u>TIME:</u>	1500	0300

Sponsor: LASL

SITE: PPG - Eniwetok - West of  
Yvonne, 4,000 ft from  
the island  
11° 32' 39" N  
162° 21' 23" E  
Site elevation: Sea level  
Water depth: 33 ft

HEIGHT OF BURST: 8.25 ft

TYPE OF BURST AND PLACEMENT:  
Surface burst from barge on  
water

CLOUD TOP HEIGHT: 20,000 ft MSL

CLOUD BOTTOM HEIGHT: NM

REMARKS:

Only individual island dose rates are available. These were obtained from helicopter surveys made by the Radiological Safety organization at H+4 hours. The helicopter survey technique called for the pilot either to land the aircraft at the desired spot, so that a ground reading could be obtained, or to make a slow pass over the desired spot at an elevation of 25 feet. Readings taken at 25 feet were multiplied by a factor of 2 in order to obtain a reasonable approximation of the true ground reading. The basic instrument used in the aerial surveys was the AN/PDR-39 survey meter modified to read up to 500 r/hr. The  $t^{-1.2}$  decay approximation was used to extrapolate the H+4 hour dose-rate readings to H+1 hour.

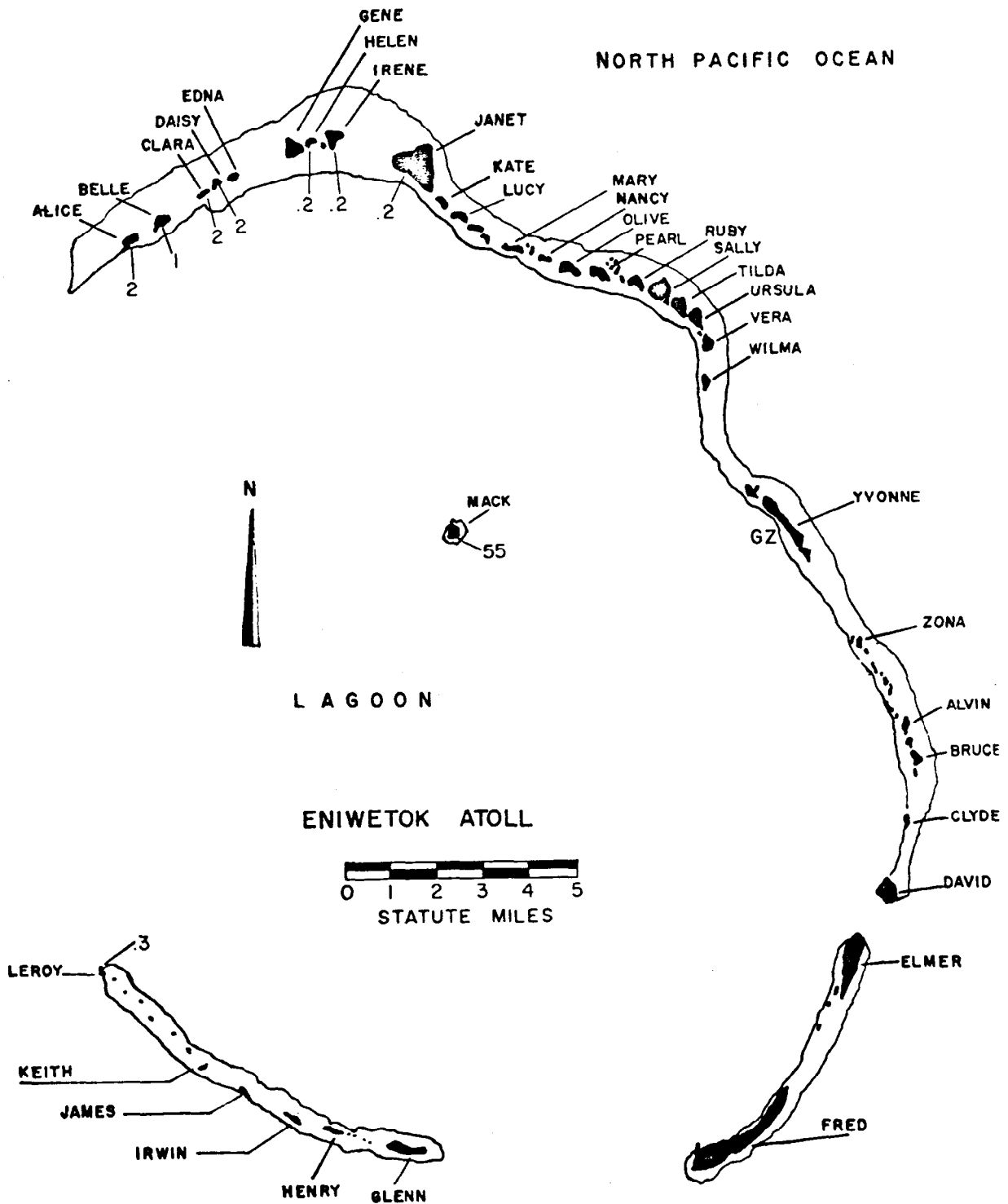


Figure 149. Operation HARDTACK I - Linden.  
Island dose rates in r/hr at H+1 hour.

TABLE 52 ENIWETOK WIND DATA FOR OPERATION HARDTACK I -

LINDEN

Altitude (MSL) feet	H-hour		H+3 hours		H+9 hours	
	Dir degrees	Speed mph	Dir degrees	Speed mph	Dir degrees	Speed mph
Surface	110	18	110	18	070	16
1,000	090	17	080	14	---	--
2,000	100	14	080	15	---	--
3,000	120	12	090	12	---	--
4,000	120	12	110	09	---	--
5,000	120	09	110	10	---	--
6,000	120	09	110	08	---	--
7,000	120	05	100	07	---	--
8,000	120	05	100	05	---	--
9,000	110	07	080	07	---	--
10,000	100	15	090	09	---	--
12,000	110	14	110	12	---	--
14,000	140	12	120	09	---	--
15,000	(130)	(14)	(120)	(12)	(120)	(14)
16,000	130	17	130	14	120	14
18,000	110	24	110	25	130	18
20,000	100	20	110	23	120	16
23,000	100	16	100	12	130	10
25,000	140	13	140	13	140	07
30,000	060	15	070	13	080	07
35,000	070	25	---	--	040	12
40,000	320	07	010	14	320	13
41,000	---	--	290	17	---	--
45,000	340	13	---	--	340	22
50,000	030	07	010	07	060	07
55,000	120	15	140	13	200	14
60,000	100	16	090	09	090	23
65,000	090	37	---	--	090	26
70,000	100	38	100	33	---	--
75,000	120	40	---	--	---	--
80,000	100	48	100	52	---	--
85,000	090	63	---	--	---	--
90,000	090	69	090	74	---	--
95,000	090	85	---	--	---	--
100,000	100	110	100	95	---	--

## NOTES:

1. Numbers in parentheses are estimated values.
2. Wind data was taken by the Eniwetok weather station.
3. Tropopause height was 54,000 ft MSL.
4. The surface air pressure was 14.65 psi, the temperature 31.2°C, the dew point 77.50°F, and the relative humidity 71%.

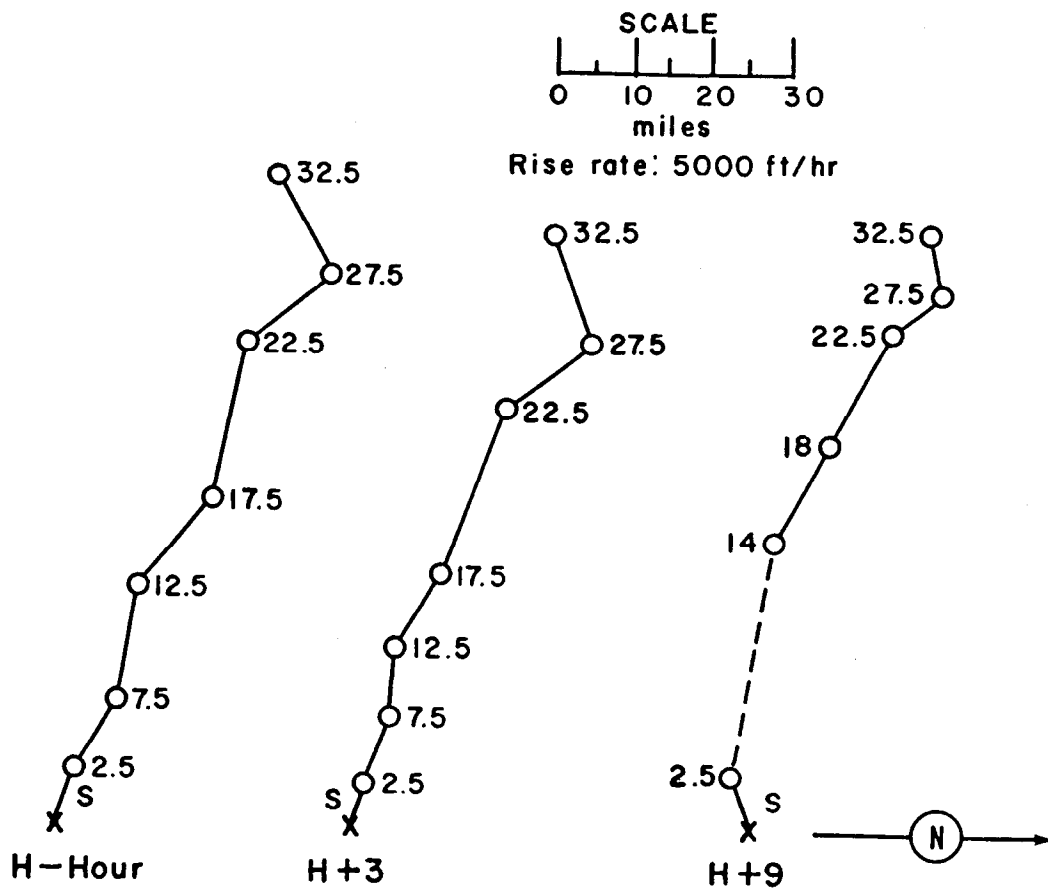


Figure 150. Hodographs for Operation HARUTACK I - Linden.

OPERATION HARDTACK I -

- Redwood

	<u>PPG Time</u>	<u>GMT</u>
<u>DATE:</u>	28 Jun 1958	27 Jun 1958
<u>TIME:</u>	0530	1730

Sponsor: UCRL

SITE: PPG - Bikini South of Fox  
11° 41' 14" N  
165° 24' 54" E  
Site elevation: Sea level

HEIGHT OF BURST: 10.79 ft

TYPE OF BURST AND PLACEMENT:  
Surface burst from barge on  
water

CLOUD TOP HEIGHT: 51,000 ft MSL  
CLOUD BOTTOM HEIGHT: 28,000 ft MSL

REMARKS:

Only individual island dose rates are available. These were obtained from Radiological Safety organization helicopter surveys at H+4 hours. The helicopter survey technique called for the pilot either to land the aircraft at the desired spot, so that a ground reading could be obtained, or to make a slow pass over the desired spot at an elevation of 25 feet. Readings taken at 25 feet were multiplied by a factor of 2 in order to obtain a reasonable approximation of the true ground reading. The basic instrument used in the aerial surveys was the AN/PDR-39 survey meter modified to read up to 500 r/hr. The  $t^{-1.2}$  decay approximation was used to extrapolate the H+4 hour dose-rate readings to H+1 hour.

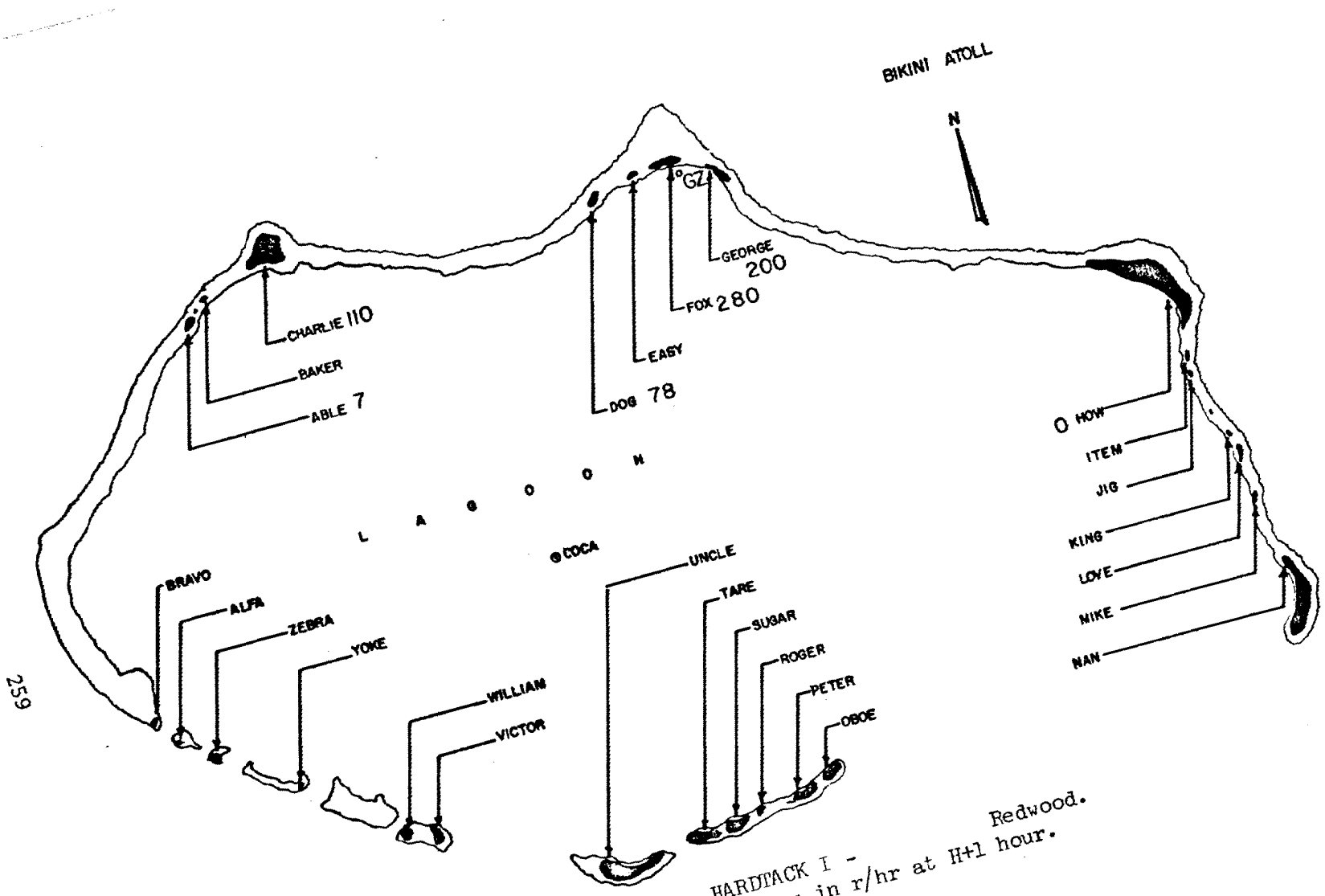


Figure 151. Operation HARDTACK I -  
Island dose rates in r/hr at H+1 hour.

TABLE 53 BIKINI WIND DATA FOR OPERATION HARDTACK I -

REDWOOD

Altitude (MSL) feet	H+ $\frac{1}{2}$ hour		H+9 $\frac{1}{2}$ hours		H+12 $\frac{1}{2}$ hours	
	Dir degrees	Speed mph	Dir degrees	Speed mph	Dir degrees	Speed mph
Surface	070	23	080	23	090	25
1,000	070	23	090	29	090	33
2,000	070	25	080	29	100	29
3,000	070	23	090	28	100	24
4,000	070	20	090	26	100	12
5,000	080	18	100	23	110	17
6,000	100	21	100	22	110	16
7,000	100	22	110	22	110	23
8,000	110	22	120	20	110	25
9,000	110	23	110	18	110	28
10,000	110	23	120	20	110	24
12,000	110	21	110	20	120	25
14,000	110	20	120	21	100	24
15,000	(110)	(18)	(110)	(21)	(100)	(25)
16,000	100	18	110	21	100	26
18,000	090	16	120	25	120	29
20,000	100	18	110	21	110	23
23,000	080	12	100	22	130	20
25,000	140	12	100	28	140	23
30,000	070	06	---	--	120	23
35,000	180	08	---	--	140	07
40,000	170	16	---	--	190	07
45,000	210	26	---	--	220	09
50,000	230	24	---	--	040	16
55,000	310	07	---	--	140	18
60,000	130	08	---	--	080	28
65,000	---	--	---	--	090	41
70,000	---	--	---	--	100	54
72,000	---	--	---	--	110	46

## NOTES:

1. Numbers in parentheses are estimated values.
2. Wind data was taken on board ship within 30 nautical miles of the tower at Nan Island, Bikini Atoll.
3. Tropopause height was 52,000 ft MSL.
4. The surface air pressure was 14.65 psi, the temperature 27.3°C, the dew point 78.5°F, and the relative humidity 92%.



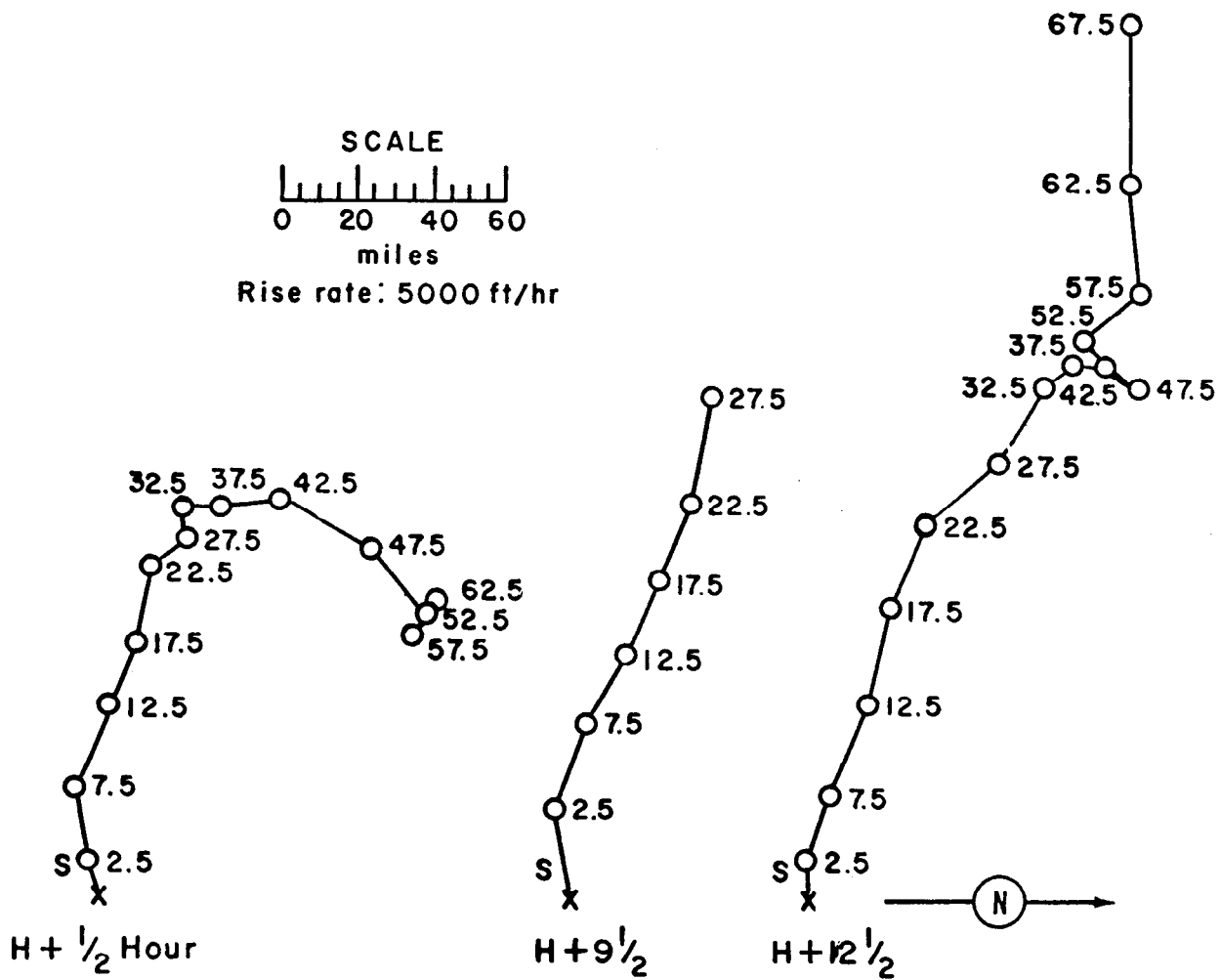


Figure 152 . Hodographs for Operation HARDTACK I - Redwood.

OPERATION HARDTACK I -

Elder

	<u>PPG Time</u>	<u>GMT</u>
<u>DATE:</u>	28 June 1958	27 June 1958
<u>TIME:</u>	0630	1830

Sponsor: LASL

SITE: PPG - Eniwetok - SW of  
Janet 4,000 ft to  
nearest edge of island  
11° 39' 48" N  
162° 13' 48" E  
Site elevation: Sea level

HEIGHT OF BURST: 9.17 ft

TYPE OF BURST AND PLACEMENT:  
Surface burst from barge on  
water.

CLOUD TOP HEIGHT: 50,000 ft MSL  
CLOUD BOTTOM HEIGHT: NM

REMARKS:

Only individual island dose rates are available. These were obtained from Radiological Safety organization helicopter surveys at H+4 hours. The helicopter survey technique called for the pilot either to land the aircraft at the desired spot, so that a ground reading could be obtained, or to make a slow pass over the desired spot at an elevation of 25 feet. Readings taken at 25 feet were multiplied by a factor of 2 in order to obtain a reasonable approximation of the true ground reading. The basic instrument used in the aerial surveys was the AN/PDR-39 survey meter modified to read up to 500 r/hr. The  $t^{-1.2}$  decay approximation was used to extrapolate the H+4 hour dose-rate readings to H+1 hour.

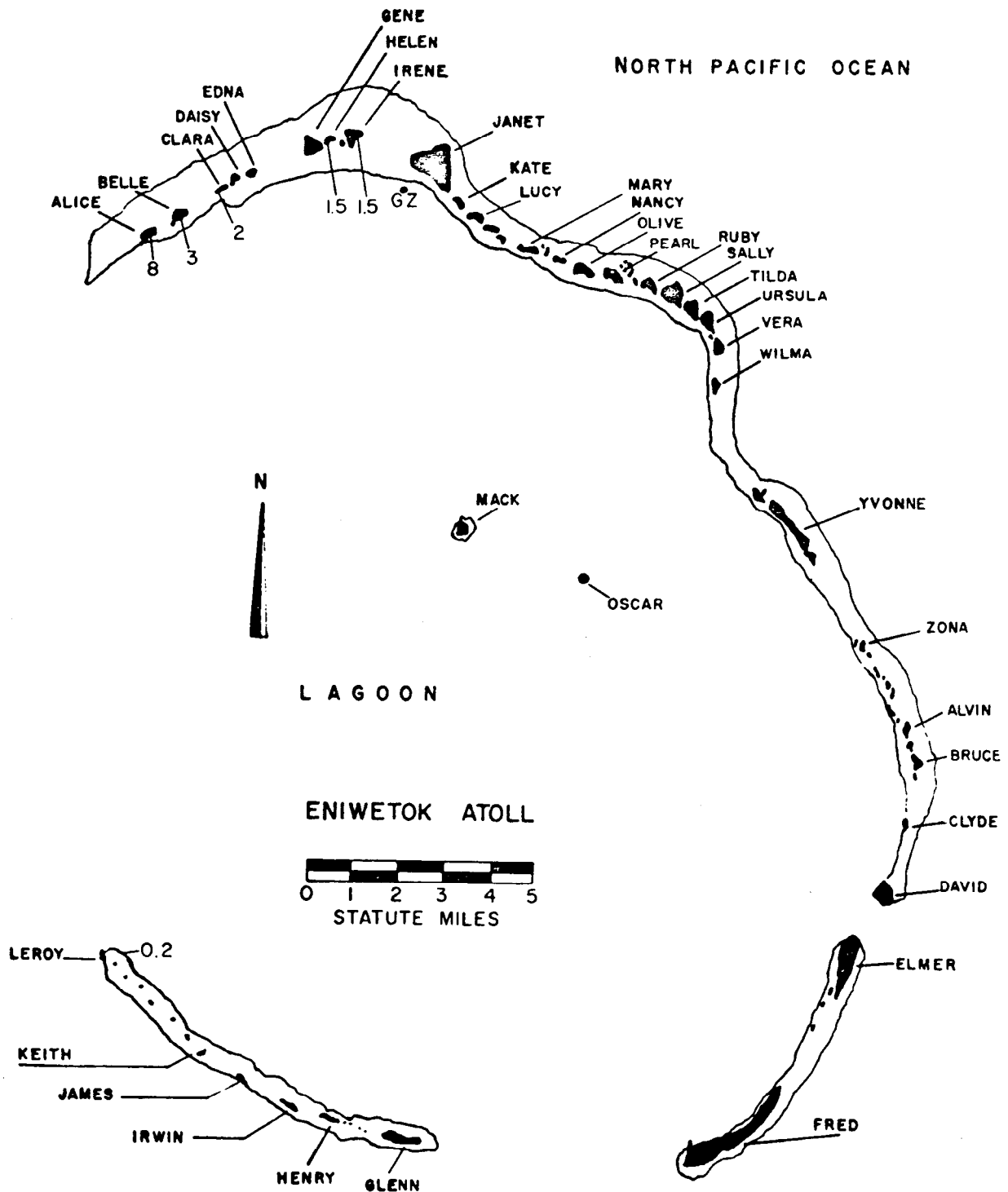


Figure 153. Operation HARDTACK I - Elder. Island dose rates in r/hr at H+1 hour.

TABLE 54 ENIWETOK WIND DATA FOR OPERATION HARDTACK I -

ELDER

Altitude (MSL) feet	H- $\frac{1}{2}$ hour		H+5 $\frac{1}{2}$ hours		H+11 $\frac{1}{2}$ hours	
	Dir degrees	Speed mph	Dir degrees	Speed mph	Dir degrees	Speed mph
Surface	080	24	090	17	100	16
1,000	070	26	070	23	100	26
2,000	070	26	090	24	100	26
3,000	080	24	100	24	100	26
4,000	090	22	100	22	100	26
5,000	090	22	100	24	100	26
6,000	100	22	110	28	100	26
7,000	120	23	110	23	100	26
8,000	130	21	110	22	100	26
9,000	130	22	100	24	100	30
10,000	120	20	110	26	100	31
12,000	090	20	100	22	100	26
14,000	090	18	100	22	100	26
15,000	(100)	(17)	(100)	(22)	(100)	(16)
16,000	110	16	100	22	100	06
18,000	120	13	120	22	080	33
20,000	110	16	120	22	(060)	(20)
23,000	110	16	120	17	100	18
25,000	090	15	100	14	110	23
30,000	230	16	180	21	140	28
34,000	---	--	160	38	---	--
35,000	190	33	(160)	(37)	140	31
40,000	180	47	160	29	190	26
45,000	180	23	(220)	(21)	240	07
50,000	180	23	280	13	150	13
53,000	---	--	180	13	---	--
55,000	120	13	(160)	(14)	270	30
60,000	100	26	100	18	110	23
65,000	100	28	---	--	090	47
70,000	060	46	100	48	090	56
75,000	100	47	---	--	090	56
80,000	090	61	090	62	090	61
85,000	090	67	---	--	090	74
90,000	090	93	100	87	090	87
95,000	090	90	---	--	090	90
100,000	---	--	100	105	---	--
105,000	---	--	100	117	---	--
110,000	---	--	100	107	---	--
116,000	---	--	100	90	---	--

## NOTES:

1. Numbers in parentheses are estimated values.
2. Wind data was taken by the Eniwetok weather station.
3. Tropopause height was 52,000 ft MSL.
4. The surface air pressure was 14.63 psi, the temperature 27.4°C, the dew point 74°F, and the relative humidity 78%.

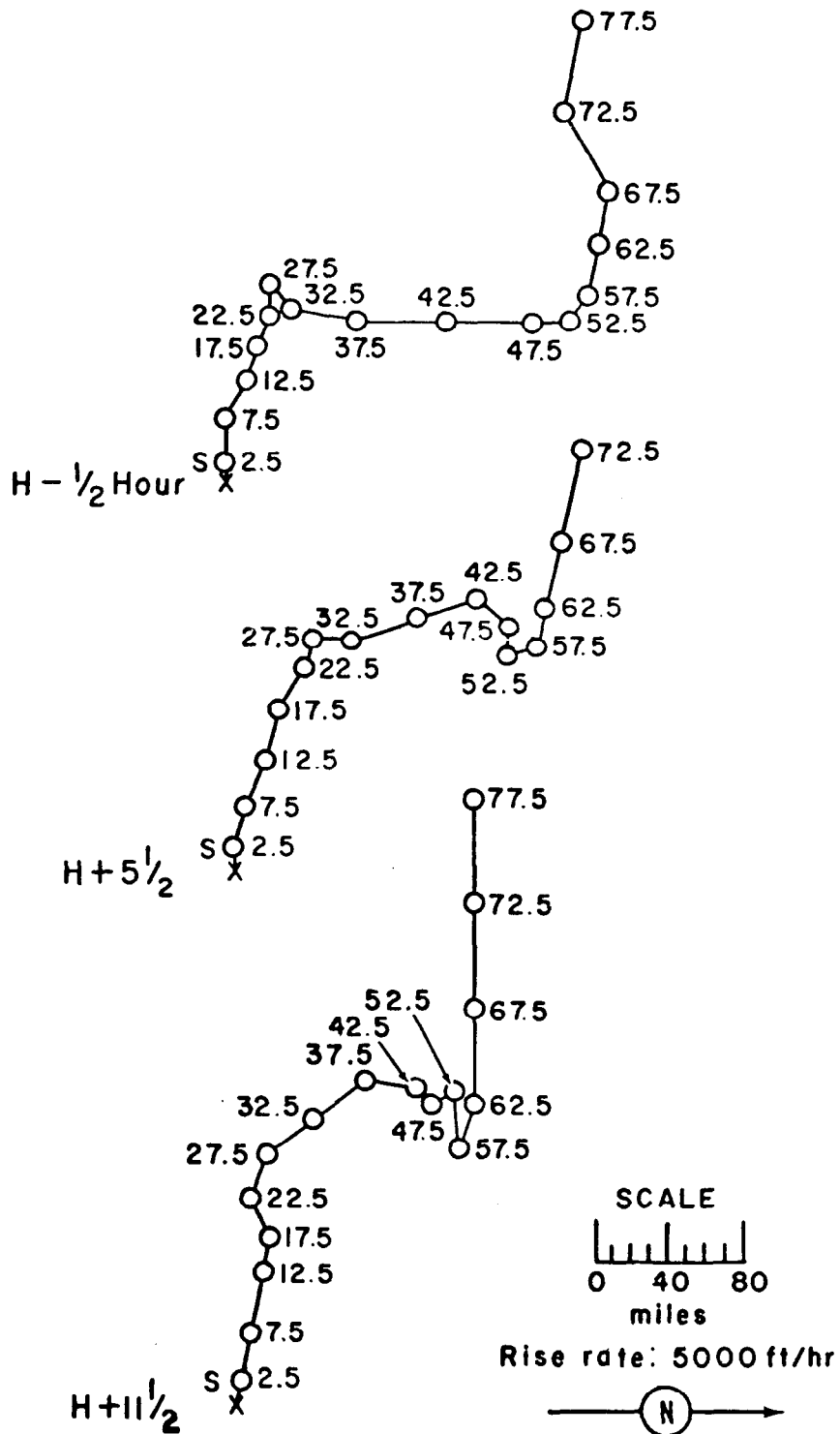


Figure 154 . Hodographs for Operation HARDTACK I -

Elder.

OPERATION HARDTACK I -

Oak

	<u>PPG Time</u>	<u>GMT</u>
<u>DATE:</u>	29 June 1958	28 June 1958
<u>TIME:</u>	0730	1930

TOTAL YIELD: 8.9 Mt

FIREBALL DATA:

Time to 1st minimum: NM  
Time to 2nd maximum: 2.98 sec  
Radius at 2nd maximum: NM

CRATER DATA:

Diameter: 4,400 ft  
Depth: 183 ft

Sponsor: LASL

SITE: PPG - Eniwetok - 3 mi  
SW of Alice

11° 36' 28" N

162° 06' 28" E

Site elevation: Sea level

Water depth: 13 ft

HEIGHT OF BURST: 6.5 ft

TYPE OF BURST AND PLACEMENT:

Surfaceburst from barge on  
water

CLOUD TOP HEIGHT: 78,000 ft MSL

CLOUD BOTTOM HEIGHT: NM

REMARKS:

Only individual island dose rates are available. These were obtained from Radiological Safety organization helicopter surveys at H+4 hours. The helicopter survey technique called for the pilot either to land the aircraft at a desired spot, so that a ground reading could be obtained or to make a slow pass over the desired spot at an elevation of 25 feet. Readings taken at 25 feet were multiplied by a factor of 2 in order to obtain a reasonable approximation of the true ground reading. The basic instrument used in the aerial surveys was the AN/PDR-39 survey meter modified to read up to 500 r/hr. The  $t^{-1.2}$  decay approximation was used to extrapolate the H+4 hour dose-rate readings to H+1 hour.

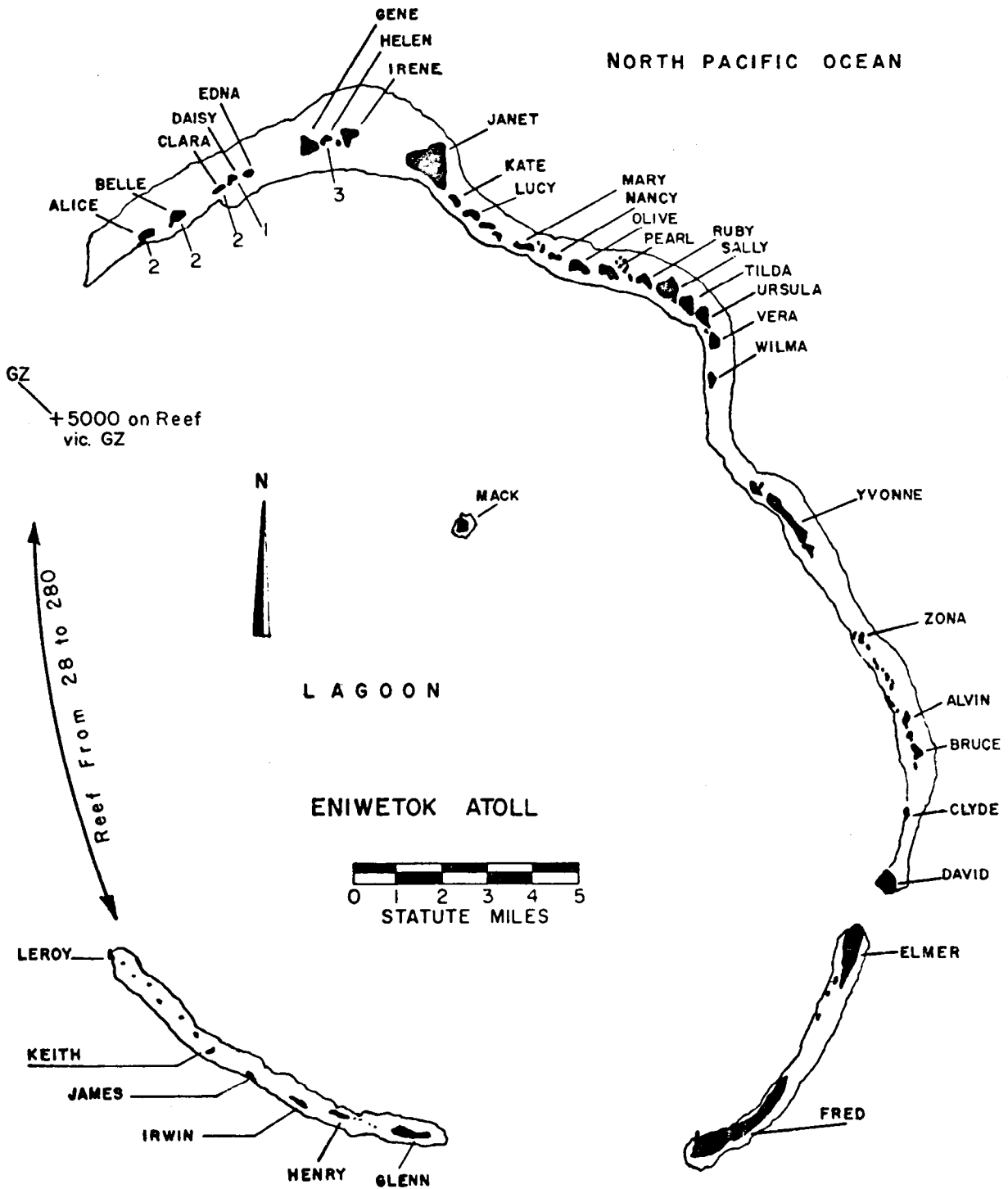


Figure 155. Operation HARDTACK I - Oak.  
Island dose rates in r/hr at H+1 hour.

TABLE 55 ENIWETOK WIND DATA FOR OPERATION HARDTACK I -- OAK

Altitude (MSL) feet	H+ $\frac{1}{2}$ hour		H+4 $\frac{1}{2}$ hours		H+9 $\frac{1}{2}$ hours	
	Dir degrees	Speed mph	Dir degrees	Speed mph	Dir degrees	Speed mph
Surface	120	16	090	12	100	22
1,000	090	22	080	17	100	30
2,000	100	24	080	22	100	30
3,000	100	24	080	22	100	28
4,000	100	24	090	20	100	60
5,000	110	22	100	20	100	23
6,000	110	20	110	17	100	16
7,000	120	20	120	17	100	18
8,000	120	20	130	17	100	18
9,000	130	18	130	17	100	17
10,000	140	17	130	17	100	13
12,000	150	16	130	18	120	13
14,000	130	18	150	22	130	12
15,000	(130)	(17)	(150)	(21)	(130)	(09)
16,000	130	17	150	20	130	07
18,000	130	17	150	20	130	07
20,000	130	18	160	20	200	05
23,000	140	17	160	26	170	12
25,000	140	22	150	23	170	12
30,000	140	16	140	20	190	09
35,000	---	--	140	16	160	10
40,000	120	20	110	16	100	16
44,000	060	14	---	--	---	--
45,000	(070)	(14)	090	18	080	17
50,000	090	13	160	21	140	08
55,000	(100)	(12)	070	08	040	12
57,000	110	12	---	--	---	--
60,000	---	--	080	31	080	30
65,000	---	--	090	33	100	35
70,000	---	--	090	43	090	41
75,000	---	--	090	56	090	54
80,000	---	--	100	67	100	67
85,000	---	--	100	97	090	78
90,000	---	--	090	72	090	84
91,000	---	--	090	73	---	--
95,000	---	--	---	--	090	82
100,000	---	--	---	--	090	95
105,000	---	--	---	--	100	106
110,000	---	--	---	--	100	115
114,000	---	--	---	--	090	121

NOTES:

1. Numbers in parentheses are estimated values.
2. Wind data was taken by the Eniwetok weather station.
3. Tropopause height was 50,000 ft MSL.
4. The surface air pressure was 14.64 psi, the temperature 27.3°C, the dew point 76.5°F, and the relative humidity 87%.



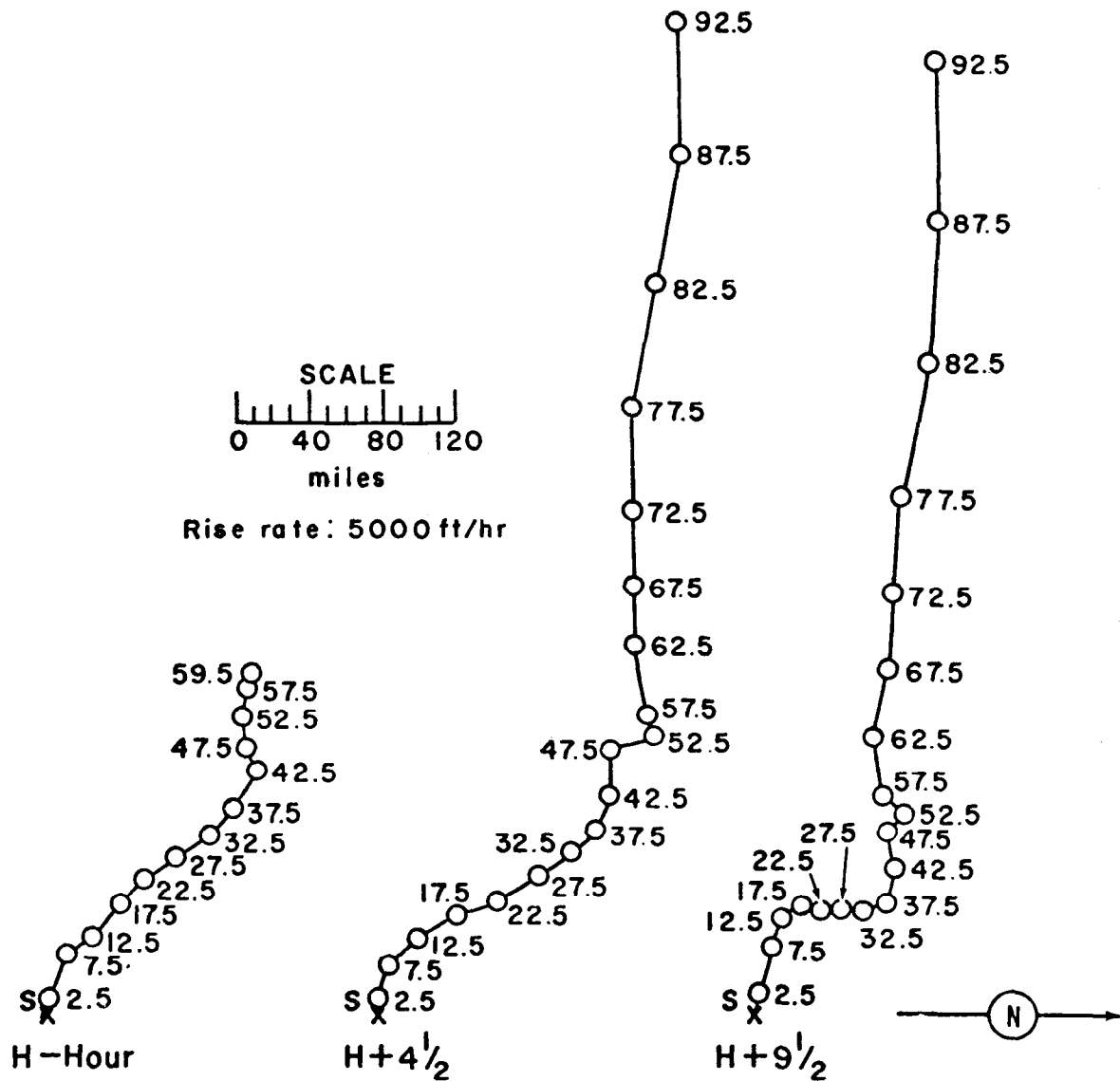


Figure 156. Hodographs for Operation HARDTACK I -

Oak.

OPERATION HARDTACK I -

Hickory

	<u>PPG Time</u>	<u>GMT</u>
<u>DATE:</u>	29 June 1958	29 June 1958
<u>TIME:</u>	1200	2400

Sponsor: UCRL

SITE: PPG - Bikini - Off west  
end of Tare  
11° 29' 46" N  
165° 22' 15" E  
Site elevation: Sea level

HEIGHT OF BURST: 12.11 ft

TYPE OF BURST AND PLACEMENT:  
Surface burst from barge on  
water

CLOUD TOP HEIGHT: 24,000 ft MSL  
CLOUD BOTTOM HEIGHT: 12,000 ft MSL

CRATER DATA: Not available

REMARKS:

Only individual island dose rates are available. These were obtained from helicopter surveys made by the Radiological Safety organization at H+4 hours. The helicopter survey technique called for the pilot either to land the aircraft at the desired spot, so that a ground reading could be obtained, or to make a slow pass over the desired spot at an elevation of 25 feet. Readings taken at 25 feet were multiplied by a factor of 2 in order to obtain a reasonable approximation of the true ground reading. The basic instrument used in the aerial surveys was the AN/PDR-39 survey meter modified to read up to 500 r/hr. The  $t^{-1.2}$  decay approximation was used to extrapolate the H+4 hour dose-rate readings to H+1 hour.

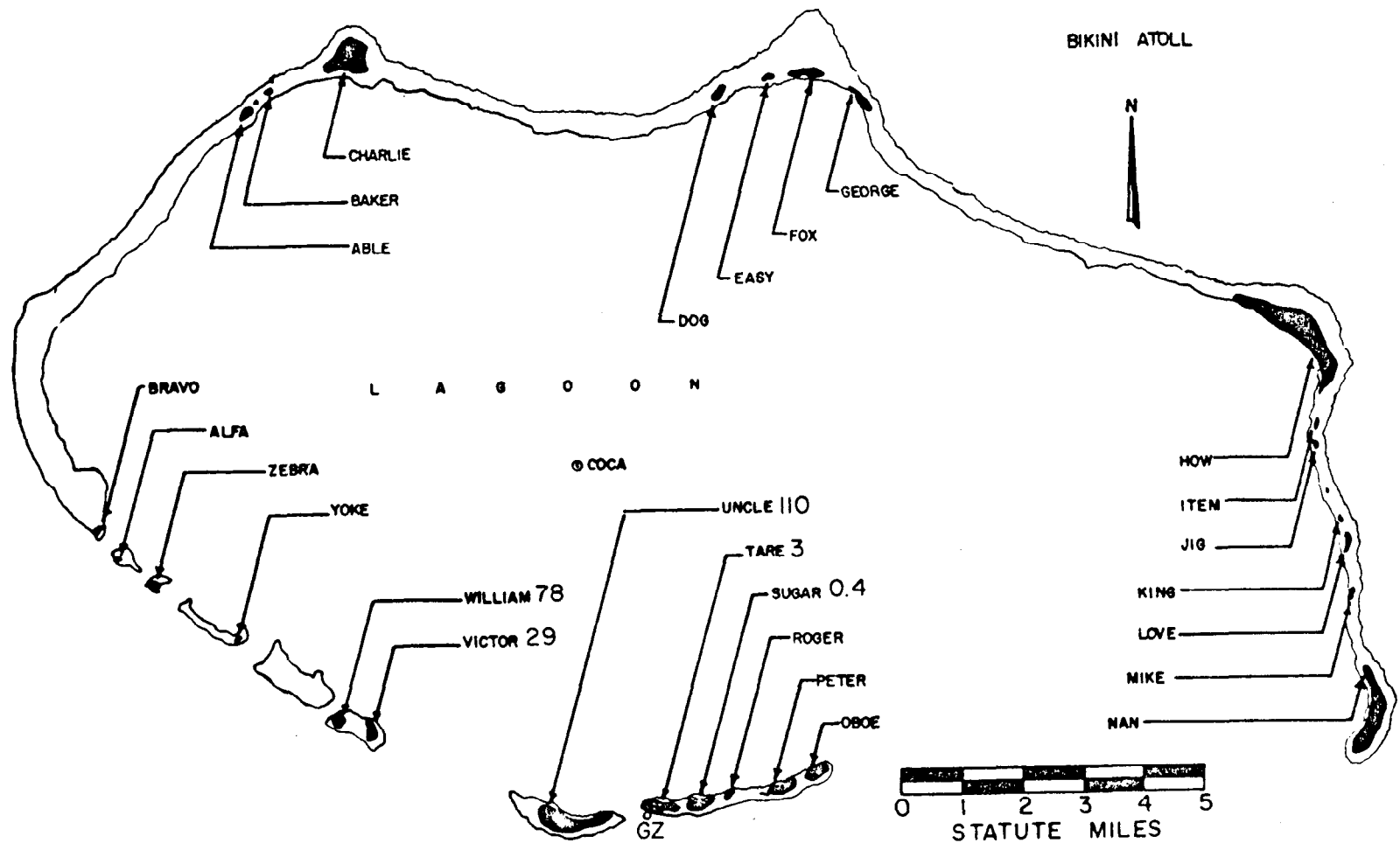


Figure 157. Operation HARDTACK I - Hickory.  
Island dose rates in r/hr at H+1 hour.

TABLE 56 BIKINI WIND DATA FOR OPERATION HARDTACK I -

HICKORY

Altitude (MSL) feet	H-hour		H+6 hours		H+12 hours	
	Dir degrees	Speed mph	Dir degrees	Speed mph	Dir degrees	Speed mph
Surface	090	09	050	23	080	17
1,000	080	23	080	28	080	22
2,000	080	23	080	36	080	24
3,000	080	24	080	36	080	23
4,000	090	24	090	16	080	21
5,000	090	24	090	31	070	20
6,000	090	21	080	29	060	21
7,000	090	22	090	24	060	21
8,000	090	20	090	22	070	18
9,000	090	17	080	15	090	21
10,000	100	18	070	12	090	20
12,000	100	14	050	13	070	21
14,000	110	15	070	14	070	21
15,000	(100)	(17)	(070)	(10)	(070)	(21)
16,000	100	20	060	08	070	21
18,000	110	21	040	15	060	23
20,000	110	12	040	16	030	15
23,000	100	09	030	06	040	09
25,000	060	06	---	--	010	16
30,000	Calm	Calm	010	07	050	03
35,000	160	08	100	08	110	12
40,000	---	--	110	09	070	08
45,000	---	--	040	20	020	14
50,000	---	--	140	10	060	03
55,000	---	--	350	12	350	28
60,000	---	--	070	40	080	35
65,000	---	--	120	25	090	18
70,000	---	--	070	41	080	62
72,000	---	--	060	41	---	--

NOTES:

1. Numbers in parentheses are estimated values.
2. Wind data was taken on board ship within 30 nautical miles of the tower at Nan Island, Bikini Atoll.
3. Tropopause height was 51,000 ft MSL.
4. The surface air pressure was 14.65 psi, the temperature 27.8°C, the dew point 81.3°F, and the relative humidity 84%.

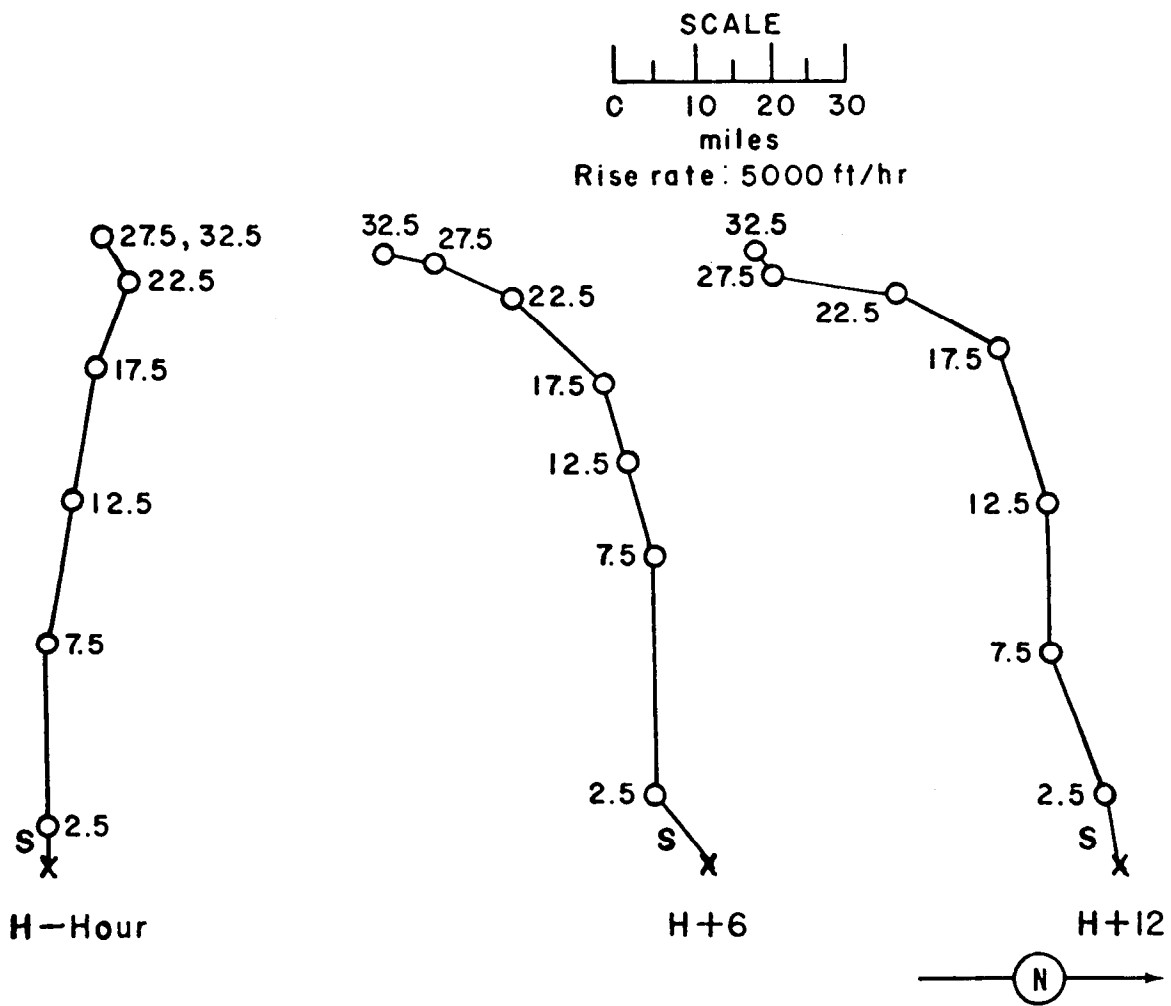


Figure 158. Hodographs for Operation HARDTACK I -

Hickory.

OPERATION HARDTACK I -

Sequoia

	<u>PPG Time</u>	<u>GMT</u>
<u>DATE:</u>	2 July 1958	1 July 1958
<u>TIME:</u>	0630	1830

Sponsor: LASL

SITE: PPG - Eniwetok -  $\frac{1}{2}$  mi  
west of Yvonne  
11° 32' 39" N  
162° 21' 23" E  
Site elevation: Sea level

HEIGHT OF BURST: 6.5 ft

TYPE OF BURST AND PLACEMENT:  
Surface burst from barge  
on water

CLOUD TOP HEIGHT: 17,000 ft MSL  
CLOUD BOTTOM HEIGHT: NM

REMARKS:

Only individual island dose rates are available. These were obtained from Radiological Safety organization helicopter surveys at H+4 hours. The helicopter survey technique called for the pilot either to land the aircraft at the desired spot, so that a ground reading could be obtained, or to make a slow pass over the desired spot at an elevation of 25 feet. Readings taken at 25 feet were multiplied by a factor of 2 in order to obtain a reasonable approximation of the true ground reading. The basic instrument used in the aerial surveys was the AN/PDR-39 survey meter modified to read up to 500 r/hr. The  $t^{-1.2}$  decay approximation was used to extrapolate the H+4 hour dose-rate readings to H+1 hour.

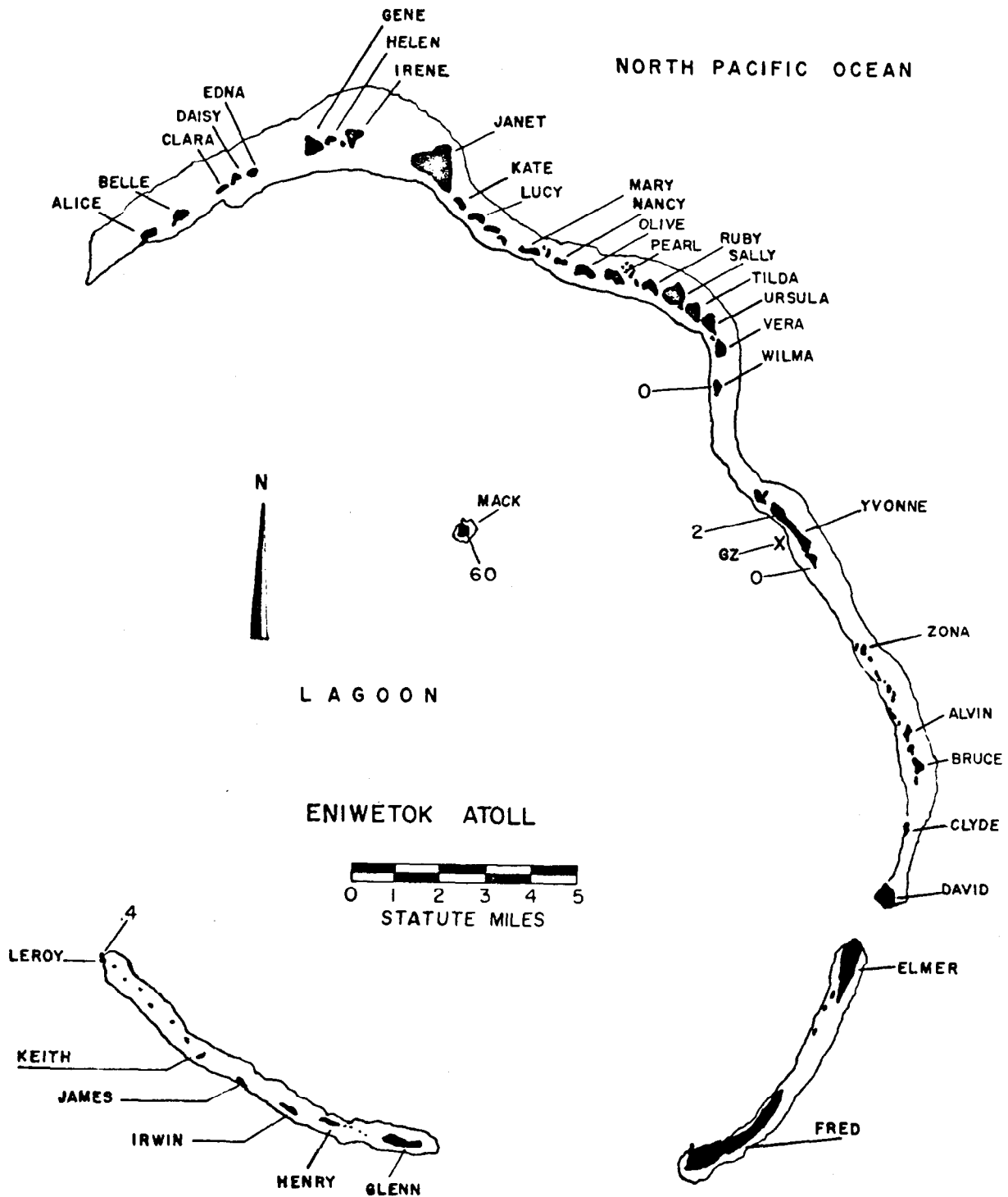


Figure 159. Operation HARDTACK I - Sequoia.  
Island dose rates in r/hr at H+1 hour.

TABLE 57 ENIWETOK WIND DATA FOR OPERATION HARDTACK I -

SEQUOIA

Altitude (MSL) feet	H- $\frac{1}{2}$ hour		H+5 $\frac{1}{2}$ hours		H+10 $\frac{1}{2}$ hours	
	Dir degrees	Speed mph	Dir degrees	Speed mph	Dir degrees	Speed mph
Surface	100	14	080	18	090	18
1,000	090	20	090	18	090	23
2,000	090	22	090	22	090	24
3,000	100	22	100	22	090	24
4,000	100	26	100	22	090	23
5,000	100	23	100	24	090	22
6,000	100	22	100	20	100	20
7,000	100	22	090	17	100	17
8,000	100	25	100	15	100	15
9,000	100	21	110	14	100	14
10,000	100	18	110	16	100	16
12,000	110	20	110	16	090	15
14,000	130	15	130	14	130	08
15,000	(120)	(13)	(130)	(13)	(130)	(09)
16,000	120	10	130	13	130	12
18,000	050	07	100	13	120	10
20,000	040	13	080	09	130	05
23,000	010	23	010	18	040	16
25,000	340	18	340	22	020	07
30,000	010	15	030	10	320	09
35,000	020	18	020	18	020	07
40,000	010	28	360	21	010	17
45,000	020	36	010	29	010	21
50,000	270	26	340	22	300	17
55,000	010	18	310	12	050	08
60,000	080	14	100	22	110	18
65,000	100	28	100	30	080	29
70,000	090	39	090	45	090	48
75,000	100	55	100	47	100	57
80,000	090	56	090	54	090	67
85,000	100	72	100	70	090	75
90,000	090	68	100	80	090	76
95,000	090	90	090	90	090	83
100,000	090	98	---	---	090	100
105,000	100	98	---	---	090	109
110,000	---	--	---	---	090	79
112,000	---	--	---	---	100	82

**NOTES:**

1. Numbers in parentheses are estimated values.
2. Wind data was taken by the Eniwetok weather station.
3. Tropopause height was 52,000 ft MSL.
4. The surface air pressure was 14.61 psi, the temperature 27.2°C, the dew point 83.5°F, and the relative humidity 76%.



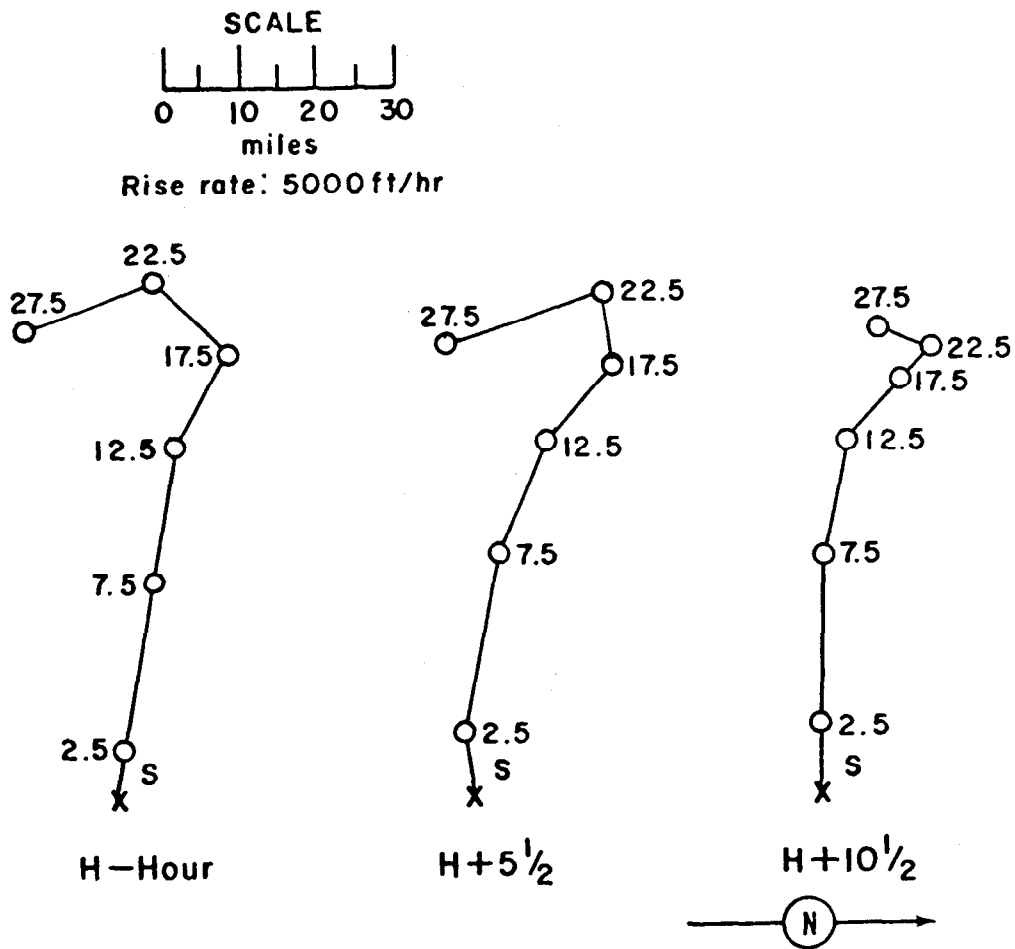


Figure 160. Hodographs for Operation HARDTACK I - Sequoia.

OPERATION HARDTACK I -

Cedar

	<u>PPG Time</u>	<u>GMT</u>
<u>DATE:</u>	3 July 1958	2 July 1958
<u>TIME:</u>	0530	1730

Sponsor: UCRL

SITE: PPG - Bikini - SW of  
Charlie, 4,000 ft from  
the island

Site elevation: Sea level

HEIGHT OF BURST: 10.84 ft

TYPE OF BURST AND PLACEMENT:

Surface burst from barge  
on water

CLOUD TOP HEIGHT: 50,000 ft MSL  
CLOUD BOTTOM HEIGHT: 35,000 ft MSL

REMARKS:

Only individual island dose rates are available. These were obtained from Radiological Safety organization helicopter surveys at H+4 hours. The helicopter survey technique called for the pilot either to land the aircraft at the desired spot, so that a ground reading could be obtained, or to make a slow pass over the desired spot at an elevation of 25 feet. Readings taken at 25 feet were multiplied by a factor of 2 in order to obtain a reasonable approximation of the true ground reading. The basic instrument used in the aerial surveys was the AN/PDR-39 survey meter modified to read up to 500 r/hr. The  $t^{-1.2}$  decay approximation was used to extrapolate the H+4 hour dose-rate readings to H+1 hour.

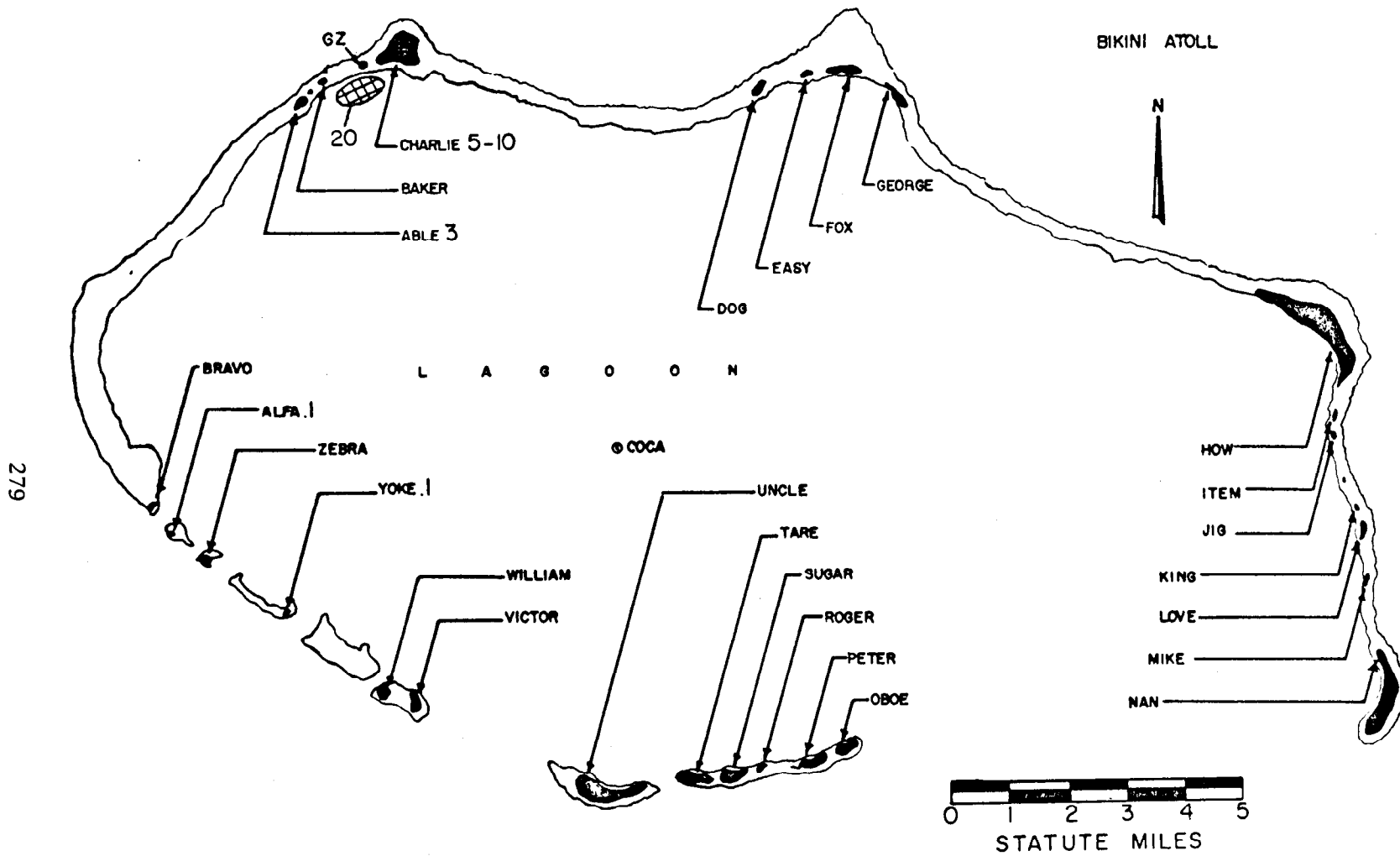


Figure 161. Operation HARDTACK I - Cedar.  
Island dose rates in r/hr at H+1 hour.

TABLE 58 BIKINI WIND DATA FOR OPERATION HARDTACK I -

CEDAR

Altitude (MSL) feet	H+ $\frac{1}{2}$ hour		H+6 $\frac{1}{2}$ hours		H+9 $\frac{1}{2}$ hours	
	Dir degrees	Speed mph	Dir degrees	Speed mph	Dir degrees	Speed mph
Surface	080	18	090	16	090	18
1,000	090	26	110	17	080	22
2,000	100	29	100	23	090	25
3,000	110	30	080	28	090	26
4,000	110	29	100	25	100	28
5,000	110	28	090	25	100	26
6,000	110	24	080	24	100	25
7,000	100	24	080	23	070	24
8,000	100	25	080	28	100	22
9,000	100	21	090	30	110	26
10,000	090	20	090	30	100	28
12,000	080	16	090	21	120	21
14,000	060	13	070	21	080	21
15,000	(040)	(13)	(070)	(20)	(090)	(20)
16,000	030	13	070	20	100	20
18,000	350	03	050	17	060	13
20,000	270	12	Calm	Calm	340	05
23,000	270	15	Calm	Calm	340	08
25,000	(250)	(16)	280	10	300	07
30,000	230	21	240	17	220	16
35,000	200	33	210	25	210	47
40,000	210	40	210	47	220	53
45,000	250	47	240	39	220	38
50,000	250	28	220	46	230	41
53,000	---	--	240	38	---	--
55,000	260	20	---	--	290	09
60,000	090	22	---	--	100	26
65,000	080	28	---	--	100	31

NOTES:

1. Numbers in parentheses are estimated values.
2. Wind data was taken on board ship within 30 nautical miles of the Tower at Nan island, Bikini Atoll.
3. Tropopause height was 51,000 ft MSL.
4. The surface air pressure was 14.65 psi, the temperature 28.4°C, the dew point 76.3°F, and the relative humidity 79%.

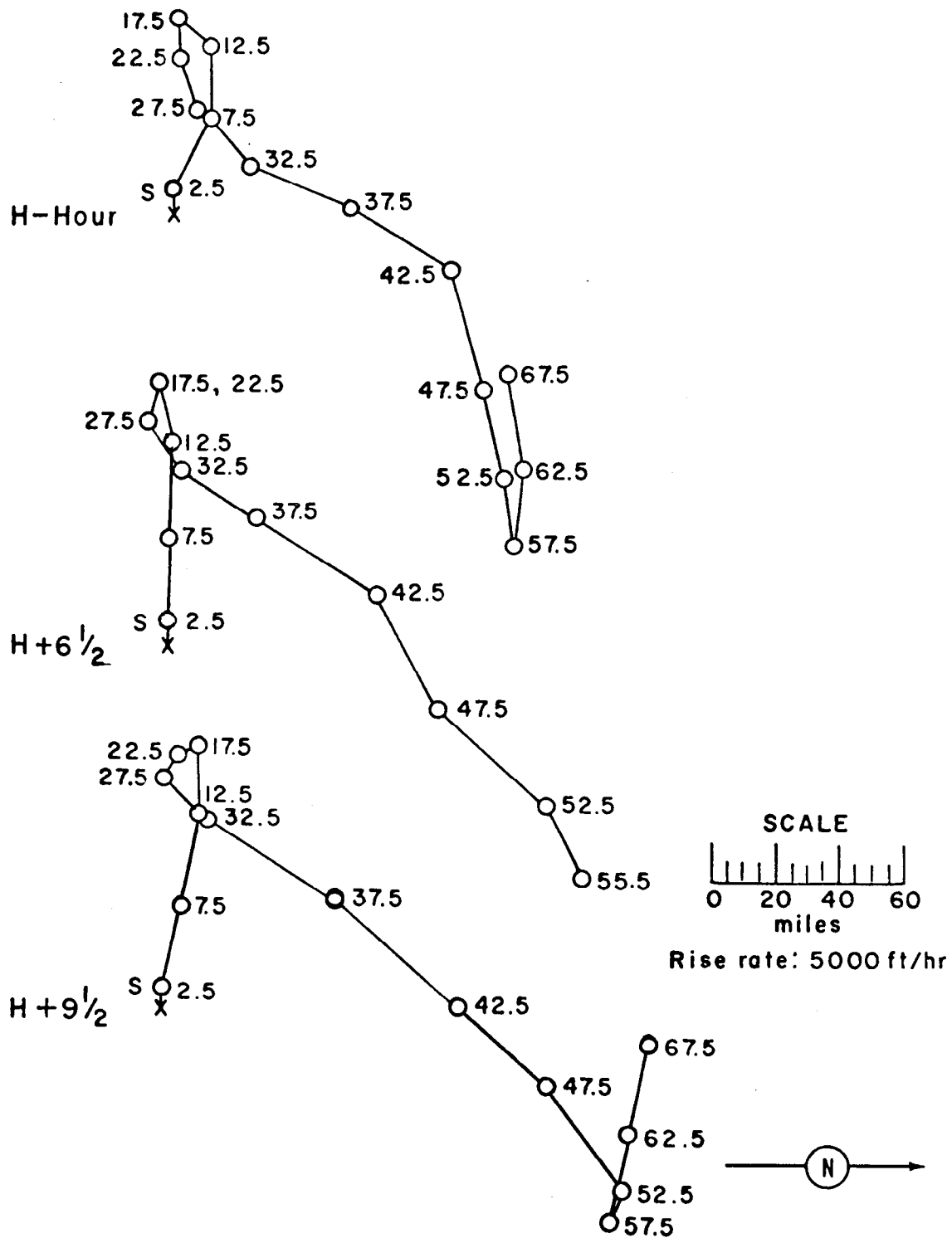


Figure 162. Hodographs for Operation HARDTACK I -

Cedar.

OPERATION HARDTACK I -

Dogwood

	<u>PPG Time</u>	<u>GMT</u>
<u>DATE:</u>	6 July 1958	5 July 1958
<u>TIME:</u>	0630	1830

Sponsor: UCRL

SITE: PPG - Eniwetok - SW of  
Janet 4,000 ft to nearest  
edge of island (Sta. 1312)  
11° 39' 48" N  
162° 13' 48" E

HEIGHT OF BURST: 12.25 ft

TYPE OF BURST AND PLACEMENT:

Surface burst from barge  
on water

CLOUD TOP HEIGHT: 58,000 ft MSL  
CLOUD BOTTOM HEIGHT: 35,000 ft MSL

REMARKS:

Only individual island dose rates are available. These were obtained from Radiological Safety organization helicopter surveys at H+4 hours. The helicopter survey technique called for the pilot either to land the aircraft at the desired spot, so that a ground reading could be obtained, or to make a slow pass over the desired spot at an elevation of 25 feet. Readings taken at 25 feet were multiplied by a factor of 2 in order to obtain a reasonable approximation of the true ground reading. The basic instrument used in the aerial surveys was the AN/PDR-39 survey meter modified to read up to 500 r/hr. The  $t^{-1.2}$  decay approximation was used to extrapolate the H+4 hour dose-rate readings to H+1 hour.

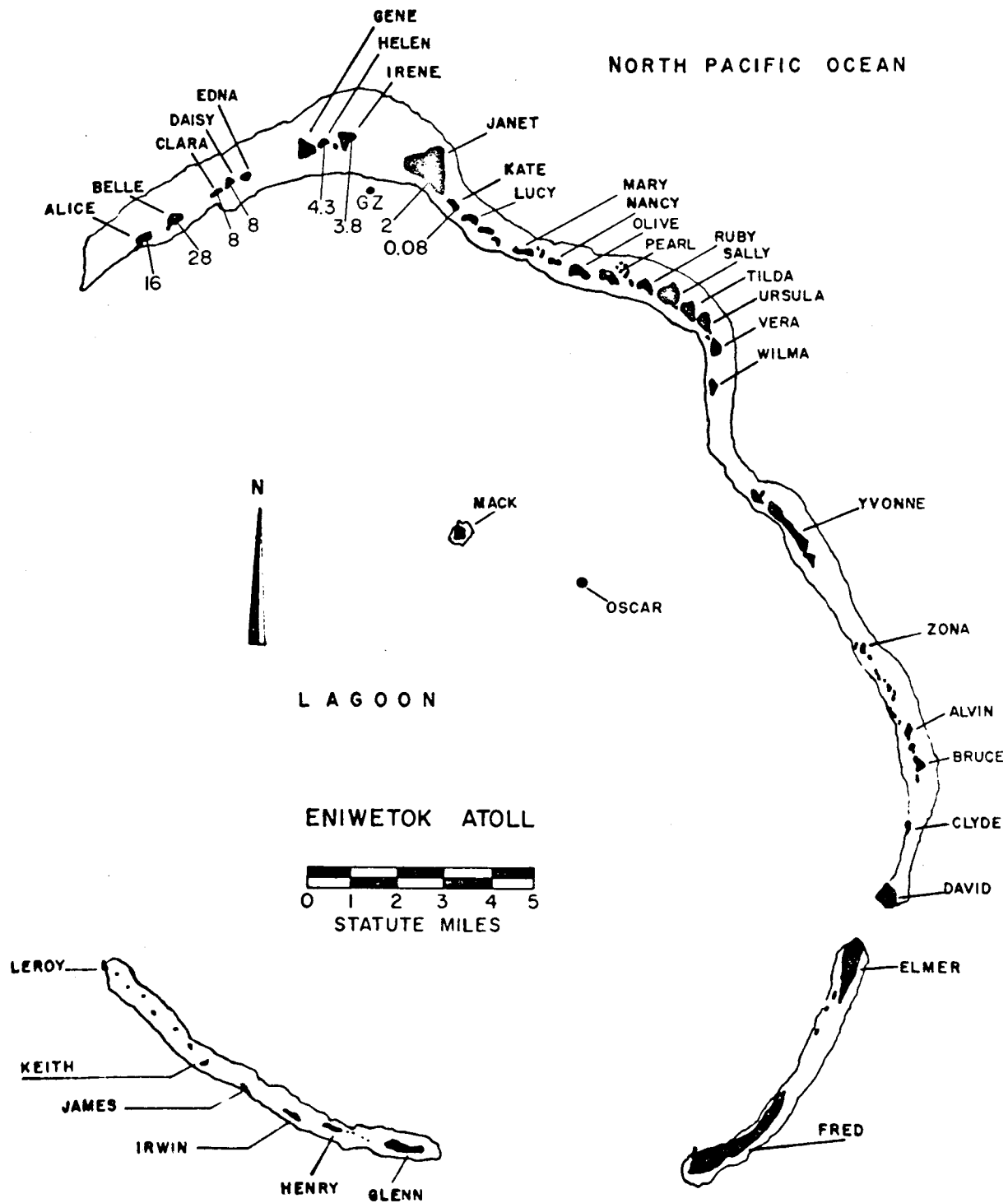


Figure 163. Operation HARDTACK I - Dogwood.  
Island dose rates in r/hr at H+1 hour.

TABLE 59 ENIWETOK WIND DATA FOR OPERATION HARDTACK I -

DOGWOOD

Altitude (MSL) feet	H- $\frac{1}{2}$ hour		H+ $\frac{1}{2}$ hours		H+ $\frac{1}{2}$ hours	
	Dir degrees	Speed mph	Dir degrees	Speed mph	Dir degrees	Speed mph
Surface	090	18	090	18	080	16
1,000	080	20	080	17	080	16
2,000	080	24	090	20	070	18
3,000	090	25	100	17	070	21
4,000	090	24	100	15	080	21
5,000	090	20	100	15	080	16
6,000	090	17	100	15	090	14
7,000	080	20	100	14	090	15
8,000	080	17	080	14	090	15
9,000	070	18	080	17	080	14
10,000	080	20	090	17	090	14
12,000	100	16	090	18	100	14
14,000	100	14	100	20	120	17
15,000	(100)	(17)	(100)	(20)	(130)	(16)
16,000	100	21	110	22	150	15
18,000	100	22	110	21	120	22
20,000	100	18	110	17	120	20
23,000	100	12	100	23	110	26
25,000	100	12	090	24	100	29
30,000	120	21	080	30	140	20
35,000	130	18	160	18	160	21
40,000	190	38	180	22	160	25
45,000	210	40	200	29	140	38
50,000	280	15	250	21	240	15
55,000	290	17	160	09	240	05
60,000	030	10	090	18	080	20
65,000	050	22	090	24	---	--
70,000	050	44	090	38	---	--
75,000	050	40	100	40	---	--
80,000	---	--	100	54	---	--
85,000	---	--	100	59	---	--
90,000	---	--	090	76	---	--
95,000	---	--	100	92	---	--
100,000	---	--	100	101	---	--
105,000	---	--	090	234	---	--

## NOTES:

1. Numbers in parentheses are estimated values.
2. Wind data was taken by the Eniwetok weather station.
3. Tropopause height was 52,000 ft MSL.
4. The surface air pressure was 14.63 psi, the temperature 27.4°C, the dew point 77°F, and the relative humidity 85%.



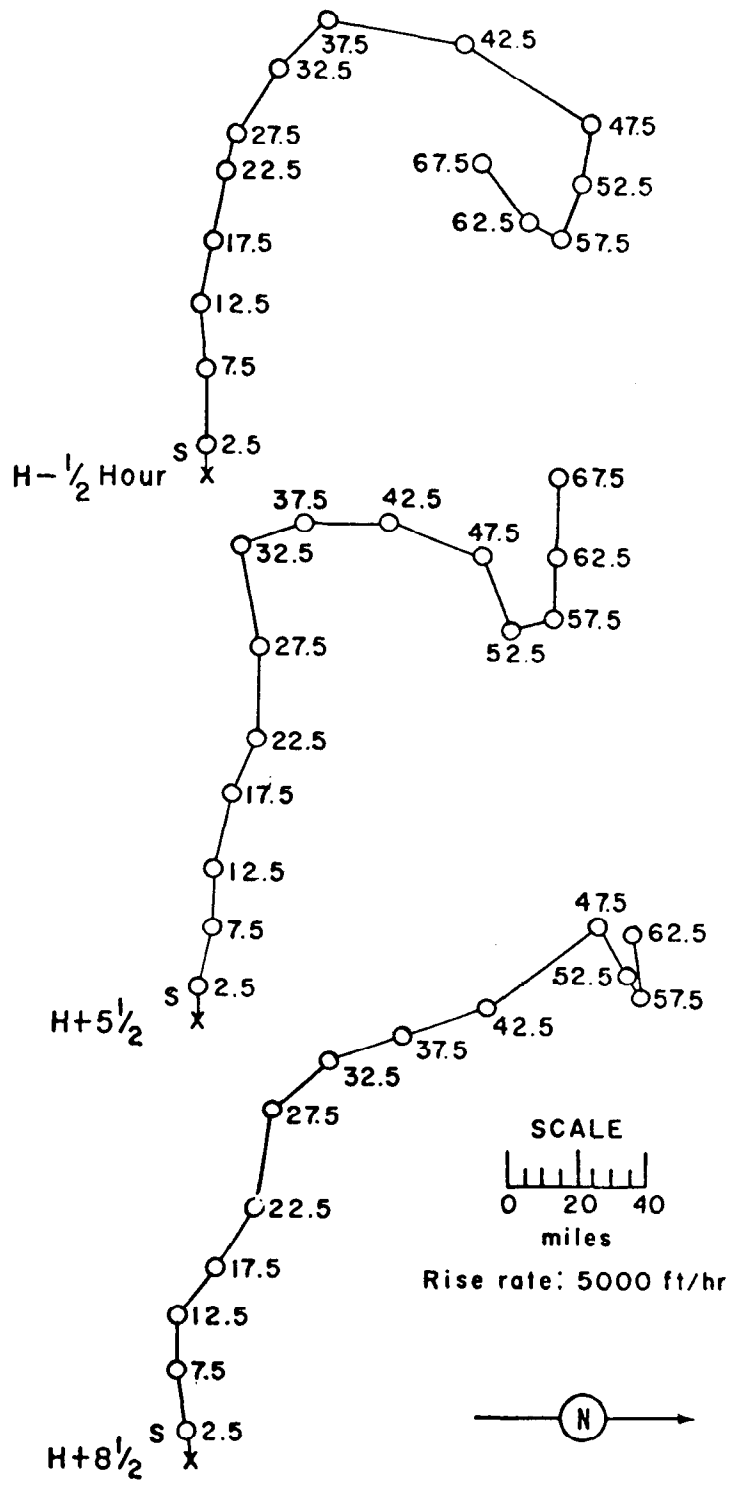


Figure 164. Hodographs for Operation HARDTACK I -

Dogwood.

OPERATION HARDTACK I -

Poplar

	<u>PPG Time</u>	<u>GMT</u>
<u>DATE:</u>	12 July 1958	12 July 1958
<u>TIME:</u>	1530	0330

Sponsor: UCRL

SITE: PPG - Bikini - SW of  
Charlie, 7,500 ft from  
the nearest edge of island  
11° 41' 17" N  
165° 15' 52" E  
Site elevation: Sea level

HEIGHT OF BURST: 11.66 ft

TYPE OF BURST AND PLACEMENT:  
Surface burst from barge on  
water over reef

CLOUD TOP HEIGHT: > 61,000 ft MSL  
CLOUD BOTTOM HEIGHT: 42,000 ft MSL

REMARKS:

Only individual island dose rates are available. These were obtained from the Radiological Safety organization helicopter surveys at H+4 hours. The helicopter survey technique called for the pilot either to land the aircraft at the desired spot, so that a ground reading could be obtained, or to make a slow pass over the desired spot at an elevation of 25 feet. Readings taken at 25 feet were multiplied by a factor of 2 in order to obtain a reasonable approximation of the true ground reading. The basic instrument used in the aerial surveys was the AN/PDR-39 survey meter modified to read up to 500 r/hr. The  $t^{-1.2}$  decay approximation was used to extrapolate the H+4 hour dose rate readings to H+1 hour.

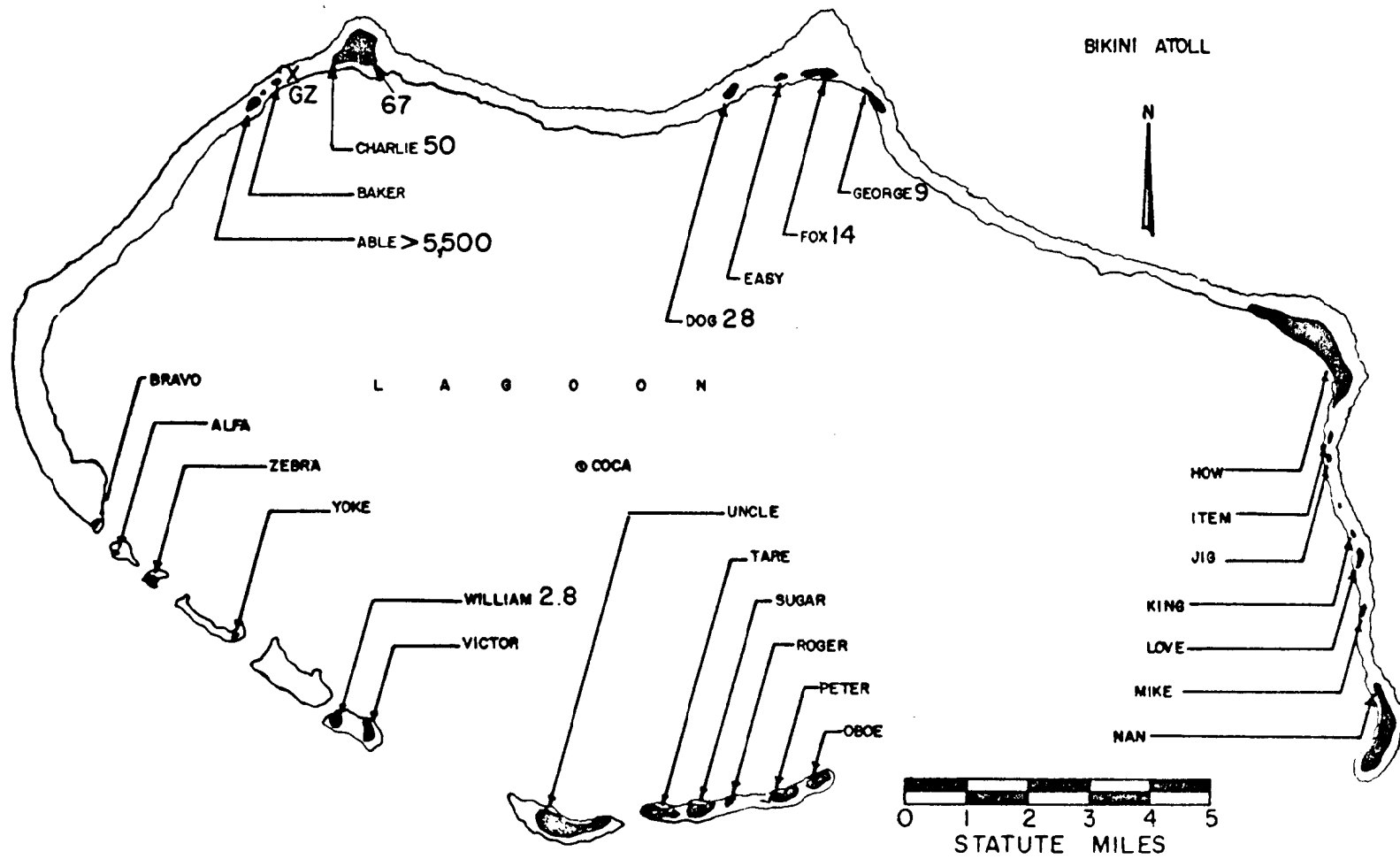


Figure 165. Operation HARDTACK I - Poplar.  
Island dose rates in r/hr at H+1 hour.

TABLE 60 BIKINI WIND DATA FOR OPERATION HARDEACK I -

POLAR

Altitude (MSL) feet	H+ $\frac{1}{2}$ hour		H+ $\frac{3}{2}$ hours	
	Dir degrees	Speed mph	Dir degrees	Speed mph
Surface	060	14	070	18
1,000	070	22	070	21
2,000	060	24	080	24
3,000	060	22	080	22
4,000	060	22	080	20
5,000	050	22	090	15
6,000	060	21	090	14
7,000	070	18	080	17
8,000	070	14	080	20
9,000	070	07	070	21
10,000	060	13	070	24
12,000	080	22	070	26
14,000	100	18	090	21
15,000	(100)	(15)	(100)	(21)
16,000	110	13	100	21
18,000	120	16	120	16
20,000	150	12	110	16
23,000	220	07	100	16
25,000	260	08	110	14
30,000	---	--	210	09
35,000	---	--	210	16
40,000	---	--	210	17
45,000	---	--	130	21
50,000	---	--	210	31
55,000	---	--	180	12
60,000	---	--	090	25
65,000	---	--	090	24
70,000	---	--	090	36
72,000	---	--	080	47

## NOTES:

1. Numbers in parentheses are estimated values.
2. Weather observations were made using the standard rawinsonde system on Nan Island (Bikini Atoll) adjacent to the Nan Tower. Additional data was taken on board destroyers.
3. Tropopause height was 55,000 ft MSL.
4. The surface air pressure was 14.62 psi, the temperature 27.9°C, the dew point 81.9°F, and the relative humidity 99%.

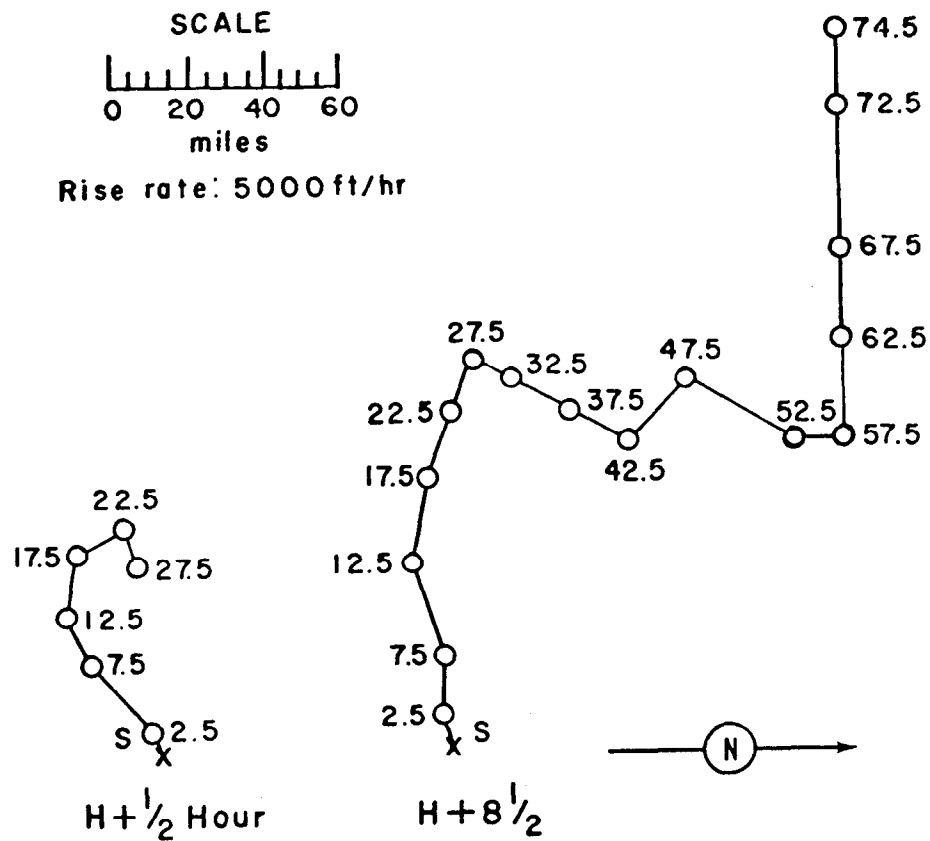


Figure 166. Hodographs for Operation HARDTACK I -

Poplar.

OPERATION HARDTACK I -

Scaevola

	<u>PPG Time</u>	<u>GMT</u>
<u>DATE:</u>	14 July 1958	14 July 1958
<u>TIME:</u>	1600	0400

Sponsor: LASL

SITE: PPG - Eniwetok - Off  
Yvonne  
11° 33' 15" N  
162° 21' 24" E  
Site elevation: Sea level

HEIGHT OF BURST: 20 ft

CLOUD TOP HEIGHT: NM  
CLOUD BOTTOM HEIGHT: NM

TYPE OF BURST AND PLACEMENT:  
Surface burst from barge  
on water

REMARKS:  
No fallout.

OPERATION HARDEACK I -

Pisonia

	<u>PPG Time</u>	<u>GMT</u>
<u>DATE:</u>	18 July 1958	17 July 1958
<u>TIME:</u>	1100	2300

Sponsor: IASL

SITE: PPG - Eniwetok - 11,000 ft  
W of Yvonne  
11° 33' N  
162° 19' 43" E  
Site elevation: Sea level

HEIGHT OF BURST: 6.5 ft

TYPE OF BURST AND PLACEMENT:  
Surface burst from barge on  
water

CLOUD TOP HEIGHT: 55,000 ft MSL  
CLOUD BOTTOM HEIGHT: NM

REMARKS:

Only individual island dose rates are available. These were obtained from Radiological Safety organization helicopter surveys at H+4 hours. The helicopter survey technique called for the pilot either to land the aircraft at the desired spot, so that a ground reading could be obtained, or to make a slow pass over the desired spot at an elevation of 25 feet. Readings taken at 25 feet were multiplied by a factor of 2 in order to obtain a reasonable approximation of the true ground reading. The basic instrument used in the aerial surveys was the AN/PDR-39 survey meter modified to read up to 500 r/hr. The  $t^{-1.2}$  decay approximation was used to extrapolate the H+4 hour dose-rate readings to H+1 hour.

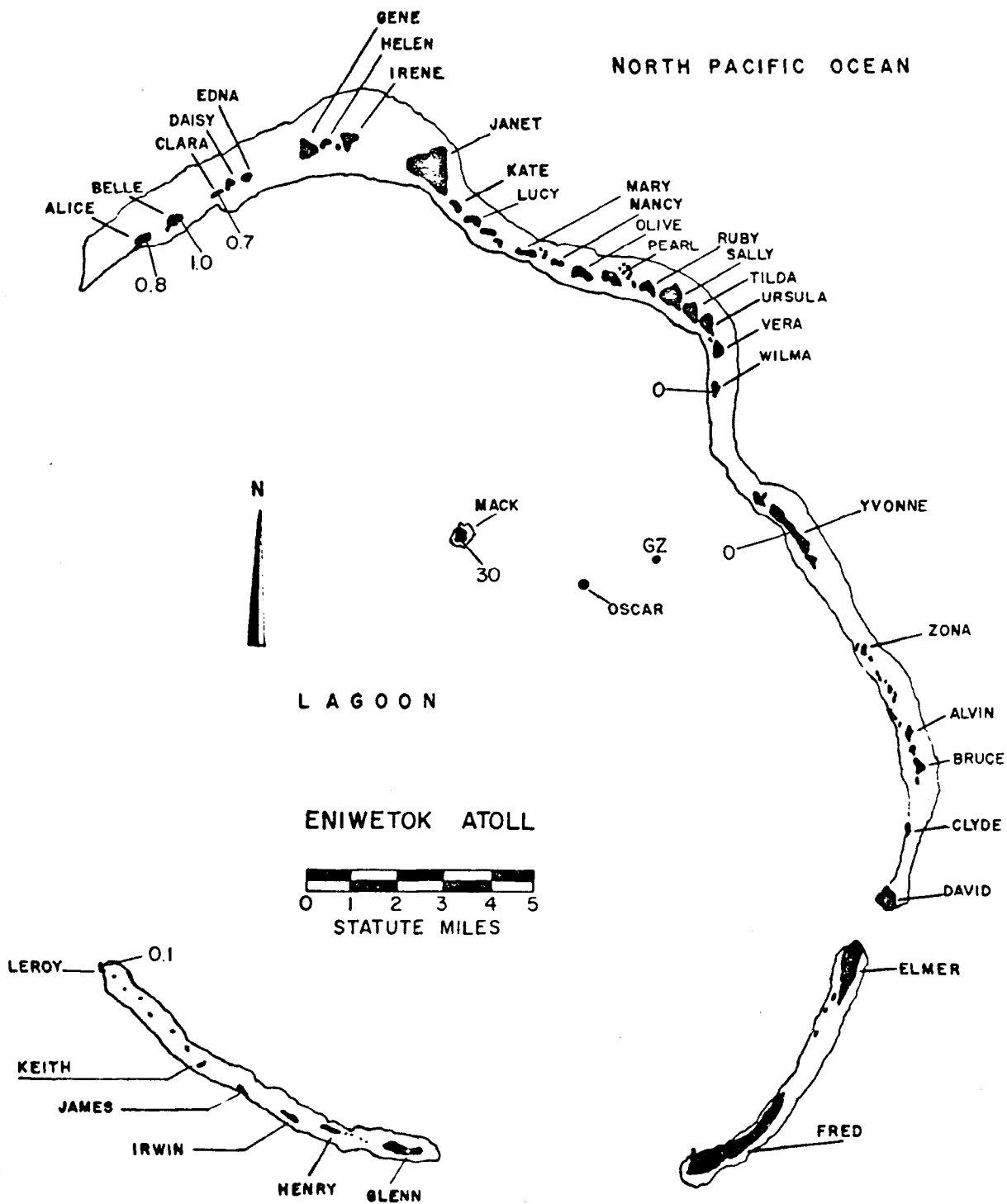


Figure 167. Operation HARDTACK I - Pisonia.  
Island dose rates in r/hr at H+1 hour.



TABLE 61 ENIWETOK WIND DATA FOR HARDEACK I -

PISONIA

Altitude (MSL) feet	H+1 hour		H+6 hours		H+13 hours	
	Dir degrees	Speed mph	Dir degrees	Speed mph	Dir degrees	Speed mph
Surface	Calm	Calm	330	09	070	14
1,000	180	09	030	05	070	22
2,000	170	10	090	09	070	20
3,000	160	14	090	12	080	17
4,000	140	17	100	13	090	15
5,000	130	14	120	14	110	15
6,000	130	12	140	16	120	14
7,000	130	14	150	17	130	10
8,000	120	10	150	18	120	10
9,000	120	08	150	20	110	14
10,000	120	13	150	17	120	18
12,000	110	12	130	13	110	14
14,000	100	09	100	12	090	14
15,000	(100)	(08)	(080)	(13)	(080)	(14)
16,000	090	07	070	15	070	14
18,000	120	17	110	05	090	09
20,000	120	14	120	02	100	05
23,000	080	18	090	14	140	09
25,000	060	15	090	17	120	12
30,000	060	22	060	15	090	07
35,000	050	21	040	17	060	07
40,000	070	09	050	12	090	09
45,000	040	20	040	06	040	06
50,000	050	12	050	15	130	10
55,000	100	12	210	05	130	12
60,000	110	22	120	30	110	20
65,000	090	31	090	39	090	44
70,000	090	52	090	38	090	45
75,000	090	55	100	51	090	54
80,000	090	67	100	61	090	76
85,000	100	68	090	78	090	80
90,000	090	82	090	87	---	--
95,000	090	75	090	98	---	--
100,000	090	97	090	83	---	--
101,000	---	--	090	76	---	--
105,000	090	101	---	--	---	--

**NOTES:**

1. Numbers in parentheses are estimated values.
2. Wind data was taken by the Eniwetok weather station.
3. The surface air pressure was 14.67 psi, the temperature 26.8°C, the dew point 74.9°F, and the relative humidity 83%.

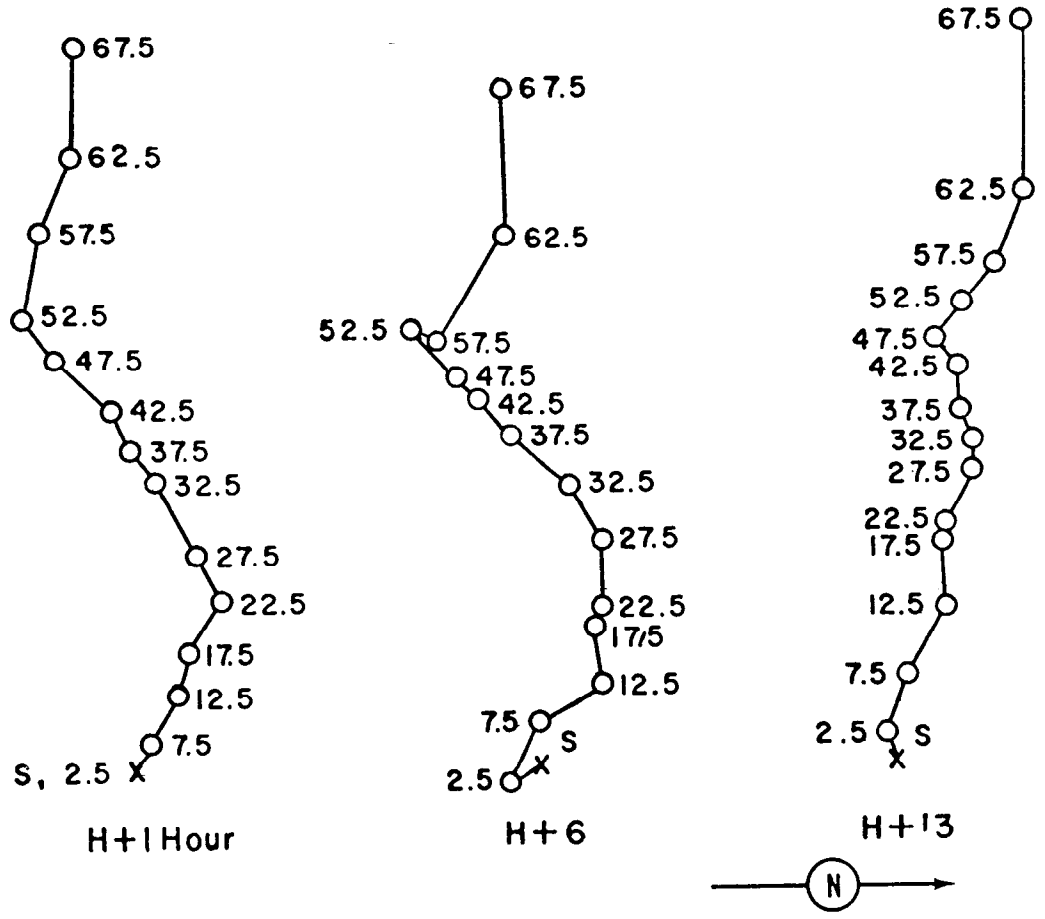
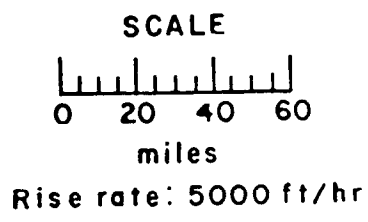


Figure 168. Hodographs for Operation HARDTACK I - Pisonia.

OPERATION HARDTACK I -

Juniper

	<u>PPG Time</u>	<u>GMT</u>
<u>DATE:</u>	22 July 1958	22 July 1958
<u>TIME:</u>	1620	0420

Sponsor: UCRL

SITE: PPG - Bikini - 4,000 ft  
from west end of Tare  
11° 29' 46" N  
165° 22' 15" E  
Site elevation: Sea level

HEIGHT OF BURST: 12.11 ft

TYPE OF BURST AND PLACEMENT:

Surface burst from barge  
on water

CLOUD TOP HEIGHT: 40,000 ft MSL  
CLOUD BOTTOM HEIGHT: 24,000 ft MSL

REMARKS:

Only individual island dose rates are available. These were obtained from Radiological Safety organization helicopter surveys at H+4 hours. The helicopter survey technique called for the pilot either to land the aircraft at the desired spot, so that a ground reading could be obtained, or to make a slow pass over the desired spot at an elevation of 25 feet. Readings taken at 25 feet were multiplied by a factor of 2 in order to obtain a reasonable approximation of the true ground reading. The basic instrument used in the aerial surveys was the AN/PDR-39 survey meter modified to read up to 500 r/hr. The  $t^{-1.2}$  decay approximation was used to extrapolate the H+4 hour dose-rate readings to H+1 hour.

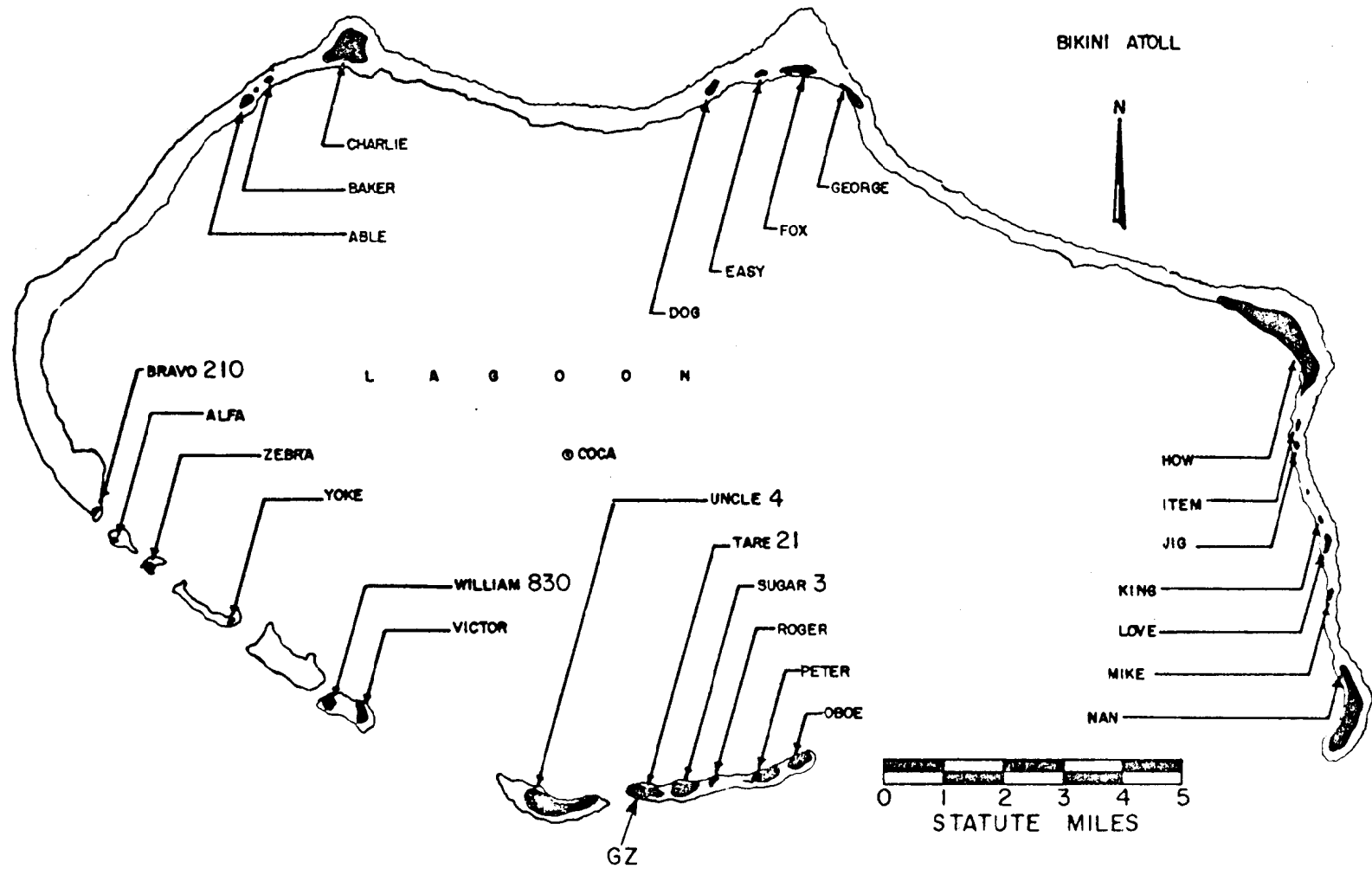


Figure 169. Operation HARDTACK I - Juniper.  
Island dose rates in r/hr at H+1 hour.

TABLE 62 BIKINI WIND DATA FOR OPERATION HARDTACK I -

JUNIPER

Altitude (MSL) feet	H+ $\frac{1}{2}$ hour		H+7 $\frac{1}{2}$ hours		H+15 $\frac{1}{2}$ hours	
	Dir degrees	Speed mph	Dir degrees	Speed mph	Dir degrees	Speed mph
Surface	080	16	100	09	110	07
1,000	080	18	100	16	110	13
2,000	090	20	100	16	120	14
3,000	100	21	110	17	120	14
4,000	100	21	110	17	120	14
5,000	100	20	110	17	110	15
6,000	110	18	110	18	110	17
7,000	110	16	100	20	110	20
8,000	110	13	090	18	100	18
9,000	110	09	090	17	100	15
10,000	110	10	080	16	100	15
12,000	120	13	090	16	100	16
14,000	120	16	090	16	100	16
15,000	(120)	(15)	(090)	(17)	(100)	(16)
16,000	130	14	100	18	100	16
18,000	130	15	100	15	100	13
20,000	130	18	110	18	090	12
23,000	130	21	120	20	100	10
25,000	140	22	140	09	100	09
30,000	140	16	150	07	080	06
35,000	150	12	300	02	260	12
40,000	310	12	310	14	330	10
45,000	090	10	070	13	300	13
50,000	120	12	120	09	050	09
55,000	230	07	320	03	060	07
60,000	080	31	090	38	090	36
65,000	090	36	080	32	---	--
70,000	100	48	080	38	---	--
75,000	090	51	090	41	---	--
80,000	080	63	080	63	---	--
85,000	090	67	090	79	---	--
90,000	080	67	090	98	---	--
95,000	080	76	090	121	---	--
100,000	090	78	---	--	---	--
105,000	090	80	---	--	---	--

## NOTES:

1. Numbers in parentheses are estimated values.
2. Weather observations were made using the standard rawinsonde system on Nan Island (Bikini Atoll) adjacent to the Nan Tower. Additional data was taken on board destroyers.
3. Tropopause height was 51,000 ft MSL.
4. The surface air pressure was 14.64 psi, the temperature 30.8°C, the dew point 78.9°F, and the relative humidity 76%.

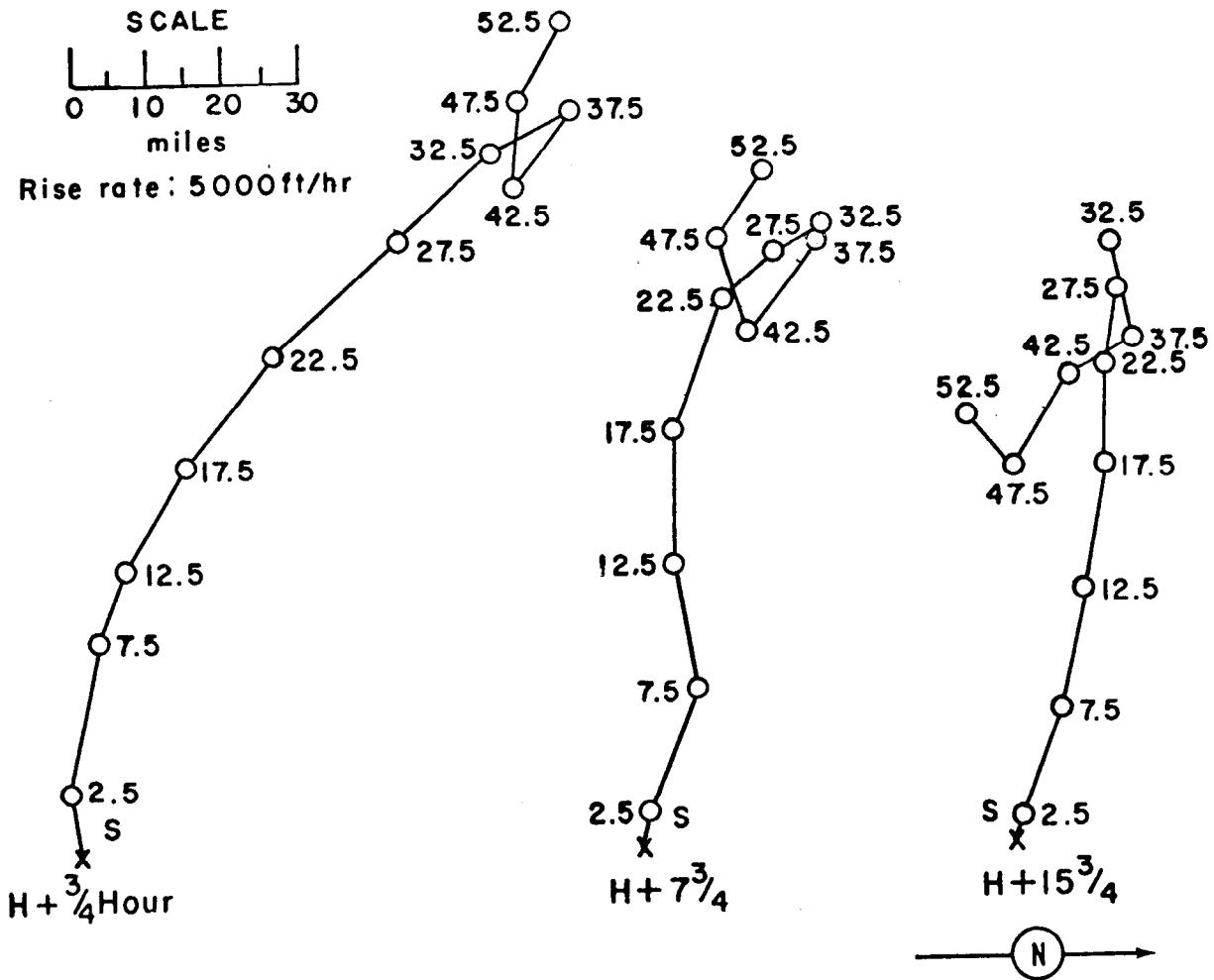


Figure 170. Hodographs for Operation HARDTACK I -

Juniper.

OPERATION HARDTACK I -

Olive

	<u>PPG Time</u>	<u>GMT</u>
<u>DATE:</u>	23 July 1958	22 July 1958
<u>TIME:</u>	0830	2030

Sponsor: UCRL

SITE: PPG - Eniwetok - SW of Janet, 4,000 ft from the nearest edge of island (Sta. 1312)  
11° 39' 48" N  
162° 13' 48" E  
Site elevation: Sea level

HEIGHT OF BURST: 8.0 ft

CLOUD TOP HEIGHT: 50,000 ft MSL  
CLOUD BOTTOM HEIGHT: 15,000 ft MSL

TYPE OF BURST AND PLACEMENT:  
Surface burst from barge on water

REMARKS:

Only individual dose rates are available. These were obtained from Radiological Safety organization helicopter surveys at H+4 hours. The helicopter survey technique called for the pilot either to land the aircraft at the desired spot, so that a ground reading could be obtained, or to make a slow pass over the desired spot at an elevation of 25 feet. Readings taken at 25 feet were multiplied by a factor of 2 in order to obtain a reasonable approximation of the true ground reading. The basic instrument used in the aerial surveys was the AN/PDR-39 survey meter modified to read up to 500 r/hr. The  $t^{-1.2}$  decay approximation was used to extrapolate the H+4 hour dose-rate readings to H+1 hour.

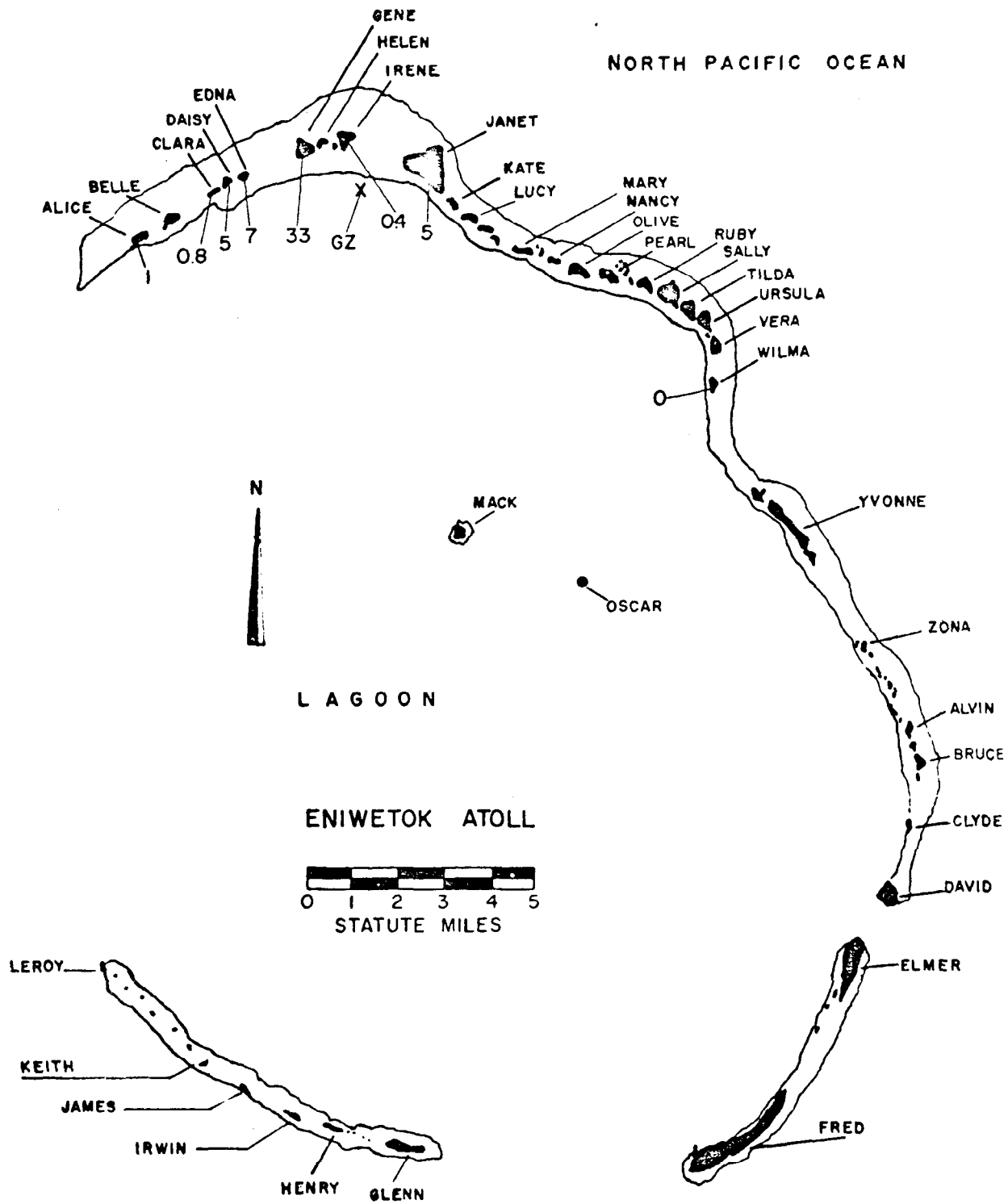


Figure 171. Operation HARDTACK I - Olive.  
Island dose rates in r/hr at H+1 hour.



TABLE 63 ENIWETOK WIND DATA FOR OPERATION HARDTACK I -

OLIVE

Altitude (MSL) feet	H-2½ hours		H-hour		H+3½ hours		H+9½ hours	
	Dir degrees	Speed mph	Dir degrees	Speed mph	Dir degrees	Speed mph	Dir degrees	Speed mph
Surface	310	18	230	18	130	18	160	21
1,000	130	25	130	23	120	20	140	15
2,000	130	32	130	29	130	24	150	17
3,000	130	29	130	26	140	22	150	21
4,000	130	26	140	24	150	20	150	21
5,000	130	26	140	24	150	20	160	21
6,000	130	26	140	24	150	22	160	20
7,000	120	29	130	28	140	26	160	17
8,000	120	29	130	29	140	28	140	17
9,000	120	26	130	25	140	24	140	16
10,000	120	23	130	23	140	22	140	16
12,000	110	23	120	23	130	22	140	20
14,000	120	24	120	24	130	24	130	20
15,000	---	--	(120)	(23)	(130)	(22)	(140)	(18)
16,000	120	23	120	22	130	20	140	18
18,000	---	--	---	--	150	23	140	20
20,000	120	21	130	23	140	26	130	20
23,000	140	17	140	17	130	17	130	20
25,000	140	24	140	18	140	12	130	18
30,000	150	15	150	14	150	12	110	15
35,000	190	17	180	17	160	17	150	10
40,000	180	13	180	15	180	17	200	09
45,000	140	10	140	14	130	18	100	10
50,000	050	07	090	07	150	07	320	12
55,000	040	15	070	15	100	14	090	26
60,000	100	33	100	32	100	31	120	25
65,000	070	33	080	37	100	41	090	38
70,000	---	--	---	--	110	38	090	38
75,000	---	--	---	--	090	52	090	59
80,000	---	--	---	--	100	70	100	67
85,000	---	--	---	--	100	74	090	67
90,000	---	--	---	--	090	82	090	89
91,000	---	--	---	--	---	--	090	92
94,000	---	--	---	--	090	90	---	--

## NOTES:

1. Numbers in parentheses are estimated values.
2. Wind data was taken by the Eniwetok weather station.
3. Tropopause height was 48,000 ft MSL.
4. H-hour values were interpolated from H-2½ hours and H+3½ hours data.
5. The surface air pressure was 14.64 psi, the temperature 26.4°C, the dew point 76°F, and the relative humidity 89%.

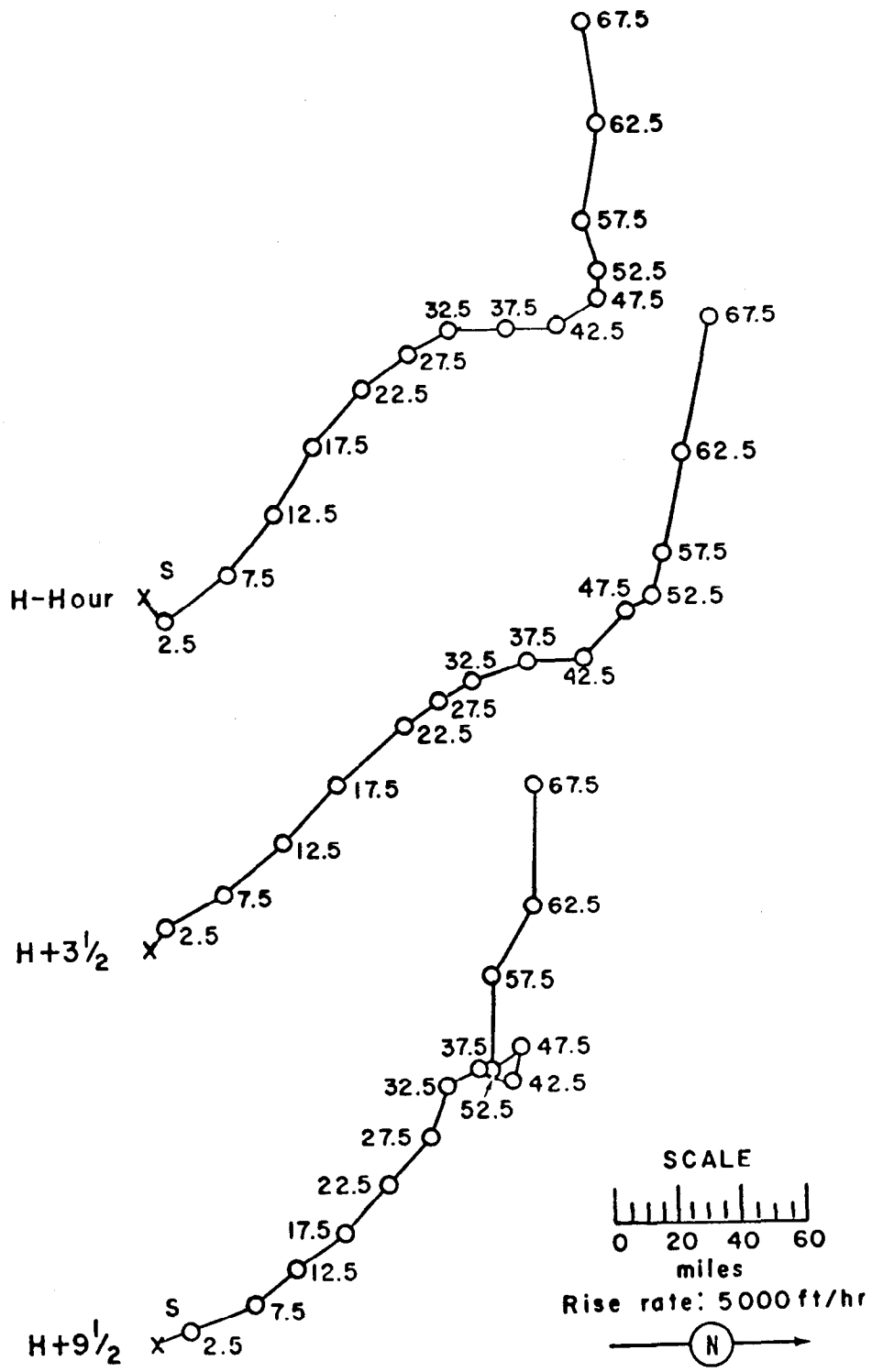


Figure 172. Hodographs for Operation HARDTACK I - Olive.

OPERATION HARDTACK I -

Pine

	<u>PPG Time</u>	<u>GMT</u>
<u>DATE:</u>	27 July 1958	26 July 1958
<u>TIME:</u>	0830	2030

Sponsor: UCRL

SITE: PPG - Eniwetok - SW of Janet, 8,000 ft to nearest edge of island  
11° 39' 22" N  
162° 13' 11" E  
Site elevation: Sea level

HEIGHT OF BURST: 8.0 ft

TYPE OF BURST AND PLACEMENT:

Surface burst from barge on water

CLOUD HEIGHT: Not available

REMARKS:

Only individual island dose rates are available. These were obtained from the Radiological Safety organization helicopter surveys at H+4 hours. The helicopter survey technique called for the pilot either to land the aircraft at the desired spot, so that a ground reading could be obtained, or to make a slow pass over the desired spot at an elevation of 25 feet. Readings taken at 25 feet were multiplied by a factor of 2 in order to obtain a reasonable approximation of the true ground reading. The basic instrument used in the aerial surveys was the AN/PDR-39 survey meter modified to read up to 500 r/hr. The  $t^{-1.2}$  decay approximation was used to extrapolate the H+4 hour dose-rate readings to H+1 hour.

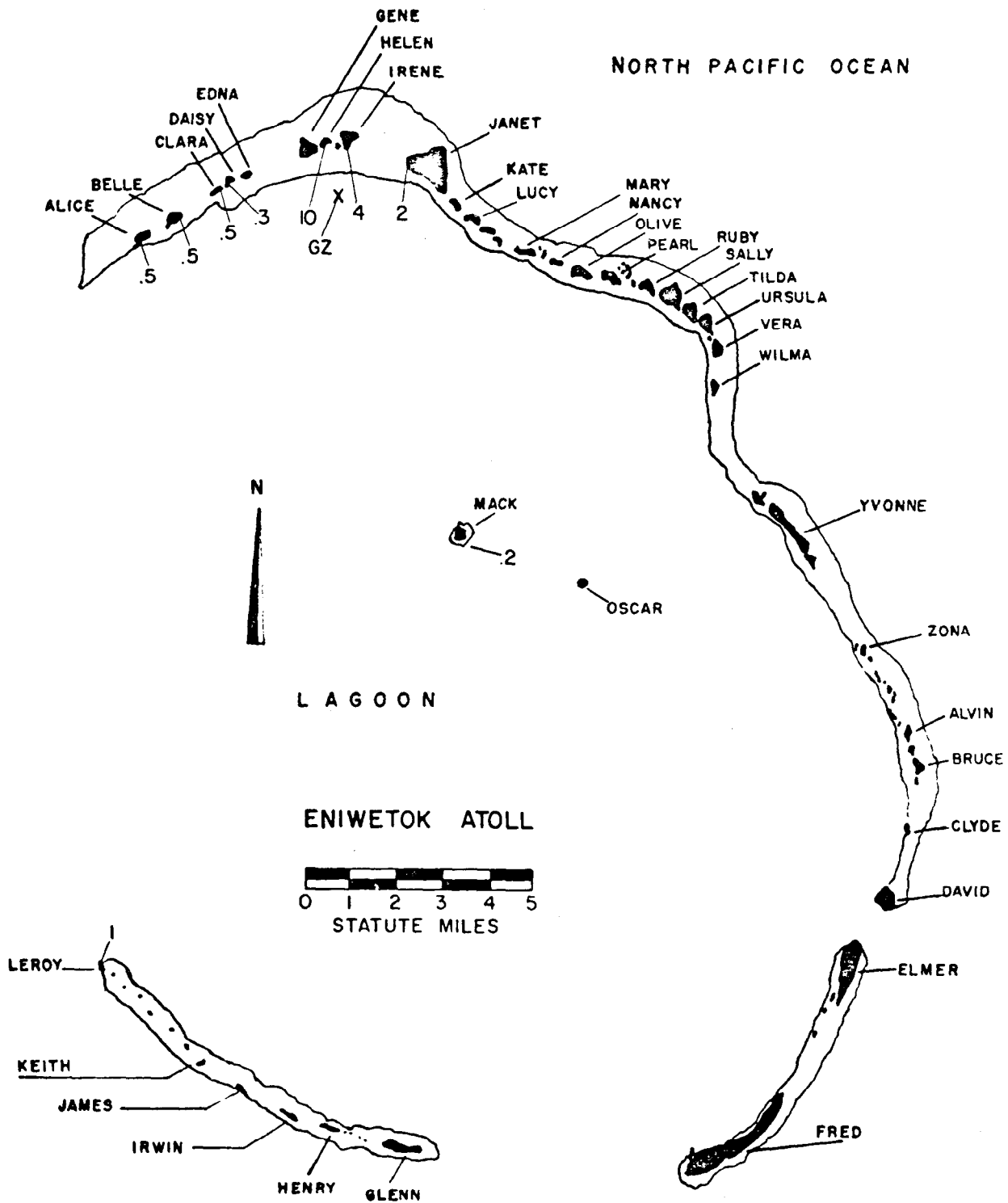


Figure 173. Operation HARDTACK I - Pine. Island dose rates in r/hr at H+1 hour.

TABLE 64 ENIVETOK WIND DATA FOR OPERATION HARDTACK I -

PINE

Altitude (MSL) feet	H-1 hour		H+3 hours		H+9 hours	
	Dir degrees	Speed mph	Dir degrees	Speed mph	Dir degrees	Speed mph
Surface	200	18	230	12	200	05
1,000	210	17	---	--	190	08
2,000	200	17	---	--	240	07
3,000	200	17	---	--	240	12
4,000	200	17	---	--	220	13
5,000	200	12	220	07	210	13
6,000	190	12	180	09	220	13
7,000	170	05	170	10	220	13
8,000	200	05	170	09	210	12
9,000	200	05	180	09	200	12
10,000	200	05	180	10	200	12
12,000	170	05	180	08	170	10
14,000	150	06	170	09	210	10
15,000	(140)	(05)	(140)	(05)	(210)	(06)
16,000	130	05	160	06	220	02
18,000	080	05	190	05	Calm	Calm
20,000	100	08	190	03	120	05
23,000	140	13	180	09	120	07
25,000	160	17	160	14	150	08
30,000	160	26	150	18	140	10
35,000	150	24	140	26	120	20
40,000	190	16	140	21	140	26
45,000	200	16	150	20	120	33
50,000	190	14	170	13	180	05
55,000	130	14	130	14	120	15
60,000	080	23	090	23	130	23
65,000	090	41	---	--	---	--
70,000	100	48	---	--	---	--
75,000	100	59	---	--	---	--
80,000	100	69	---	--	---	--
85,000	100	81	---	--	---	--
90,000	100	91	100	68	---	--
92,000	---	--	100	70	---	--
95,000	100	90	---	--	---	--
100,000	100	99	---	--	---	--
105,000	100	240	---	--	---	--
110,000	100	126	---	--	---	--
115,000	100	232	---	--	---	--

## NOTES:

1. Numbers in parentheses are estimated values.
2. Wind data was taken by the Eniwetok weather station.
3. Tropopause height was 52,000 ft MSL.
4. The surface air pressure was 14.64 psi, the temperature 26.7°C, the dew point 75.5°F, and the relative humidity 85%.

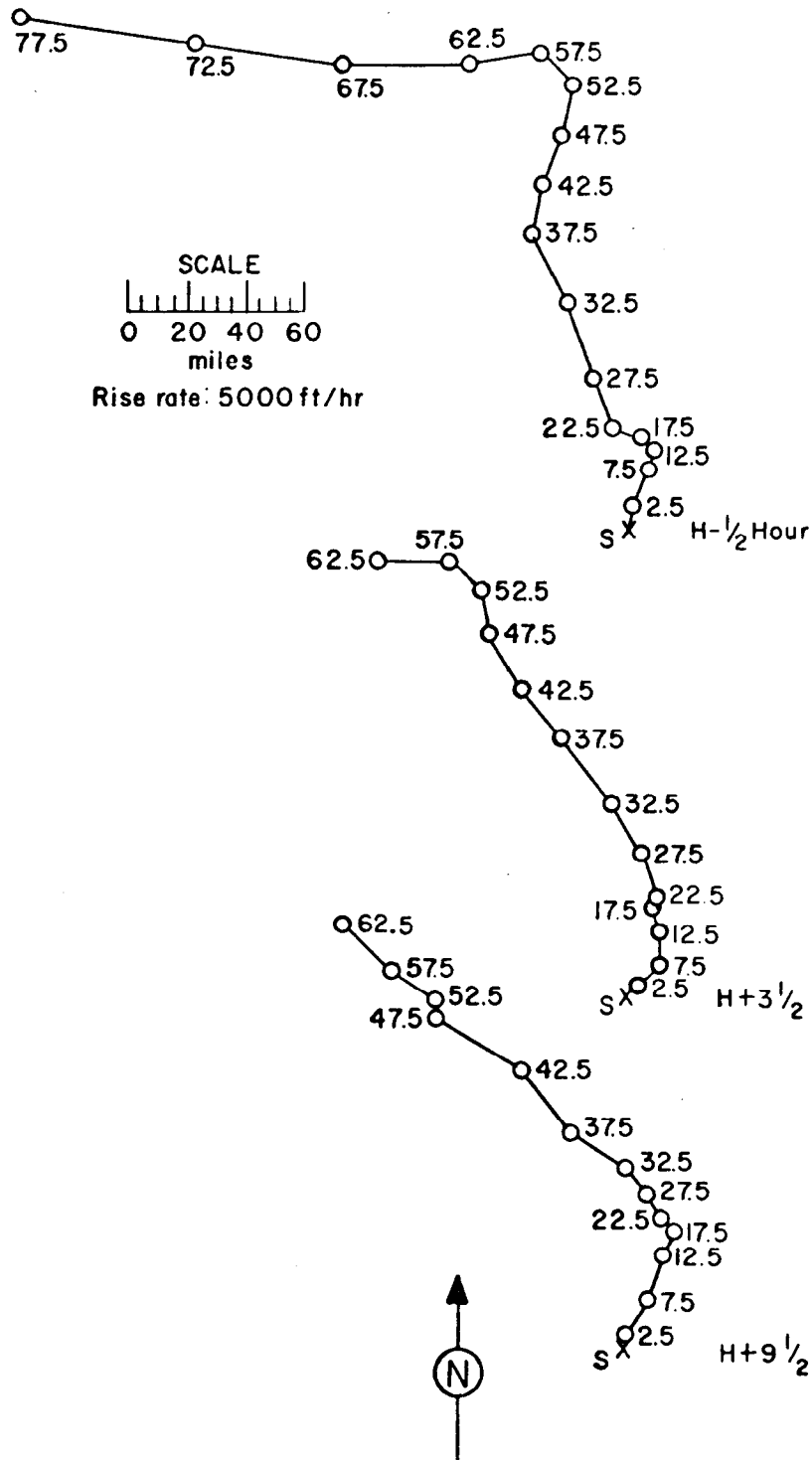


Figure 174. Hodographs for Operation HARDTACK I -

Pine.

OPERATION HARDTACK I - Teak

	<u>PPG Time</u>	<u>GMT</u>
<u>DATE:</u>	31 July 1958	31 July 1958
<u>TIME:</u>	2350	1050

Sponsor: DOD

SITE: PPG - Johnston Island  
16° 44' 38" N  
169° 32' 00" W

HEIGHT OF BURST: 250,000 ft

TYPE OF BURST AND PLACEMENT:

High altitude burst from  
Redstone missile over  
vicinity of Johnston Island.

REMARKS:

No local fallout.

CLOUD TOP HEIGHT: NM

CLOUD BOTTOM HEIGHT: NM

OPERATION HARDTACK I -

Quince

	<u>PPG Time</u>	<u>GMT</u>
<u>DATE:</u>	6 Aug 1958	6 Aug 1958
<u>TIME:</u>	1415	0215

Sponsor: UCRL - DOD

SITE: PPG - Eniwetok - Yvonne  
11° 33' 15" N  
162° 21' 24" E  
Site elevation: Sea level

HEIGHT OF BURST: 3 ft

TYPE OF BURST AND PLACEMENT:  
Surface burst from platform  
on coral soil

CLOUD TOP HEIGHT: 1,500 ft MSL  
CLOUD BOTTOM HEIGHT: NM

REMARKS:

Only alpha contamination resulted from this detonation. Surface alpha monitoring was conducted throughout the area on D and D+1 day with PAC-3G gas-flow proportional alpha counters. The readings were taken in counts per minute, corrected for the probe area, and multiplied by the appropriate shielding factors to compensate for the roughness of the surface monitored. The two isoconcentration lines shown are the most significant ones, since 3,500  $\mu\text{g}/\text{m}^2$  is the chronic hazard limit and any concentration in excess of 1,000  $\mu\text{g}/\text{m}^2$  requires decontamination. It is interesting to note that in the great majority of cases the alpha concentrations in the downwind area were higher on D+1 than on D day.



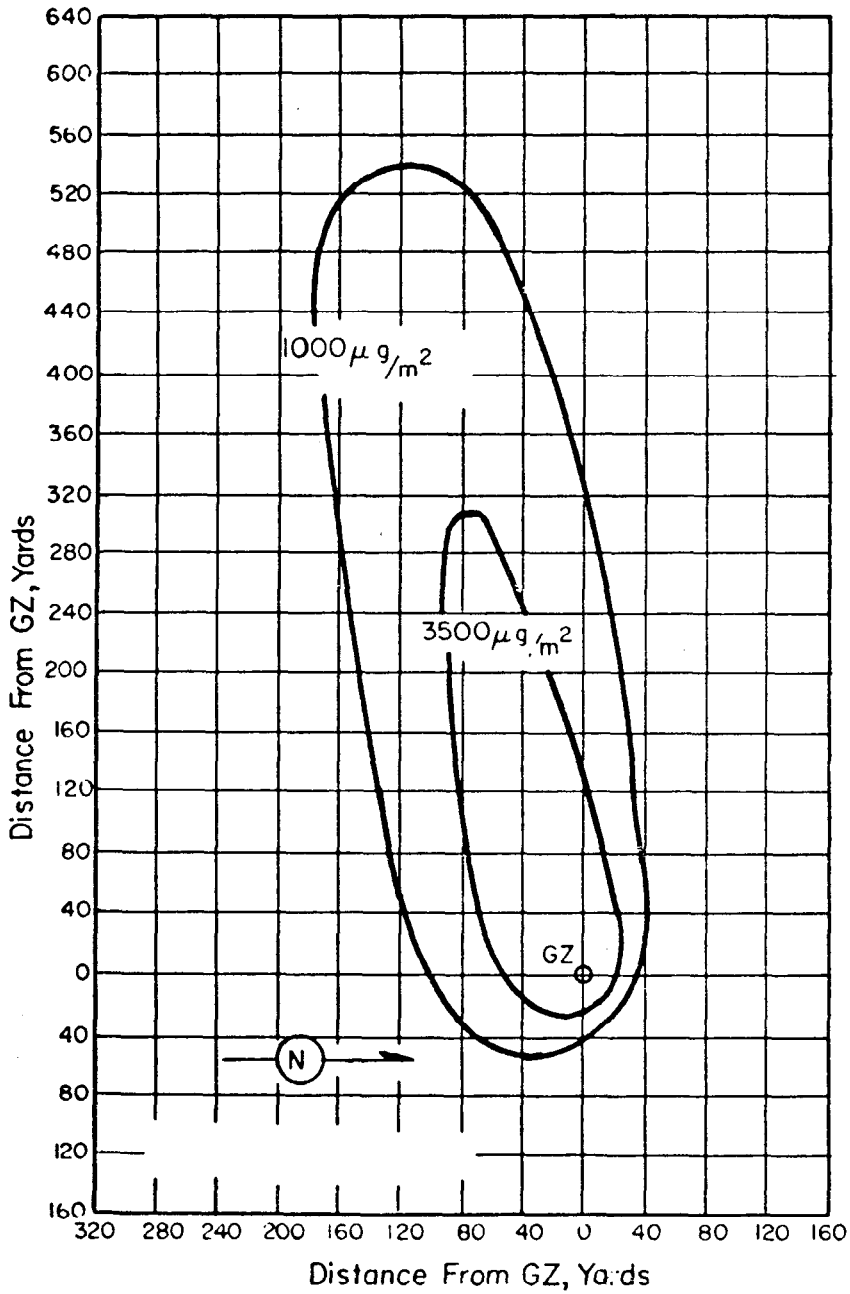


Figure 175. Operation HARDTACK I - Quince.  
Alpha contamination in micrograms per square meter.

TABLE 65 ENIWETOK WIND DATA FOR OPERATION HARDTACK I -

QUINCE

Altitude (MSL) feet	H-hour	
	Dir degrees	Speed mph
Surface	060	13
241	070	14
482	070	14
723	070	16
964	080	16

NOTE: Wind data was taken by the Eniwetok weather station.

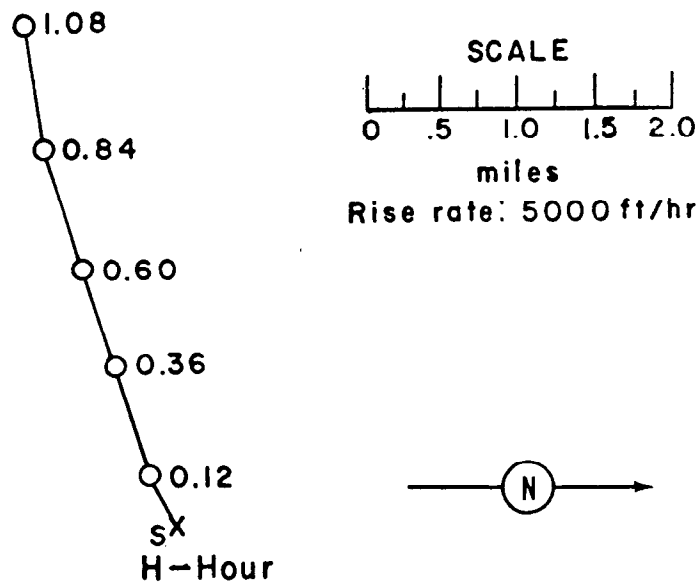


Figure 176. Hodograph for Operation HARDTACK I -

Quince.

OPERATION HARDEACK I -

Orange

	<u>PPG Time</u>	<u>GMT</u>
<u>DATE:</u>	11 Aug 1958	11 Aug 1958
<u>TIME:</u>	2330	1030

Sponsor: DOD

SITE: PPG - Johnston  
16° 21' 30" N  
169° 32' 08" E

HEIGHT OF BURST: 141,1000

TYPE OF BURST AND PLACEMENT:  
High altitude burst from  
Redstone missile over the  
vicinity of Johnston Island.

CLOUD TOP HEIGHT: NM

CLOUD BOTTOM HEIGHT: NM

REMARKS: No local fallout.

OPERATION HARDTACK I -

Fig

	<u>PPG Time</u>	<u>GMT</u>
<u>DATE:</u>	18 Aug 1958	18 Aug 1958
<u>TIME:</u>	1600	0400

Sponsor: UCRL - DOD

SITE: PPG - Eniwetok -  
Yvonne  
11° 33' 15" N  
162° 21' 24" E

Site elevation: Sea level

HEIGHT OF BURST: 1.5 ft

TYPE OF BURST AND PLACEMENT:

Surface burst from platform  
over ~~Nevada~~ soil

CLOUD TOP HEIGHT: 5,400 ft MSL

CLOUD BOTTOM HEIGHT: 4,300 ft MSL

REMARKS:

The dose-rate contours were obtained by ground survey readings made by scientific projects. Actual decay measurements were used to correct the dose-rate readings to H+1 hour. The portion of the pattern on the island is reliable. That portion which is over water is less reliable because it was not based upon free-field dose-rate readings but upon calculations made from readings taken on five barges and from samples collected in sticky pans mounted on 87 buoys.

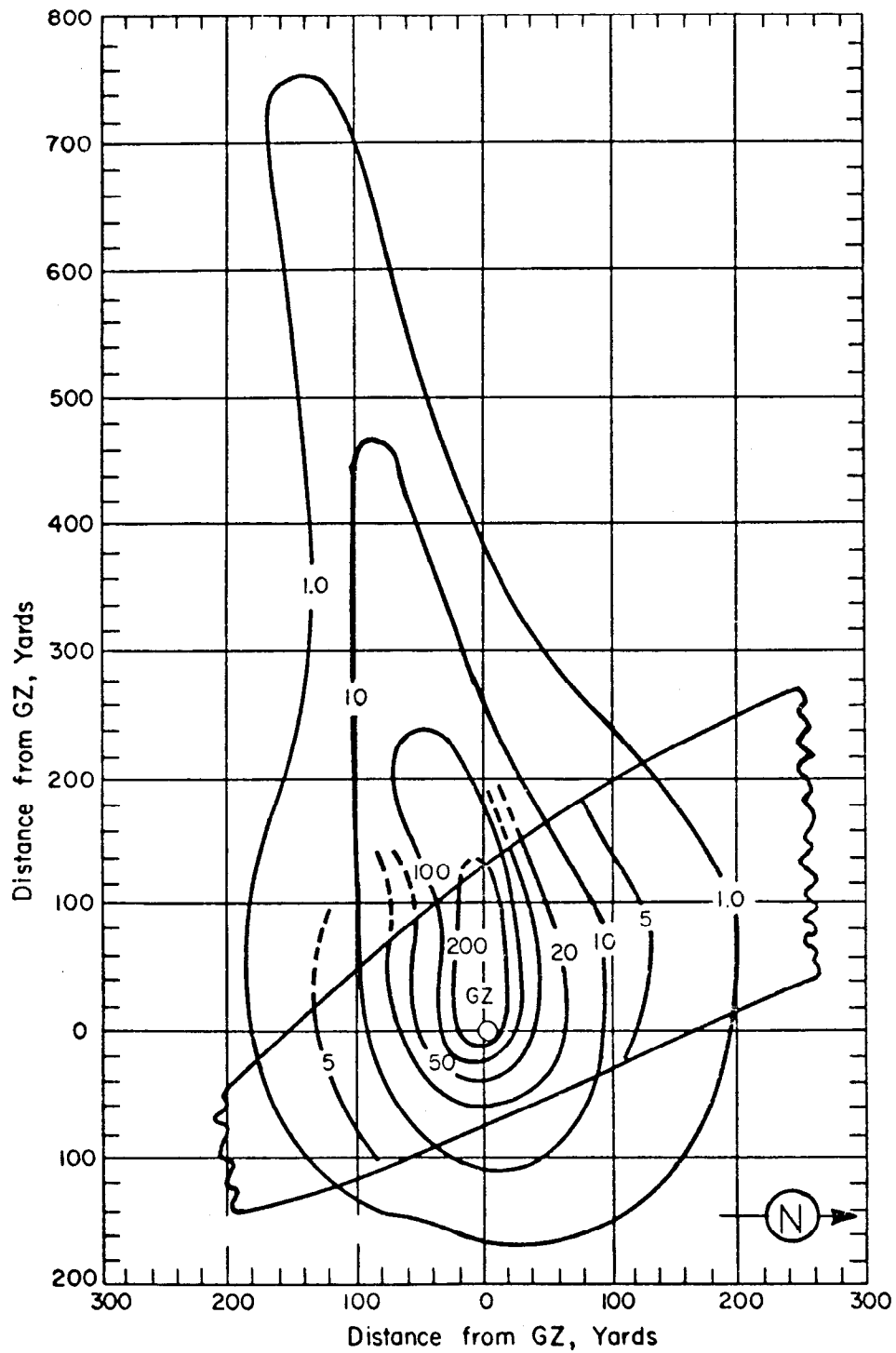


Figure 177. Operation HARDTACK I - Fig.  
On-site dose rate contours in r/hr at H+1 hour.

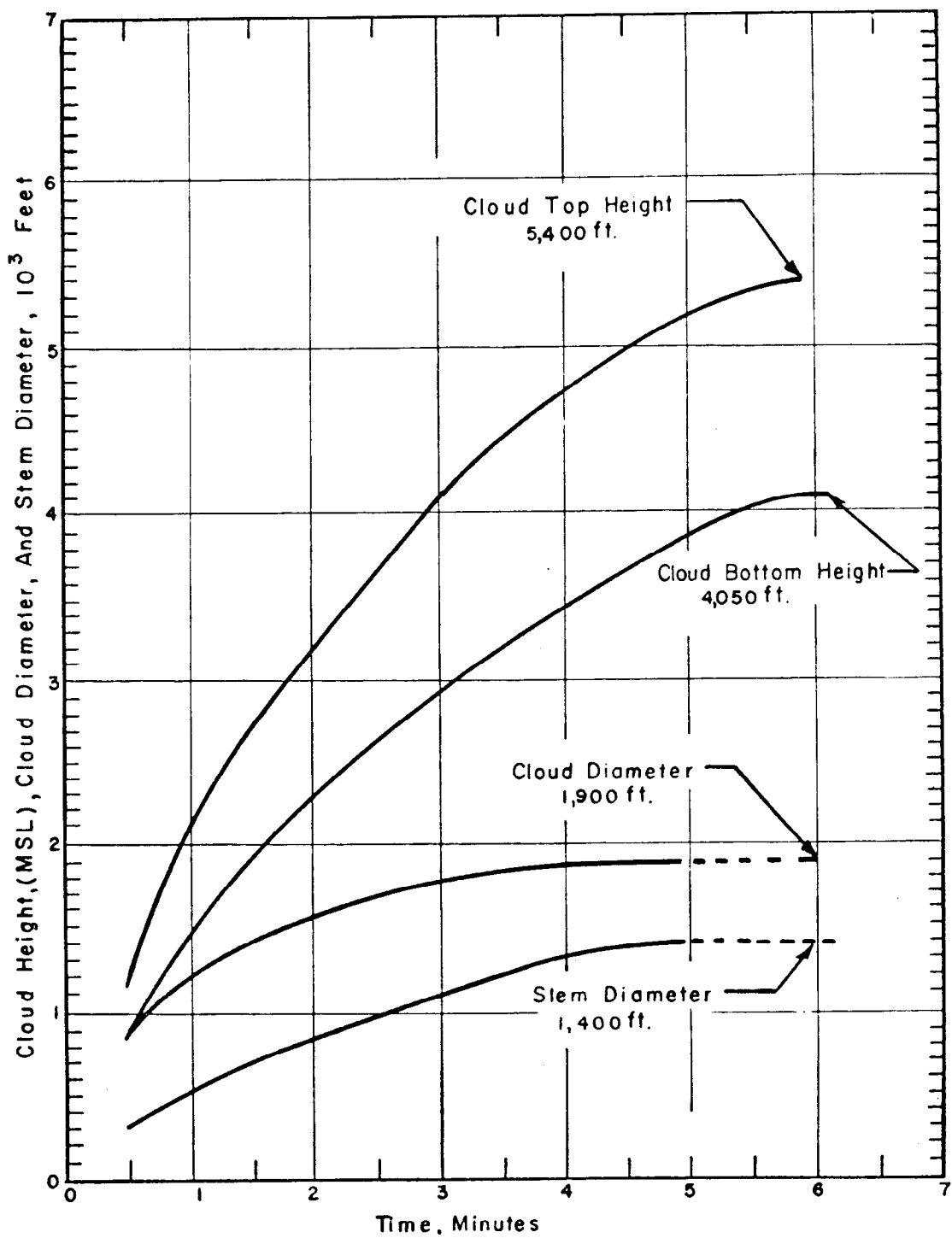


Figure 178. Cloud Dimensions: Operation HARDTACK I -

Fig.

TABLE 66 ENIWETOK WIND DATA FOR OPERATION HARDTACK I -

FIG

Altitude Range (MSL) feet	H-hour	
	Dir degrees	Speed mph
0 - 1,000	080	17
1,000 - 2,000	090	19
2,000 - 3,000	100	18
3,000 - 4,000	110	19
4,000 - 5,000	100	18
5,000 - 6,000	100	18
6,000 - 7,000	090	18
7,000 - 8,000	090	21
8,000 - 9,000	090	21
9,000 - 10,000	080	21

- NOTES: 1. Wind data was obtained by the weather stations on Yvonne Island (Eniwetok Atoll); which were located 1,000 yds and 1,500 yds from GZ.
2. The surface air pressure was 14.62 psi, the temperature 30°C, the dew point 78°F, and the relative humidity 77%.

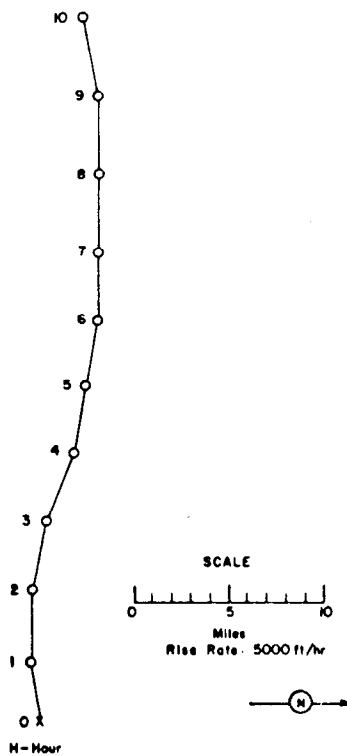


Figure 179. Hodograph for Operation HARDTACK I -

Fig.

OPERATION ARGUS -

ARGUS I

	<u>Local Time</u>	<u>GMT</u>
<u>DATE:</u>	27 Aug 1958	27 Aug 1958
<u>TIME:</u>	0128	0228

TOTAL YIELD: 1-2 kt estimated

FIREBALL DATA:

Time to 1st minimum: NM  
Time to 2nd maximum: NM  
Radius at 2nd maximum: NM

REMARKS:

No fallout.

Sponsor: DOD

SITE: South Atlantic  
38° 48' S  
11° 55' W

HEIGHT OF BURST: ~ 300 miles

TYPE OF BURST AND PLACEMENT:  
High altitude burst

CLOUD TOP HEIGHT: NM  
CLOUD BOTTOM HEIGHT: NM



OPERATION ARGUS -

ARGUS II

	<u>Local Time</u>	<u>GMT</u>
<u>DATE:</u>	30 Aug 1958	30 Aug 1958
<u>TIME:</u>	0218	0318

TOTAL YIELD: 1-2 kt estimated

FIREBALL DATA:

Time to 1st minimum: NM  
Time to 2nd maximum: NM  
Radius at 2nd maximum: NM

CLOUD TOP HEIGHT: NM  
CLOUD BOTTOM HEIGHT: NM

REMARKS: No fallout

Sponsor: DOD

SITE: South Atlantic  
49° 23' S  
08° 43' W

HEIGHT OF BURST: ~ 300 miles

TYPE OF BURST AND PLACEMENT:  
High altitude burst

OPERATION ARGUS -

ARGUS III

	<u>Local time</u>	<u>GMT</u>
<u>DATE:</u>	6 Sep 1958	6 Sep 1958
<u>TIME:</u>	2113	2213

TOTAL YIELD: 1-2 kt estimated

FIREBALL DATA:

Time to 1st minimum: NM  
Time to 2nd maximum: NM  
Radius at 2nd maximum: NM

REMARKS: No fallout

Sponsor: DOD

SITE: South Atlantic  
49° 30' S  
10° 24' W

HEIGHT OF BURST: ~ 300 miles

TYPE OF BURST AND PLACEMENT:  
High altitude burst

CLOUD TOP HEIGHT: NM  
CLOUD BOTTOM HEIGHT: NM

OPERATION DOMINIC - Adobe

	<u>LOCT</u>	<u>GMT</u>
<u>DATE:</u>	25 Apr 1962	25 Apr 1962
<u>TIME:</u>	0545	1545

SPONSOR: LASL

SITE: Christmas Island, GZ-10

SITE ELEVATION: Sea Level

HEIGHT OF BURST:

TYPE OF BURST AND PLACEMENT:

Air (free fall), over  
Pacific Ocean

OPERATION DOMINIC - Aztec

	<u>LOCT</u>	<u>GMT</u>
<u>DATE:</u>	27 Apr 1962	27 Apr 1962
<u>TIME:</u>	0601	1601

SPONSOR: LASL

SITE: Christmas Island, GZ-10

SITE ELEVATION: Sea Level

HEIGHT OF BURST:

TYPE OF BURST AND PLACEMENT:

Air (free fall), over Pacific  
Ocean

OPERATION DOMINIC - Arkansas

	<u>LOCT</u>	<u>GMT</u>
<u>DATE:</u>	2 May 1962	2 May 1962
<u>TIME:</u>	0801	1801

SPONSOR: LRL

SITE: Christmas Island, GZ-15

SITE ELEVATION: Sea Level

HEIGHT OF BURST:

TYPE OF BURST AND PLACEMENT:

Air (parachute drop), over  
Pacific Ocean

OPERATION DOMINIC -

Questa

DATE:    LOCT            GMT  
          4 May 1962      4 May 1962  
TIME:    0904                    1904

SPONSOR:    LASL

SITE:    Christmas Island, GZ-15

SITE ELEVATION:    Sea Level

HEIGHT OF BURST:

TYPE OF BURST AND PLACEMENT:

Air (free fall), over  
Pacific Ocean

OPERATION DOMINIC -

Frigate  
Bird

DATE:    LOCT            GMT  
          6 May 1962      6 May 1962  
TIME:    1330                    2330

SPONSOR:    LRL

SITE:    Johnston Island danger area  
          4° 50' N  
          149° 49' W

SITE ELEVATION:    Sea Level

HEIGHT OF BURST:

TYPE OF BURST AND PLACEMENT:

Air, from Polaris missile

OPERATION DOMINIC -

Yukon

DATE:    LOCT            GMT  
          8 May 1962      8 May 1962  
TIME:    0801                    1801

SPONSOR:    LRL

SITE:    Christmas Island, GZ-10

SITE ELEVATION:    Sea Level

HEIGHT OF BURST:

TYPE OF BURST AND PLACEMENT:

Air (parachute drop), over  
Pacific Ocean

OPERATION DOMINIC - Mesilla

LOCT                      GMT  
DATE: 9 May 1962      9 May 1962  
TIME: 0701              1701

SPONSOR: LASL

SITE: Christmas Island, GZ-10

SITE ELEVATION: Sea Level

HEIGHT OF BURST:

TYPE OF BURST AND PLACEMENT:

Air (free fall), over  
Pacific Ocean

OPERATION DOMINIC - Muskegon

LOCT                      GMT  
DATE: 11 May 1962      11 May 1962  
TIME: 0537              1537

SPONSOR: LRL

SITE: Christmas Island, GZ-10

SITE ELEVATION: Sea Level

HEIGHT OF BURST:

TYPE OF BURST AND PLACEMENT:

Air (parachute drop), over  
Pacific Ocean

OPERATION DOMINIC - Sword  
Fish

PST                      GMT  
DATE: 11 May 1962      11 May 1962  
TIME: 1202              2002

SPONSOR: DOD

SITE: ~400 miles west of San Diego  
31° 14.7' ± 0.3' N  
124° 13.3' ± 0.3' W

SITE ELEVATION: Sea Level

DEPTH OF BURST:

WATER DEPTH: 17,100 ft

TYPE OF BURST AND PLACEMENT:

Underwater, from anti-  
submarine rocket

REMARKS:

Figure 180 illustrates the growth and movement of the pool of radio-activity resulting from the Sword Fish test. The contours from D-day to D+6 days represent readings in mR/hr at 500 feet above the water surface.

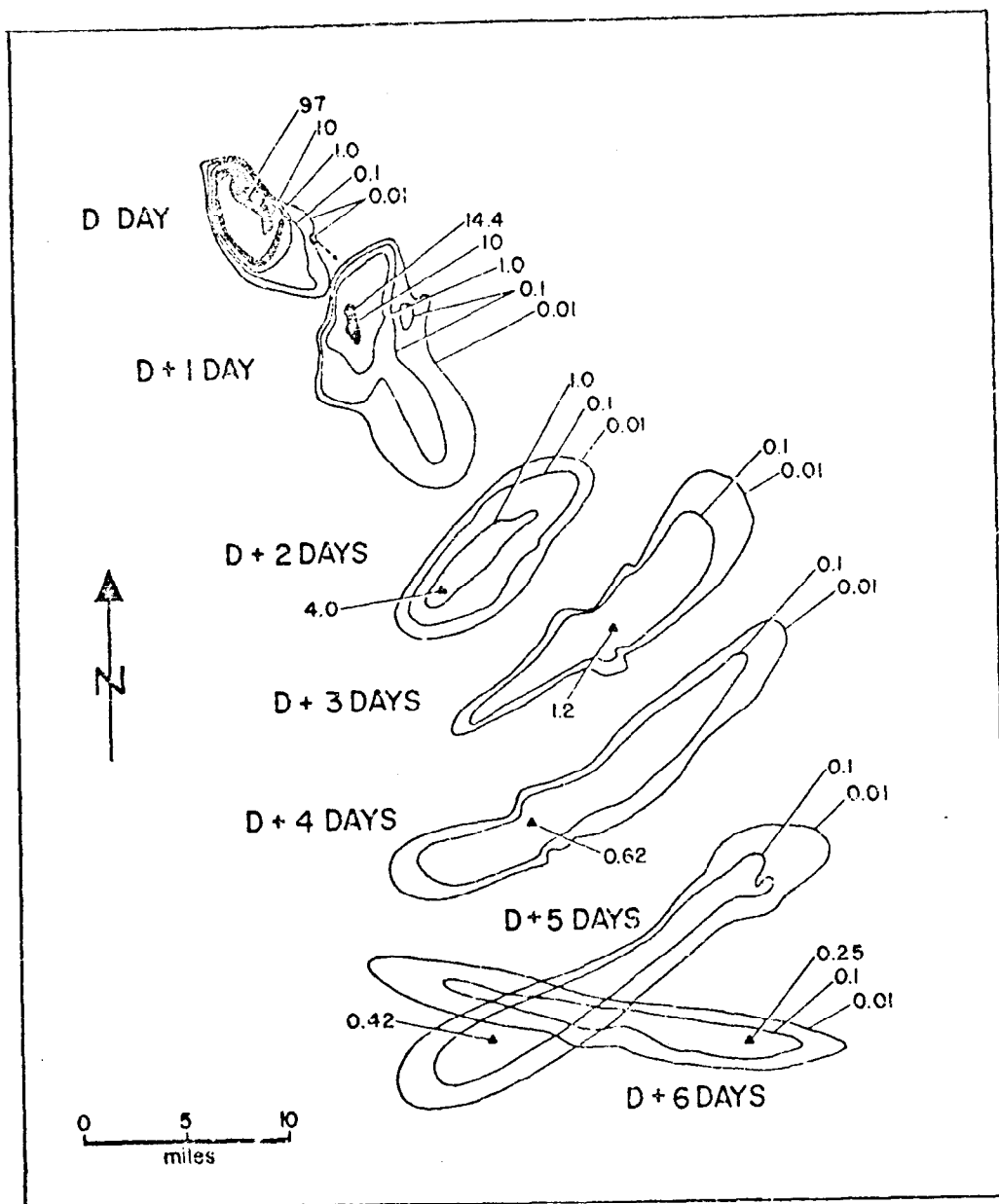


Figure 180 OPERATION DOMINIC - Sword Fish contours showing growth and movement of the pool of radioactivity from D-day to D+6 days. Contours values in mR/hr at the survey aircraft height of 500 feet

OPERATION DOMINIC - Encino

	<u>LOCT</u>	<u>GMT</u>
<u>DATE:</u>	12 May 1962	12 May 1962
<u>TIME:</u>	0702	1702

Sponsor: LASL

SITE: Christmas Island, GZ-12

SITE ELEVATION: Sea Level

HEIGHT OF BURST:

TYPE OF BURST AND PLACEMENT:

Air (free fall), over  
Pacific Ocean

OPERATION DOMINIC - Swanee

	<u>LOCT</u>	<u>GMT</u>
<u>DATE:</u>	14 May 1962	14 May 1962
<u>TIME:</u>	0521	1521

SPONSOR: LRL

SITE: Christmas Island, GZ-10

SITE ELEVATION: Sea Level

HEIGHT OF BURST:

TYPE OF BURST AND PLACEMENT:

Air (parachute drop),  
over Pacific Ocean

OPERATION DOMINIC - Chetco

	<u>LOCT</u>	<u>GMT</u>
<u>DATE:</u>	19 May 1962	19 May 1962
<u>TIME:</u>	0536	1536

SPONSOR: LRL

SITE: Christmas Island, GZ-10

SITE ELEVATION: Sea Level

HEIGHT OF BURST:

TYPE OF BURST AND PLACEMENT:

Air (parachute drop), over  
Pacific Ocean

OPERATION DOMINIC - Tanana

	<u>LOCT</u>	<u>GMT</u>
<u>DATE:</u>	25 May 1962	25 May 1962
<u>TIME:</u>	0608	1608

SPONSOR: LRL

SITE: Christmas Island, GZ-10

SITE ELEVATION: Sea Level

HEIGHT OF BURST:

TYPE OF BURST AND PLACEMENT:

Air (parachute drop), over  
Pacific Ocean

OPERATION DOMINIC - Nambe

	<u>LOCT</u>	<u>GMT</u>
<u>DATE:</u>	27 May 1962	27 May 1962
<u>TIME:</u>	0702	1702

SPONSOR: LASL

SITE: Christmas Island, GZ-10

SITE ELEVATION: Sea Level

HEIGHT OF BURST:

TYPE OF BURST AND PLACEMENT:

Air (free fall), over  
Pacific Ocean

OPERATION DOMINIC - Alma

	<u>LOCT</u>	<u>GMT</u>
<u>DATE:</u>	8 Jun 1962	8 Jun 1962
<u>TIME:</u>	0702	1702

SPONSOR: LASL

SITE: Christmas Island, GZ-15

SITE ELEVATION: Sea Level

HEIGHT OF BURST:

TYPE OF BURST AND PLACEMENT:

Air (free fall), over  
Pacific Ocean



OPERATION DOMINIC -- Truckee

DATE:     LOCT            GMT  
          9 Jun 1962       9 Jun 1962  
TIME:     0537            1537

SPONSOR:   LRL

SITE:    Christmas Island, GZ-10

SITE ELEVATION:   Sea Level

HEIGHT OF BURST:

TYPE OF BURST AND PLACEMENT:

Air (parachute drop), over  
Pacific Ocean

OPERATION DOMINIC -            Yeso

DATE:     LOCT            GMT  
          10 Jun 1962       10 Jun 1962  
TIME:     0601            1601

SPONSOR:   LASL

SITE:    Christmas Island, GZ-20

SITE ELEVATION:   Sea Level

HEIGHT OF BURST:

TYPE OF BURST AND PLACEMENT:

Air (free fall), over  
Pacific Ocean

OPERATION DOMINIC -            Harlem

DATE:     LOCT            GMT  
          12 Jun 1962       12 Jun 1962  
TIME:     0537            1537

SPONSOR:   LRL

SITE:    Christmas Island, GZ-17

SITE ELEVATION:   Sea Level

HEIGHT OF BURST:

TYPE OF BURST AND PLACEMENT:

Air (parachute drop), over  
Pacific Ocean

OPERATION DOMJNIC - Rinconada

	<u>LOCT</u>	<u>GMT</u>
<u>DATE:</u>	15 Jun 1962	15 Jun 1962
<u>TIME:</u>	0600	1600

SPONSOR: LASL

SITE: Christmas Island, GZ-17

SITE ELEVATION: Sea Level

HEIGHT OF BURST:

TYPE OF BURST AND PLACEMENT:

Air (free fall), over  
Pacific Ocean

OPERATION DOMINIC - Dulce

	<u>LOCT</u>	<u>GMT</u>
<u>DATE:</u>	17 Jun 1962	17 Jun 1962
<u>TIME:</u>	0600	1600

SPONSOR: LASL

SITE: Christmas Island, GZ-10

SITE ELEVATION: Sea Level

HEIGHT OF BURST:

TYPE OF BURST AND PLACEMENT:

Air (free fall), over  
Pacific Ocean

OPERATION DOMINIC - Petit

	<u>LOCT</u>	<u>GMT</u>
<u>DATE:</u>	19 Jun 1962	19 Jun 1962
<u>TIME:</u>	0501	1501

SPONSOR: LRL

SITE: Christmas Island, GZ-17

SITE ELEVATION: Sea Level

HEIGHT OF BURST:

TYPE OF BURST AND PLACEMENT:

Air (parachute drop), over  
Pacific Ocean

OPERATION DOMINIC - Otowi

	<u>LOCT</u>	<u>GMT</u>
<u>DATE:</u>	22 Jun 1962	22 Jun 1962
<u>TIME:</u>	0600	1600

SPONSOR: LASL

SITE: Christmas Island, GZ-10

SITE ELEVATION: Sea Level

HEIGHT OF BURST:

TYPE OF BURST AND PLACEMENT:

Air (free fall), over  
Pacific Ocean

OPERATION DOMINIC - Bighorn

	<u>LOCT</u>	<u>GMT</u>
<u>DATE:</u>	27 Jun 1962	27 Jun 1962
<u>TIME:</u>	0519	1519

SPONSOR: LRL

SITE: Christmas Island, GZ-30

SITE ELEVATION: Sea Level

HEIGHT OF BURST:

TYPE OF BURST AND PLACEMENT:

Air (parachute drop), over  
Pacific Ocean

OPERATION DOMINIC - Bluestone

	<u>LOCT</u>	<u>GMT</u>
<u>DATE:</u>	30 Jun 1962	30 Jun 1962
<u>TIME:</u>	0521	1521

SPONSOR: LRL

SITE: Christmas Island, GZ-25

SITE ELEVATION: Sea Level

HEIGHT OF BURST:

TYPE OF BURST AND PLACEMENT:

Air (parachute drop), over  
Pacific Ocean

OPERATION DOMINIC - Star Fish Prime

DATE:      LOCT              GMT  
8 Jul 1962    9 Jul 1962  
TIME:      2200              0900

TOTAL YIELD: 1.4 Mt

SPONSOR: DOD

SITE: Johnston Island  
16° 28' 06.32" N  
169° 37' 48.27" W

SITE ELEVATION: Sea Level

HEIGHT OF BURST: 249 miles

TYPE OF BURST AND PLACEMENT:  
High altitude, from Thor  
missile

REMARKS:

This event was conducted as a part of the Fish Bowl Series.

OPERATION DOMINIC -                      Sunset

DATE:      LOCT              GMT  
10 Jul 1962    10 Jul 1962  
TIME:      0633              1633

SPONSOR: LASL

SITE: Christmas Island, GZ-17

SITE ELEVATION: Sea Level

HEIGHT OF BURST:

TYPE OF BURST AND PLACEMENT:  
Air (free fall), over  
Pacific Ocean

OPERATION DOMINIC -

Pamlico

	<u>LOCT</u>	<u>GMT</u>
<u>DATE:</u>	11 Jul 1962	11 Jul 1962
<u>TIME:</u>	0537	1537

SPONSOR: LRL

SITE: Christmas Island, GZ-25

SITE ELEVATION: Sea Level

HEIGHT OF BURST:

TYPE OF BURST AND PLACEMENT:

Air (parachute drop), over  
Pacific Ocean

OPERATION DOMINIC - Androscoggin

	<u>LOCT</u>	<u>GMT</u>
<u>DATE:</u>	2 Oct 1962	2 Oct 1962
<u>TIME:</u>	0517	1617

SPONSOR: LRL

SITE: Johnston Island  
13° 38.5' N  
172° 11.1' W

SITE ELEVATION: Sea Level

HEIGHT OF BURST:

TYPE OF BURST AND PLACEMENT:

Air (parachute drop), over  
Pacific Ocean

OPERATION DOMINIC - Bumping

	<u>LOCT</u>	<u>GMT</u>
<u>DATE:</u>	6 Oct 1962	6 Oct 1962
<u>TIME:</u>	0502	1602

SPONSOR: LRL

SITE: Johnston Island  
14° 30' N  
168° 15' W

SITE ELEVATION: Sea Level

HEIGHT OF BURST:

TYPE OF BURST AND PLACEMENT:

Air (parachute drop), over  
Pacific Ocean

OPERATION DOMINIC -

Chama

	<u>LOCT</u>	<u>GMT</u>
<u>DATE:</u>	18 Oct 1962	18 Oct 1962
<u>TIME:</u>	0501	1601

SPONSOR: LASL

SITE: Johnston Island  
14° 32' N  
108° 44.7' W

SITE ELEVATION: Sea Level

HEIGHT OF BURST:

TYPE OF BURST AND PLACEMENT:  
Air (free fall), over Pacific  
Ocean

OPERATION DOMINIC - Check Mate

	<u>LOCT</u>	<u>GMT</u>
<u>DATE:</u>	19 Oct 1962	20 Oct 1962
<u>TIME:</u>	2130	0830

SPONSOR: DOD

SITE: Johnston Island  
16° 04' 20.57" N  
169° 36' 35.95" W

SITE ELEVATION: Sea Level

HEIGHT OF BURST:

TYPE OF BURST AND PLACEMENT:  
High altitude, from XM-23  
Strypi (Sergeant) missile

REMARKS:

This event was conducted as a part of the Fish Bowl Series.

OPERATION DOMINIC - Blue Gill Triple Prime

	<u>LOCT</u>	<u>GMT</u>
<u>DATE:</u>	25 Oct 1962	26 Oct 1962
<u>TIME:</u>	2259	0959

SPONSOR: DOD

SITE: Johnston Island  
16° 24' 57.03" N  
169° 36' 11.15" W

SITE ELEVATION: Sea Level

HEIGHT OF BURST:

TYPE OF BURST AND PLACEMENT:  
High altitude, from Thor missile

REMARKS:

This event was conducted as part of the Fish Bowl Series.

OPERATION DOMINIC - Calamity

	<u>LOCT</u>	<u>GMT</u>
<u>DATE:</u>	27 Oct 1962	27 Oct 1962
<u>TIME:</u>	0446	1546

SPONSOR: LRL

SITE: Johnston Island  
14° 31.1' N  
168° 15.6' W

SITE ELEVATION: Sea Level

HEIGHT OF BURST:

TYPE OF BURST AND PLACEMENT:  
Air (parachute drop), over  
Pacific Ocean

OPERATION DOMINIC - Housatonic

	<u>LOCT</u>	<u>GMT</u>
<u>DATE:</u>	30 Oct 1962	30 Oct 1962
<u>TIME:</u>	0501	1601

SPONSOR: LRL

SITE: Johnston Island  
13° 36.8' N  
172° 13' W

SITE ELEVATION: Sea Level

HEIGHT OF BURST:

TYPE OF BURST AND PLACEMENT:  
Air (parachute drop), over  
Pacific Ocean

OPERATION DOMINIC - King Fish

	<u>LOCT</u>	<u>GMT</u>
<u>DATE:</u>	1 Nov 1962	1 Nov 1962
<u>TIME:</u>	0110	1210

SPONSOR: DOD

SITE: Johnston Island  
16° 06' 48.61" N  
169° 40' 56.02" W

SITE ELEVATION: Sea Level

HEIGHT OF BURST:

TYPE OF BURST AND PLACEMENT:  
High altitude, from Thor  
missile

REMARKS:

This event was conducted as a part of the Fish Bowl Series.



OPERATION DOMINIC - Tight Rope

	<u>LOCT</u>	<u>GMT</u>
<u>DATE:</u>	3 Nov 1962	4 Nov 1962
<u>TIME:</u>	2030	0730

SPONSOR: DOD

SITE: Johnston Island  
16° 42' 26.71" N  
169° 32' 32.66" W

SITE ELEVATION: Sea Level

HEIGHT OF BURST:

TYPE OF BURST AND PLACEMENT:  
High altitude, from Nike-  
Hercules missile

REMARKS:

This event was conducted as a part of the Fish Bowl Series.



## APPENDIX A

### Announced United States Nuclear Detonations

Yields are listed as: Low (less than 20 kt)  
Intermediate (20 to 999 kt inclusive)  
Low Megaton (one to several megatons).

Prior to October 1958, testing was conducted on an intermittent basis and each series of tests was designated by a series name, such as OPERATION CROSSROADS. The United States conducted no tests from October 30, 1958 to September 1961. After resumption of testing, tests were conducted year around and were listed by fiscal year. For example, all NTS tests during FY-1962, which ended June 30, 1962, were in the OPERATION NOUGAT series except for four surface tests (Little Feller I and II, Small Boy and Johnny Boy) designated DOMINIC II, which were a continuation of the DOMINIC I series conducted in the Pacific.

## ANNOUNCED UNITED STATES NUCLEAR DETONATIONS

EVENT NAME	DATE (GCT)	LOCATION	TYPE	PURPOSE	YIELD RANGE
TRINITY FIRST TEST OF AN A-BOMB	07/16/45	ALAMOGORDO	TOWER	WEAPONS RELATED	19KT
WORLD WAR II FIRST COMBAT USE-HIROSHIMA	08/05/45	JAPAN	AIRDROP	COMBAT	13 KT
WORLD WAR II SECOND COMBAT USE-NAGASAKI	08/09/45	JAPAN	AIRDROP	COMBAT	23 KT
		OPERATION CROSSROADS			
ABLE	06/30/46	BIKINI	AIRDROP	WEAPONS RELATED	23 KT
BAKER	07/24/46	BIKINI	UW	WEAPONS RELATED	23 KT
		OPERATION SANDSTONE			
X-RAY	04/14/48	ENIWETOK	TOWER	WEAPONS RELATED	37KT
YOKE	04/30/48	ENIWETOK	TOWER	WEAPONS RELATED	49KT
ZEBRA	05/14/48	ENIWETOK	TOWER	WEAPONS RELATED	18KT
		OPERATION RANGER			
ABLE	01/27/51	NTS	AIRDROP	WEAPONS RELATED	1KT
BAKER	01/28/51	NTS	AIRDROP	WEAPONS RELATED	8KT
EASY	02/01/51	NTS	AIRDROP	WEAPONS RELATED	1KT
BAKER-2	02/02/51	NTS	AIRDROP	WEAPONS RELATED	8KT
FOX	02/06/51	NTS	AIRDROP	WEAPONS RELATED	22KT
		OPERATION GREENHOUSE			
DOG	04/07/51	ENIWETOK	TOWER	WEAPONS RELATED	
EASY	04/20/51	ENIWETOK	TOWER	WEAPONS RELATED	47KT
GEORGE	05/08/51	ENIWETOK	TOWER	WEAPONS RELATED	
ITEM	05/24/51	ENIWETOK	TOWER	WEAPONS RELATED	
		OPERATION BUSTER-JANGLE			
ABLE	10/22/51	NTS	TOWER	WEAPONS RELATED	LESS THAN 0.1KT
BAKER	10/28/51	NTS	AIRDROP	WEAPONS RELATED	3.5KT
CHARLIE	10/30/51	NTS	AIRDROP	WEAPONS RELATED	14KT
DOG	11/01/51	NTS	AIRDROP	WEAPONS RELATED	21KT
EASY	11/05/51	NTS	AIRDROP	WEAPONS RELATED	31KT
SUGAR	11/19/51	NTS	SURFACE	WEAPONS RELATED	1.2KT

## ANNOUNCED UNITED STATES NUCLEAR DETONATIONS

EVENT NAME	DATE (GCT)	LOCATION	TYPE	PURPOSE	YIELD RANGE
UNCLE	11/29/51	NTS OPERATION TUMBLER-SNAPPER	CRATER	WEAPONS RELATED	1.2KT
ABLE	04/01/52	NTS	AIRDROP	WEAPONS RELATED	1KT
BAKER	04/15/52	NTS	AIRDROP	WEAPONS RELATED	1KT
CHARLIE	04/22/52	NTS	AIRDROP	WEAPONS RELATED	31KT
DOG	05/01/52	NTS	AIRDROP	WEAPONS RELATED	19KT
EASY	05/07/52	NTS	TOWER	WEAPONS RELATED	12KT
FOX	05/25/52	NTS	TOWER	WEAPONS RELATED	11KT
GEORGE	06/01/52	NTS	TOWER	WEAPONS RELATED	15KT
HOW	06/05/52	NTS OPERATION IVY	TOWER	WEAPONS RELATED	14KT
MIKE EXPERIMENTAL THERMONUCLEAR	10/31/52	ENIWE TOK DEVICE	SURFACE	WEAPONS RELATED	10.4MT
KING	11/15/52	ENIWE TOK OPERATION UPSHOT-KNOTHOLE	AIRDROP	WEAPONS RELATED	500 KT
ANNIE	03/17/53	NTS	TOWER	WEAPONS RELATED	16KT
NANCY	03/24/53	NTS	TOWER	WEAPONS RELATED	24KT
RUTH	03/31/53	NTS	TOWER	WEAPONS RELATED	0.2KT
DIXIE	04/06/53	NTS	AIRDROP	WEAPONS RELATED	11KT
RAY	04/11/53	NTS	TOWER	WEAPONS RELATED	0.2KT
BADGER	04/18/53	NTS	TOWER	WEAPONS RELATED	23KT
SIMON	04/25/53	NTS	TOWER	WEAPONS RELATED	43KT
ENCORE	05/08/53	NTS	AIRDROP	WEAPONS RELATED	27KT
HARRY	05/19/53	NTS	TOWER	WEAPONS RELATED	32KT
GRABLE FIRED FROM 280MM GUN	05/25/53	NTS	GUN	WEAPONS RELATED	15KT
CLIMAX	06/04/53	NTS OPERATION CASTLE	AIRDROP	WEAPONS RELATED	61KT
BRAVO EXPERIMENTAL THERMONUCLEAR	02/28/54	BIKINI DEVICE	SURFACE	WEAPONS RELATED	15MT

## ANNOUNCED UNITED STATES NUCLEAR DETONATIONS

EVENT NAME	DATE (GCT)	LOCATION	TYPE	PURPOSE	YIELD RANGE
ROME0	03/26/54	BIKINI	BARGE	WEAPONS RELATED	11 MT
KOON	04/06/54	BIKINI	SURFACE	WEAPONS RELATED	110 KT
UNION	04/25/54	BIKINI	BARGE	WEAPONS RELATED	6.9 MT
YANKEE	05/04/54	BIKINI	BARGE	WEAPONS RELATED	13.5 MT
NECTAR	05/13/54	ENIWETOK	BARGE	WEAPONS RELATED	1.69 MT
OPERATION TEAPOT					
WASP	02/18/55	NTS	AIRDROP	WEAPONS RELATED	1KT
MOTH	02/22/55	NTS	TOWER	WEAPONS RELATED	2KT
TESLA	03/01/55	NTS	TOWER	WEAPONS RELATED	7KT
TURK	03/07/55	NTS	TOWER	WEAPONS RELATED	43KT
HORNET	03/12/55	NTS	TOWER	WEAPONS RELATED	4KT
BEE	03/22/55	NTS	TOWER	WEAPONS RELATED	8KT
ESS	03/23/55	NTS	CRATER	WEAPONS RELATED	1KT
APPLE-1	03/29/55	NTS	TOWER	WEAPONS RELATED	14KT
WASP PRIME	03/29/55	NTS	AIRDROP	WEAPONS RELATED	3KT
HA	04/06/55	NTS	AIRDROP	WEAPONS RELATED	3KT
POST	04/09/55	NTS	TOWER	WEAPONS RELATED	2KT
MET	04/15/55	NTS	TOWER	WEAPONS RELATED	22KT
APPLE-2	05/05/55	NTS	TOWER	WEAPONS RELATED	29KT
ZUCCHINI	05/15/55	NTS	TOWER	WEAPONS RELATED	28KT
OPERATION WIGWAM					
WIGWAM	05/14/55		UW	WEAPONS RELATED	30KT
29 DEGREES N-126 DEGREES W					
OPERATION REDWING					
LACROSSE	05/04/56	ENIWETOK	SURFACE	WEAPONS RELATED	40 KT
CHEROKEE	05/20/56	BIKINI	AIRDROP	WEAPONS RELATED	SEVERAL MT
FIRST AIR DROP BY U.S. OF A THERMONUCLEAR WEAPON					
ZUNI	05/27/56	BIKINI	SURFACE	WEAPONS RELATED	3.5 MT
YUMA	05/27/56	ENIWETOK		WEAPONS RELATED	

## ANNOUNCED UNITED STATES NUCLEAR DETONATIONS

EVENT NAME	DATE (GCT)	LOCATION	TYPE	PURPOSE	YIELD RANGE
ERIE	05/30/56	ENIWETOK	TOWER	WEAPONS RELATED	
SEMINOLE	06/06/56	ENIWETOK	SURFACE	WEAPONS RELATED	
FLATHEAD	06/11/56	BIKINI	BARGE	WEAPONS RELATED	
BLACKFOOT	06/11/56	ENIWETOK	TOWER	WEAPONS RELATED	
KICKAPOO	06/13/56	ENIWETOK		WEAPONS RELATED	
OSAGE	06/16/56	ENIWETOK	AIRDROP	WEAPONS RELATED	
INCA	06/21/56	ENIWETOK		WEAPONS RELATED	
DAKOTA	06/25/56	BIKINI	BARGE	WEAPONS RELATED	
MOHAWK	07/02/56	ENIWETOK		WEAPONS RELATED	
APACHE	07/08/56	ENIWETOK	BARGE	WEAPONS RELATED	
NAVAJO	07/10/56	BIKINI	BARGE	WEAPONS RELATED	
TEWA	07/20/56	BIKINI	BARGE	WEAPONS RELATED	5 MT
HURON	07/21/56	ENIWETOK	BARGE	WEAPONS RELATED	
OPERATION PLUMBBOB					
BOLTZMAN	05/28/57	NTS	TOWER	WEAPONS RELATED	12KT
FRANKLIN	06/02/57	NTS	TOWER	WEAPONS RELATED	140 TONS
LASSEN	06/05/57	NTS	BALLOON	WEAPONS RELATED	0.5 TONS
WILSON	06/18/57	NTS	BALLOON	WEAPONS RELATED	10KT
PRISCILLA	06/24/57	NTS	BALLOON	WEAPONS RELATED	37KT
HOOD	07/05/57	NTS	BALLOON	WEAPONS RELATED	74KT
DIABLO	07/15/57	NTS	TOWER	WEAPONS RELATED	17KT
JOHN	07/19/57	NTS	ROCKET	WEAPONS RELATED	ABOUT 2KT
KEPLER	07/24/57	NTS	TOWER	WEAPONS RELATED	10KT
OWENS	07/25/57	NTS	BALLOON	WEAPONS RELATED	9.7KT
STOKES	08/07/57	NTS	BALLOON	WEAPONS RELATED	19KT
SHASTA	08/18/57	NTS	TOWER	WEAPONS RELATED	17KT
DOPPLER	08/23/57	NTS	BALLOON	WEAPONS RELATED	11KT

## ANNOUNCED UNITED STATES NUCLEAR DETONATIONS

EVENT NAME	DATE (GCT)	LOCATION	TYPE	PURPOSE	YIELD RANGE
FRANKLIN PRIME	08/30/57	NTS	BALLOON	WEAPONS RELATED	4.7KT
SHOKY	08/31/57	NTS	TOWER	WEAPONS RELATED	44KT
GALILEO	09/02/57	NTS	TOWER	WEAPONS RELATED	11KT
WHEELER	09/06/57	NTS	BALLOON	WEAPONS RELATED	197 TONS
LAPLACE	09/08/57	NTS	BALLOON	WEAPONS RELATED	1KT
FIZEAU	09/14/57	NTS	TOWER	WEAPONS RELATED	11KT
NEWTON	09/16/57	NTS	BALLOON	WEAPONS RELATED	12KT
RAINIER FIRST TUNNEL EMPLACEMENT	09/19/57	NTS	TUNNEL	WEAPONS RELATED	1.7KT
WHITNEY	09/23/57	NTS	TOWER	WEAPONS RELATED	19KT
CHARLESTON	09/28/57	NTS	BALLOON	WEAPONS RELATED	12KT
MORGAN	10/07/57	NTS	BALLOON	WEAPONS RELATED	8KT
OPERATION HARDTACK I					
YUCCA 12 DEGREES 37 MIN N-163 DEGREES 01 MIN E	04/28/58		BALLOON	WEAPONS RELATED	
CACTUS	05/05/58	ENIWETOK	SURFACE	WEAPONS RELATED	18 KT
FIR	05/11/58	BIKINI	BARGE	WEAPONS RELATED	
BUTTERNUT	05/11/58	ENIWETOK	BARGE	WEAPONS RELATED	
KOA	05/12/58	ENIWETOK	SURFACE	WEAPONS RELATED	1.37 MT
WAHOO	05/16/58	ENIWETOK	UW	WEAPONS RELATED	
HOLLY	05/20/58	ENIWETOK	BARGE	WEAPONS RELATED	
NUTMEG	05/21/58	BIKINI	BARGE	WEAPONS RELATED	
YELLOWWOOD	05/26/58	ENIWETOK	BARGE	WEAPONS RELATED	
MAGNOLIA	05/26/58	ENIWETOK	BARGE	WEAPONS RELATED	
TOBACCO	05/30/58	ENIWETOK	BARGE	WEAPONS RELATED	
SYCAMORE	05/31/58	BIKINI	BARGE	WEAPONS RELATED	
ROSE	06/02/58	ENIWETOK	BARGE	WEAPONS RELATED	
UMBRELLA	06/08/58	ENIWETOK	UW	WEAPONS RELATED	



## ANNOUNCED UNITED STATES NUCLEAR DETONATIONS

EVENT NAME	DATE (GCT)	LOCATION	TYPE	PURPOSE	YIELD RANGE
MAPLE	06/10/50	BIKINI	BARGE	WEAPONS RELATED	
ASPEN	06/14/50	BIKINI	BARGE	WEAPONS RELATED	
WALNUT	06/14/50	ENIWETOK	BARGE	WEAPONS RELATED	
LINDEN	06/18/50	ENIWETOK	BARGE	WEAPONS RELATED	
REDWOOD	06/27/50	BIKINI	BARGE	WEAPONS RELATED	
ELDER	06/27/50	ENIWETOK	BARGE	WEAPONS RELATED	
OAK	06/28/50	ENIWETOK	BARGE	WEAPONS RELATED	0.9 MT
HICKORY	06/29/50	BIKINI	BARGE	WEAPONS RELATED	
SEQUOIA	07/01/50	ENIWETOK	BARGE	WEAPONS RELATED	
CEDAR	07/02/50	BIKINI	BARGE	WEAPONS RELATED	
DOGWOOD	07/05/50	ENIWETOK	BARGE	WEAPONS RELATED	
POPLAR	07/12/50	BIKINI	BARGE	WEAPONS RELATED	
PISONIA	07/17/50	ENIWETOK		WEAPONS RELATED	
JUNIPER	07/22/50	BIKINI	BARGE	WEAPONS RELATED	
OLIVE	07/22/50	ENIWETOK	BARGE	WEAPONS RELATED	
PINE	07/26/50	ENIWETOK	BARGE	WEAPONS RELATED	
TEAK	08/01/50	JOHNSTON ISL AREA	ROCKET	WEAPONS RELATED	MEGATON RANGE
QUINCE	08/06/50	ENIWETOK		WEAPONS RELATED	
ORANGE	08/12/50	JOHNSTON ISL AREA	ROCKET	WEAPONS RELATED	MEGATON RANGE
FIG	08/18/50	ENIWETOK		WEAPONS RELATED	
OPERATION ARGUS					
ARGUS I ABOUT 300 MILES ALTITUDE	08/27/50	SOUTH ATLANTIC	ROCKET	WEAPONS RELATED	1-2KT
ARGUS II ABOUT 300 MILES ALTITUDE	08/30/50	SOUTH ATLANTIC	ROCKET	WEAPONS RELATED	1-2KT
ARGUS III ABOUT 300 MILES ALTITUDE	09/06/50	SOUTH ATLANTIC	ROCKET	WEAPONS RELATED	1-2KT
OPERATION HARDTACK II					
EDDY	09/19/50	NTS	BALLOON	WEAPONS RELATED	83 TONS

## ANNOUNCED UNITED STATES NUCLEAR DETONATIONS

EVENT NAME	DATE (GCT)	LOCATION	TYPE	PURPOSE	YIELD RANGE
MORA	09/29/58	NTS	BALLOON	WEAPONS RELATED	2KT
TAMALPAIS SLIGHT VENTING	10/08/58	NTS	TUNNEL	WEAPONS RELATED	72 TONS
QUAY	10/10/58	NTS	TOWER	WEAPONS RELATED	79 TONS
LEA	10/13/58	NTS	BALLOON	WEAPONS RELATED	1.4KT
HAMILTON	10/15/58	NTS	TOWER	WEAPONS RELATED	1.2 TONS
LOGAN	10/16/58	NTS	TUNNEL	WEAPONS RELATED	5KT
DONA ANA	10/16/58	NTS	BALLOON	WEAPONS RELATED	37 TONS
RIO ARRIBA	10/18/58	NTS	TOWER	WEAPONS RELATED	90 TONS
SOCORRO	10/22/58	NTS	BALLOON	WEAPONS RELATED	6KT
WRANGELL	10/22/58	NTS	BALLOON	WEAPONS RELATED	115 TONS
RUSHMORE	10/22/58	NTS	BALLOON	WEAPONS RELATED	188 TONS
SANFORD	10/26/58	NTS	BALLOON	WEAPONS RELATED	4.9KT
DE BACA	10/26/58	NTS	BALLOON	WEAPONS RELATED	2.2KT
EVANS VENTING	10/29/58	NTS	TUNNEL	WEAPONS RELATED	55 TONS
HUMBOLDT	10/29/58	NTS	TOWER	WEAPONS RELATED	7.8 TONS
SANTA FE	10/30/58	NTS	BALLOON	WEAPONS RELATED	1.3KT
BLANCA SLIGHT VENTING	10/30/58	NTS	TUNNEL	WEAPONS RELATED	19KT
OPERATION NOUGAT					
ANTLER	09/15/61	NTS	TUNNEL	WEAPONS RELATED	2.4KT
SHREW LOW YIELD MEANS LESS THAN 20KT	09/16/61	NTS	SHAFT	WEAPONS RELATED	LOW
CHENA	10/10/61	NTS	TUNNEL	WEAPONS RELATED	LOW
MINK	10/29/61	NTS	SHAFT	WEAPONS RELATED	LOW
FISHER	12/03/61	NTS	SHAFT	WEAPONS RELATED	13.5KT
GNOME MULTIPLE-PURPOSE EXPERIMENT IN SALT-FORMED CAVITY 60-80 FT.HIGH	12/10/61	CARLSBAD	SHAFT	PLOWSHARE	3.1KT

## ANNOUNCED UNITED STATES NUCLEAR DETONATIONS

EVENT NAME	DATE (GCT)	LOCATION	TYPE	PURPOSE	YIELD RANGE
MAD	12/13/61	NTS	SHAFT	WEAPONS RELATED	0.43KT
RINGTAIL	12/17/61	NTS	SHAFT	WEAPONS RELATED	LOW
FEATHER	12/22/61	NTS	TUNNEL	WEAPONS RELATED	LOW
STOAT	01/09/62	NTS	SHAFT	WEAPONS RELATED	4.5KT
AGOUTI	01/18/62	NTS	SHAFT	WEAPONS RELATED	5.9KT
DORMOUSE	01/30/62	NTS	SHAFT	WEAPONS RELATED	LOW
STILLWATER	02/08/62	NTS	SHAFT	WEAPONS RELATED	2.7KT
ARMADILLO	02/09/62	NTS	SHAFT	WEAPONS RELATED	6.6KT
HARDHAT GRANITE	02/15/62	NTS	SHAFT	WEAPONS RELATED	5.9KT
CHINCHILLA	02/19/62	NTS	SHAFT	WEAPONS RELATED	1.8KT
CODSAW	02/19/62	NTS	SHAFT	WEAPONS RELATED	LOW
CIMARRON	02/23/62	NTS	SHAFT	WEAPONS RELATED	11.2KT
PLATYPUS	02/24/62	NTS	SHAFT	WEAPONS RELATED	LOW
PAMPAS	03/01/62	NTS	SHAFT	JOINT US-UK	LOW
DANNY BOY CRATER DIAMETER 265 FT. DEPTH 84 FT. IN BASALT	03/05/62	NTS	CRATER	WEAPONS RELATED	0.42KT
ERMINE	03/06/62	NTS	SHAFT	WEAPONS RELATED	LOW
BRAZOS	03/08/62	NTS	SHAFT	WEAPONS RELATED	7.6KT
HOGNOSE	03/15/62	NTS	SHAFT	WEAPONS RELATED	LOW
HOOSIC	03/28/62	NTS	SHAFT	WEAPONS RELATED	3KT
CHINCHILLA II	03/31/62	NTS	SHAFT	WEAPONS RELATED	LOW
DORMOUSE II	04/05/62	NTS	SHAFT	WEAPONS RELATED	10KT
PASSAIC	04/06/62	NTS	SHAFT	WEAPONS RELATED	LOW
HUDSON	04/12/62	NTS	SHAFT	WEAPONS RELATED	LOW
PLATTE	04/14/62	NTS	TUNNEL	WEAPONS RELATED	1.7KT
DEAD	04/21/62	NTS	SHAFT	WEAPONS RELATED	LOW

## ANNOUNCED UNITED STATES NUCLEAR DETONATIONS

EVENT NAME	DATE (GCT)	LOCATION	TYPE	PURPOSE	YIELD RANGE
ADOBÉ	04/25/62	CHRISTMAS ISL AREA	AIRDROP	WEAPONS RELATED	INTERMEDIATE
1962 PACIFIC TESTS WERE DESIGNATED OPERATION DOMINIC I INTERMEDIATE MEANS 20 TO 1000 KT					
AZTEC	04/27/62	CHRISTMAS ISL AREA	AIRDROP	WEAPONS RELATED	INTERMEDIATE
BLACK	04/27/62	NTS	SHAFT	WEAPONS RELATED	LOW
ARKANSAS	05/02/62	CHRISTMAS ISL AREA	AIRDROP	WEAPONS RELATED	LOW MEGATON
QUESTA	05/04/62	CHRISTMAS ISL AREA	AIRDROP	WEAPONS RELATED	INTERMEDIATE
FRIGATE BIRD	05/06/62	CHRISTMAS ISL AREA	MISSILE	WEAPONS RELATED	
WARHEAD IN MISSILE LAUNCHED FROM POLARIS SUBMARINE					
PACA	05/07/62	NTS	SHAFT	WEAPONS RELATED	LOW
YUKON	05/08/62	CHRISTMAS ISL AREA	AIRDROP	WEAPONS RELATED	INTERMEDIATE
MESILLA	05/09/62	CHRISTMAS ISL AREA	AIRDROP	WEAPONS RELATED	INTERMEDIATE
MUSKOGON	05/11/62	CHRISTMAS ISL AREA	AIRDROP	WEAPONS RELATED	INTERMEDIATE
SHORDFISH	05/11/62	EASTERN PACIFIC	UM	WEAPONS RELATED	LOW
ANTISUBMARINE ROCKET /ASROC/ SYSTEM PROOF TEST					
ENCINO	05/12/62	CHRISTMAS ISL AREA	AIRDROP	WEAPONS RELATED	INTERMEDIATE
AARDVARK	05/12/62	NTS	SHAFT	WEAPONS RELATED	38KT
SHANEE	05/14/62	CHRISTMAS ISL AREA	AIRDROP	WEAPONS RELATED	INTERMEDIATE
EEL	05/19/62	NTS	SHAFT	WEAPONS RELATED	LOW
CHETCO	05/19/62	CHRISTMAS ISL AREA	AIRDROP	WEAPONS RELATED	INTERMEDIATE
WHITE	05/25/62	NTS	SHAFT	WEAPONS RELATED	LOW
TANANA	05/25/62	CHRISTMAS ISL AREA	AIRDROP	WEAPONS RELATED	LOW
NAMBE	05/27/62	CHRISTMAS ISL AREA	AIRDROP	WEAPONS RELATED	INTERMEDIATE
RACCOON	06/01/62	NTS	SHAFT	WEAPONS RELATED	LOW
PACKRAT	06/06/62	NTS	SHAFT	WEAPONS RELATED	LOW
ALMA	06/08/62	CHRISTMAS ISL AREA	AIRDROP	WEAPONS RELATED	INTERMEDIATE
TRUCKEE	06/09/62	CHRISTMAS ISL AREA	AIRDROP	WEAPONS RELATED	INTERMEDIATE
YESO	06/10/62	CHRISTMAS ISL AREA	AIRDROP	WEAPONS RELATED	LOW MEGATON
HARLEM	06/12/62	CHRISTMAS ISL AREA	AIRDROP	WEAPONS RELATED	INTERMEDIATE

## ANNOUNCED UNITED STATES NUCLEAR DETONATIONS

EVENT NAME	DATE (GCT)	LOCATION	TYPE	PURPOSE	YIELD RANGE
DES MOINES	06/13/62	NTS	TUNNEL	WEAPONS RELATED	LOW
RINCONADA	06/15/62	CHRISTMAS ISL AREA	AIRDROP	WEAPONS RELATED	INTERMEDIATE
DULCE	06/17/62	CHRISTMAS ISL AREA	AIRDROP	WEAPONS RELATED	INTERMEDIATE
PETIT	06/19/62	CHRISTMAS ISL AREA	AIRDROP	WEAPONS RELATED	LOW
DAMAN I	06/21/62	NTS	SHAFT	WEAPONS RELATED	LOW
OTOWI	06/22/62	CHRISTMAS ISL AREA	AIRDROP	WEAPONS RELATED	INTERMEDIATE
BIGHORN	06/27/62	CHRISTMAS ISL AREA	AIRDROP	WEAPONS RELATED	MEGATON RANGE
HAYMAKER	06/27/62	NTS	SHAFT	WEAPONS RELATED	56KT
MARSHMALLOW OOD EVENT	06/28/62	NTS	TUNNEL	WEAPONS RELATED	LOW
BLUESTONE	06/30/62	CHRISTMAS ISL AREA	AIRDROP	WEAPONS RELATED	LOW MEGATON
SACRAMENTO	06/30/62	NTS	SHAFT	WEAPONS RELATED	LOW
OPERATION STORAX					
SEDAN	07/06/62	NTS	CRATER	PLOWSHARE	100KT
EXCAVATION EXPERIMENT-CRATER 1280 FT. DIAM 320 FT. DEEP-THERMONUCLEAR DEV.					
LITTLE FELLER II	07/07/62	NTS	SURFACE	WEAPONS RELATED	LOW
SLIGHTLY ABOVE GROUND. DOMINIC II SERIES.					
STARFISH PRIME	07/09/62	JOHNSTON ISL AREA	ROCKET	WEAPONS RELATED	1.4 MEGATONS
HIGH ALTITUDE-450 KM					
SUNSET	07/10/62	CHRISTMAS ISL AREA	AIRDROP	WEAPONS RELATED	INTERMEDIATE
PAMLIGO	07/11/62	CHRISTMAS ISL AREA	AIRDROP	WEAPONS RELATED	LOW MEGATON
JOHNNY BOY	07/11/62	NTS	SURFACE	WEAPONS RELATED	0.5
SLIGHTLY ABOVE GROUND. DOMINIC II SERIES.					
HERRIMAC	07/13/62	NTS	SHAFT	WEAPONS RELATED	LOW
SMALL BOY	07/14/62	NTS	SURFACE	WEAPONS RELATED	LOW
SLIGHTLY ABOVE GROUND. DOMINIC II SERIES.					
LITTLE FELLER I	07/17/62	NTS	SURFACE	WEAPONS RELATED	LOW
TROOP PARTICIPATION. SLIGHTLY ABOVE GROUND. DOMINIC II SERIES.					
WICHITA	07/27/62	NTS	SHAFT	WEAPONS RELATED	LOW
YORK	08/24/62	NTS	SHAFT	WEAPONS RELATED	LOW
BOBAC	08/24/62	NTS	SHAFT	WEAPONS RELATED	LOW

## ANNOUNCED UNITED STATES NUCLEAR DETONATIONS

EVENT NAME	DATE (GCT)	LOCATION	TYPE	PURPOSE	YIELD RANGE
HYRAX	09/14/62	NTS	SHAFT	WEAPONS RELATED	LOW
PEBA	09/20/62	NTS	SHAFT	WEAPONS RELATED	LOW
ALLEGHENY	09/29/62	NTS	SHAFT	WEAPONS RELATED	LOW
ANDROSCOGGIN	10/02/62	JOHNSTON ISL AREA	AIRDROP	WEAPONS RELATED	INTERMEDIATE
MISSISSIPPI	10/05/62	NTS	SHAFT	WEAPONS RELATED	110 KT
BUMPING	10/06/62	JOHNSTON ISL AREA	AIRDROP	WEAPONS RELATED	LOW
ROANOKE	10/12/62	NTS	SHAFT	WEAPONS RELATED	LOW
CHAMA	10/18/62	JOHNSTON ISL AREA	AIRDROP	WEAPONS RELATED	LOW MEGATON
BANDICOOT	10/19/62	NTS	SHAFT	WEAPONS RELATED	LOW
CHECKMATE HIGH ALTITUDE - TENS OF KMS	10/20/62	JOHNSTON ISL AREA	ROCKET	WEAPONS RELATED	LOW
BLUEGILL 3PRIME HIGH ALTITUDE - TENS OF KMS	10/26/62	JOHNSTON ISL AREA	ROCKET	WEAPONS RELATED	SUBMEGATON
SANTEE	10/27/62	NTS	SHAFT	WEAPONS RELATED	LOW
CALAMITY	10/27/62	JOHNSTON ISL AREA	AIRDROP	WEAPONS RELATED	INTERMEDIATE
HOUSATONIC	10/30/62	JOHNSTON ISL AREA	AIRDROP	WEAPONS RELATED	MEGATON RANGE
KINGFISH HIGH ALTITUDE - TENS OF KMS	11/01/62	JOHNSTON ISL AREA	ROCKET	WEAPONS RELATED	SUBMEGATON
TIGHTROPE HIGH ALTITUDE - TENS OF KMS	11/04/62	JOHNSTON ISL AREA	ROCKET	WEAPONS RELATED	LOW
ANACOSTIA DEVICE DEVELOPMENT	11/27/62	NTS	SHAFT	PLOWSHARE	LOW
TENDRAC	12/07/62	NTS	SHAFT	JOINT US-UK	LOW
MADISON	12/12/62	NTS	TUNNEL	WEAPONS RELATED	LOW
NUMBAT	12/12/62	NTS	SHAFT	WEAPONS RELATED	LOW

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