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

Volume I -Continental U.S. Tests

General Electric Company-TEMPO
DASIAC
816 State Street
Santa Barbara, California 93102

1 May 1979

Extract

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Fallout patterns from U.S. continental nuclear weapons tests. Also given are time and place of test and ambient winds.

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PREFACE

This report has been prepared to serve as an unclassified source of information and data concerning the atmospheric nuclear test program conducted by the United States prior to 1963. The information contained herein was reproduced directly from the classified versions of the DASA 1251 series of reports. The classified material which was deleted to prepare this report was in accordance with the requirements of the Atomic Energy Act of 1954 and would not contribute to an understanding of the radiation interactions with personnel. All fallout plots and radiation contours are presented exactly as they appeared in the classified version of DASA 1251.

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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 hours, 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, 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 altitudes 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 could 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.

OPERATION TRINITY

	MST	GMT
DATE:	16 Jul 1945	16 Jul 1945
TIME:	0529	1229

TOTAL YIELD: 19 kt

FIREBALL DATA:

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

Sponsor: LASL

SITE: 57 miles Northwest of Alamogordo, New Mexico

Coordinates: 33° 40' 31" N
106° 28' 29" W

Site elevation: 4,624 ft

HEIGHT OF BURST: 100 ft

TYPE OF BURST AND PLACEMENT:
Tower burst

CLOUD TOP HEIGHT: 35,000 ft MSL
CLOUD BOTTOM HEIGHT: 10,600 ft MSL

CRATER DATA: Diameter: 1,100 ft
Depth: 9.5 ft

REMARKS:

Extensive surveys were made four hours after the shot with beta and gamma survey meters. The measurements were adjusted to H+1 hour by using the $t^{-1.2}$ law to approximate the decay.

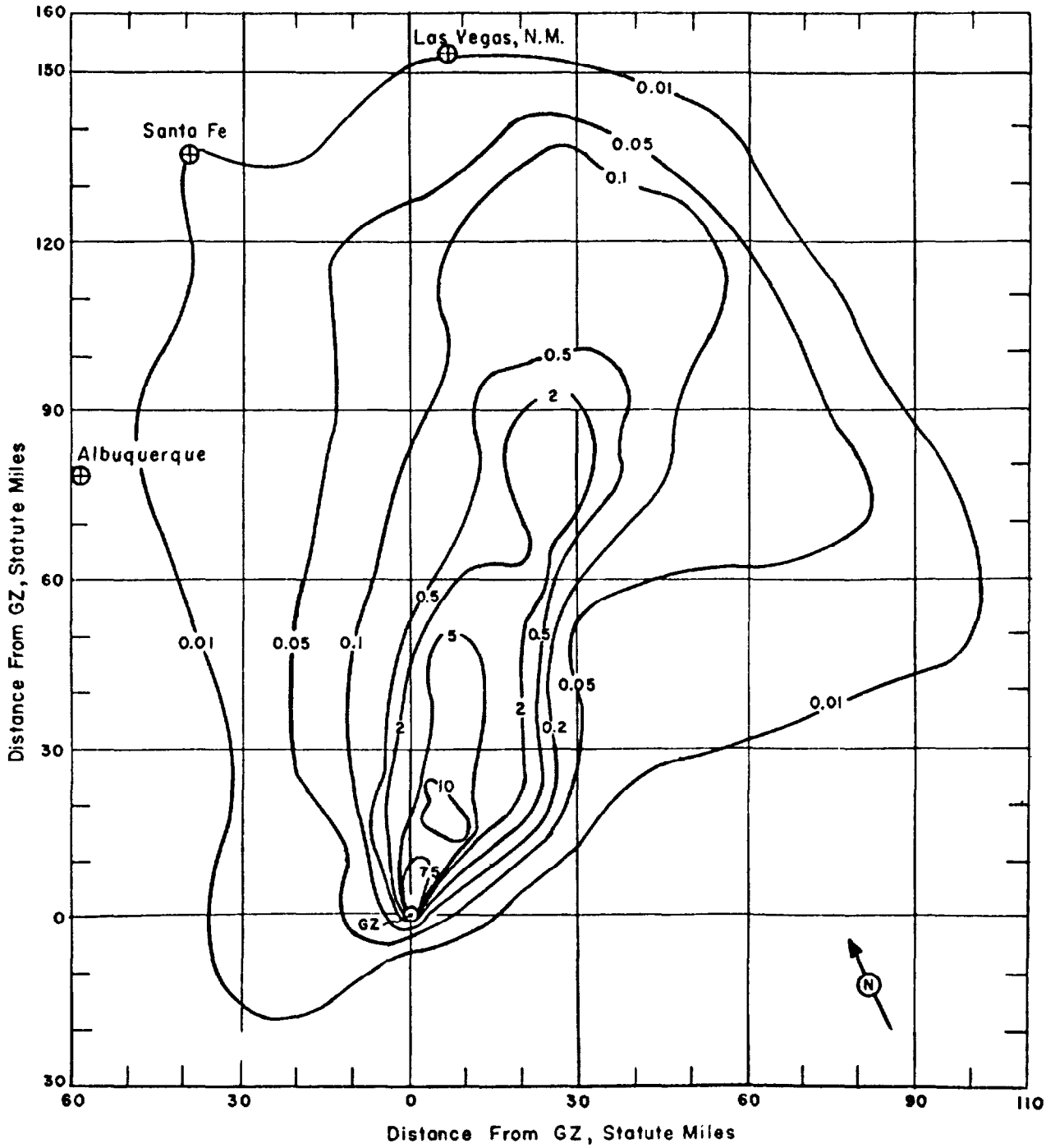


Figure 1. Operation TRINITY off-site dose rate contours in r/hr at H+1 hour.

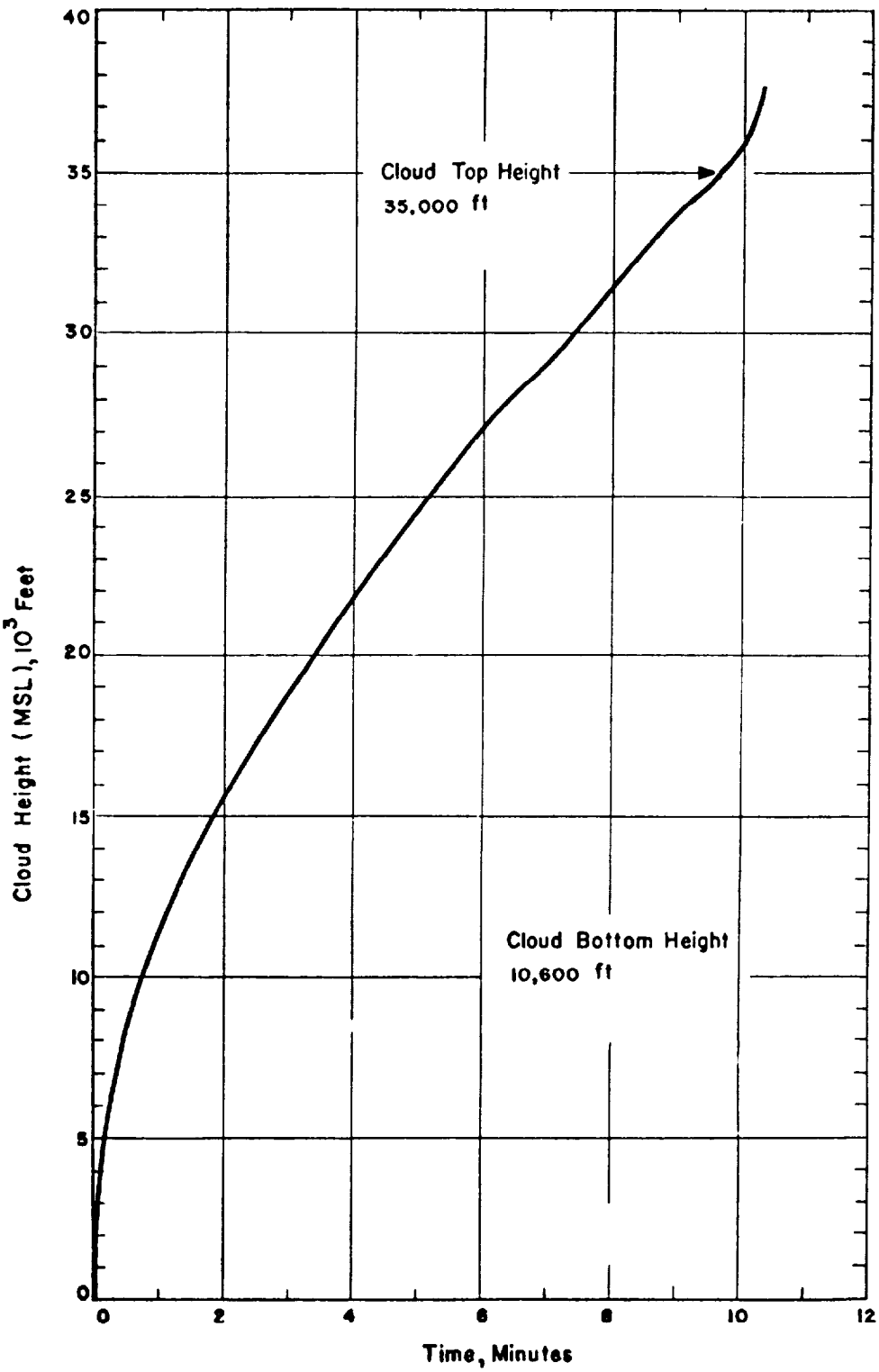


Figure 2. Cloud Dimensions: Operation TRINITY.

TABLE 1 ALAMOGORDO, NEW MEXICO WIND DATA FOR OPERATION TRINITY

Altitude (MSL)	H-hour		H+1½ hours		H+4 hours		H+7 hours		H+10¼ hours	
	Dir	Speed	Dir	Speed	Dir	Speed	Dir	Speed	Dir	Speed
feet	degrees	mph	degrees	mph	degrees	mph	degrees	mph	degrees	mph
5,100	110	04	---	--	---	--	---	--	---	--
5,300	160	07	330	04	160	03	240	01	140	09
6,000	200	06	260	03	150	03	120	02	100	04
6,700	230	07	230	04	140	03	140	05	100	03
7,300	250	08	250	04	160	03	130	07	140	05
7,900	250	10	270	03	160	05	130	07	150	07
8,500	240	08	250	04	150	05	130	06	170	07
9,100	230	07	230	04	170	05	130	08	[illegible]	07
9,700	220	08	230	07	190	07	140	10	[illegible]	06
10,300	220	12	230	10	210	10	150	10	170	05
10,900	220	11	230	13	200	11	150	08	180	04
11,500	200	08	220	12	180	11	150	05	070	02
12,100	190	07	170	10	170	11	190	03	310	05
12,700	170	09	160	11	180	11	240	03	310	06
13,300	170	12	160	12	190	11	240	04	320	04
13,900	160	12	170	14	210	12	250	06	310	05
14,500	150	13	180	16	200	13	270	08	290	06
15,100	140	13	180	15	180	13	280	10	280	06
15,700	130	16	190	13	170	16	280	08	290	06
16,300	120	16	190	12	170	16	270	05	280	07
16,900	140	12	190	07	190	11	250	04	290	05
17,500	160	10	160	07	210	03	240	05	270	03
17,600	150	13	---	--	---	--	---	--	---	--
18,100	---	--	170	05	320	02	260	05	270	03
18,600	150	12	---	--	---	--	---	--	---	--
18,700	---	--	210	04	280	02	260	06	270	01
19,300	---	--	220	03	270	03	250	06	130	03
19,600	180	04	---	--	---	--	---	--	---	--
19,900	---	--	---	--	270	02	250	06	180	05
20,600	250	04	---	--	---	--	---	--	---	--
21,600	240	08	---	--	---	--	---	--	---	--
21,700	---	--	---	--	---	--	220	11	210	08
22,600	220	11	---	--	---	--	---	--	---	--
22,900	---	--	---	--	---	--	190	17	210	16
23,600	220	15	---	--	---	--	---	--	---	--
24,600	220	15	---	--	---	--	---	--	---	--
29,600	230	16	---	--	---	--	---	--	---	--
34,600	230	27	---	--	---	--	---	--	---	--
39,600	240	19	---	--	---	--	---	--	---	--
44,600	290	18	---	--	---	--	---	--	---	--
48,600	280	11	---	--	---	--	---	--	---	--

Note: At H-hour the surface air pressure was 12.39 psi and the temperature 21.8°C.

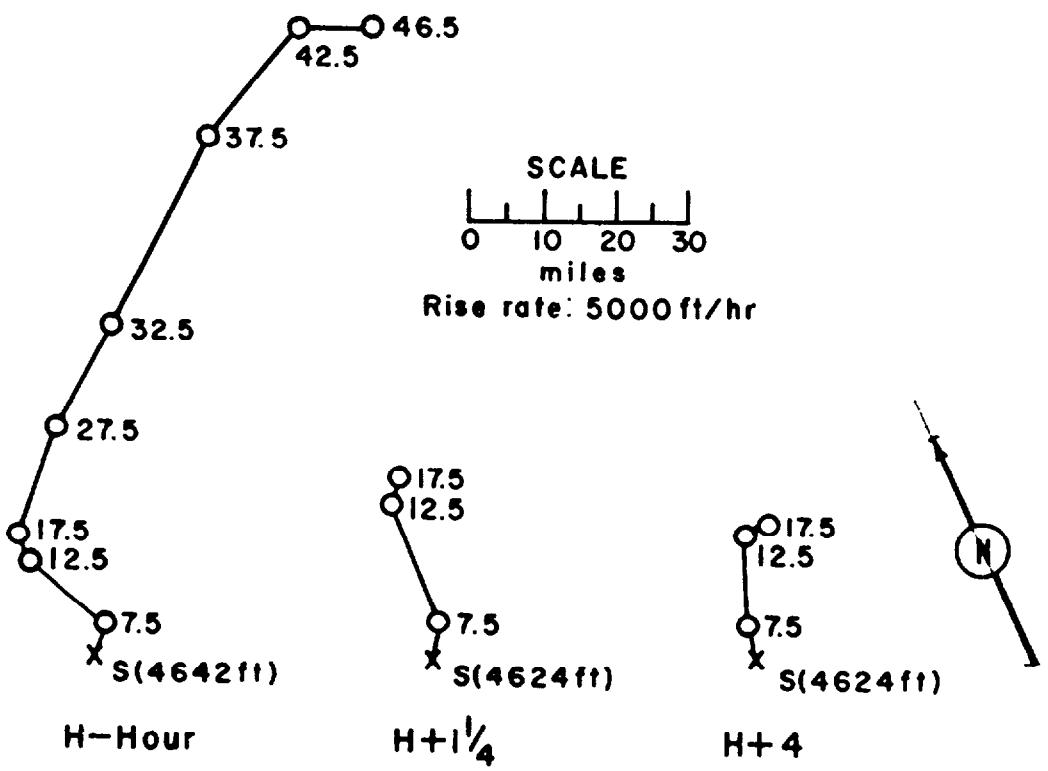


Figure 3. Hodographs for Operation TRINITY

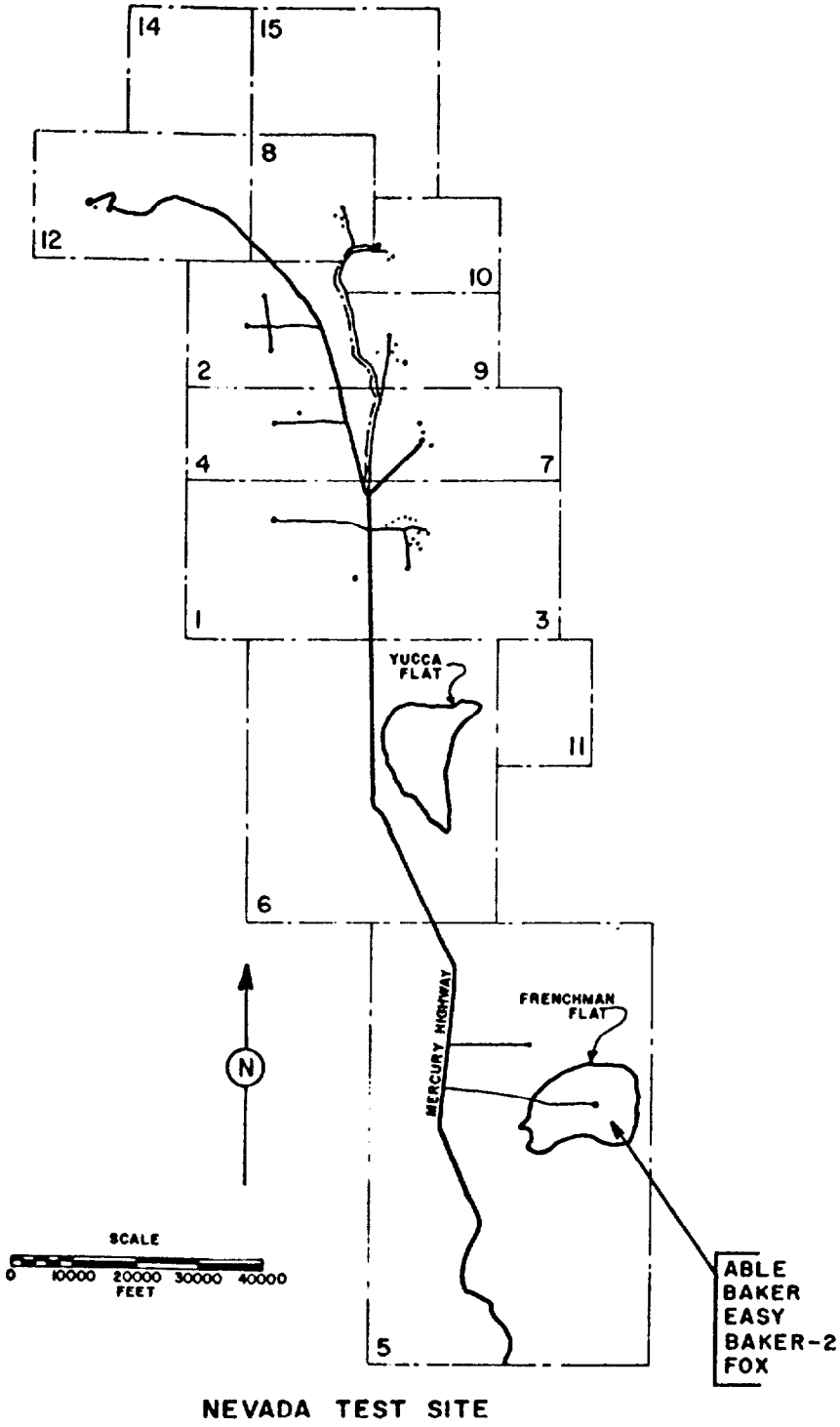


Figure 4 . Operation RANGER, Shot Locations.

OPERATION RANGER - Able

	PST	GMT
DATE:	27 Jan 1951	27 Jan 1951
TIME:	0545	1345

TOTAL YIELD: 1 kt

FIREBALL DATA:

Time to 1st minimum:	3.4 msec
Time to 2nd maximum:	NM
Radius at 2nd maximum:	NM

Sponsor: LASL

SITE: NTS - Frenchman Flat
36° 48' N
115° 57' W
Site elevation: 3,140 ft

HEIGHT OF BURST: 1,060 ft

TYPE OF BURST AND PLACEMENT:
Air burst

CLOUD TOP HEIGHT: 17,000 ft MSL
CLOUD BOTTOM HEIGHT: No available

REMARKS:

No local fallout. An induced-activity pattern was constructed from readings taken from H+1$\frac{1}{4}$ hours and to H+1$\frac{1}{2}$ hours along azimuths west and south of GZ. No decay correction was used. All the values below 20 mr/hr were measured with Geiger-Mueller type-2610A survey instruments. The values above 20 mr/hr were measured with high- and low-range Juno ionization-type meters.

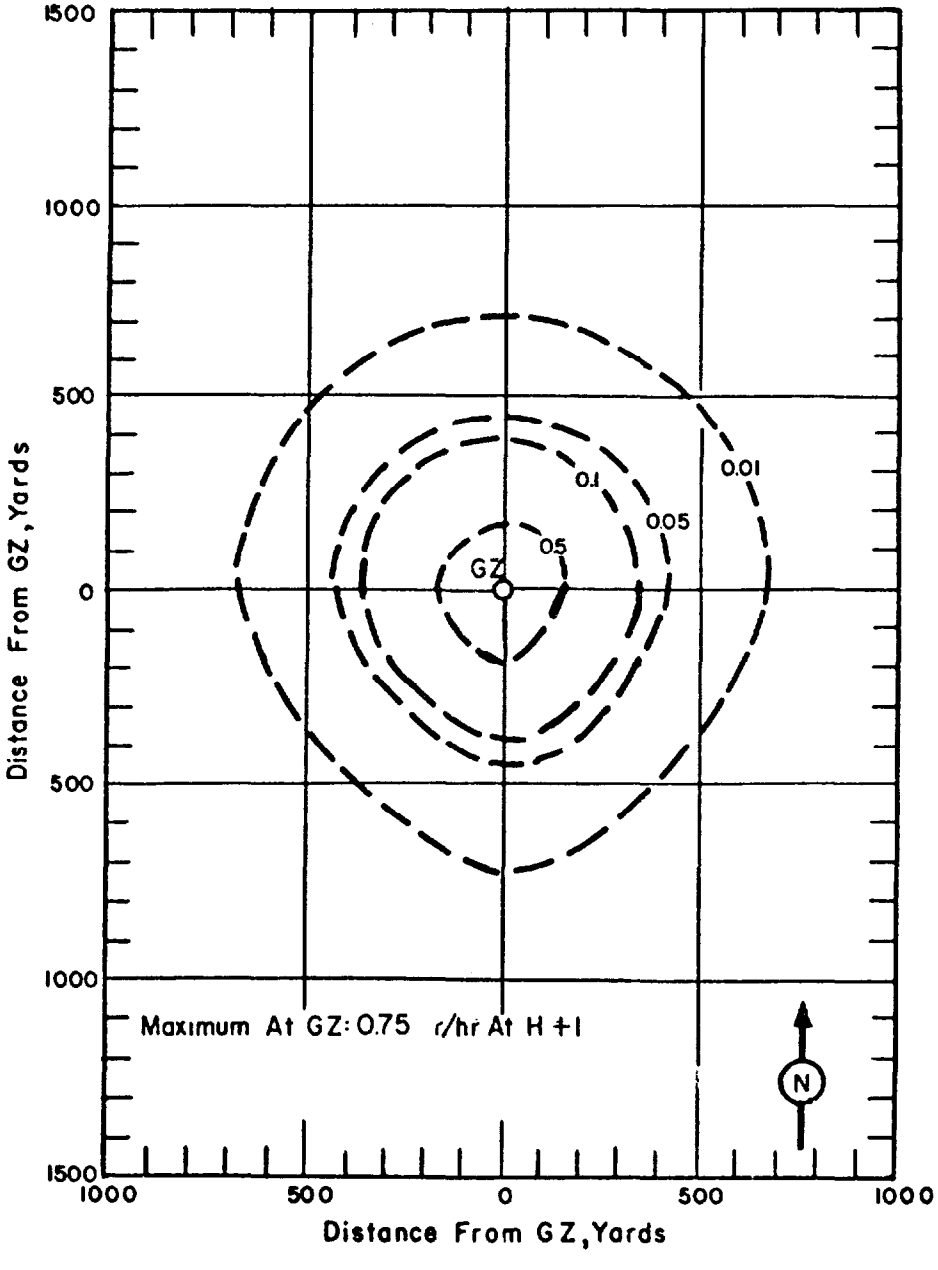


Figure 5. Operation RANGER - Able. On-site dose rate contours in r/hr at H+1 hour.

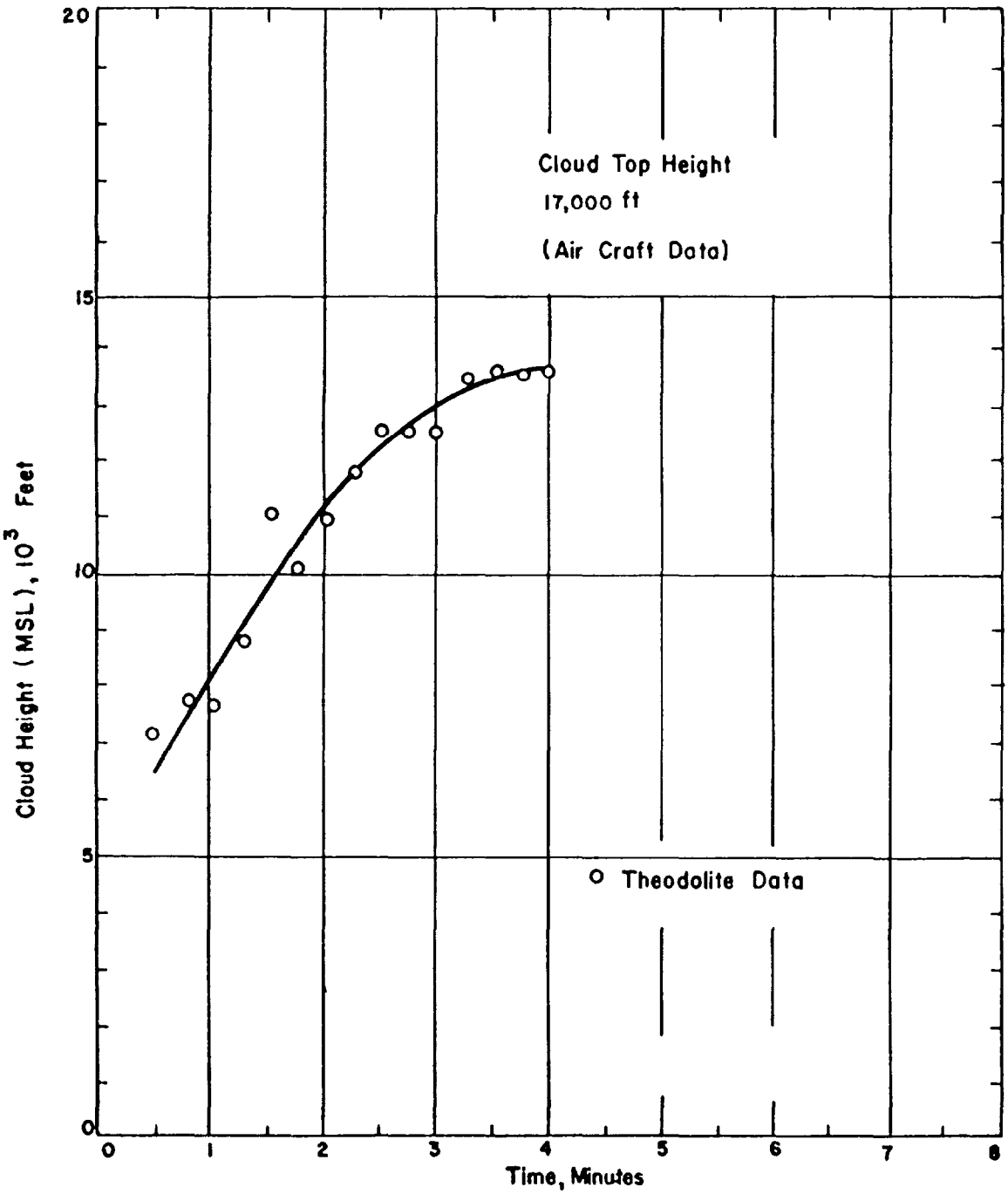


Figure 6. Cloud Dimensions: Operation RANGER - Able

TABLE 2 NEVADA WIND DATA FOR OPERATION RANGER - ABLE

Altitude (MSL)	H-1¾ hours		H-hour		H+1¼ hours	
	Dir	Speed	Dir	Speed	Dir	Speed
feet	degrees	mph	degrees	mph	degrees	mph
Surface	130	03	130	02	Calm	Calm
4,000	140	03	140	02	Calm	Calm
5,000	230	07	230	06	230	05
6,000	210	21	190	13	180	07
7,000	210	21	220	16	220	14
8,000	240	14	270	13	290	13
9,000	260	17	280	17	300	17
10,000	260	20	280	21	300	21
12,000	260	20	280	24	300	28
14,000	---	--	270	21	270	21
16,000	260	20	250	16	250	15
18,000	---	--	270	35	270	35
20,000	---	--	270	35	270	35

NOTES:

1. Wind data was obtained from the Ranger control point located on the slope of a mountain approximately 10 miles (in a southwesterly direction) from Frenchman Lake.
2. Tropopause height was 33,000 ft MSL.
3. H-hour values were determined by interpolation between the H-1¾ and H+1¼ hour values.
4. The surface air pressure was 13.10 psi, the temperature -2.0°C and the relative humidity 73%.

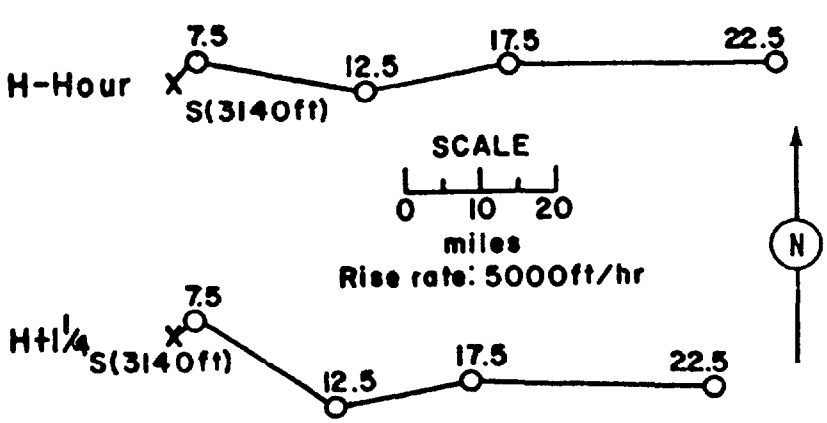


Figure 7. Hodographs for Operation Ranger - Able.

OPERATION RANGER - Baker-1

	PST	GMT
DATE:	28 Jan 1951	28 Jan 1951
TIME:	0552	1352

TOTAL YIELD: 8 kt

FIREBALL DATA:

Time to 1st minimum: 6.8 msec
Time to 2nd maximum: NM
Radius at 2nd maximum: NM

Sponsor: LASL

SITE: NTS - Frenchman Flat
36° 48' N
115° 57' W
Site elevation: 3,140 ft

HEIGHT OF BURST: 1,080 ft

TYPE OF BURST AND PLACEMENT:
Air burst

CLOUD TOP HEIGHT: 35,000 ft MSL
CLOUD BOTTOM HEIGHT: Not available

CRATER DATA: No crater

REMARKS:

No local fallout. An idealized induced-activity pattern was constructed from readings taken from H+1$\frac{1}{4}$ hours and to H+1$\frac{1}{2}$ hours along one azimuth west of GZ. No decay correction was used. All the values below 20 mr/hr were measured with Geiger-Mueller type 2610A survey instruments. The values above 20 mr/hr were measured with high- and low-range Juno ionization-type meters.

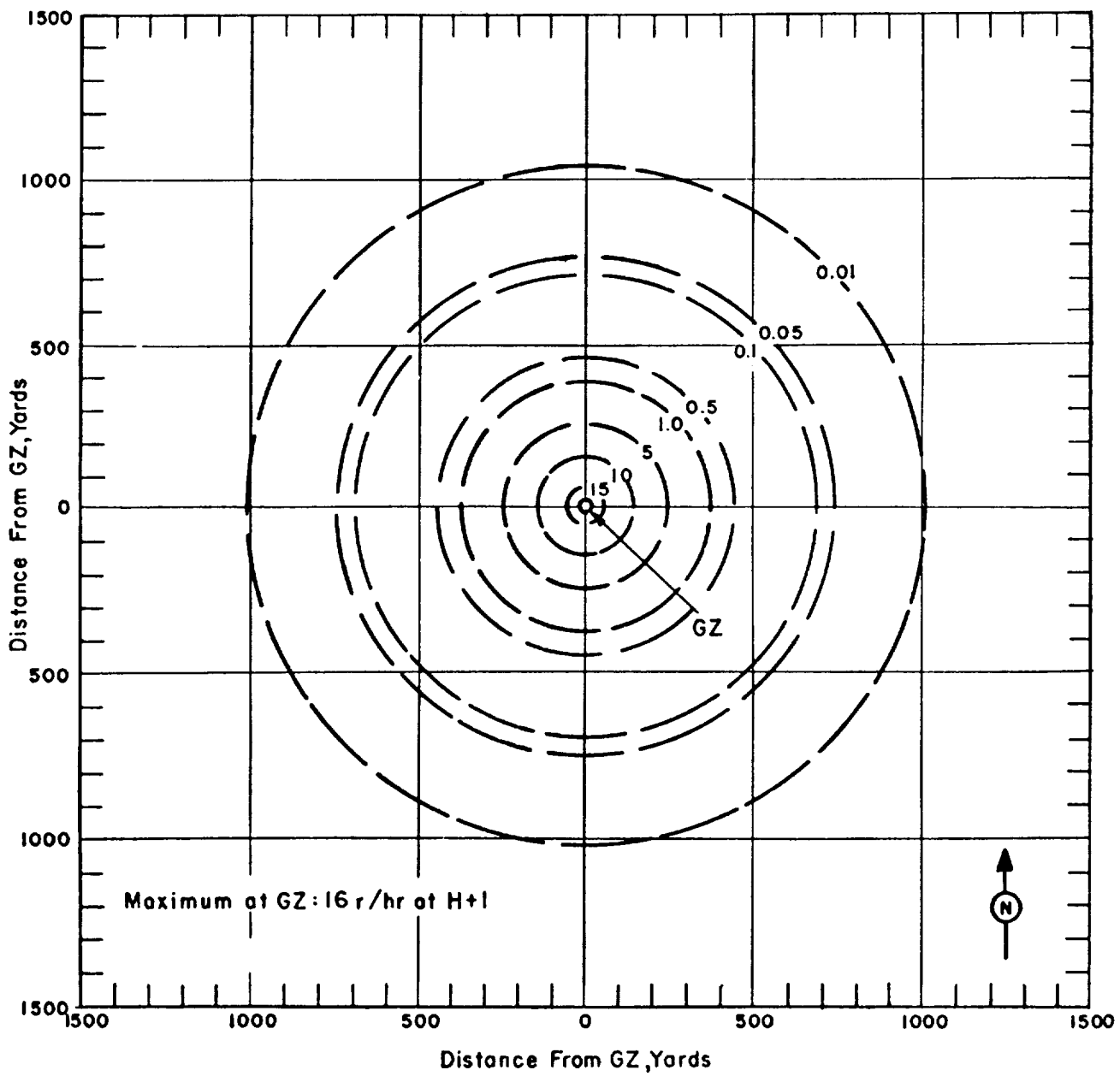


Figure 8. Operation RANGER - Baker. On-site dose rate contours in r/hr at H+1 hour.

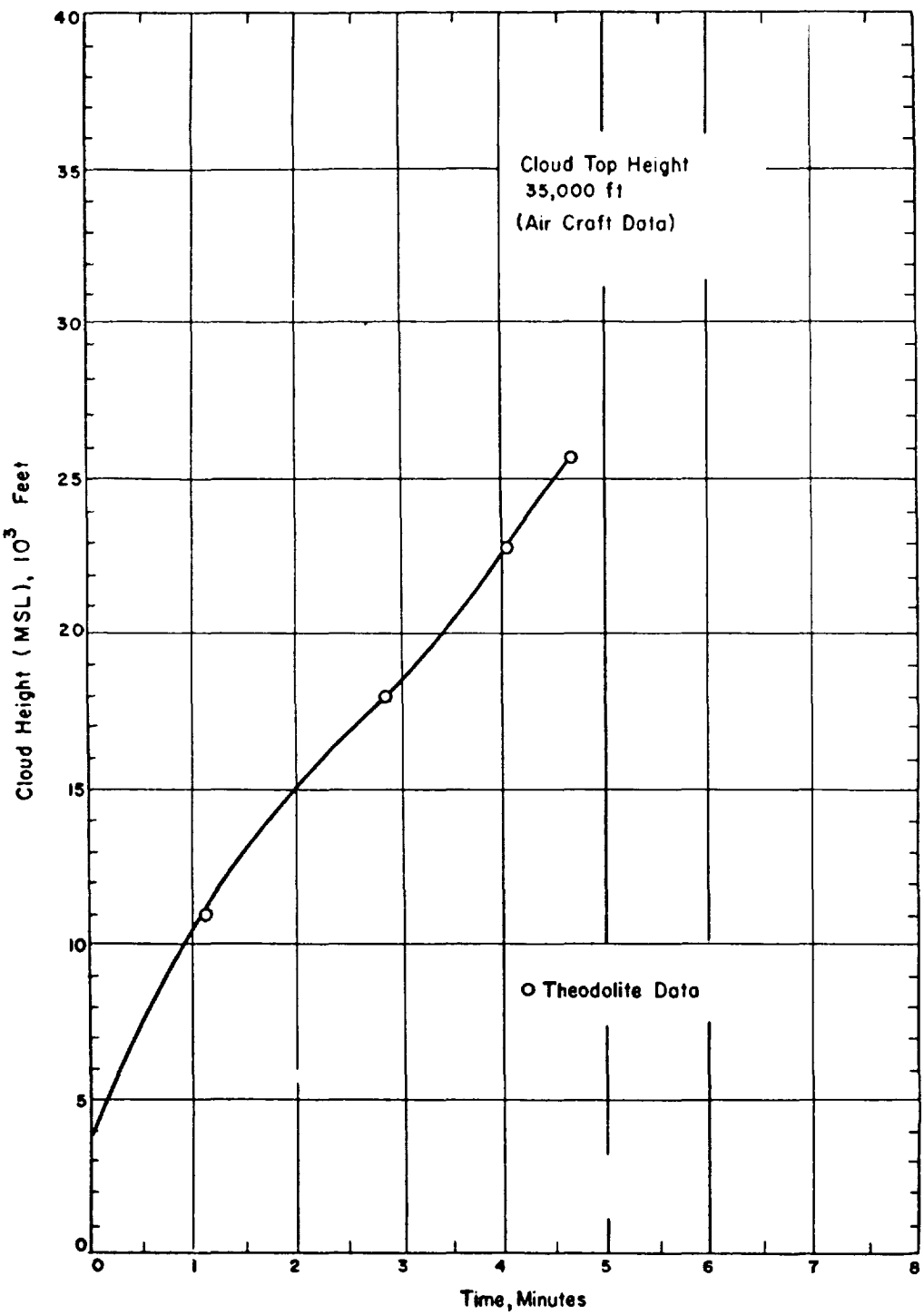


Figure 9 . Cloud Dimensions: Operation RANGER - Baker 1.

TABLE 3 NEVADA WIND DATA FOR OPERATION RANGER BAKER-1

Altitude (MSL)	H-1¾ hours		H-hour		H+1¼ hours	
	Dir	Speed	Dir	Speed	Dir	Speed
feet	degrees	mph	degrees	mph	degrees	mph
Surface	200	03	190	07	180	09
4,000	200	05	190	07	190	09
5,000	240	13	240	12	240	12
6,000	230	18	240	15	240	14
7,000	240	15	250	10	250	07
8,000	260	12	270	09	270	08
10,000	260	13	280	15	300	18
12,000	250	15	270	18	290	21
15,000	---	--	(310)	(23)	(310)	(23)
16,000	---	--	310	24	310	24
18,000	---	--	310	31	310	31
20,000	---	--	300	26	300	26
25,000	---	--	290	41	290	41
30,000	---	--	290	38	290	38

NOTES:

1. Numbers in parenthesis are estimated values.
2. Wind data was obtained from the Ranger control point located on the slope of a mountain approximately 10 miles (in a southwesterly direction) from Frenchman Lake.
3. Tropopause height was 32,000 ft MSL.
4. H-hour values were determined by interpolating between the H-1¾ and H+1¼ hour values.
5. The surface air pressure was 13.04 psi, the temperature -2.8°C, and the relative humidity 87%.

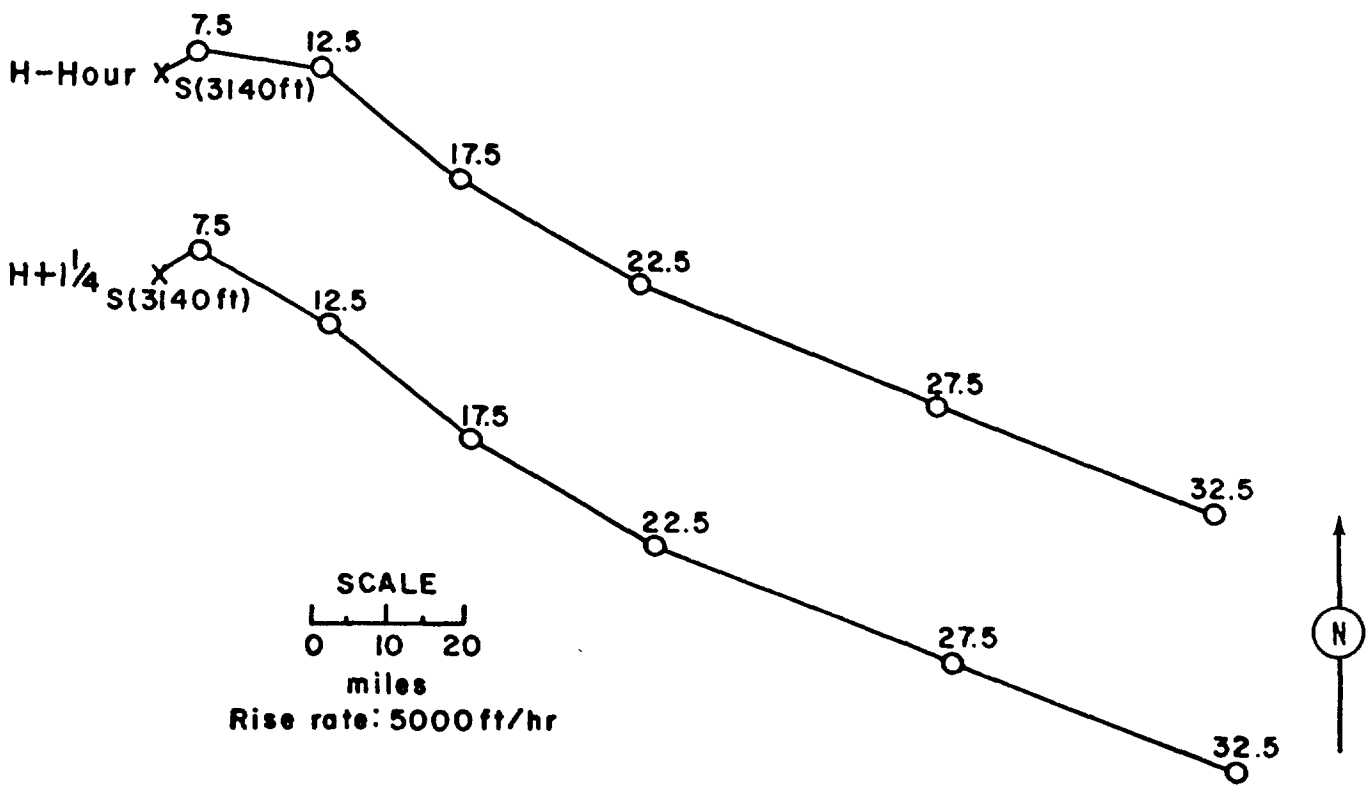


Figure 10. Hodographs for Operation RANGER - Baker-1.

OPERATION RANGER - Easy

	PST	GMT
DATE:	1 Feb 1951	1 Feb 1951
TIME:	0547	1347

TOTAL YIELD: 1 kt

FIREBALL DATA:
Time to 1st minimum: 5.0 msec
Time to 2nd maximum: NM
Radius at 2nd maximum: NM

CRATER DATA: No crater

Sponsor: LASL

SITE: NTS - Frenchman Flat
36° 48' N
115° 57' W
Site elevation: 3,140 ft

HEIGHT OF BURST: 1,080 ft

TYPE OF BURST AND PLACEMENT:
Air burst

CLOUD TOP HEIGHT: 12,500 ft MSL
CLOUD BOTTOM HEIGHT: Not available

REMARKS:

No local fallout. Induced activity pattern was constructed from readings taken from H+1 hour and to H+1½ hours along four azimuths: north, east, south, and west. No decay correction was used. All the values below 20 mr/hr were measured with Geiger-Mueller type 2610A survey instruments. The values above 20 mr/hr were measured with high- and low-range Juno ionization-type meters.

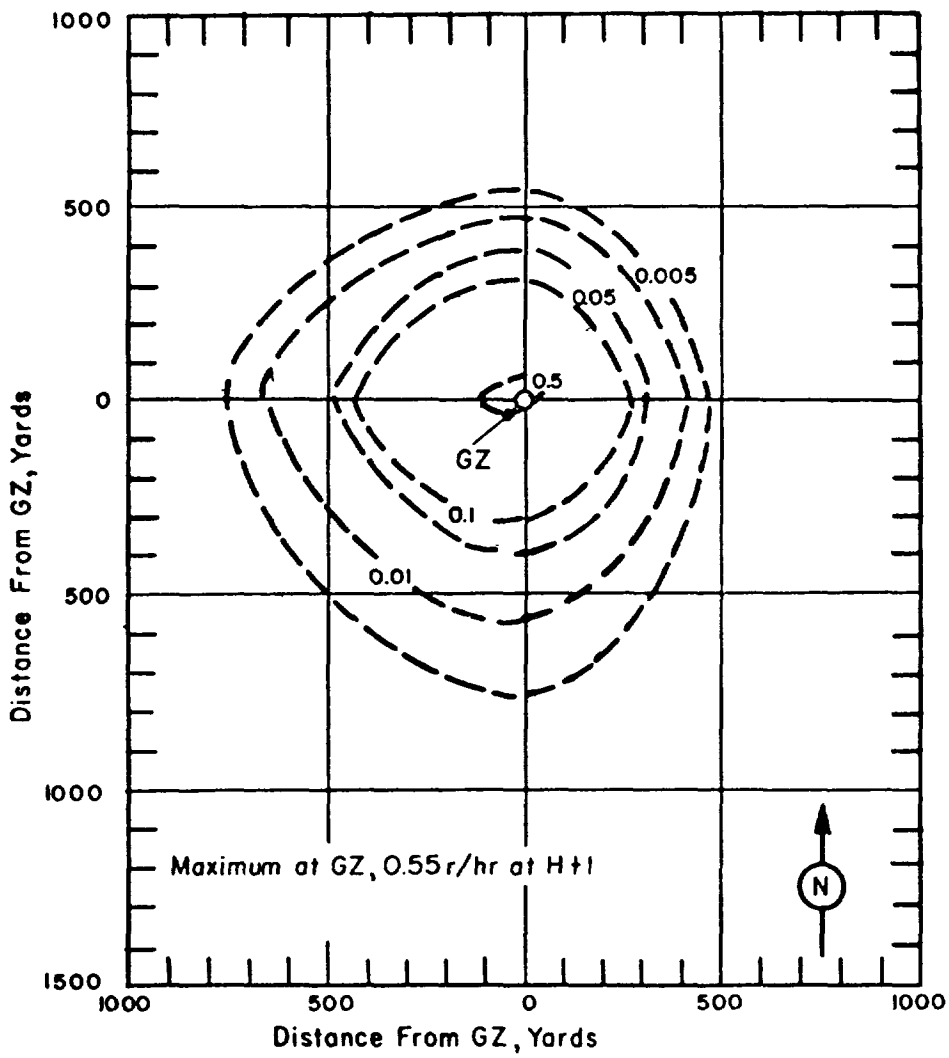


Figure 11. Operation RANGER - Easy. On-site dose rate contours in r/hr at H+1 hour.

TABLE 4 NEVADA WIND DATA FOR OPERATION RANGER - EASY

Altitude (MSL)	H-$1\frac{3}{4}$ hours		H-hour		H+$1\frac{1}{4}$ hours	
	Dir	Speed	Dir	Speed	Dir	Speed
feet	degrees	mph	degrees	mph	degrees	mph
Surface	020	03	010	02	Calm	Calm
4,000	020	05	010	02	Calm	Calm
5,000	020	17	030	11	040	06
6,000	100	09	060	10	010	10
7,000	050	16	360	18	340	21
8,000	360	23	340	29	330	32
9,000	340	31	340	26	340	24
10,000	340	26	340	30	340	32
12,000	330	26	340	45	340	62

NOTES:

1. H-hour values were determined by interpolating between the H-$1\frac{3}{4}$ and H+$1\frac{1}{4}$ hour values.
2. Wind data was obtained from the Ranger control point located on the slope of a mountain approximately 10 miles (in a southwesterly direction) from Frenchman Lake.
3. Tropopause height was 35,000 ft MSL.
4. The surface air pressure was 13.33 psi, the temperature -11.5°C and the relative humidity 89%.

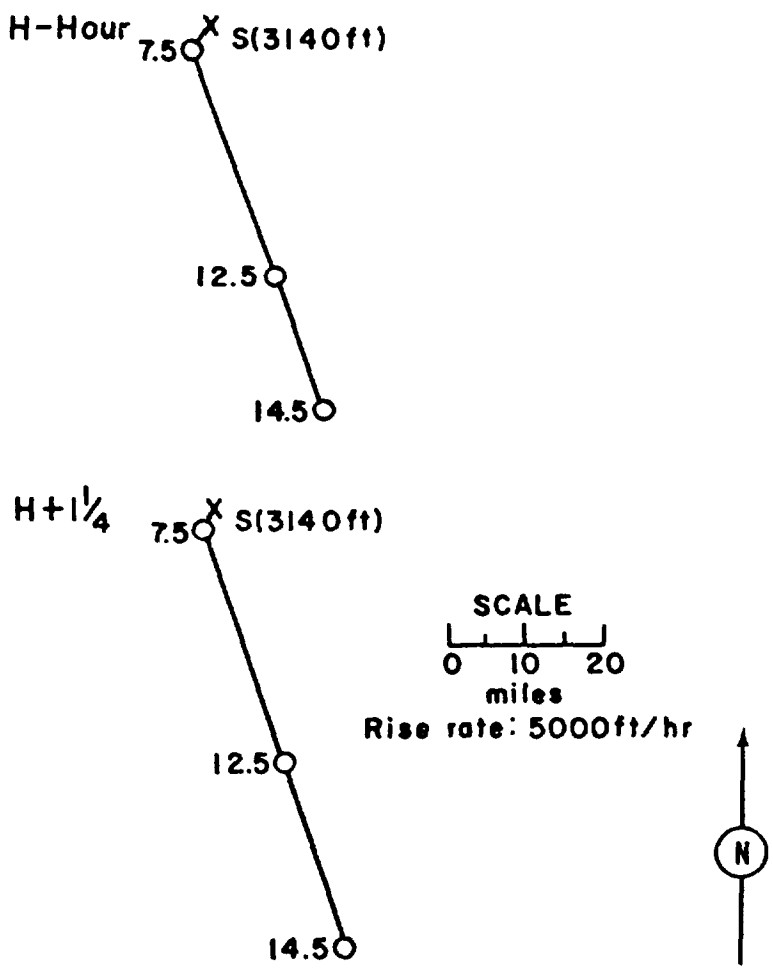


Figure 12. Hodographs for Operation RANGER - Easy.

OPERATION RANGER - Baker 2

	PST	GMT
DATE:	2 Feb 1951	2 Feb 1951
TIME:	0549	1349

Sponsor: LASL

SITE: NTS - Frenchman Flat
36° 48' N
115° 57' W
Site elevation: 3,140 ft

TOTAL YIELD: 8 kt

HEIGHT OF BURST: 1,100 ft

TYPE OF BURST AND PLACEMENT:
Air burst

FIREBALL DATA:

Time to 1st minimum:	8.9 to 9.2 msec
Time to 2nd maximum:	NM
Radius at 2nd maximum:	NM

CLOUD TOP HEIGHT: 28,000 ft MSL
CLOUD BOTTOM HEIGHT: Not available

CRATER DATA: No crater

REMARKS:

No local fallout. Induced-activity pattern was constructed from 8 surveys made from H+1 and to H+28 hours along stakes placed 100 yd apart on four azimuths, north, east, south, and west. Decay corrections were made from measurements along the west azimuth. All the values below 20 mr/hr were measured with Geiger-Mueller type 2610A survey instruments. The values above 20 mr/hr were measured with high- and low-range Juno ionization-type meters.

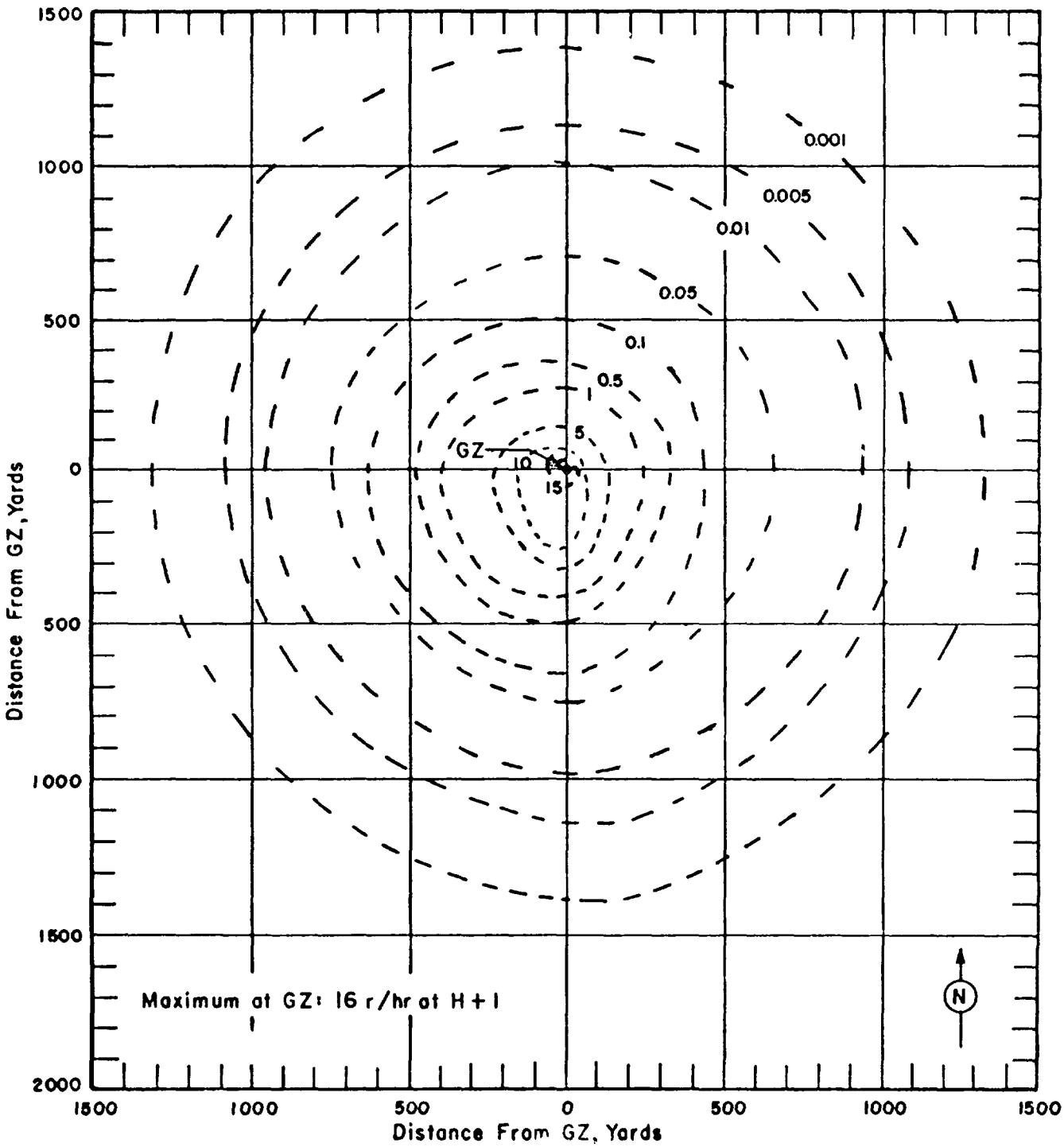


Figure 13. Operation RANGER - Baker 2. On-site dose rate contours in r/hr at H+1 hour.

TABLE 5 NEVADA WIND DATA FOR OPERATION RANGER - BAKER-2

Altitude (MSL)	H-1¾ hours		H-hour		H+1¼ hours	
	Dir	Speed	Dir	Speed	Dir	Speed
feet	degrees	mph	degrees	mph	degrees	mph
Surface	Calm	Calm	Calm	Calm	Calm	Calm
4,000	Calm	Calm	Calm	Calm	Calm	Calm
5,000	180	02	190	02	190	02
6,000	240	01	230	05	220	07
7,000	190	10	210	15	220	17
8,000	190	22	210	26	220	30
9,000	240	26	250	26	260	26
10,000	260	24	260	25	270	28
12,000	280	29	290	33	290	36
14,000	290	22	290	35	290	43
15,000	---	--	(290)	(45)	(290)	(45)
16,000	---	--	290	47	290	47
18,000	---	--	280	43	280	43
20,000	---	--	290	51	290	51

NOTES:

1. Numbers in parentheses are estimated values.
2. Wind data was obtained from the Ranger control point located on the slope of a mountain approximately 10 miles (in a southwesterly direction) from Frenchman Lake.
3. H-hour values were determined by interpolating between the H-1¾ and H+1¼ hour values.
4. Tropopause height was 38,000 ft MSL.
5. The surface air pressure was 12.81 psi, the temperature -9.2°C and the relative humidity 79%.

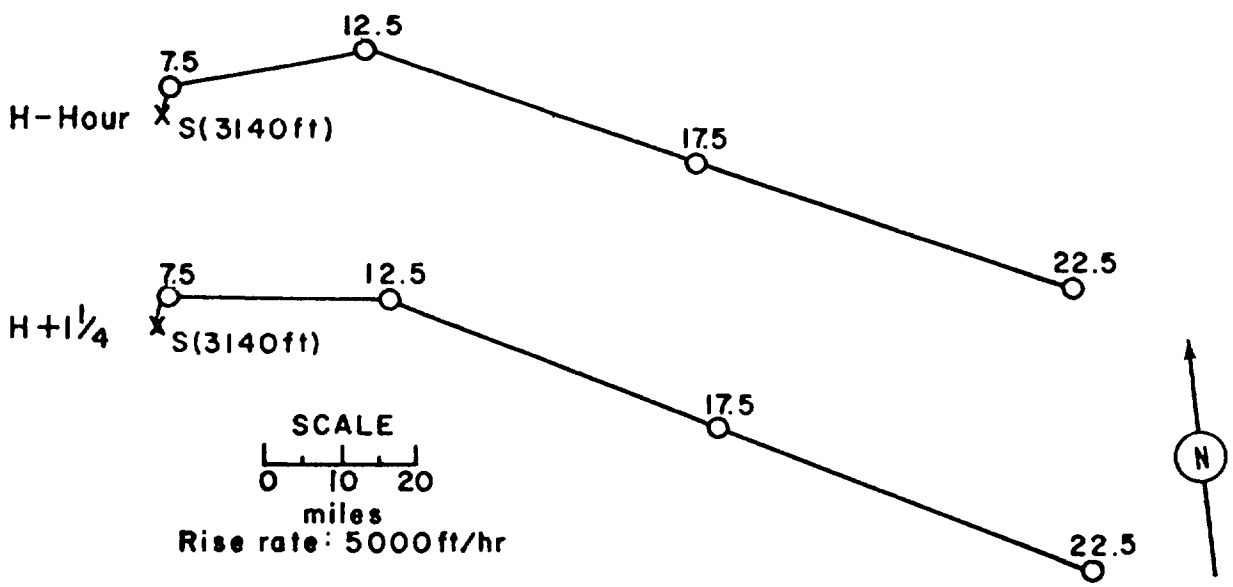


Figure 14. Hodographs for Operation RANGER - Baker-2.

OPERATION RANGER - Fox

	PST	GMT
DATE:	6 Feb 1951	6 Feb 1951
TIME:	0547	1347

Sponsor: LASL

SITE: NTS - Frenchman Flat
36° 48' N
115° 57' W
Site elevation: 3,140 ft

TOTAL YIELD: 22 kt

HEIGHT OF BURST: 1,435 ft

TYPE OF BURST AND PLACEMENT:
Air burst

FIREBALL DATA:

Time to 1st minimum:	7.6 to 15.4 msec
Time to 2nd maximum:	NM
Radius at 2nd maximum:	NM

CLOUD TOP HEIGHT: 43,000 ft MSL
CLOUD BOTTOM HEIGHT: 27,000 ft MSL

CRATER DATA: No Crater

REMARKS:

No local fallout. Induced-activity pattern was constructed from readings taken from H+$\frac{3}{4}$ hours and to H+1$\frac{1}{2}$ hours along azimuth. No decay correction was used. All the values below 20 mr/hr were measured with Geiger-Mueller type-2610A survey instruments. The values above 20 mr/hr were measured with high- and low-range Juno ionization-type meters.

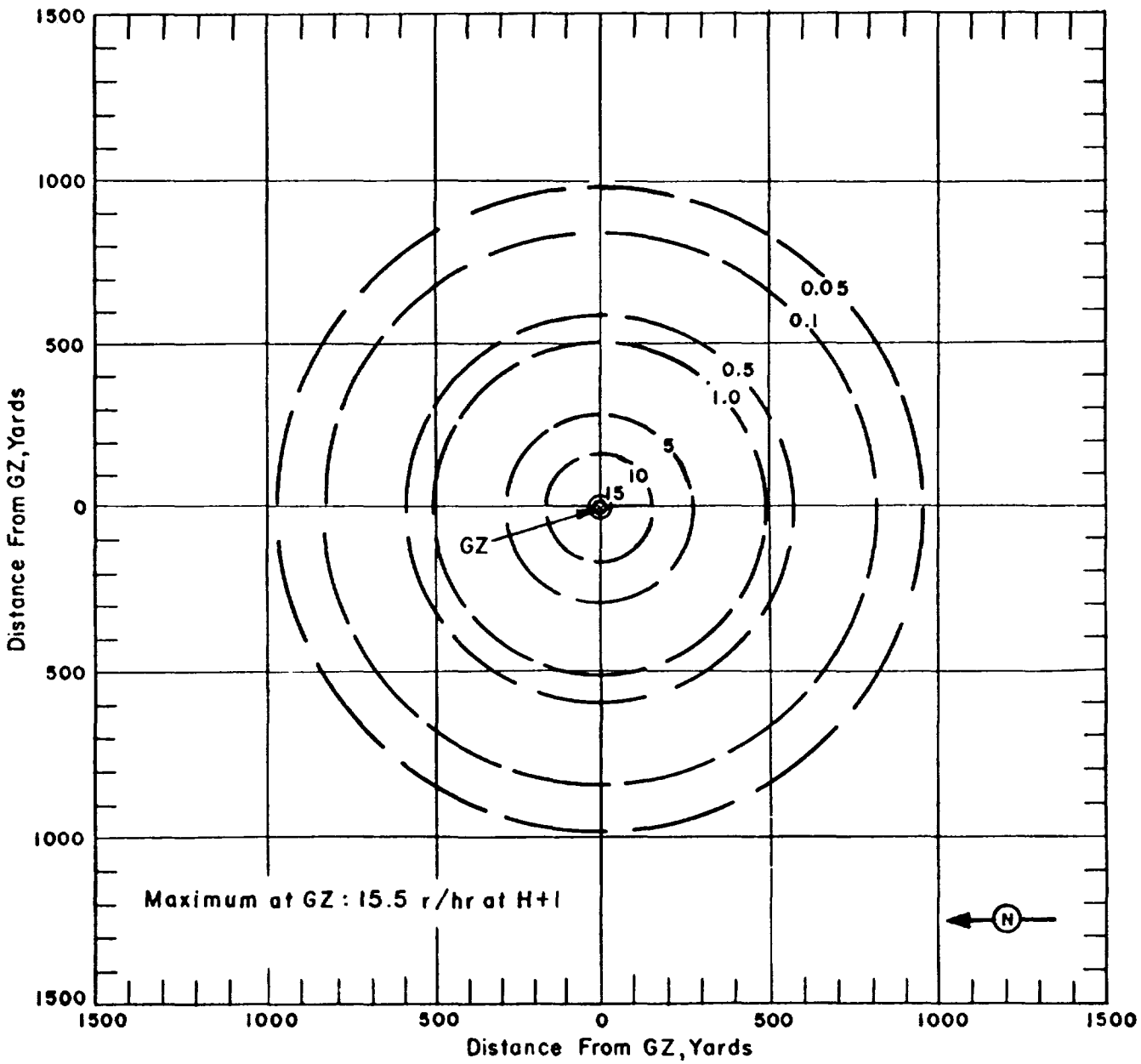


Figure 15. Operation RANGER - Fox. On-site dose rate contours in r/hr at H+1 hour.

TABLE 6 NEVADA WIND DATA FOR OPERATION RANGER FOX

Altitude (MSL)	H-1¾ hours	
	Dir	Speed
feet	degrees	mph
Surface	150	02
4,000	140	02
5,000	050	08
6,000	350	10
7,000	310	09
8,000	270	12
9,000	290	21
10,000	310	31
12,000	330	51
14,000	340	49
15,000	(340)	(53)
16,000	330	56
18,000	330	45
20,000	310	56
25,000	300	58
30,000	290	52

NOTES:

1. Numbers in parentheses are estimated values.
2. Wind data was obtained from the Ranger control point located on the slope of a mountain approximately 10 miles (in a southwesterly direction) from Frenchman Lake.
3. Tropopause height was 40,000 ft MSL.
4. The surface air pressure was 13.18 psi, the temperature -2.0°C and the relative humidity 85%.

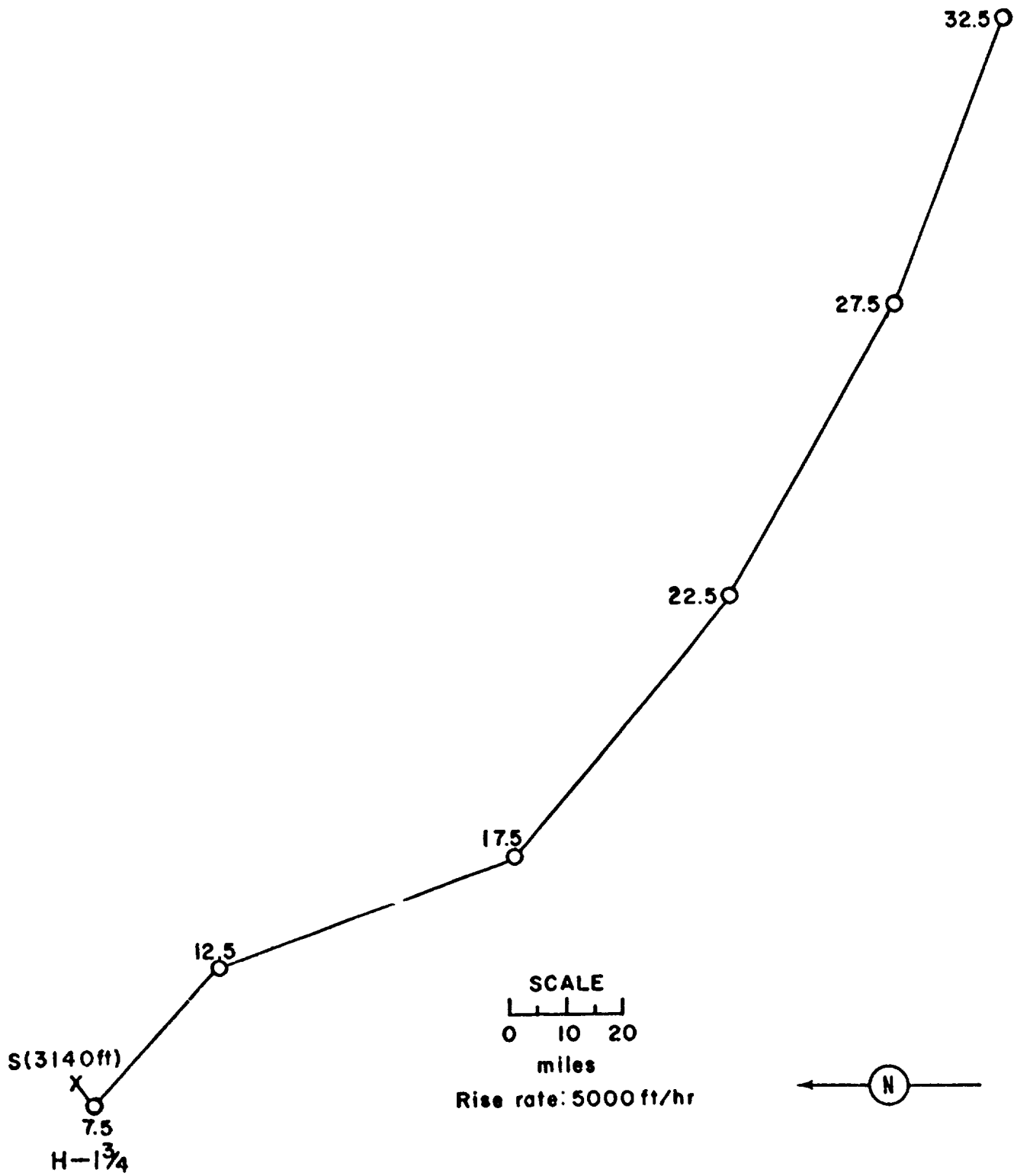
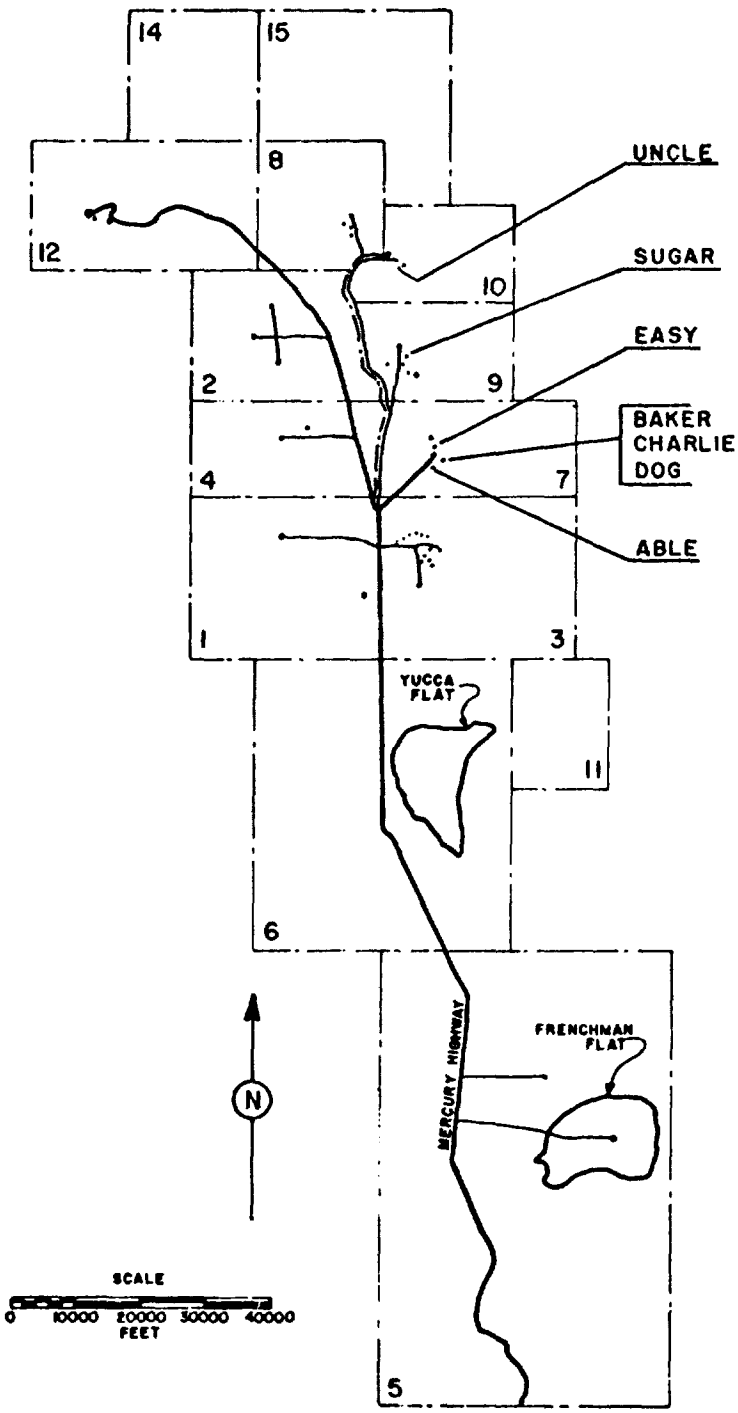


Figure 16. Hodograph for Operation RANGER - Fox.



NEVADA TEST SITE

Figure 17. Operation BUSTER-JANGLE, Shot Locations.

OPERATION BUSTER - JANGLE - Able

	PST	GMT
DATE:	22 Oct 1951	22 Oct 1951
TIME:	0600	1400

TOTAL YIELD: <0.1 kt

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

CRATER DATA: No crater

Sponsor: LASL

SITE: NTS - Area 7 - Station 5
37° 05' 02" N
116° 01' 26" W
Site elevation: 4,169.17 ft

HEIGHT OF BURST: 100 ft

TYPE OF BURST AND PLACEMENT:
Tower burst over Nevada soil

CLOUD TOP HEIGHT: 8,000 ft MSL
CLOUD BOTTOM HEIGHT: 6,700 ft MSL

REMARKS:

Gamma contamination was insignificant. The alpha contamination shown is based upon readings taken on D day and D+1 and is reported in counts per minute with 50% geometry. Missiles were scattered over a 500-yard radius. Readings on some pieces were greater than 20,000 counts per minute.

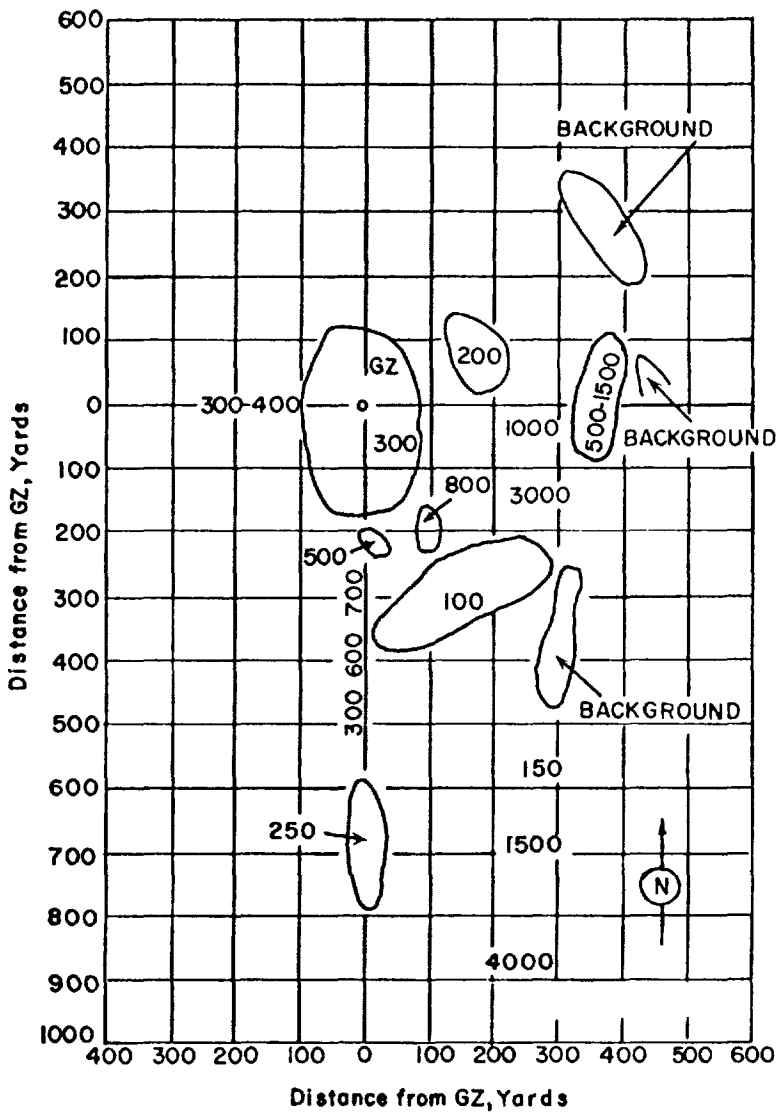


Figure 18. Operation BUSTER-JANGLE - Able.
Alpha contamination designated in counts per minute with 50% geometry.

TABLE 7 NEVADA WIND DATA FOR OPERATION BUSTER-JANGLE — ABLE

Altitude (MSL)	H-hour		H+1 hour		H+7 hours	
	Dir	Speed	Dir	Speed	Dir	Speed
feet	degrees	mph	degrees	mph	degrees	mph
Surface	320	06	320	09	270	07
5,000	320	10	320	10	320	07
6,000	310	17	310	17	320	05
7,000	310	20	310	20	330	03
8,000	310	20	310	20	330	06
9,000	310	21	310	21	320	07
10,000	300	20	300	20	300	07
12,000	320	29	320	29	320	22
14,000	320	39	320	39	320	33
15,000	---	--	320	41	310	38
16,000	320	54	320	54	310	43
18,000	320	55	320	55	310	39
20,000	320	47	320	47	320	57
23,000	---	--	320	55	---	--
25,000	320	61	---	--	320	87

NOTE:
Wind data was obtained by the Mercury Weather Station located at the C. P. At H-hour the pressure at ground zero was 874 mb, the temperature 5.8°C and the relative humidity 22 percent.

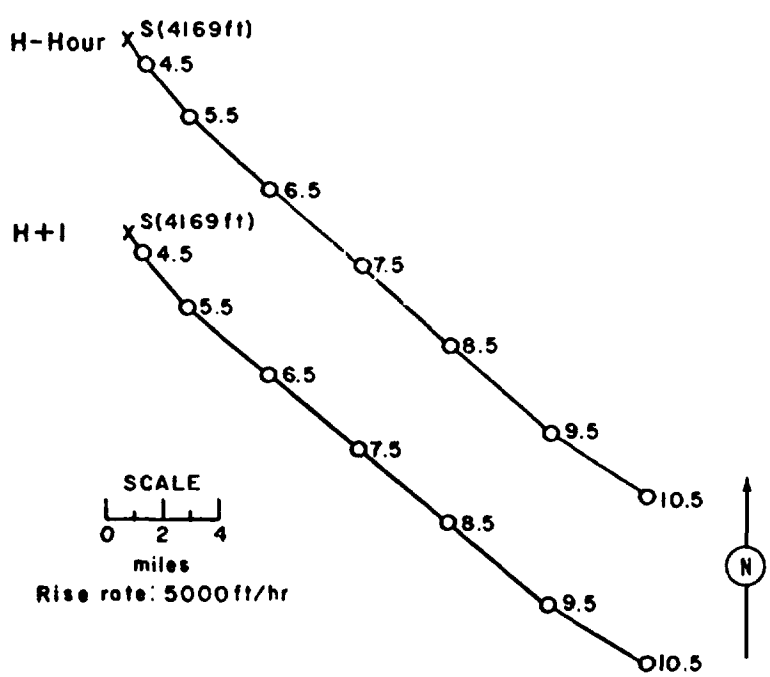


Figure 19. Hodographs for Operation BUSTER-JANGLE — Able.

OPERATION BUSTER-JANGLE - Baker

	PST	GCT
DATE:	28 Oct 1951	28 Oct 1951
TIME:	0720	1520

TOTAL YIELD: 3.5 kt

FIREBALL DATA:

Time to 1st minimum: 5.5 to 6.0 msec
Time to 2nd maximum: NM
Radius at 2nd maximum: NM

Sponsor: LASL

SITE: NTS - Area 7 - Station 3
37° 05' 06" N
116° 01' 12" W
Site elevation: 4,193 ft

HEIGHT OF BURST: 1,118 ft

CLOUD TOP HEIGHT: 31,700 ft MSL
CLOUD BOTTOM HEIGHT: 23,000 ft MSL

CRATER DATA: No crater

TYPE OF BURST AND PLACEMENT:
Air burst over Nevada soil

REMARKS:

The contours resulting from this shot were due primarily to neutron-induced activity. Readings were obtained by monitors during area surveys or recovery operations and were taken 3 ft above ground with T1B or SU-10 ionization-chamber survey meters. The pattern was obtained from readings taken at H+11 hours and corrected to H+1 hour, using the decay curve for neutron-induced activity in Nevada soil

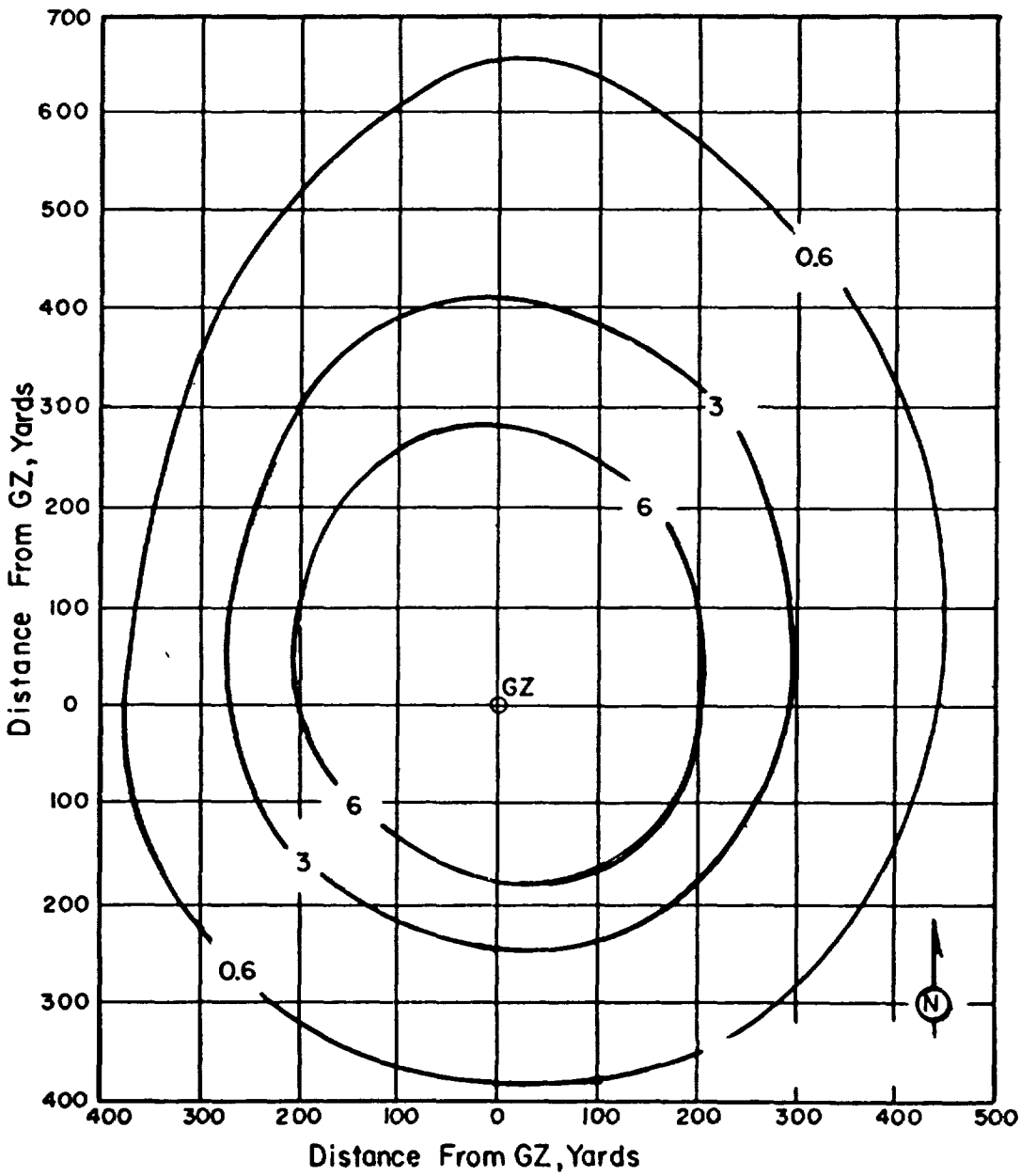


Figure 20. Operation BUSTER-JANGLE - Baker.
On-site dose rate contours in r/hr at H+1 hour.

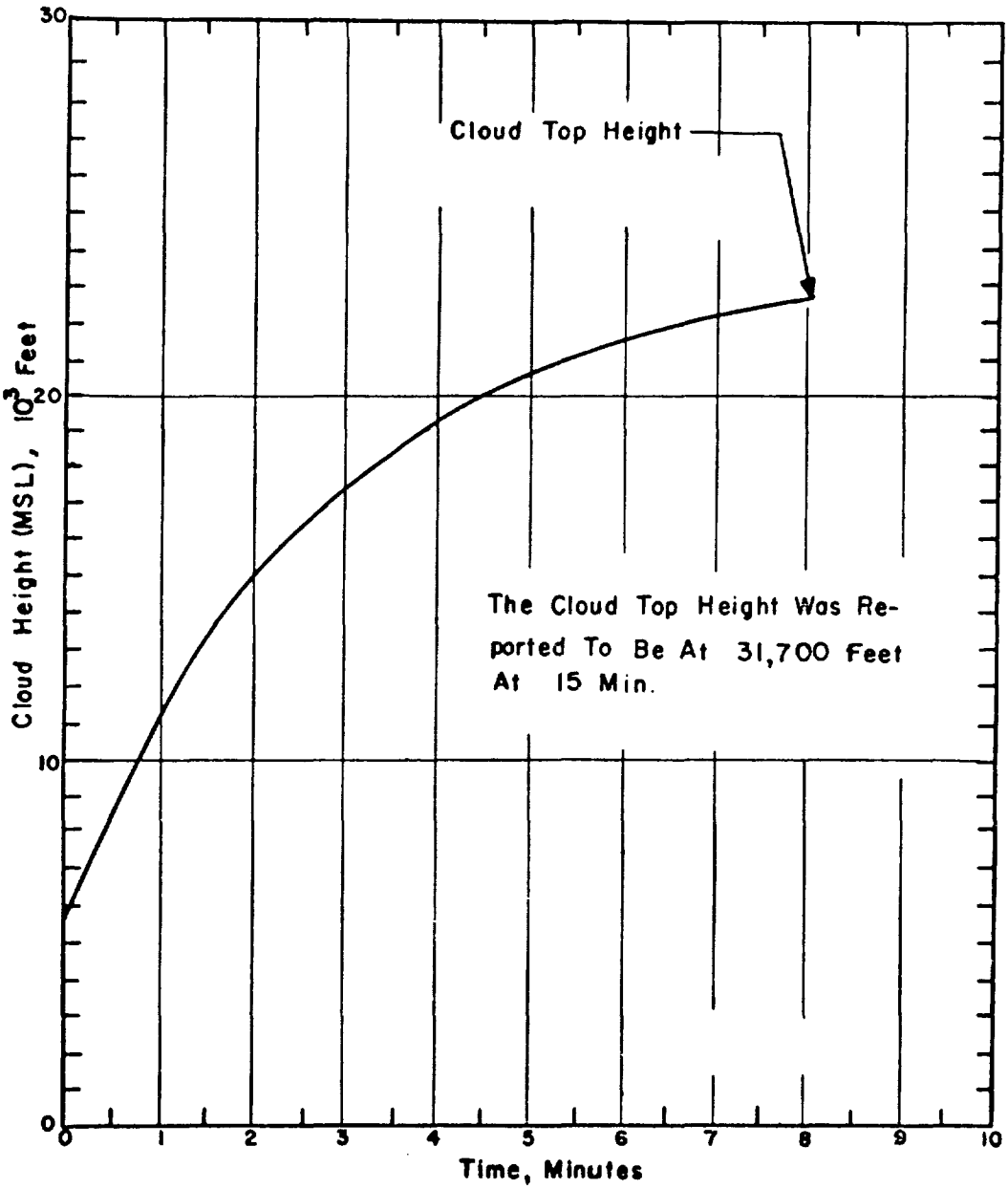


Figure 21. Cloud Dimensions: Operation BUSTER-JANGLE - Baker.

TABLE 8 NEVADA WIND DATA FOR OPERATION BUSTER-JANGLE BAKER

Altitude (MSL)	H-hour		H+2½ hours	
	Dir	Speed	Dir	Speed
feet	degrees	mph	degrees	mph
Surface	320	10	340	07
5,000	---	--	020	14
6,000	030	23	040	18
7,000	---	--	040	23
8,000	050	29	040	25
9,000	---	--	040	25
10,000	070	17	030	20
12,000	100	14	050	05
14,000	050	17	080	13
15,000	(050)	(20)	(080)	(13)
16,000	050	21	070	14
18,000	050	25	060	18
20,000	050	26	050	26
23,000	050	32	---	--
25,000	050	44	050	24
30,000	060	50	050	22
35,000	060	63	---	--

NOTES:

1. Numbers in parentheses are estimated values.
2. Wind data was obtained by the Mercury Weather Station at the C. P.
3. Tropopause height was 39,000 ft MSL.
4. At H-hour the pressure at ground zero was 877 mb, the temperature 11.4°C and the relative humidity 28 percent.

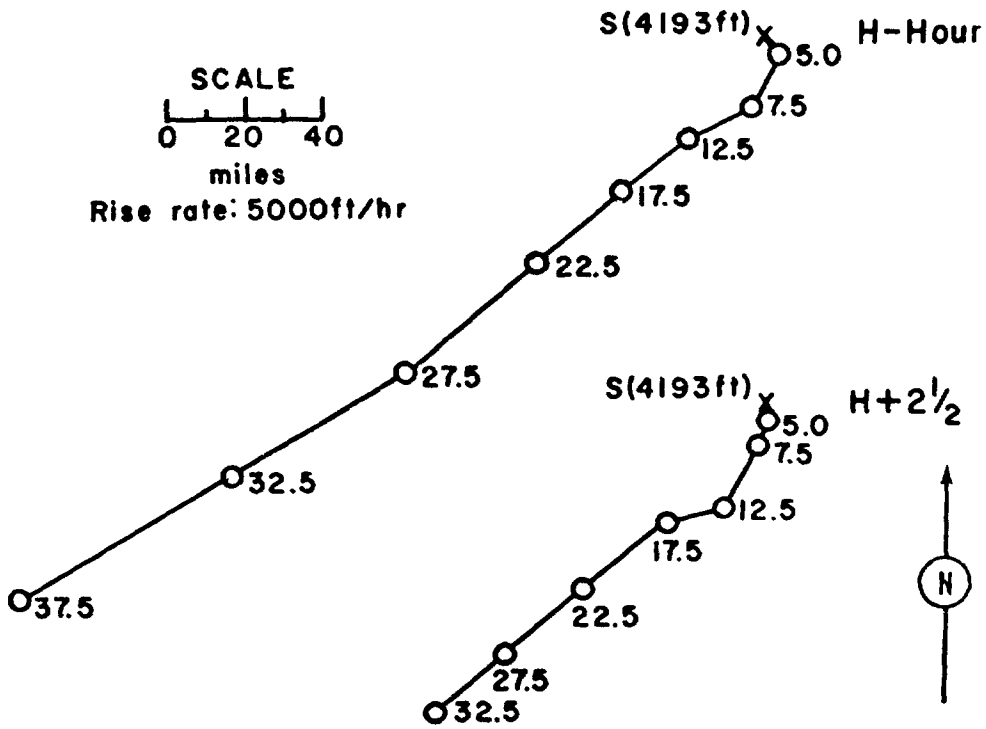


Figure 22. Hodographs for Operation BUSTER-JANGLE - Baker

OPERATION BUSTER-JANGLE - Charlie

	PST	GCT
DATE:	30 Oct 1951	30 Oct 1951
TIME:	0700	1500

TOTAL YIELD: 14 kt

FIREBALL DATA:

Time to 1st minimum:	12.5 to 13.0 msec
Time to 2nd maximum:	130 to 135 msec
Radius at 2nd maximum:	NM

CRATER DATA: No crater

Sponsor: LASL

SITE: NTS - Areas 7 - Station 3
37° 05' 06" N
116° 01' 13" W
Site elevation: 4,193 ft

HEIGHT OF BURST: 1,132 ft

TYPE OF BURST AND PLACEMENT:
Air burst over Nevada soil

CLOUD TOP HEIGHT: 41,000 ft MSL
CLOUD BOTTOM HEIGHT: 27,000 ft MSL

REMARKS:

The contours resulting from this shot were due primarily to neutron-induced activity. Readings were obtained by monitors during area surveys or recovery operations and were taken 3 ft above ground with T1B or SU-10 ionization-chamber survey meters. The pattern was obtained from readings taken at H+9 hours and corrected to H+1 hour using the decay curve for neutron-induced activity in Nevada soil,

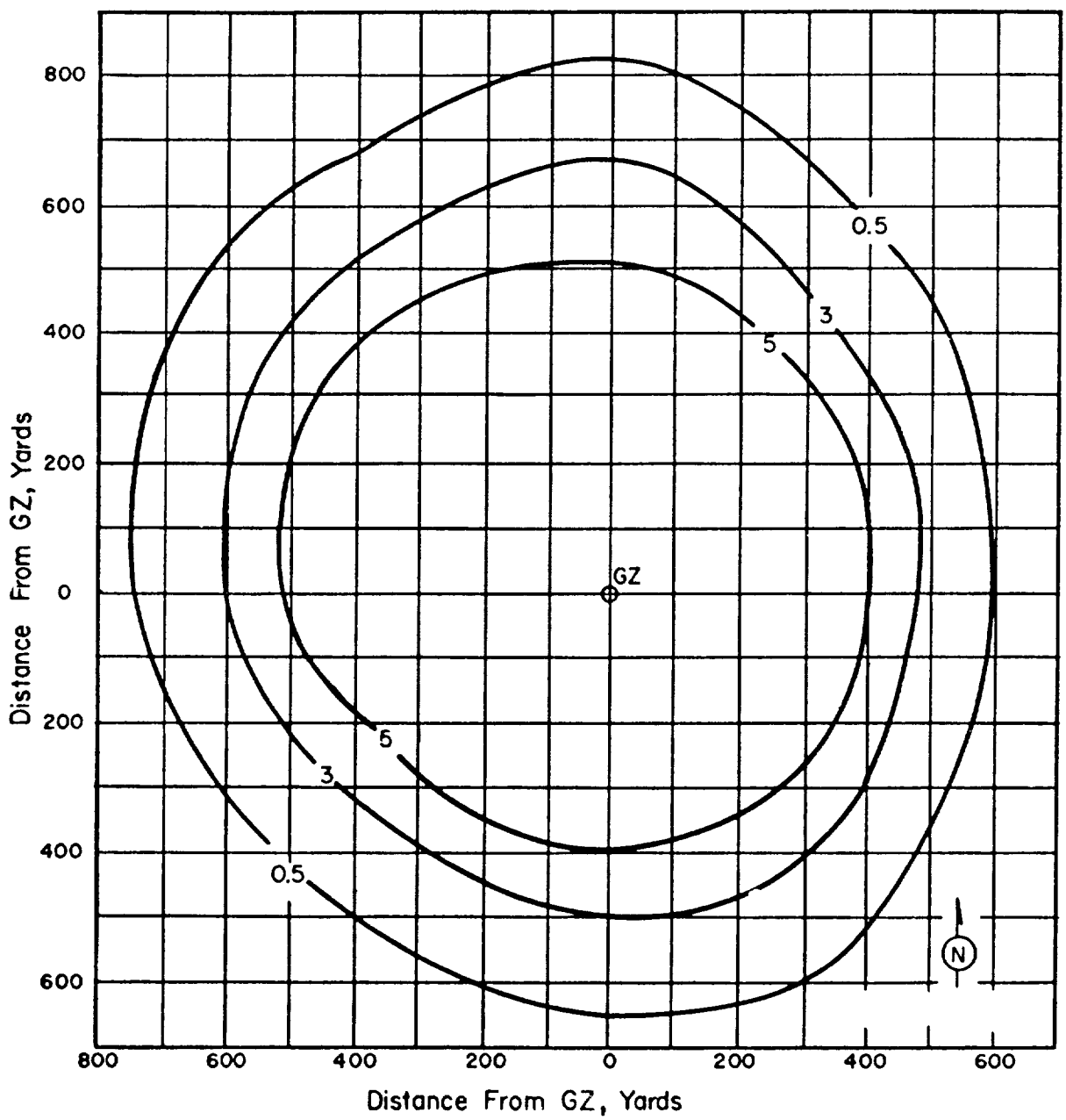


Figure 23. Operation BUSTER-JANGLE - Charlie.
On-site dose rate contours in r/hr at H+1 hour.

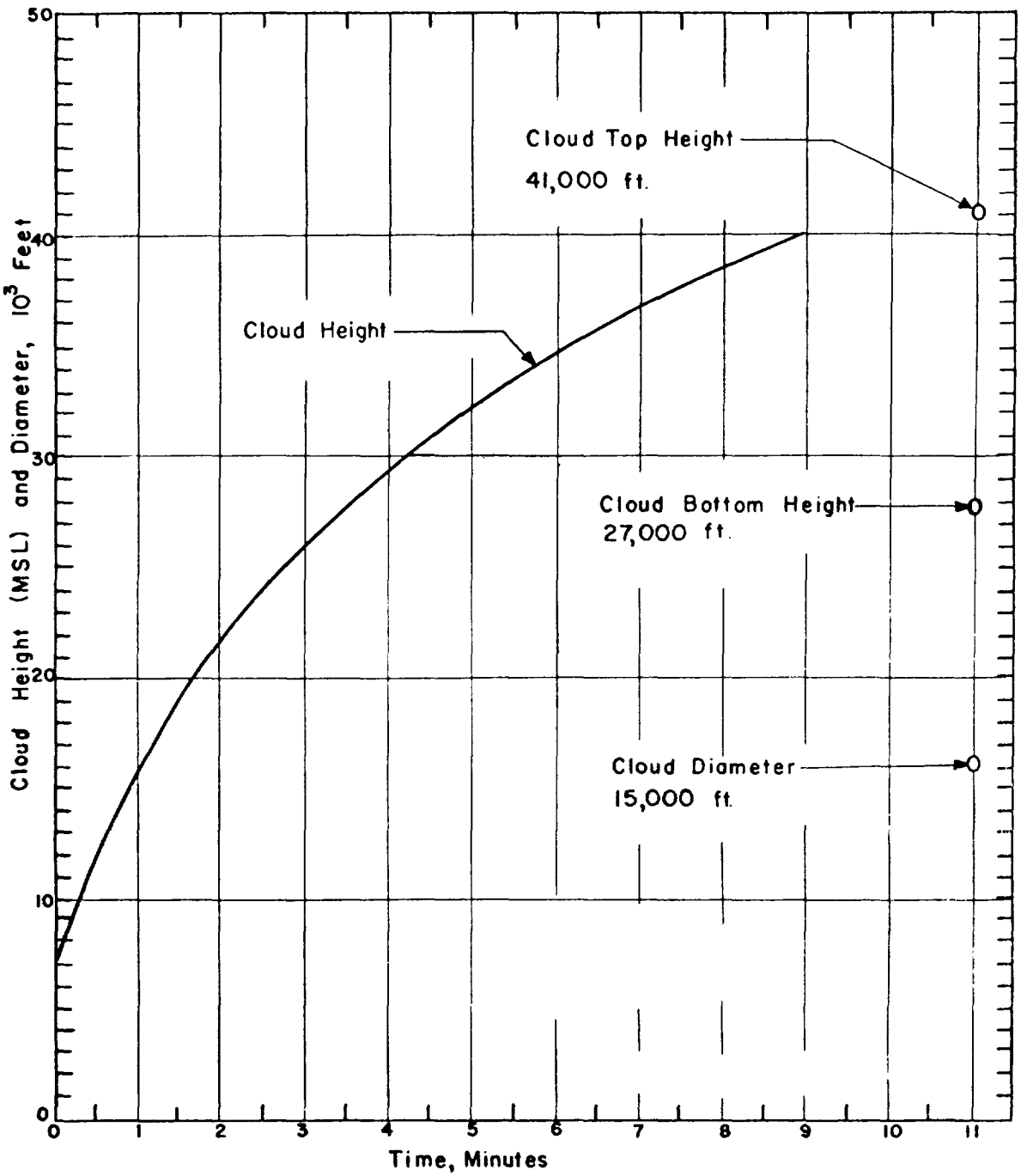


Figure 24. Cloud Dimensions: Operation BUSTER-JANGLE - Charlie.

TABLE 9 NEVADA WIND DATA FOR OPERATION BUSTER-JANGLE — CHARLIE

Altitude (MSL)	H-hour		H+1 hour		H+3 hours		H+6 hours	
	Dir	Speed	Dir	Speed	Dir	Speed	Dir	Speed
feet	degrees	mph	degrees	mph	degrees	mph	degrees	mph
Surface	360	06	360	06	310	05	090	06
5,000	---	--	340	07	Calm	Calm	040	03
6,000	290	05	290	05	Calm	Calm	020	05
7,000	---	--	290	06	Calm	Calm	350	05
8,000	290	12	290	12	260	02	300	08
9,000	---	--	270	13	270	02	280	08
10,000	230	06	230	06	250	05	290	05
12,000	130	07	130	07	180	06	090	03
14,000	080	09	080	09	100	05	070	08
15,000	(080)	(10)	070	07	090	09	040	10
16,000	080	12	080	12	070	13	050	15
18,000	090	20	090	20	050	20	060	13
20,000	070	24	070	24	050	16	090	10
23,000	060	29	---	--	---	--	---	--
25,000	050	32	050	32	060	25	040	18
30,000	050	35	---	--	050	38	030	28
35,000	060	29	---	--	060	31	030	20
40,000	230	40	---	--	---	--	220	12
45,000	---	--	---	--	---	--	220	05
50,000	---	--	---	--	---	--	290	17

NOTES:

1. Numbers in parentheses are estimated values.
2. Wind data was obtained by the Mercury Weather Station located at the C. P.
3. Tropopause height was 38,000 ft MSL.
4. At H-hour the pressure at ground zero was 872 mb, the temperature 5.3°C and the relative humidity 14 percent.

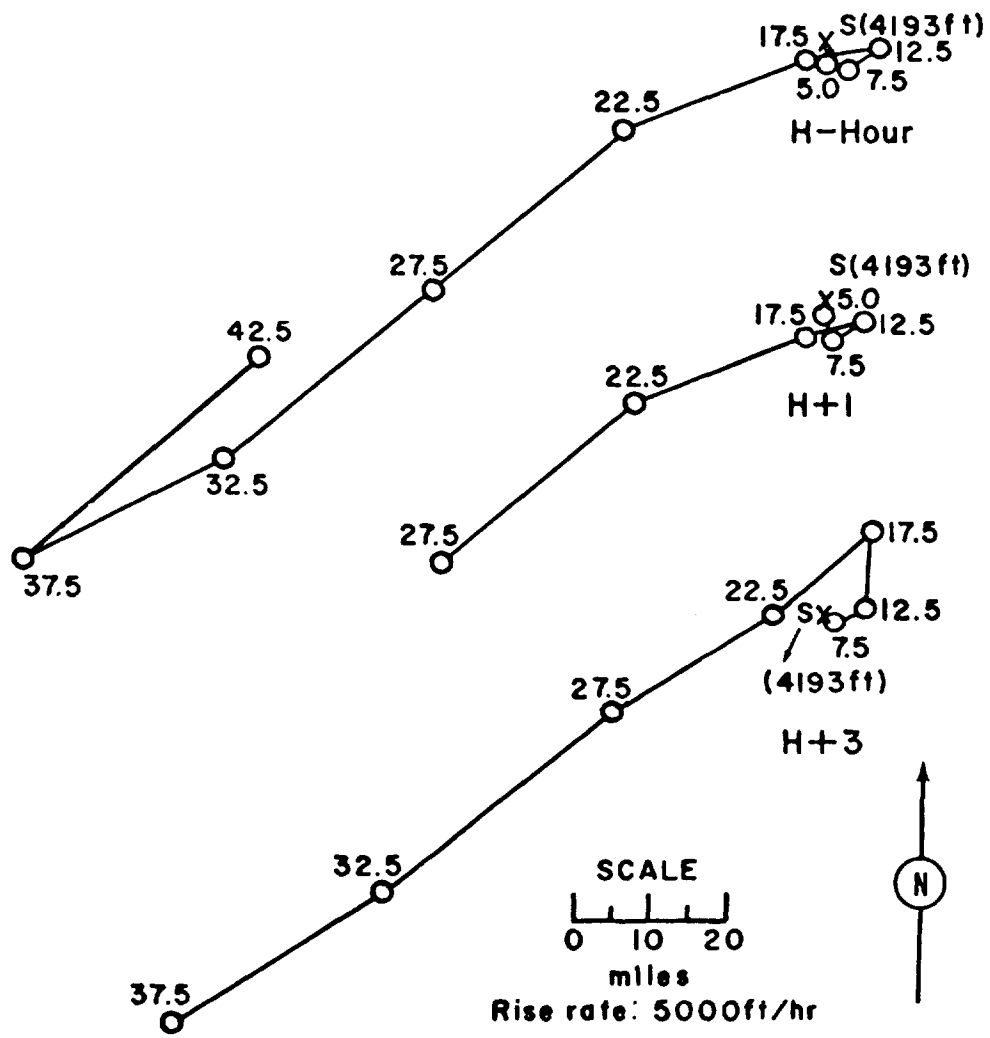


Figure 25 Hodographs for Operation BUSTER-JANGLE - Charlie.

OPERATION BUSTER-JANGLE - Dog

	PST	GCT
DATE:	1 Nov 1951	1 Nov 1951
TIME:	0730	1530

Sponsor: LASL

SITE: NTS - Area 7 - Station 3
37° 05' 05" N
116° 01" 11" W
Site elevation: 4,193 ft

TOTAL YIELD: 21 kt

HEIGHT OF BURST: 1,417 ft

FIREBALL DATA:
Time to 1st minimum: 15.6 msec
Time to 2nd maximum: 160 to 175 msec
Radius at 2nd maximum: NM

TYPE OF BURST AND PLACEMENT:
Air burst over Nevada soil

CRATER DATA: No crater

CLOUD TOP HEIGHT: 46,000 ft MSL
CLOUD BOTTOM HEIGHT: 31,000 ft MSL

REMARKS:

The contours resulting from this shot were due primarily to neutron-induced activity. Readings were obtained by monitors during area surveys or recovery operations and were taken 3 ft above ground with T1B or SU-10 ionization-chamber survey meters. The pattern was obtained from readings taken at H+25½ hours and corrected to H+1 hour using the decay curve for neutron-induced activity in Nevada soil

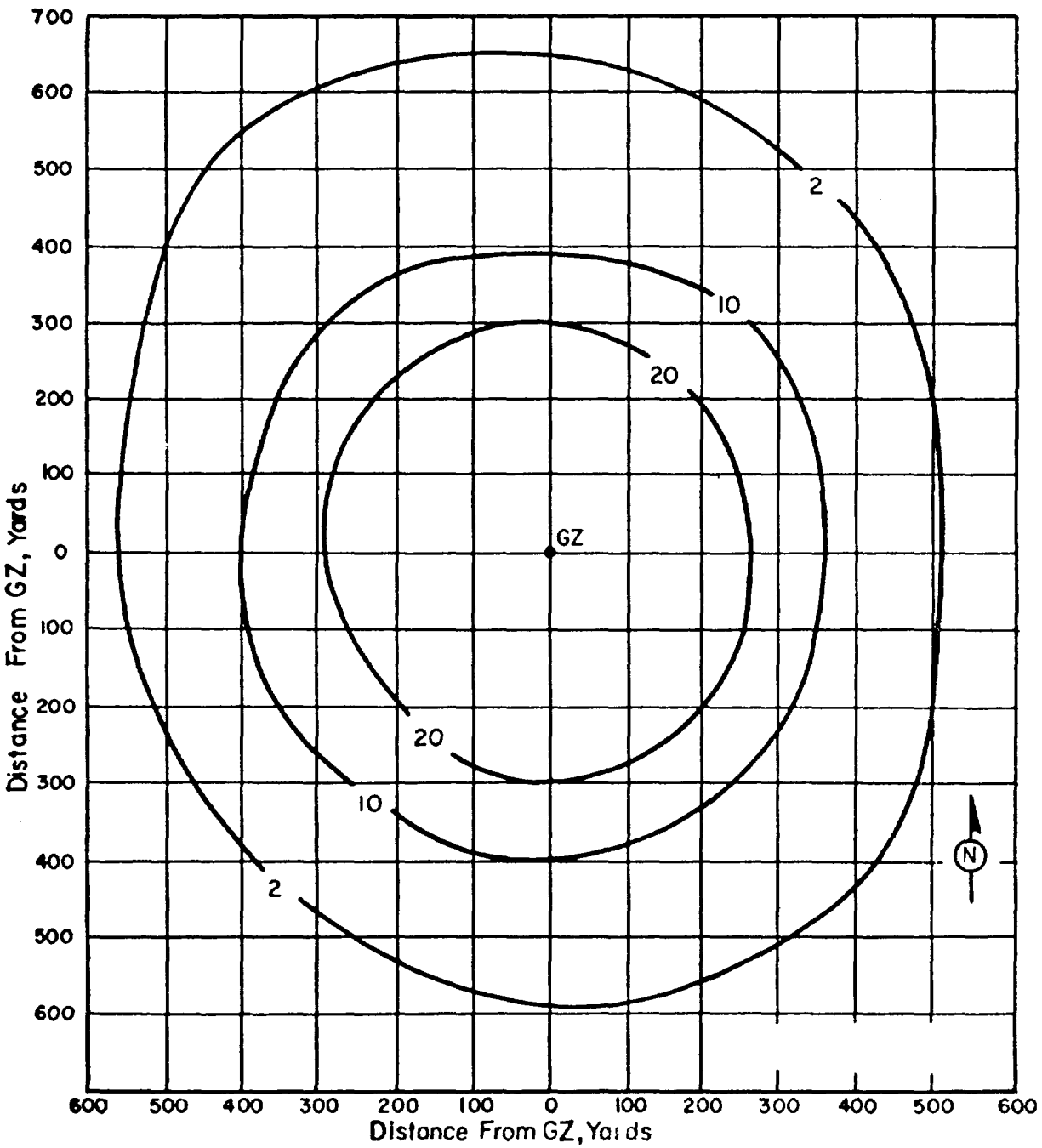


Figure 26. Operation BUSTER-JANGLE - Dog. On-site dose rate contours in r/hr at H+1 hour.

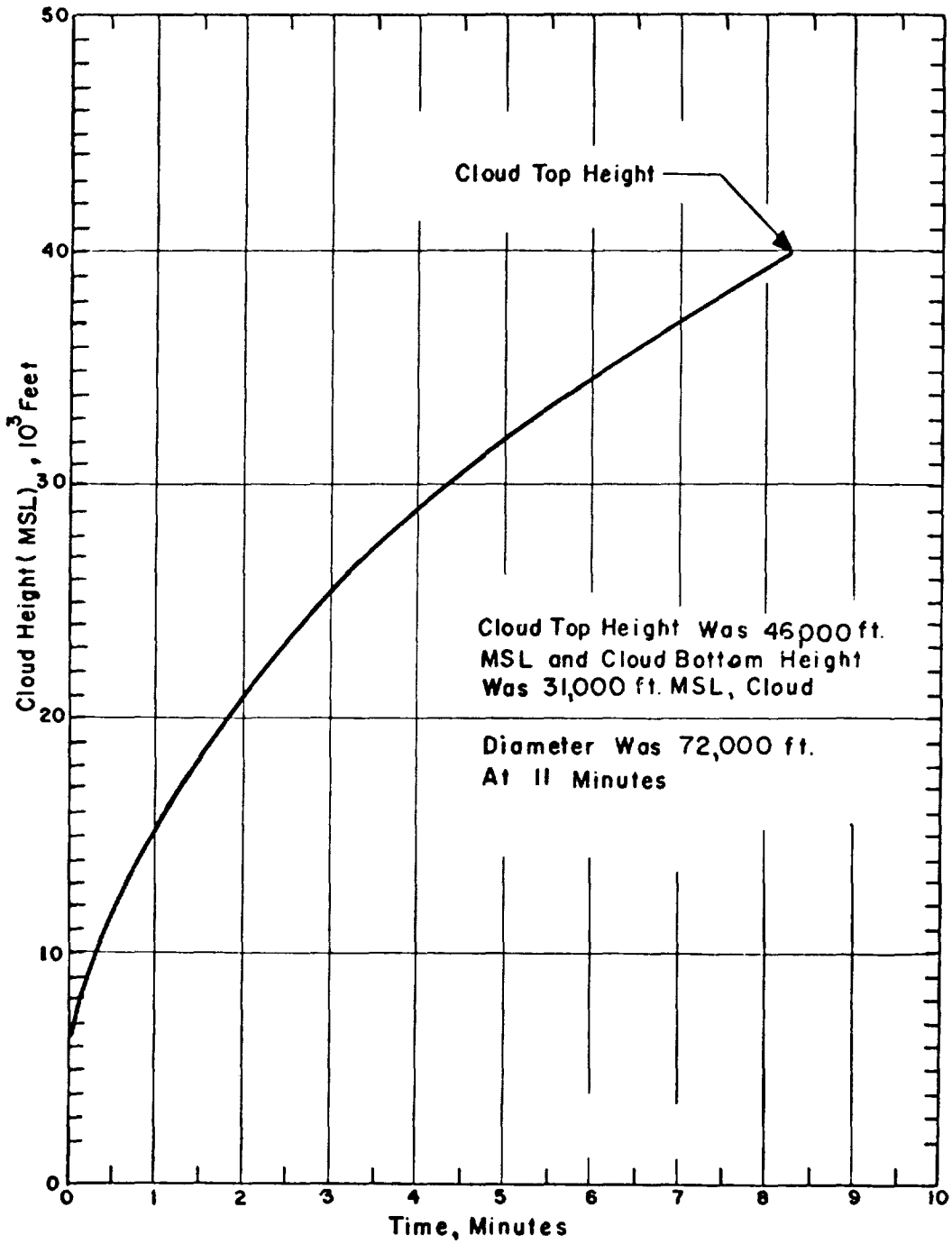


Figure 27. Cloud Dimensions: Operation BUSTER-JANGLE - Dog.

TABLE 10 NEVADA WIND DATA FOR OPERATION BUSTER-JANGLE — DOG

Altitude (MSL)	H-hour		H+1½ hours		H+2½ hours		H+5½ hours	
	Dir	Speed	Dir	Speed	Dir	Speed	Dir	Speed
feet	degrees	mph	degrees	mph	degrees	mph	degrees	mph
Surface	340	02	040	07	350	17	360	08
5,000	---	--	360	07	360	17	020	08
6,000	320	14	330	10	350	15	030	10
7,000	---	--	340	17	330	10	010	15
8,000	320	35	350	24	330	13	350	13
9,000	---	--	350	20	310	18	320	12
10,000	320	37	350	18	340	26	320	16
12,000	320	38	320	31	340	48	340	35
14,000	320	41	330	40	340	52	340	47
15,000	(320)	(45)	(320)	(45)	(340)	(50)	340	47
16,000	320	48	320	49	340	49	330	38
18,000	320	60	320	53	330	63	330	63
20,000	320	63	320	54	330	76	330	66
23,000	320	58	---	--	---	--	---	--
25,000	320	58	330	52	---	--	---	--
30,000	320	73	---	--	---	--	---	--
35,000	320	76	---	--	---	--	---	--
40,000	320	80	---	--	---	--	---	--

NOTES:

1. Numbers in parentheses are estimated values.
2. Wind data was obtained by the Mercury Weather Station located at the C. P.
3. Tropopause height was 38,000 ft MSL.
4. At H-hour the pressure at ground zero was 876 mb, the temperature 15.5°C and the relative humidity 43 percent.

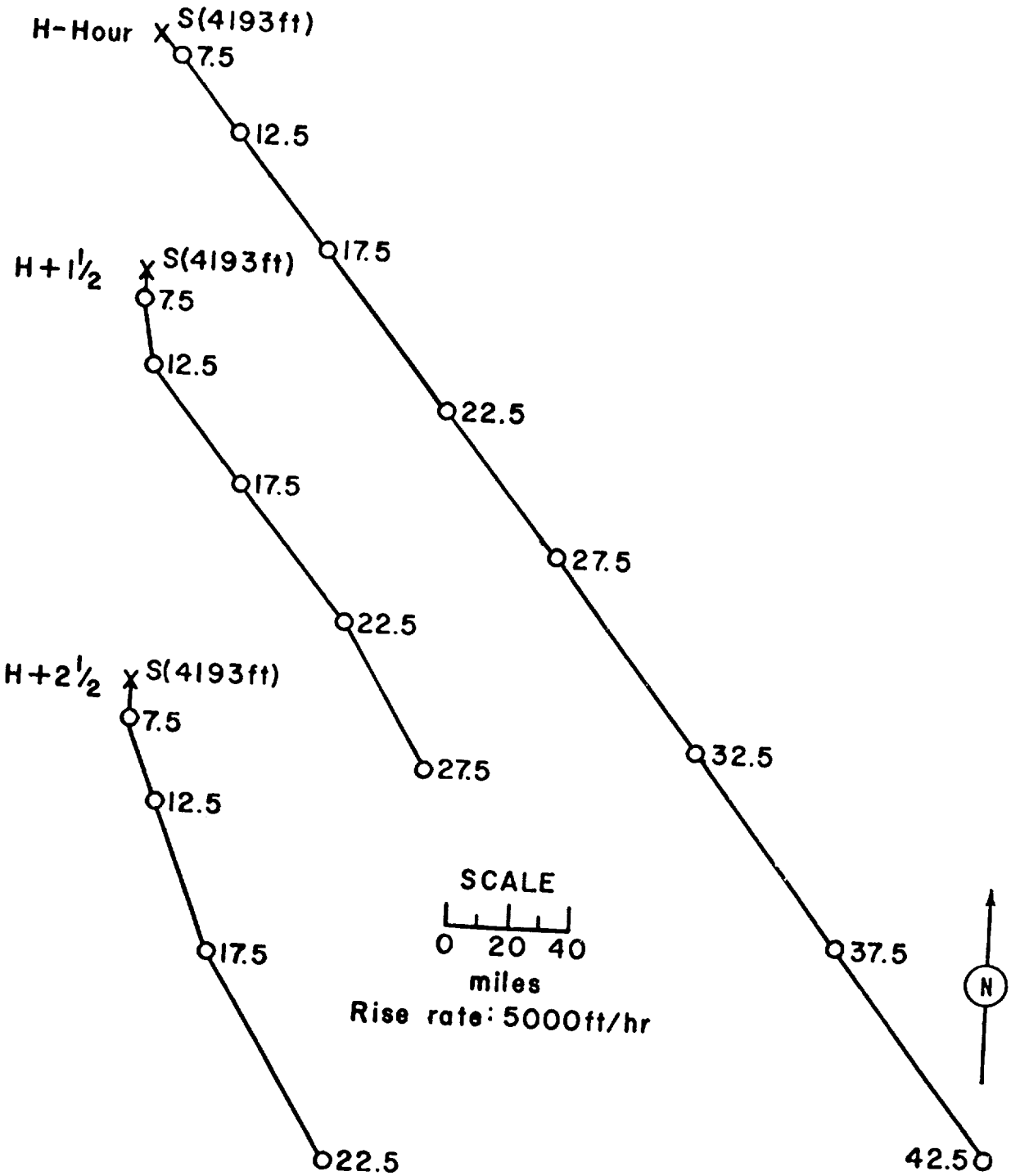


Figure 28. Hodographs for Operation BUSTER-JANGLE - Dog.

OPERATION BUSTER-JANGLE - Easy

	PST	GCT
DATE:	5 Nov 1951	5 Nov 1951
TIME:	0830	1630

Sponsor: LASL

SITE: NTS - Area 7 - Station 1
37° 05' 31" N
116° 01' 28" W
Site elevation: 4,224 ft

TOTAL YIELD: 31.0 kt

HEIGHT OF BURST: 1,314 ft

TYPE OF BURST AND PLACEMENT:
Air burst over Nevada soil

FIREBALL DATA:

Time to 1st minimum:	15 to 20 msec
Time to 2nd maximum:	190 to 210 msec
Radius at 2nd maximum:	NM

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

CRATER DATA: No crater

REMARKS:

The contours resulting from this shot were due primarily to neutron-induced activity. Readings were obtained by monitors during area surveys or recovery operations and were taken 3 ft above ground with T1B or SU-10 ionization chamber survey meters. The pattern was obtained from readings taken at H+24 hours and corrected to H+1 hour, using the decay curve for neutron-induced activity in Nevada soil

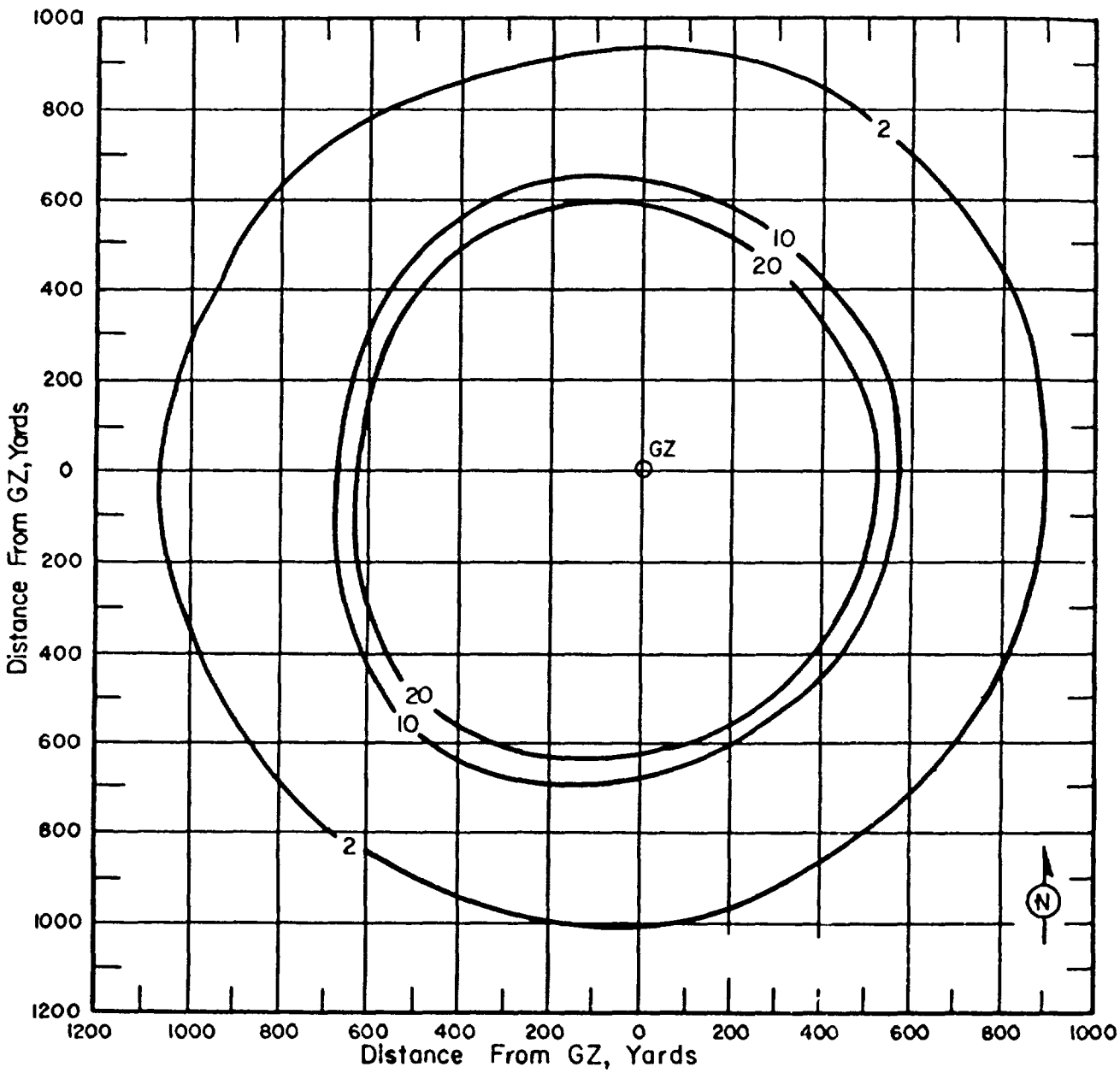


Figure 29. Operation BUSTER-JANGLE - Easy.
On-site dose rate contours in r/hr at H+1 hour.

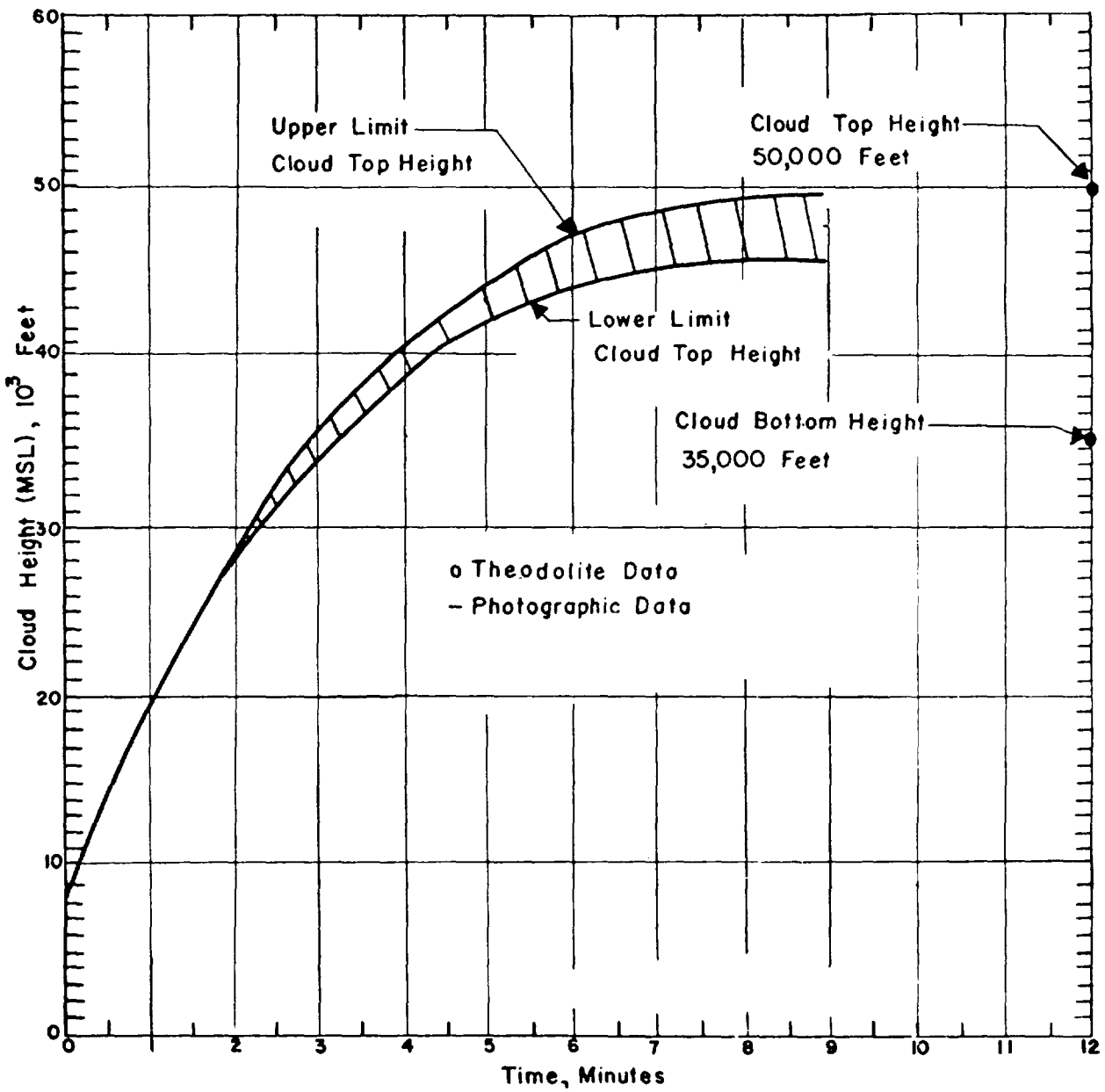


Figure 30. Cloud Dimensions: Operation BUSTER-JANGLE - Easy.

TABLE 11 NEVADA WIND DATA FOR OPERATION BUSTER-JANGLE - EASY

Altitude (MSL)	H-hour		H+½ hour	
	Dir	Speed	Dir	Speed
feet	degrees	mph	degrees	mph
Surface	020	15	020	10
5,000	---	--	020	16
6,000	010	29	010	18
7,000	---	--	360	18
8,000	020	18	020	16
9,000	---	--	040	18
10,000	050	21	070	22
12,000	040	25	040	25
14,000	010	38	---	--
15,000	(360)	(37)	360	36
16,000	340	37	340	35
18,000	350	26	340	28
20,000	320	22	310	26
25,000	360	38	360	38
28,000	350	32	---	--
30,000	350	31	---	--
35,000	350	40	---	--
40,000	340	52	---	--
45,000	330	63	---	--

NOTES:

1. Numbers in parentheses are estimated values.
2. Wind data was obtained by the Mercury Weather Station located at the C. P.
3. Tropopause height was 35,000 ft MSL.
4. At H-hour the pressure at ground zero was 878 mb, the temperature 11.3°C and the relative humidity 17%.

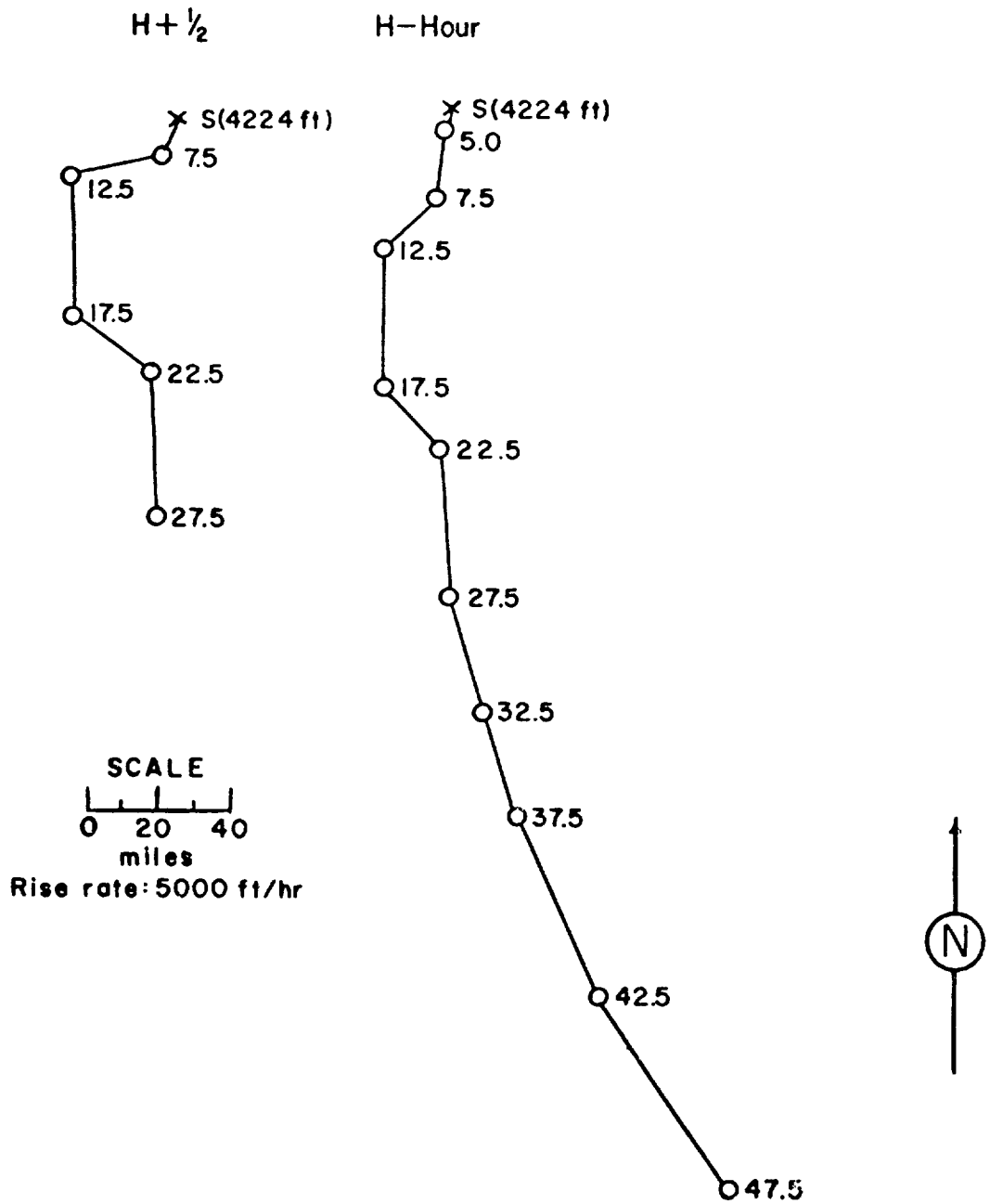


Figure 31. Hodographs for Operation BUSTER-JANGLE - Easy.

OPERATION BUSTER-JANGLE - Sugar

	PST	GMT
DATE:	19 Nov 1951	19 Nov 1951
TIME:	0900	1700

Sponsor: DOD

SITE: NTS - Area 9
37° 07' 54" N
116° 02' 19" W
Site elevation: 4,215 ft

TOTAL YIELD: 1.2 kt

HEIGHT OF BURST: 3.5 ft

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

FIREBALL DATA:
Time to 1st minimum: 6 - 7 msec
Time to 2nd maximum: NM
Radius at 2nd maximum: NM

CLOUD TOP HEIGHT: 15,000 ft MSL
CLOUD BOTTOM HEIGHT: 11,000 ft MSL

CRATER DATA: Diameter: 90 ft
Depth: 21 ft at crater lip
Volume: 50,000 ft^3
maximum dose rate: 7500 r/hr at H+1 hour

REMARKS:

The contamination resulting from this shot was well documented to several thousand yards. The on-site pattern was drawn from the data and maps of three scientific projects and can be considered reliable. Direct measurements of radiation fields at one hour after burst were obtained with constant-recording scintillation counters. Additional readings were taken with AN/PDR-T1B survey meters over the period 24 to 70 hours after burst. These readings were corrected to the reference time of one hour by the use of the $t^{-1.2}$ decay approximation. The off-site pattern is less reliable because only a limited number of readings were available.

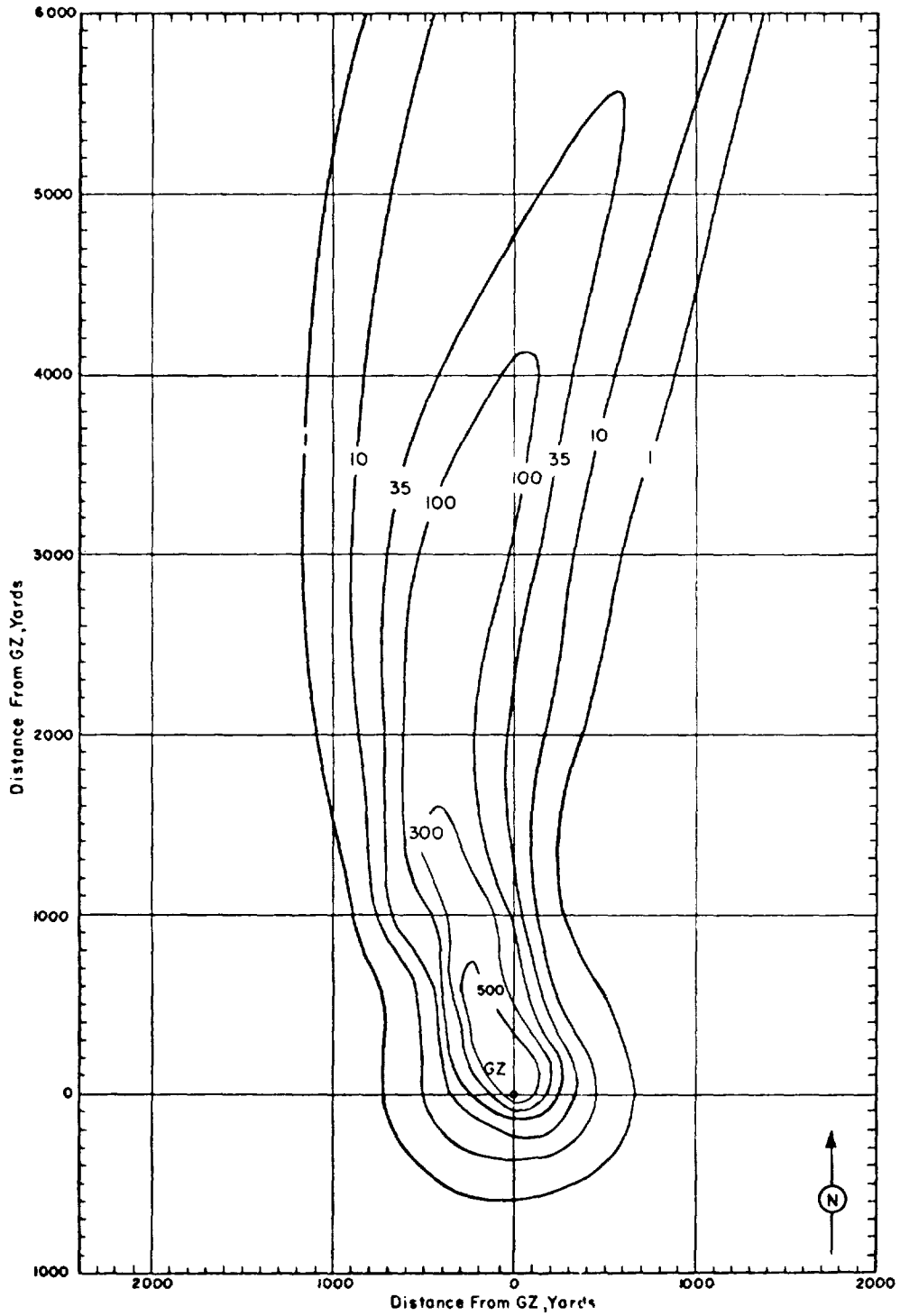


Figure 32. Operation BUSTER-JANGLE - Sugar.
On-site dose rate contours in r/hr at H+1 hour.

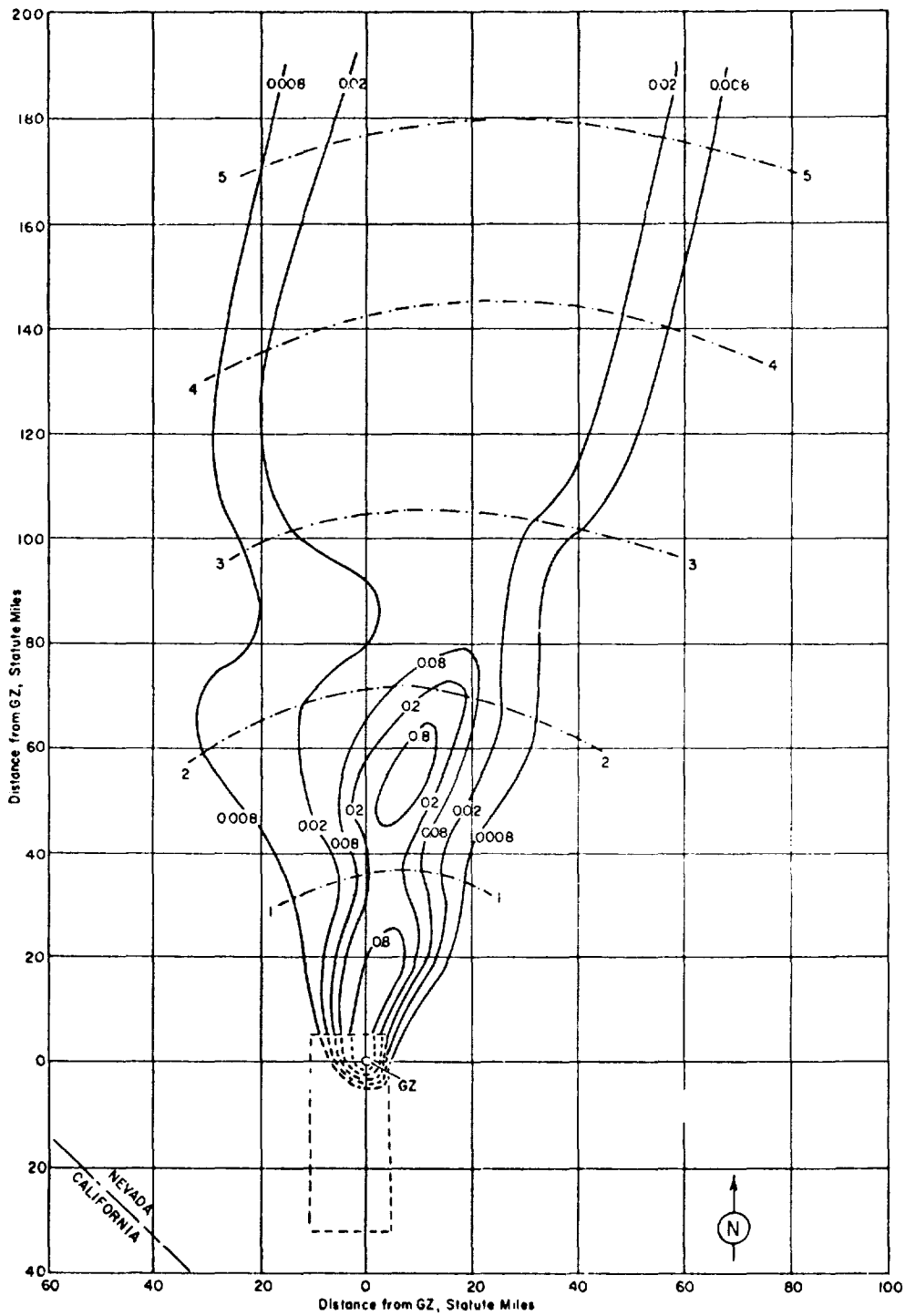


Figure 33. Operation BUSTER-JANGLE - Sugar.
Off-site dose rate contours in r/hr at H+1 hour.

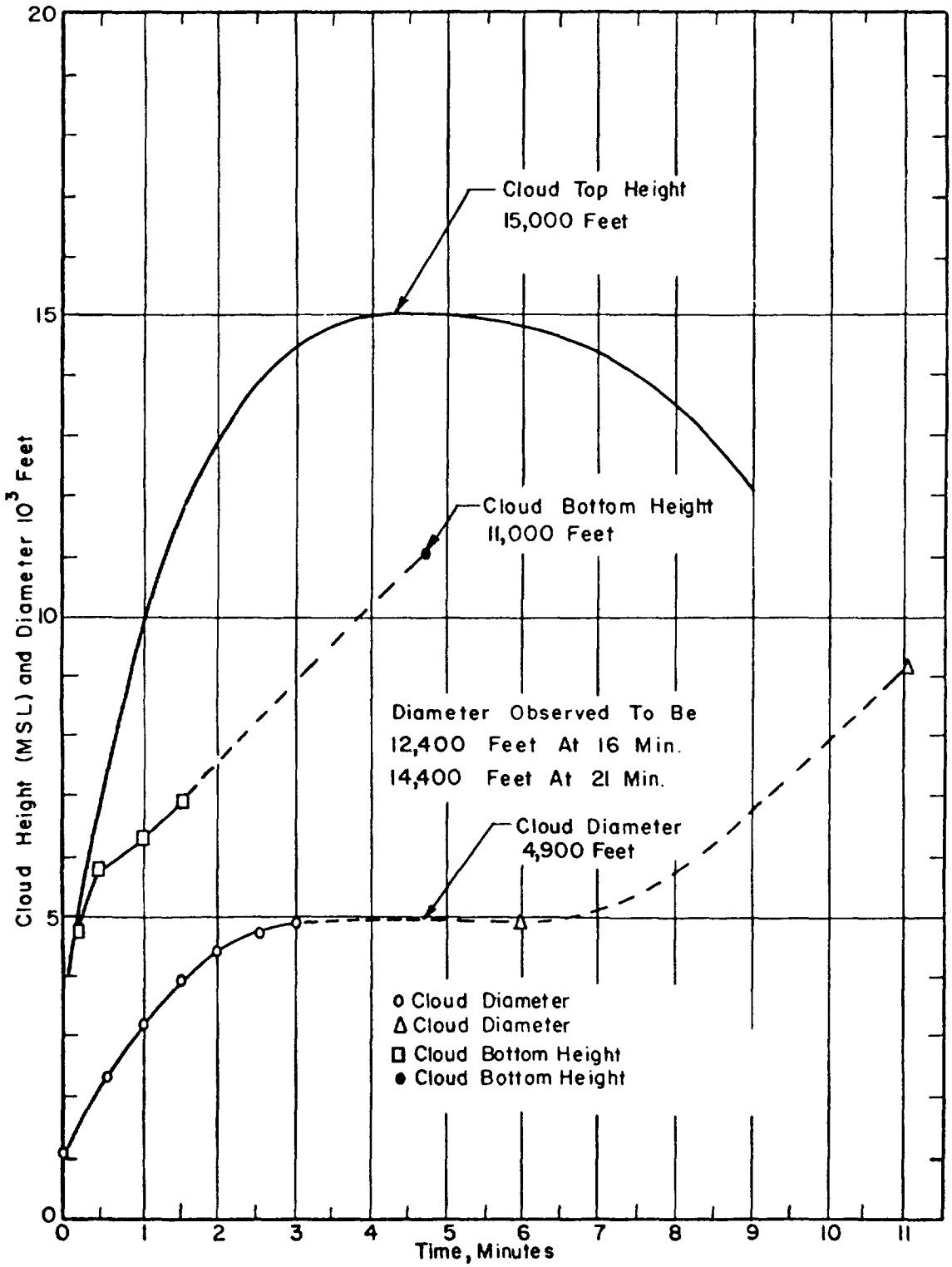


Figure 34. Cloud Dimensions: Operation BUSTER-JANGLE - Sugar.

TABLE 12 NEVADA WIND DATA FOR OPERATION BUSTER-JANGLE - SUGAR

Altitude (MSL)	H-hour		H+1 hour		H+4 hours	
	Dir	Speed	Dir	Speed	Dir	Speed
feet	degrees	mph	degrees	mph	degrees	mph
Surface	190	02	Calm	Calm	180	09
5,000	---	--	Calm	Calm	170	12
6,000	170	15	170	15	170	18
7,000	---	--	180	23	180	26
8,000	180	30	180	30	180	31
9,000	---	--	200	32	180	35
10,000	200	37	200	37	190	42
12,000	200	42	200	42	210	51
14,000	210	46	210	46	210	44
15,000	---	--	210	47	210	45
16,000	210	51	210	51	200	66
18,000	200	72	200	72	200	55
20,000	200	62	200	62	190	69
25,000	210	71	---	--	---	--
30,000	210	80	---	--	---	--
35,000	210	90	---	--	---	--

NOTES:

1. Wind data was obtained by the Mercury Weather Station located at the C. P.
2. At H-hour the pressure of ground zero was 871.5 mb, the temperature 1°C and the relative humidity 47%.

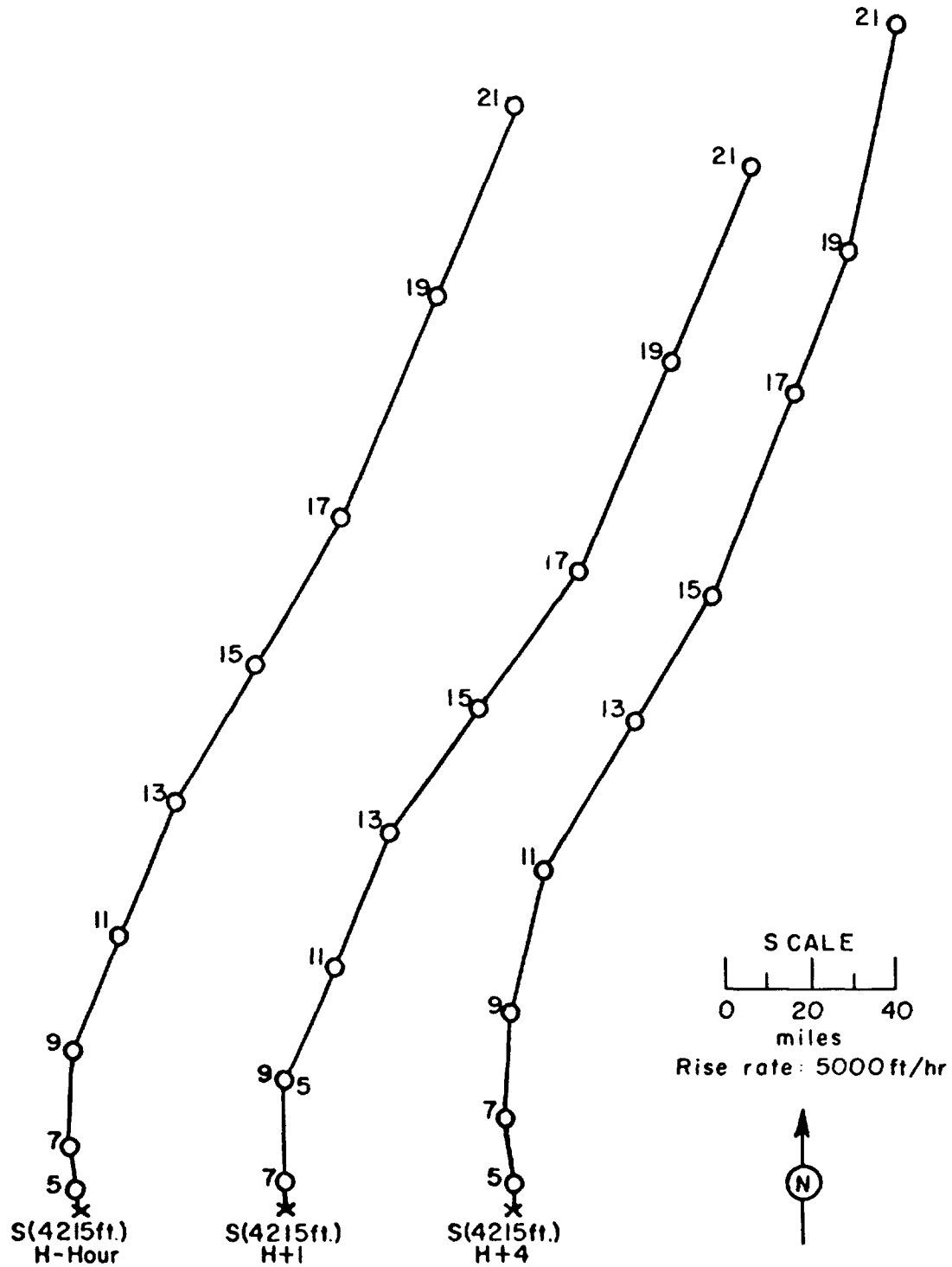


Figure 35. Hodographs for Operation BUSTER-JANGLE - Sugar.

OPERATION BUSTER-JANGLE - Uncle

	PST	GMT
DATE:	29 Nov 1951	29 Nov 1951
TIME:	1200	2000

TOTAL YIELD: 1.2 kt

FIREBALL DATA:

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

Sponsor: DOD - LASL

SITE: NTS - Area 10
37° 10' 11" N
116° 02' 33" W
Site elevation: 4,299 ft

HEIGHT OF BURST: -17 ft
Underground

TYPE OF BURST AND PLACEMENT:
Underground burst - Filled shaft in Nevada soil

CLOUD TOP HEIGHT: 11,500 ft MSL
CLOUD BOTTOM HEIGHT: Not available

CRATER DATA: Diameter: 260 ft Maximum dose rate: ~ 7500 r/hr at H+1 hour
Depth: 53 ft at crater lip
Volume: 980,000 ft^3

REMARKS:

The contamination resulting from this shot was well documented to several thousand yards. The on-site pattern was drawn from the data and maps of three scientific projects and can be considered reliable. Direct measurements of radiation fields at one hour after burst were obtained with constant-recording scintillation counters. Additional readings were taken with AN/PDR-T1B survey meters over the period 24 to 70 hours after burst. These readings were corrected to the reference time of one hour by the use of the $t^{-1.2}$ decay approximation. The off-site pattern is less reliable because only a limited number of readings were available.

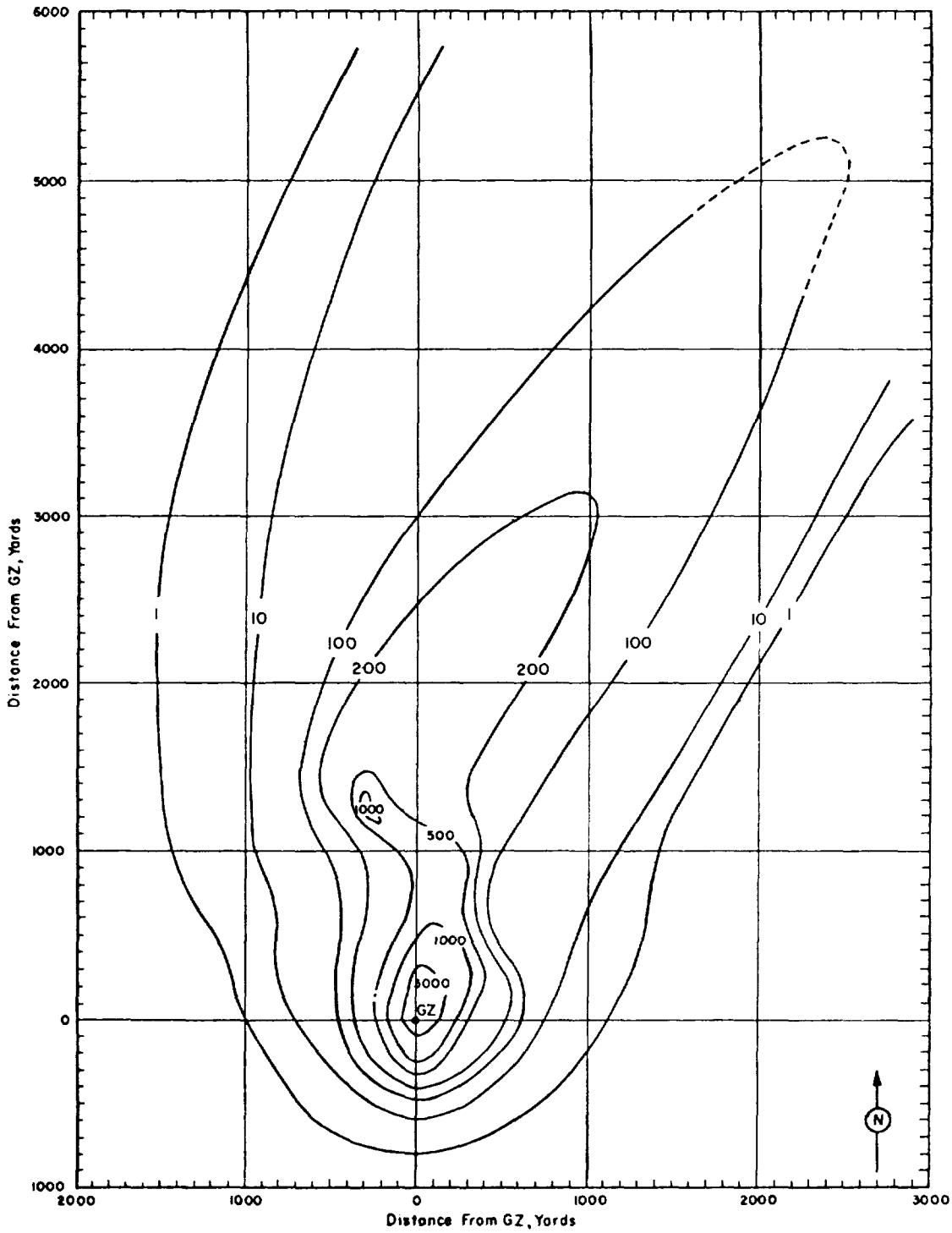


Figure 36. Operation BUSTER-JANGLE - Uncle.
On-site dose rate contours in r/hr at H+1 hour.

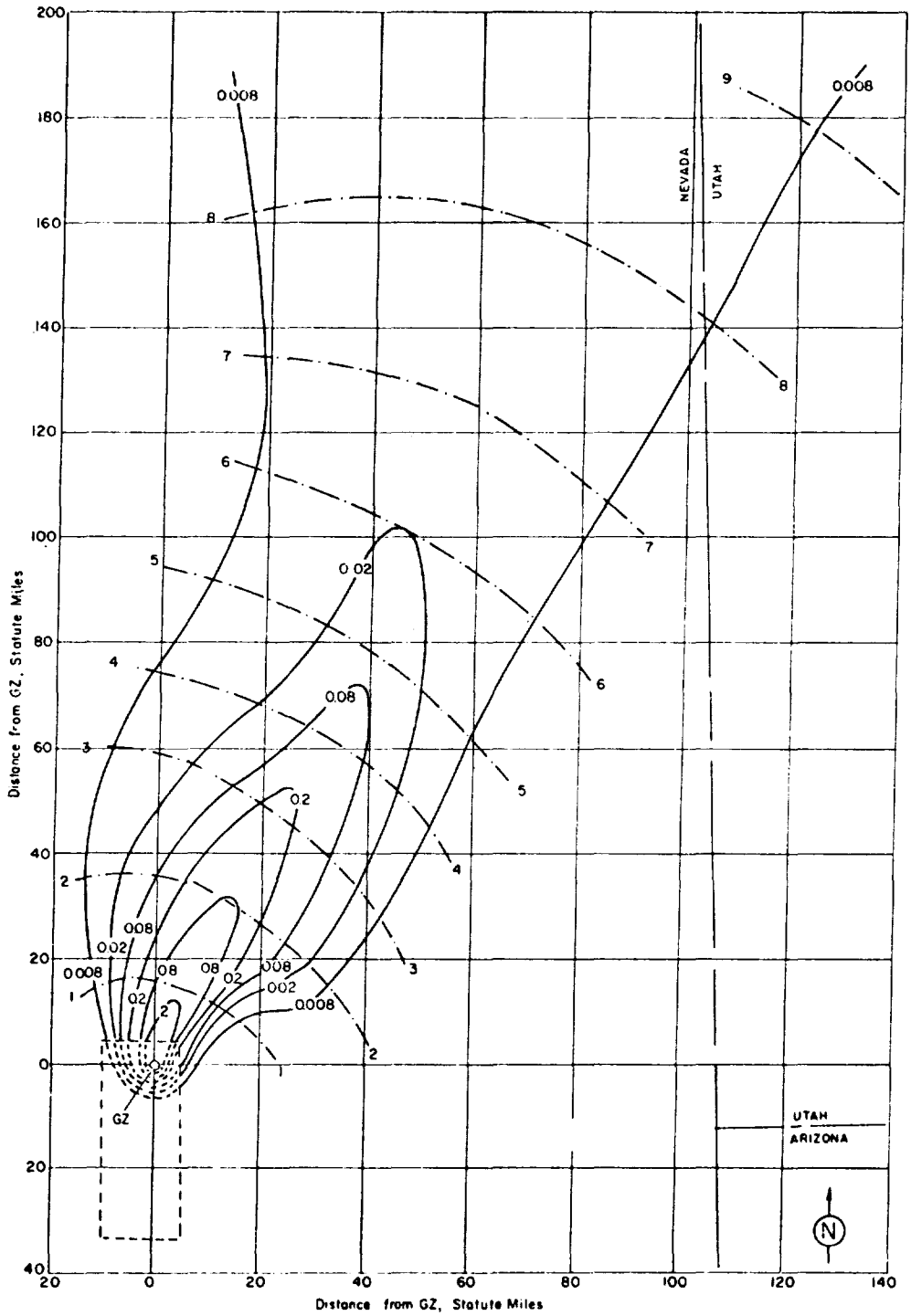


Figure 37. Operation BUSTER-JANGLE - Uncle.
Off-site dose rate contours in r/hr at H+1 hour.

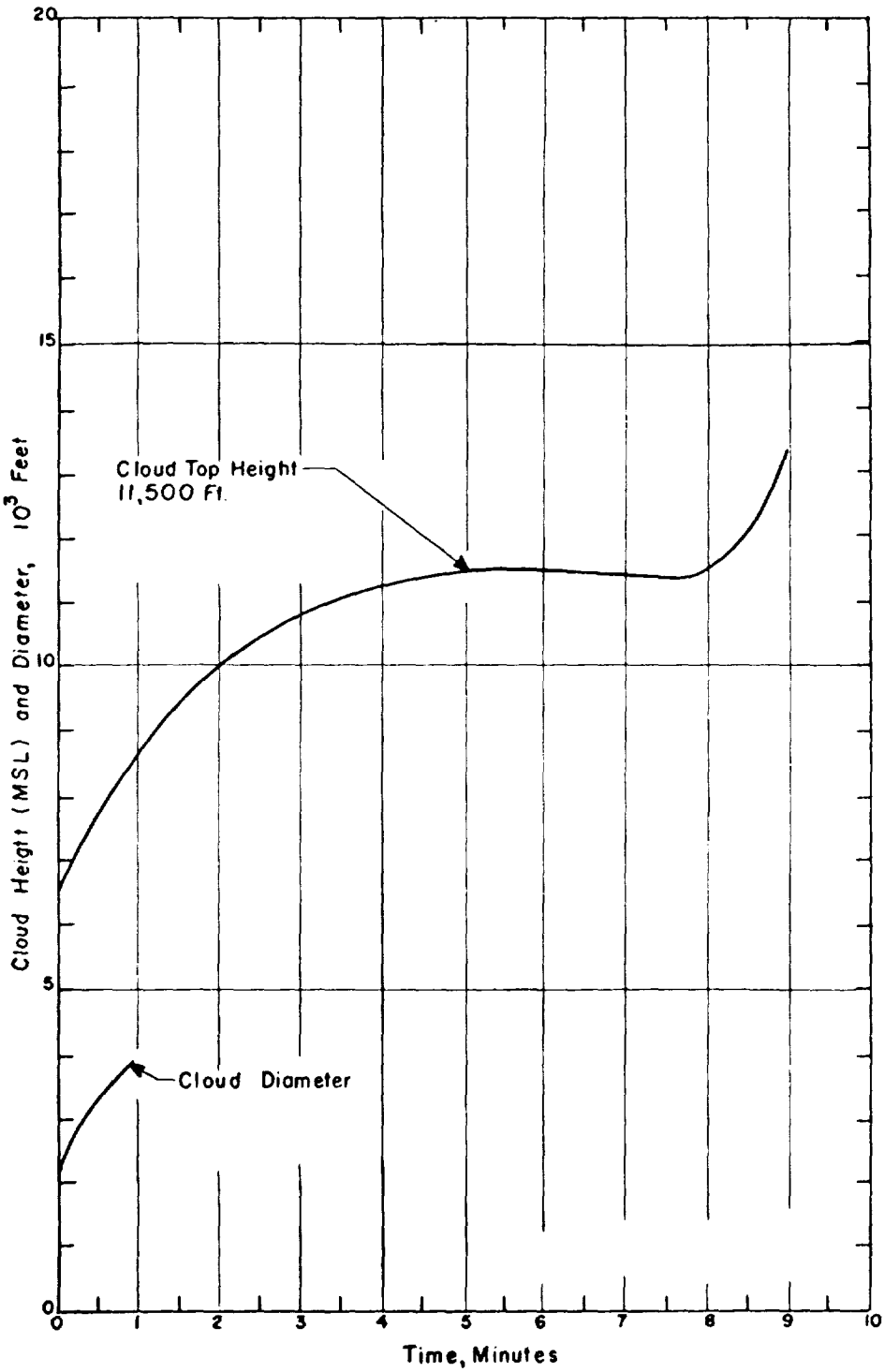


Figure 38. Cloud Dimensions: Operation BUSTER-JANGLE - Uncle.

TABLE 13 NEVADA WIND DATA FOR OPERATION BUSTER-JANGLE - UNCLE

Altitude (MSL)	H-hour		H+1 hour	
	Dir	Speed	Dir	Speed
feet	degrees	mph	degrees	mph
Surface	180	02	040	03
5,000	---	--	050	03
6,000	190	06	290	05
7,000	---	--	180	09
8,000	210	17	210	17
9,000	---	--	220	24
10,000	230	24	220	25
12,000	240	28	250	22
14,000	250	29	250	21
15,000	---	--	260	26
16,000	250	34	250	30
18,000	250	34	250	36
20,000	250	34	250	41
25,000	250	41	250	41
30,000	250	43	250	43

NOTES:

1. Wind data was obtained by the Mercury Weather Station located at the C. P.
2. At H-hour the pressure at GZ was 872 mb, the temperature 14.5°C and the relative humidity 35%.

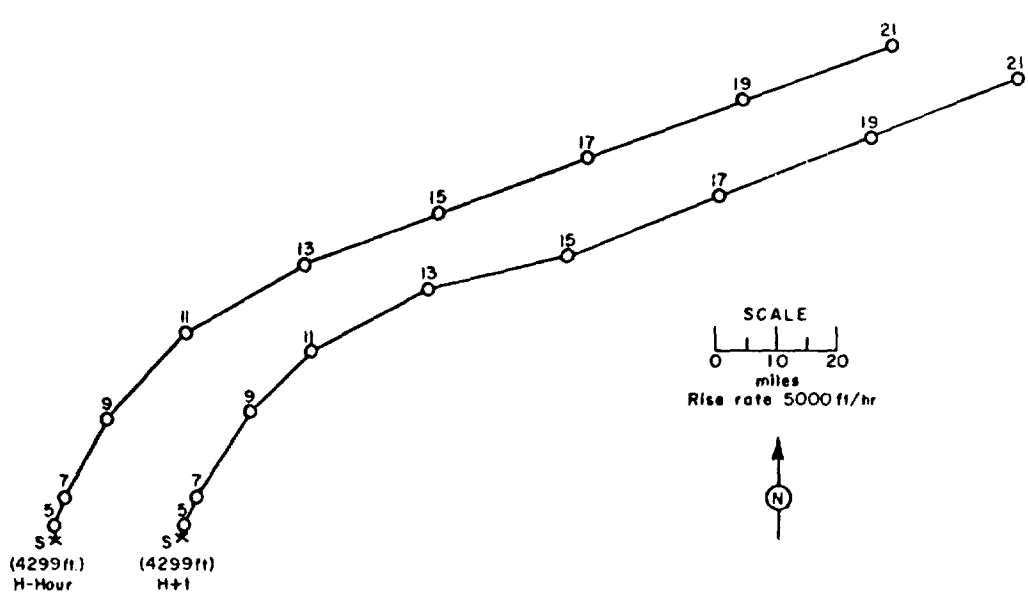
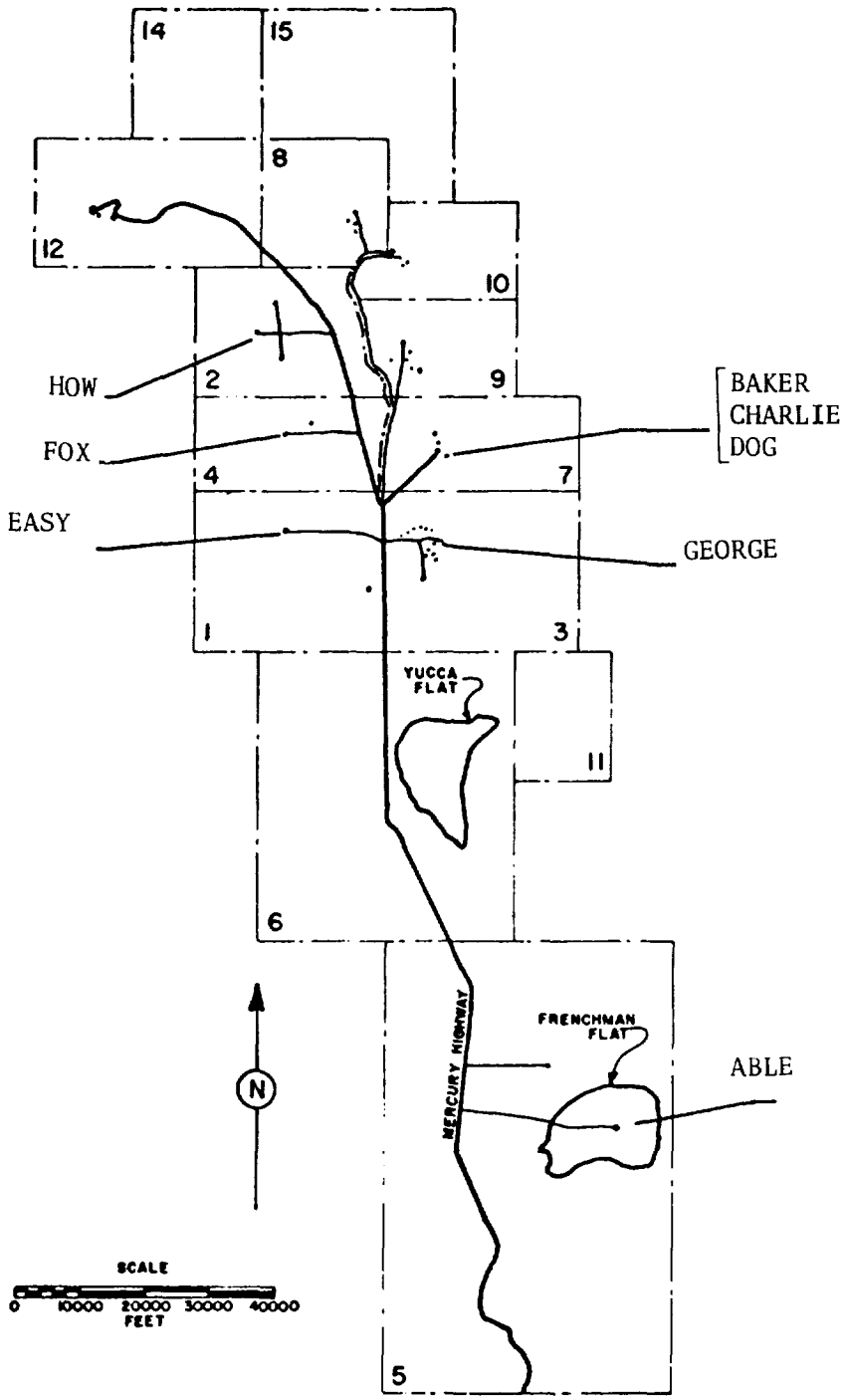


Figure 39. Hodographs for Operation BUSTER-JANGLE - Uncle.



NEVADA TEST SITE

Figure 40. Operation TUMBLER-SNAPPER, Shot Locations.

OPERATION TUMBLER-SNAPPER - ABLE

	PST	GMT
DATE:	1 Apr 1952	1 Apr 1952
TIME:	0900	1700

TOTAL YIELD: 1 kt

FIREBALL DATA:
Time to 1st minimum: 2.85 to 5.5 msec
Time to 2nd maximum: 90 to 125 msec
Radius at 2nd maximum: NM

Sponsor: DOD - LASL

SITE: NTS - Frenchman Flat
36° 47' 54" N
115° 56' 08" W
Site elevation: 3,077 ft

HEIGHT OF BURST: 793 ft

TYPE OF BURST AND PLACEMENT:
Air burst over Nevada soil

CLOUD TOP HEIGHT: 16,200 ft MSL
CLOUD BOTTOM HEIGHT: Not available

CRATER DATA: No crater

REMARKS:

The contours resulting from this shot were due primarily to neutron-induced activity. Readings were taken by radiological safety survey teams working with test recovery parties on D day, D+1 day and D+2 day. These readings were extrapolated to H+1 hour, using the generalized decay curve for neutron-induced activity in Nevada soil

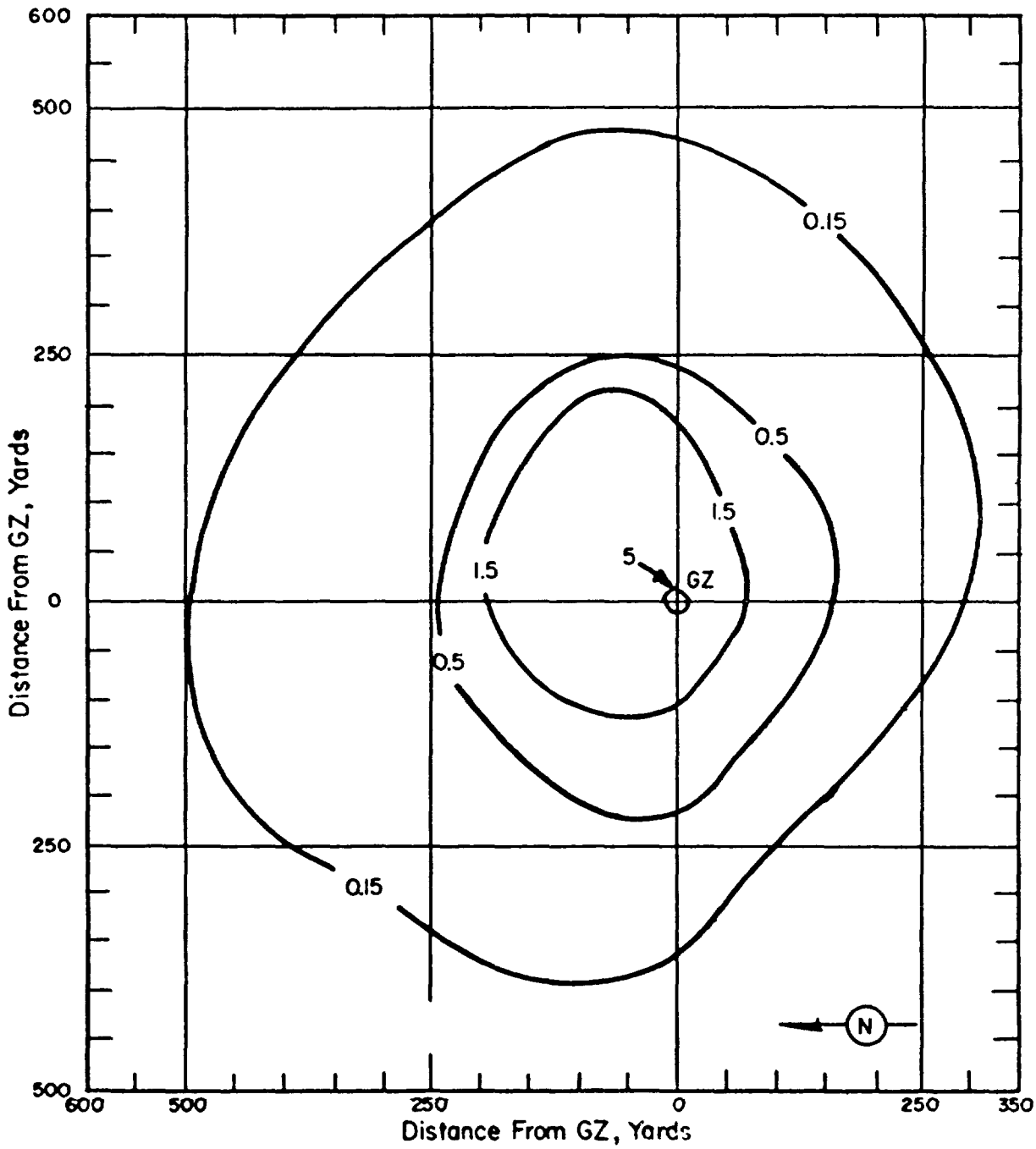


Figure 41. Operation TUMBLER-SNAPPER - ABLE On-site dose rate contours in r/hr at H+1 hour.

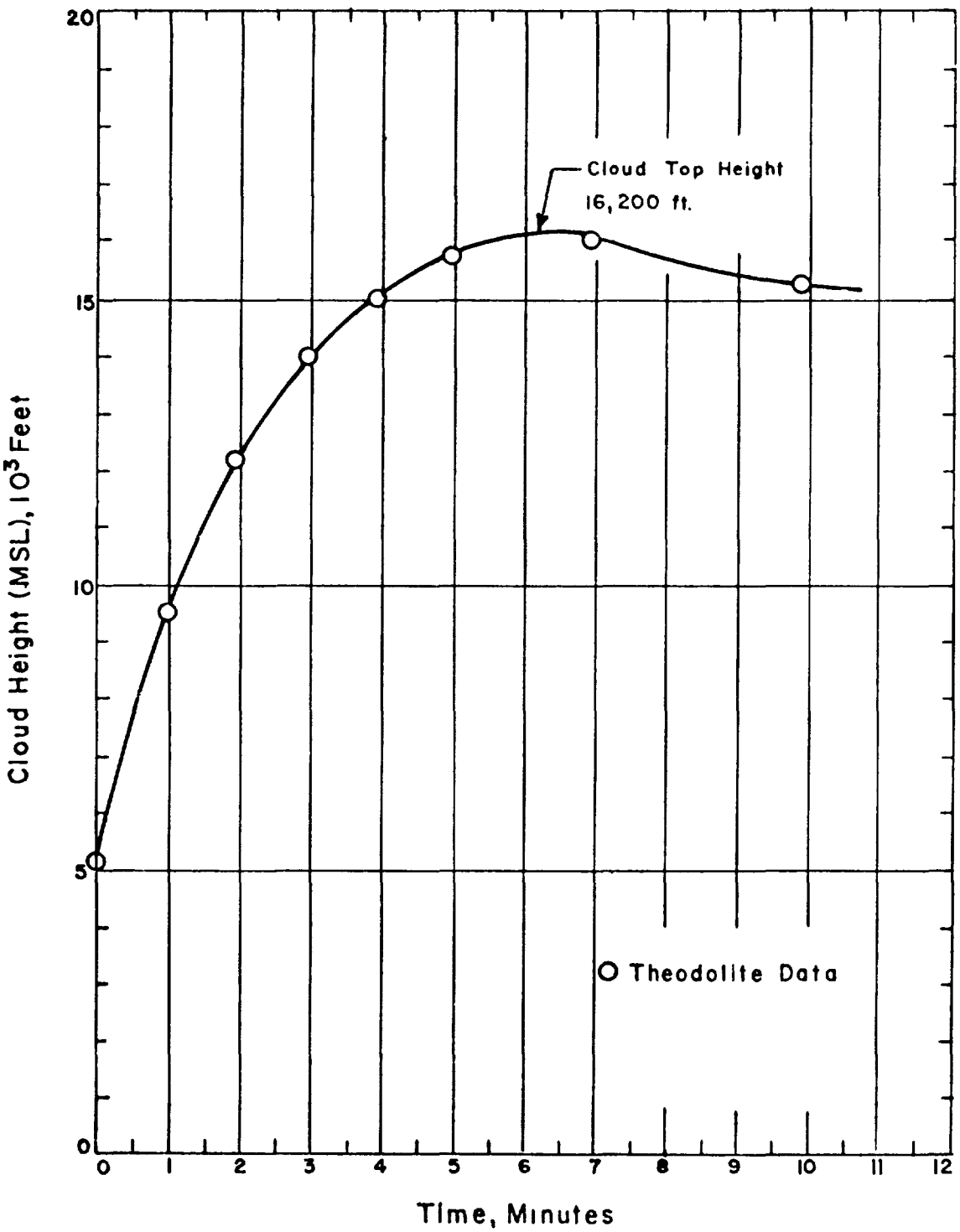


Figure 42. Cloud Dimensions: Operation TUMBLER-SNAPPER-ABLE

TABLE 14 NEVADA WIND DATA FOR OPERATION TUMBLER-SNAPPER -ABLE

Altitude (MSL)	H-hour Dir	H-hour Speed
feet	degrees	mph
Surface	050	07
5,000	090	06
6,000	120	06
7,000	140	08
8,000	170	09
9,000	200	09
10,000	210	12
12,000	250	17
14,000	250	16
15,000	260	20
16,000	260	23
18,000	260	39
20,000	260	42
25,000	260	49
30,000	270	74

NOTES:

1. Wind data was obtained by the Mercury Weather Station located at the C. P.
2. Tropopause height was 42,000 ft MSL.
3. At H-hour the pressure at ground zero was 914 mb, the temperature 58°F and the relative humidity 28%.

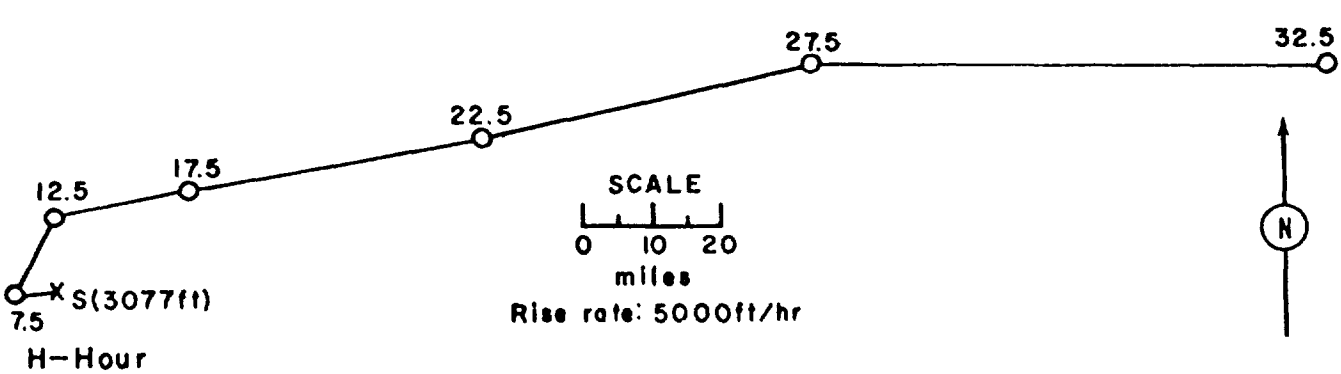


Figure 43. Hodograph for Operation TUMBLER-SNAPPER- ABLE

OPERATION TUMBLER SNAPPER - BAKER

	PST	GMT
DATE:	15 Apr 1952	15 Apr 1952
TIME:	0930	1730

Sponsor: DOD - LASL

SITE: NTS - Area 7 - Target 3
37° 05' 03" N
116° 01' 10" W
Site elevation: 4,193 ft

TOTAL YIELD: 1 kt

HEIGHT OF BURST: 1,109 ft

TYPE OF BURST AND PLACEMENT:
Air burst over Nevada soil

CRATER DATA: No crater

FIREBALL DATA:

Time to 1st minimum:	3 to 5 msec
Time to 2nd maximum:	90 to 105 msec
Radius at 2nd maximum:	NM

CLOUD TOP HEIGHT: 15,700 ft MSL

CLOUD BOTTOM HEIGHT: 10,000 ft MSL

REMARKS:

The contours resulting from this shot were due primarily to neutron-induced activity. Readings were taken by radiological safety survey teams on D day, D+1 day, D+2 days, and D+3 days along eight radial lines of numbered wooden stakes placed 100 yards apart. The readings were extrapolated to H+1 hour using the decay curve for neutron-induced activity in Nevada soil

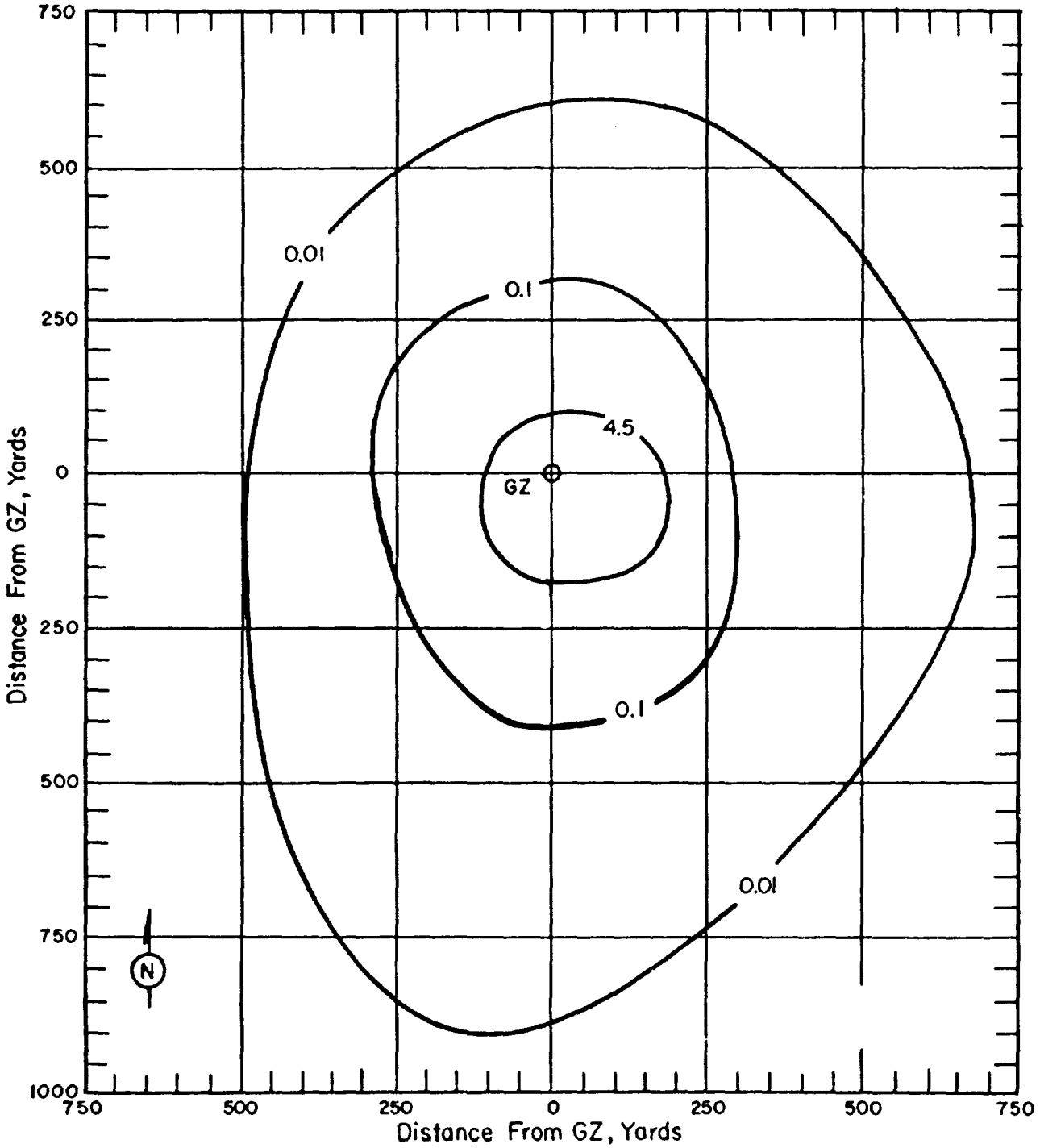


Figure 44. Operation TUMBERL-SNAPPER - BAKER On-site dose rate contours in r/hr at H+1 hour.

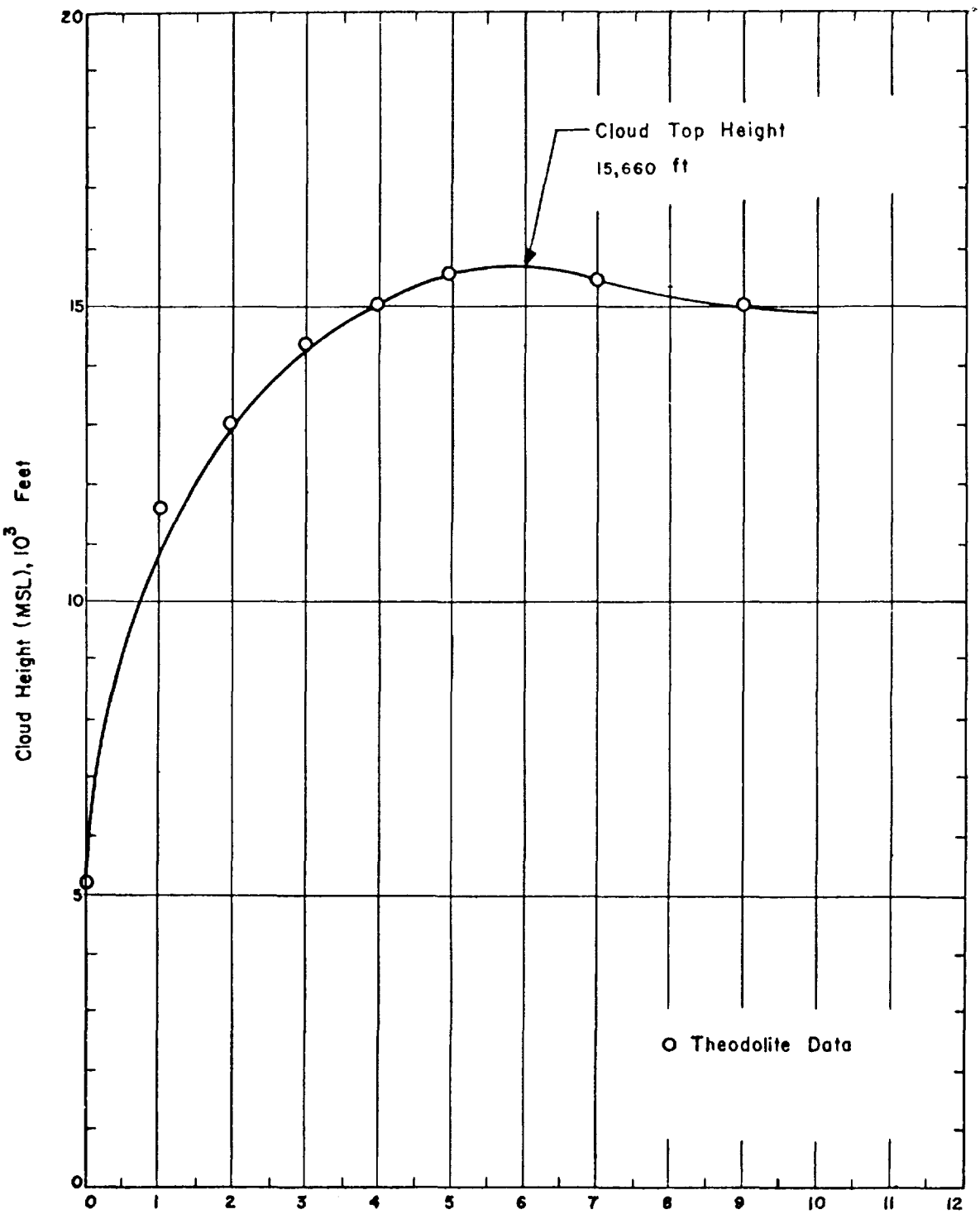


Figure 45. Cloud Dimensions: Operation TUMBLER-SNAPPER-BAKER

TABLE 15 NEVADA WIND DATA FOR OPERATION TUMBLER-SNAPPER- BAKER

Altitude (MSL)	H-hour Dir	H-hour Speed	Altitude (MSL)	H-hour Dir	H-hour Speed
feet	degrees	mph	feet	degrees	mph
Surface	050	07	16,000	310	21
5,000	040	07	18,000	310	21
6,000	040	07	20,000	300	29
7,000	050	10	25,000	270	35
8,000	040	14	30,000	260	40
9,000	030	14	35,000	260	25
10,000	360	10	40,000	270	32
12,000	340	09	45,000	270	46
14,000	320	10	50,000	270	46
15,000	310	16	55,000	270	26

NOTES:
1. Wind data was obtained by the Mercury Weather Station located at the C. P.
2. Tropopause height was 38,000 ft MSL.
3. At H-hour the pressure at ground zero was 878 mb, the temperature 52.8°F and the relative humidity 30%.

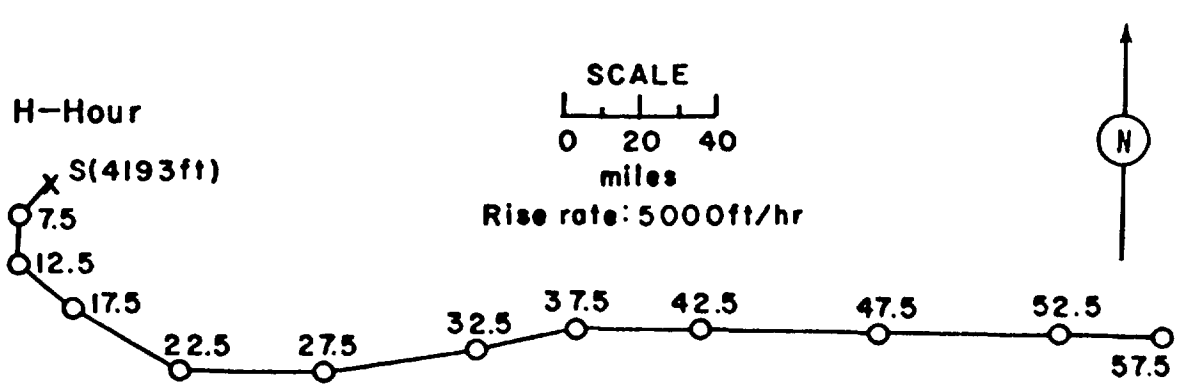


Figure 46. Hodograph for Operation - TUMBLER-SNAPPER- BAKER

OPERATION TUMBLER-SNAPPER - CHARLIE

	PST	GMT
DATE:	22 Apr 1952	22 Apr 1952
TIME:	0930	1730

Sponsor: DOD - LASL

SITE: NTS - Area 7 - Target 3
37° 05' 04" N
116° 01' 13" W
Site elevation: 4,193 ft

TOTAL YIELD: 31 kt

HEIGHT OF BURST: 3,447 ft

TYPE OF BURST AND PLACEMENT:
Air burst over Nevada soil

FIREBALL DATA:
Time to 1st minimum: 15 to 18.5 msec
Time to 2nd maximum: 150 to 190 msec
Radius at 2nd maximum: NM

CLOUD TOP HEIGHT: 42,000 ft MSL
CLOUD BOTTOM HEIGHT: 31,000 ft MSL

CRATER DATA: No crater

REMARKS:

The contours resulting from this shot were due primarily to neutron-induced activity. Readings were taken on D day and D+1 day by the radiological safety survey teams along eight radial lines of numbered wooden stakes placed 100 yards apart. These readings were extrapolated to H+1 hour, using the decay curve for neutron-induced activity in Nevada soil

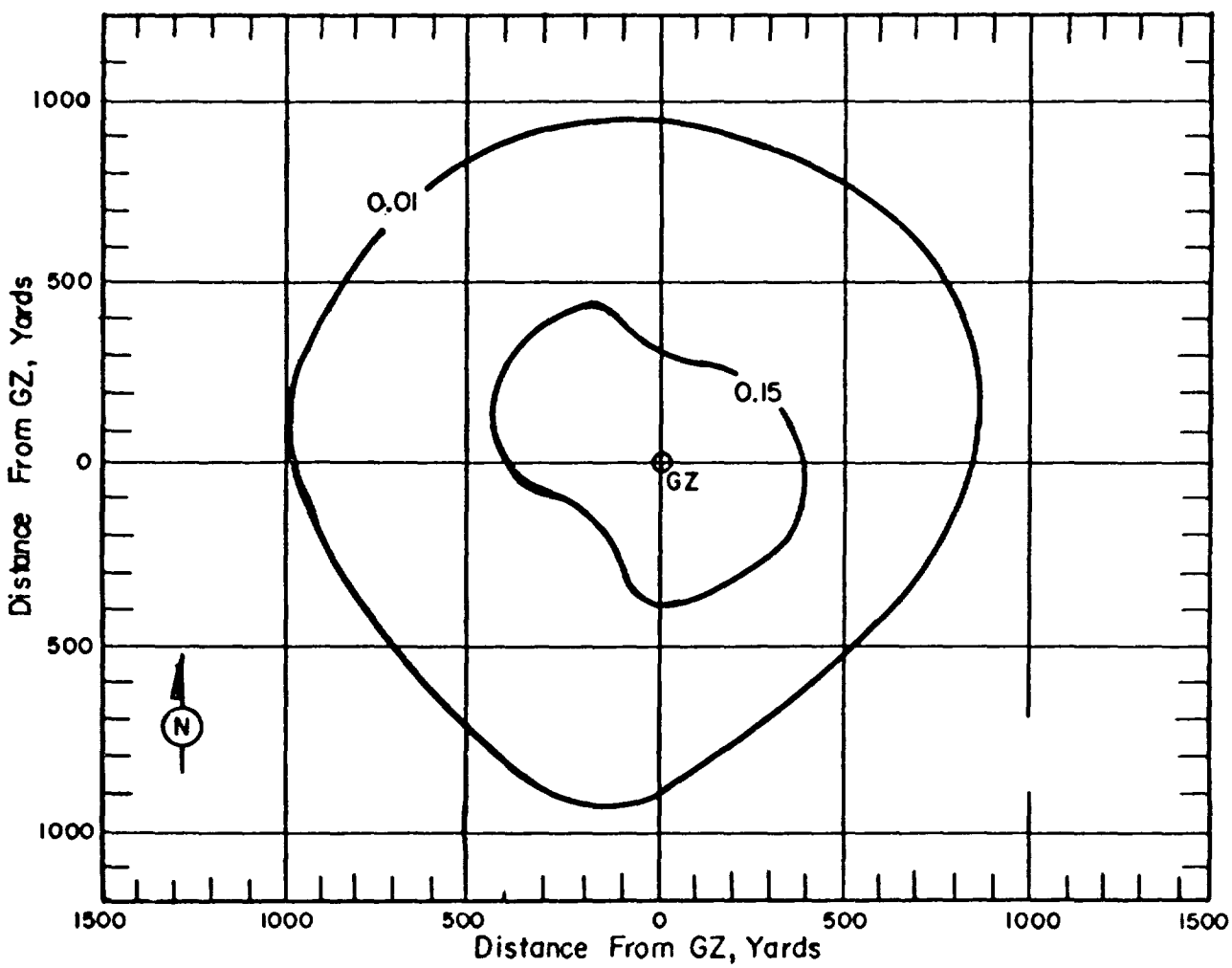


Figure 47. Operation TUMBLER-SNAPPER - CHARLIE On-site dose rate contours in r/hr at H+1 hour.

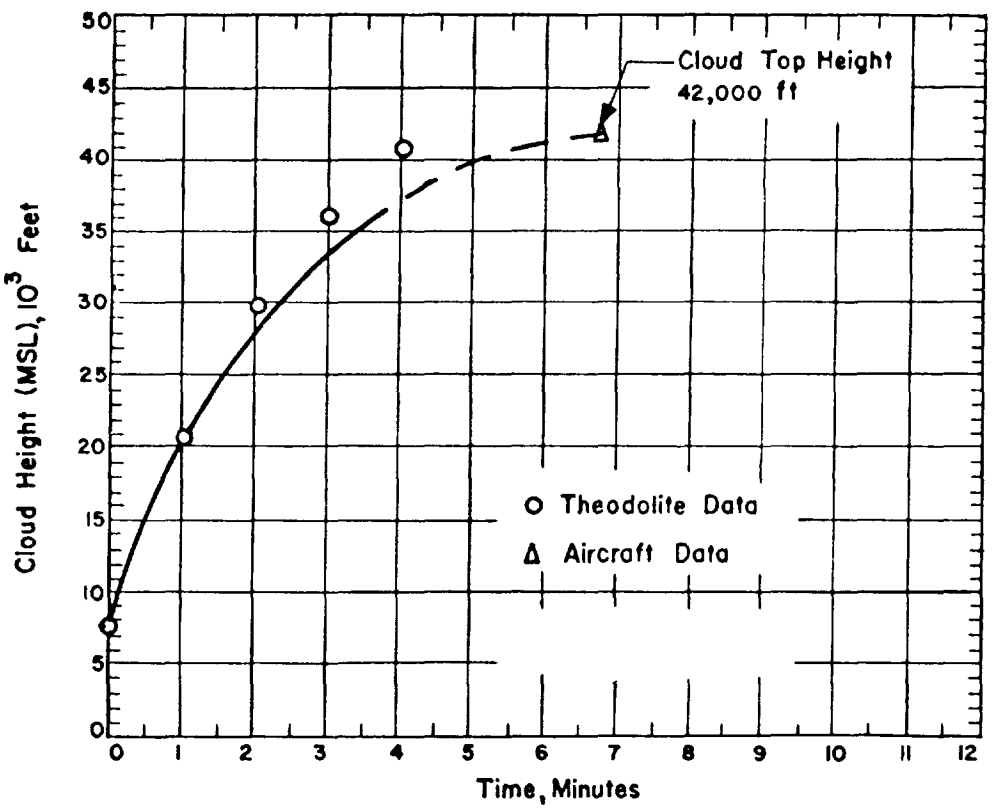


Figure 48. Cloud Dimensions: Operation TUMBLER-SNAPPER-CHARLIE

TABLE 16 NEVADA WIND DATA FOR OPERATION TUMBLER-SNAPPER-CHARLIE

Altitude (MSL)	H-hour Dir	H-hour Speed	Altitude (MSL)	H-hour Dir	H-hour Speed
feet	degrees	mph	feet	degrees	mph
Surface	230	07	15,000	330	18
5,000	220	09	16,000	330	16
6,000	220	09	18,000	330	15
7,000	210	08	20,000	340	17
8,000	210	06	25,000	330	18
9,000	240	03	30,000	310	33
10,000	290	06	35,000	290	17
12,000	350	09	40,000	270	25
14,000	360	18	45,000	250	32

NOTES:

1. Wind data was obtained by the Mercury Weather Station located at the C. P.
2. Tropopause height was 38,000 ft MSL.
3. At H-hour the pressure at ground zero was 873 mb, the temperature 66.1°F and the relative humidity 30%.

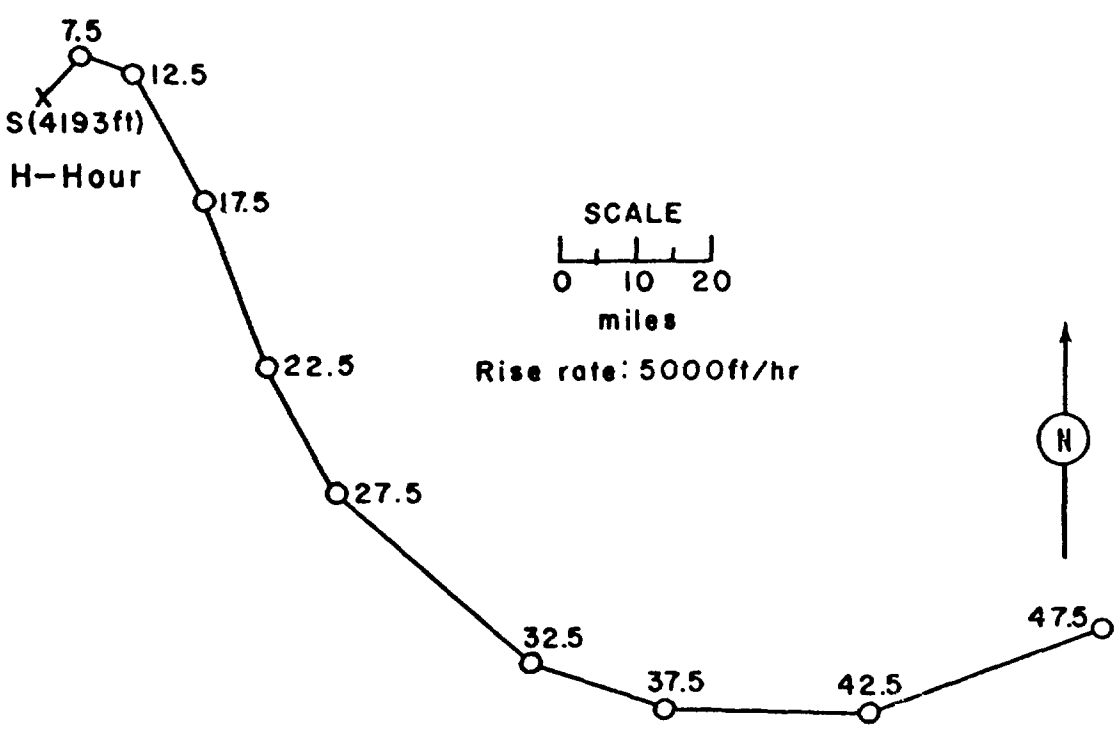


Figure 49. Hodograph for Operation TUMBLER-SNAPPER-CHARLIE

OPERATION TUMBLER-SNAPPER - DOG

	PST	GMT
DATE:	1 May 1952	1 May 1952
TIME:	0830	1630

Sponsor: LASL

Site: NTS - Area 7 - Target 3
37° 05' 03" N
116° 01' 13" W
Site elevation: 4,193 ft

TOTAL YIELD: 19 kt

HEIGHT OF BURST: 1,040 ft

TYPE OF BURST AND PLACEMENT:
Air burst over Nevada soil

FIREBALL DATA:
Time to 1st minimum: 12.5 to 15 msec
Time to 2nd maximum: 130 to 160 msec
Radius at 2nd maximum: NM

CLOUD TOP HEIGHT: 44,000 ft MSL
CLOUD BOTTOM HEIGHT: 28,000 ft MSL

CRATER DATA: No crater

REMARKS:

The contours resulting from this shot were due primarily to neutron-induced activity. Readings were taken by radiological survey teams along eight radial lines of numbered wooden stakes placed 100 yards apart. These readings were taken between H+36 minutes and H+66 minutes. No decay corrections were made.

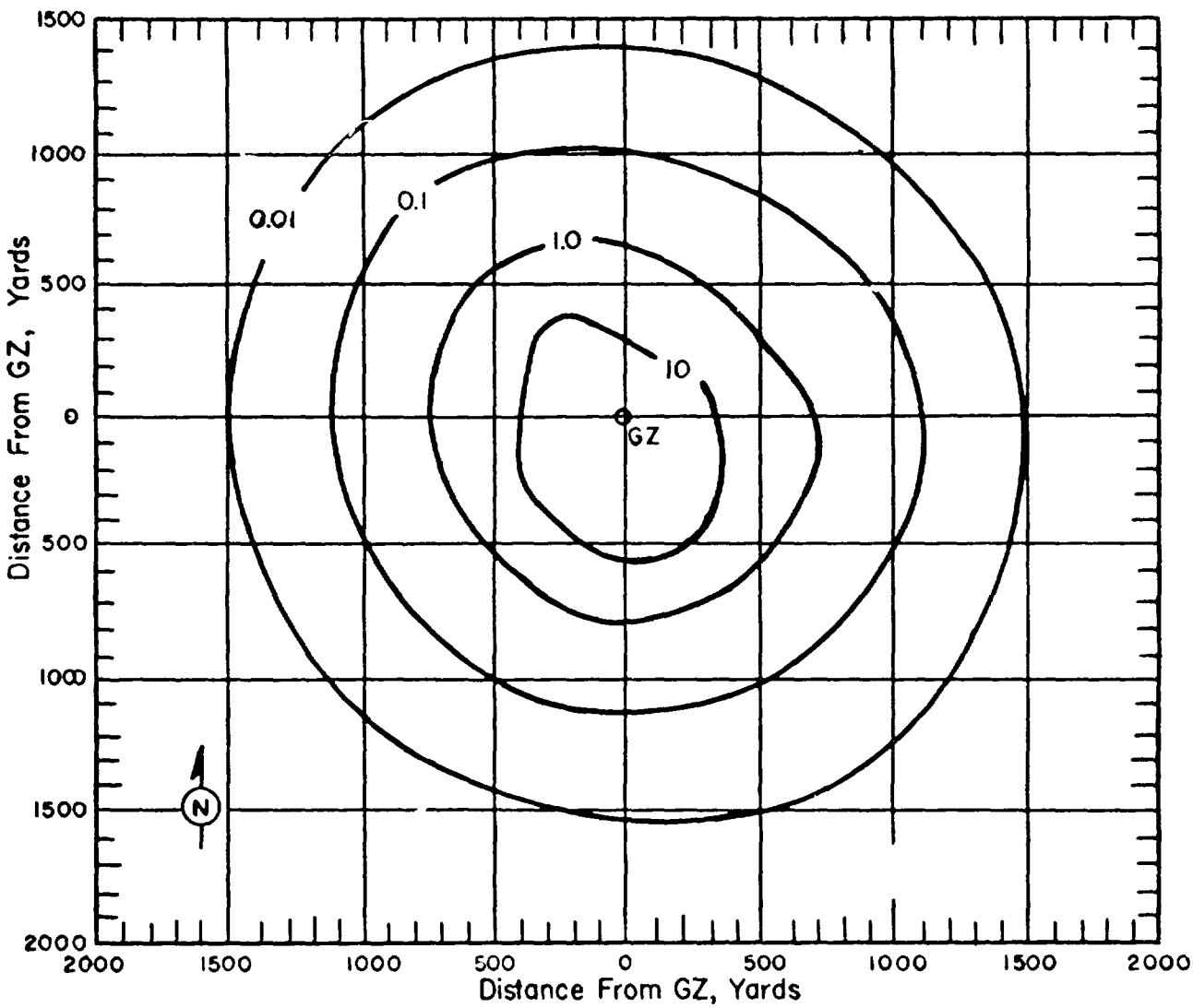


Figure 50. Operation TUMBLER-SNAPPER - DOG On-site dose rate contours in r/hr at H+1 hour.

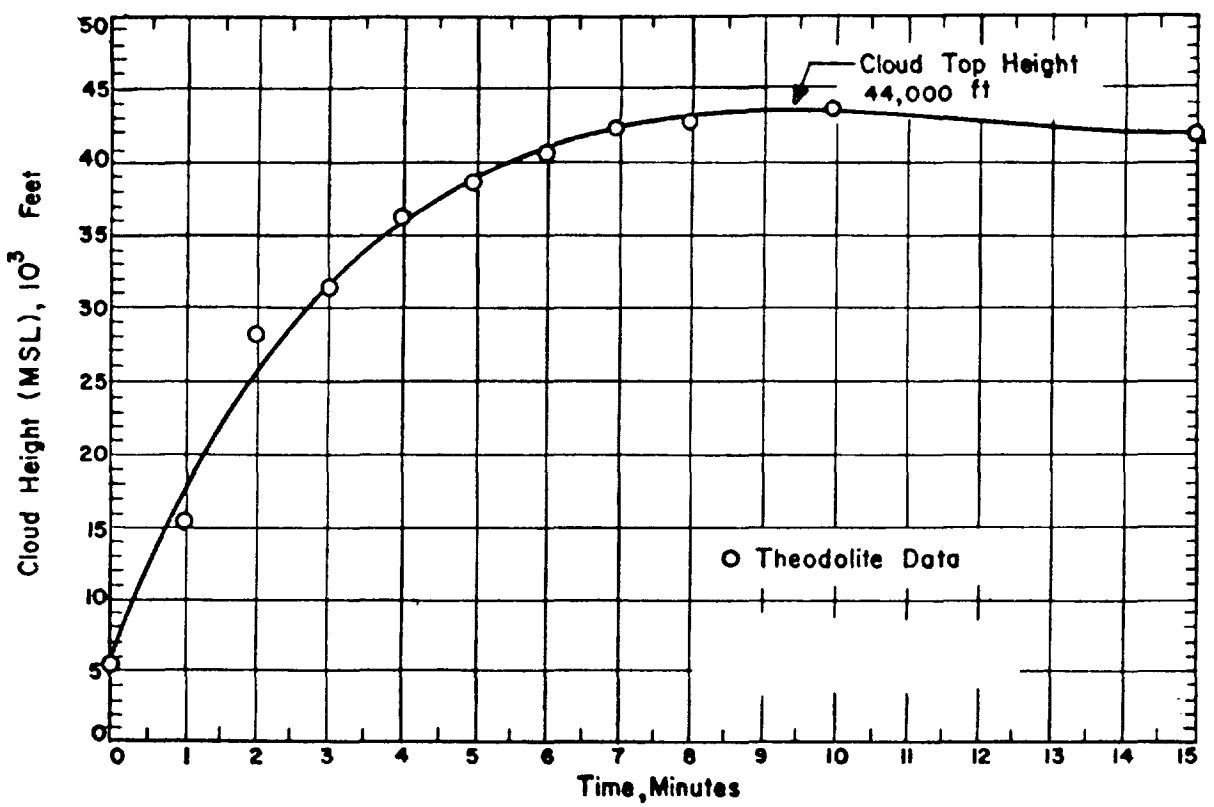


Figure 51. Cloud Dimensions: Operation TUMBLER-SNAPPER-DOG

TABLE 17 NEVADA WIND DATA FOR OPERATION TUMBLER-SNAPPER-DOG

Altitude (MSL)	H-hour Dir	H-hour Speed	Altitude (MSL)	H-hour Dir	H-hour Speed
feet	degrees	mph	feet	degrees	mph
Surface	020	03	14,000	250	14
5,000	240	05	15,000	260	18
6,000	210	07	16,000	280	22
7,000	200	10	18,000	270	30
8,000	190	13	20,000	260	36
9,000	180	14	25,000	260	24
10,000	190	15	30,000	250	44
12,000	190	14	35,000	260	47

NOTES:

1. Wind data was obtained by the Mercury Weather Station located at the C. P.
2. Tropopause height was 38,000 ft MSL.
3. At H-hour the pressure at ground zero was 877 mb, the temperature 62.8°F and the relative humidity 47%.

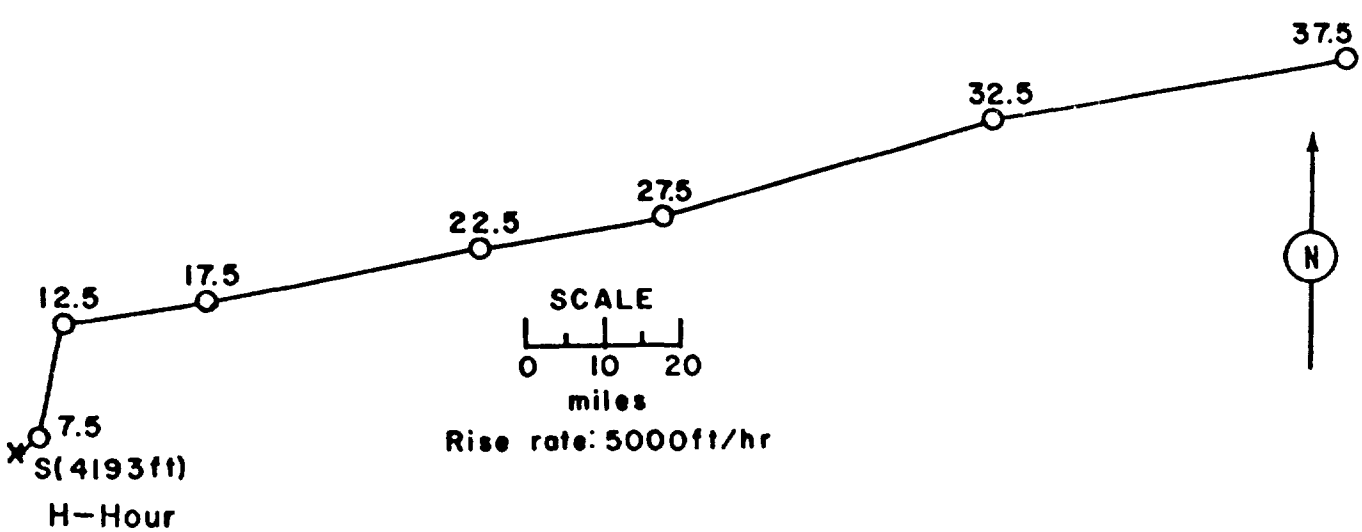


Figure 52. Hodograph for Operation TUMBLER-SNAPPER-DOG

OPERATION TUMBLER - SNAPPER - EASY

	PST	GMT
DATE:	7 May 1952	7 May 1952
TIME:	0415	1215

Sponsor: LASL

SITE: NTS - Area T-1
37° 03' 11" N
116° 06' 20" W
Site elevation: 4,329.25 ft

TOTAL YIELD: 12 kt

HEIGHT OF BURST: 300 ft

TYPE OF BURST AND PLACEMENT:
Tower burst over Nevada soil

FIREBALL DATA:
Time to 1st minimum: 9.3 to 12.5 msec
Time to 2nd maximum: 95
Radius at 2nd maximum: NM

CLOUD TOP HEIGHT: 34,000 ft MSL
CLOUD BOTTOM HEIGHT: Not available

CRATER DATA: No crater

REMARKS:

The on-site fallout pattern was obtained from readings of radiological survey teams on D+1 day along eight radial lines of numbered stakes 300 feet apart. The stakes within approximately 1200 to 1500 feet of ground zero were destroyed or blown down so that they did not provide adequate reference points. The survey readings were extrapolated to H+1 hour by using the $t^{-1.2}$ decay approximation. The off-site readings were obtained by ground mobile monitors of the Radiological Safety organization on D-day. These readings were extrapolated to H+1 hour by using the $t^{-1.2}$ decay approximation.

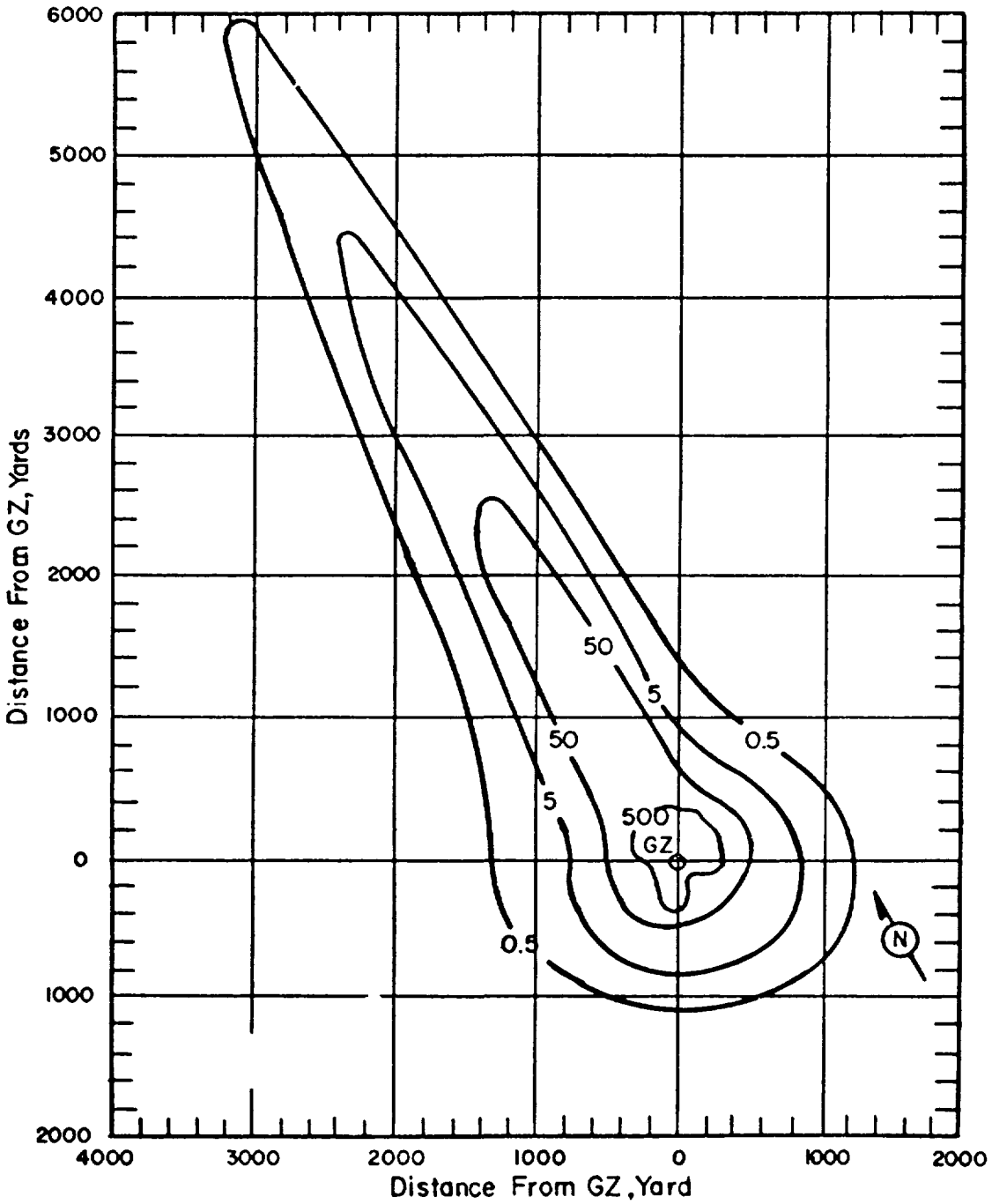


Figure 53. Operation TUMBLER-SNAPPER-EASY. On-site dose rate contours in r/hr at H+1 hour.

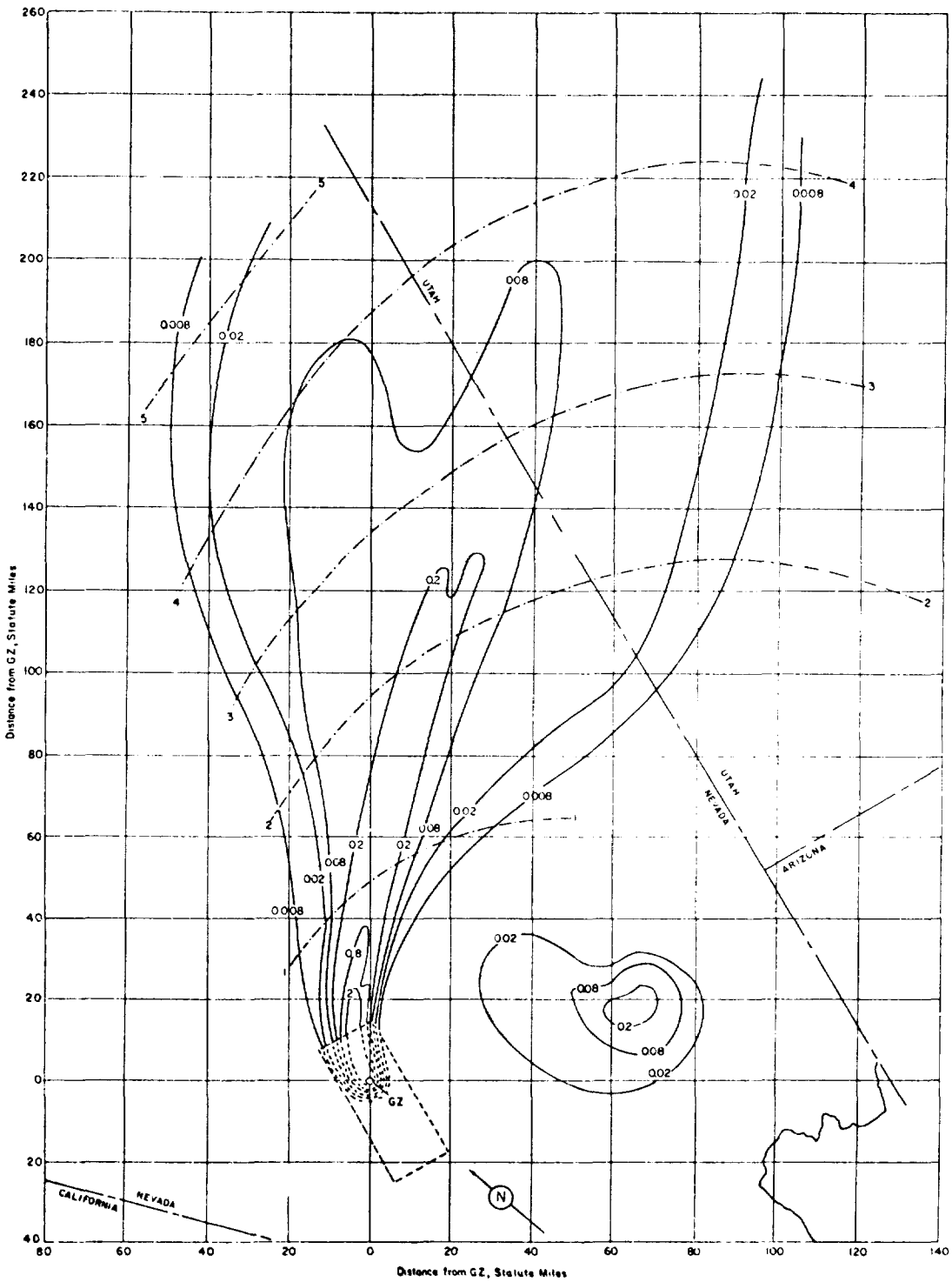


Figure 54. Operation TUMBLER-SNAPPER-EASY Off-site dose rate contours in r/hr at H+1 hour.

TABLE 18 NEVADA WIND DATA FOR OPERATION TUMBLER-SNAPPER- EASY

Altitude (MSL)	H-hour Dir	H-hour Speed	Altitude (MSL)	H-hour Dir	H-hour Speed
feet	degrees	mph	feet	degrees	mph
Surface	Calm	Calm	12,000	190	52
4,000	Calm	Calm	14,000	190	62
5,000	Calm	Calm	15,000	190	56
6,000	180	23	16,000	210	55
7,000	180	30	18,000	210	67
8,000	180	37	20,000	220	77
9,000	190	40	25,000	220	90
10,000	180	41	30,000	220	107

NOTES:

1. Wind data was obtained by the Mercury Weather Station located at the C. P.
2. Tropopause height was 41,000 ft MSL.
3. At H-hour the pressure at ground zero was 868 mb, the temperature 60.5°F and the relative humidity 40%.

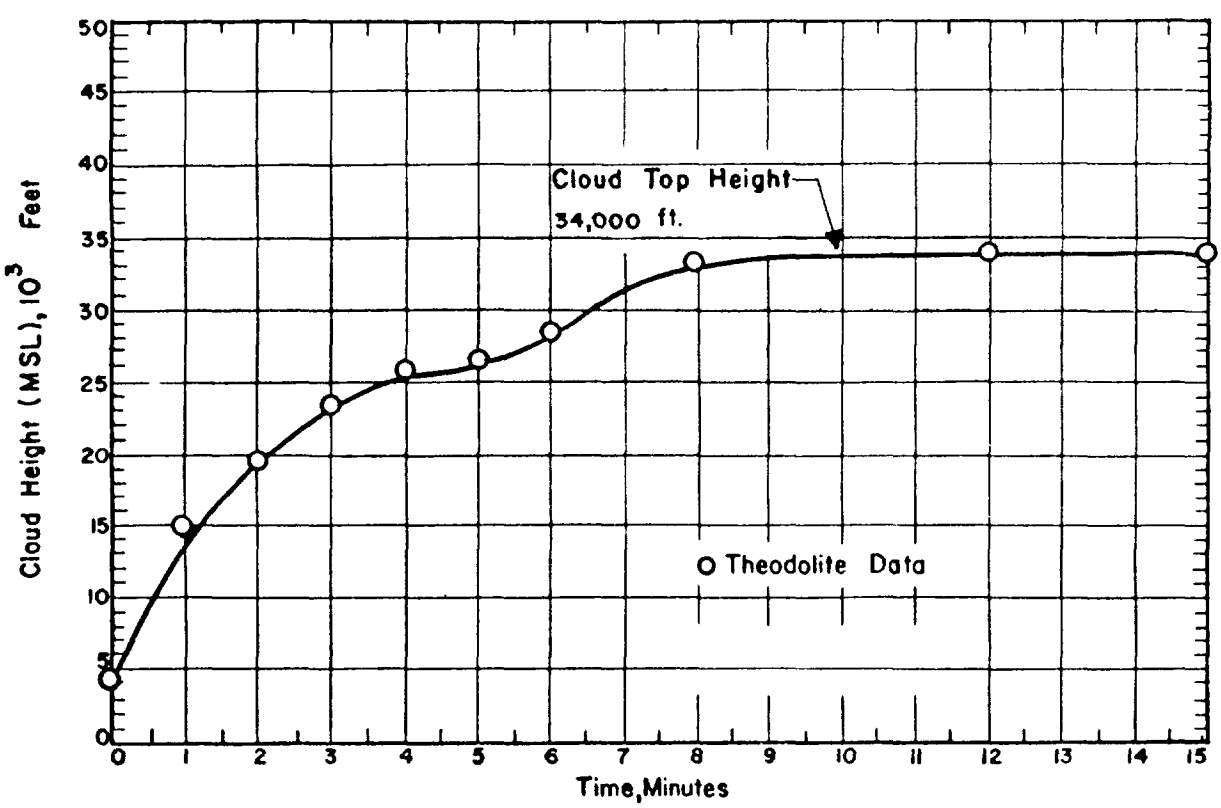


Figure 55. Cloud Dimensions: Operation TUMBLER-SNAPPER-EASY

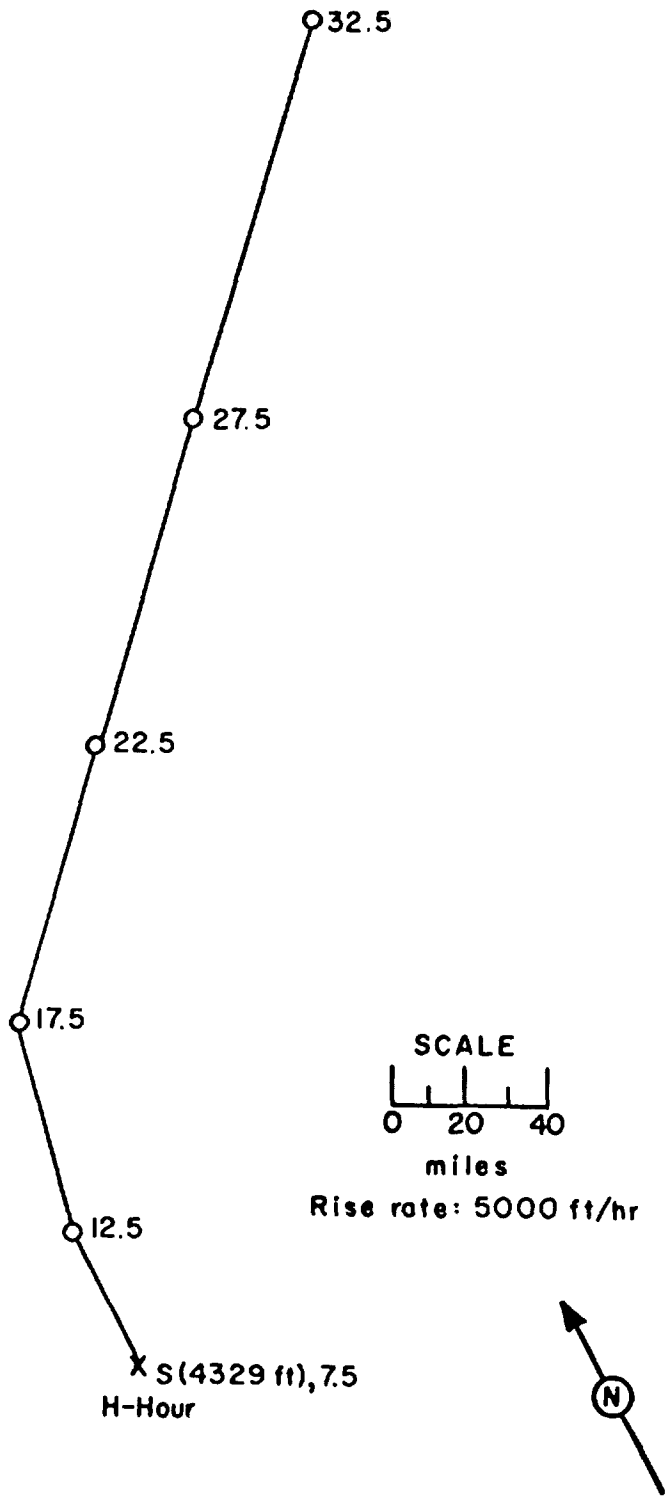


Figure 56. Hodograph for Operation TUMBLER-SNAPPER-EASY

OPERATION TUMBLER-SNAPPER - FOX

	PST	GMT
DATE:	25 May 1952	25 May 1952
TIME:	0400	1200

TOTAL YIELD: 11 kt

FIREBALL DATA:
Time to 1st minimum: 10 to 13 msec
Time to 2nd maximum: 110 msec
Radius at 2nd maximum: NM

CRATER DATA: No crater

Sponsor: LASL

SITE: NTS - Area 4
37° 05' 44" N
116° 06' 20" W
Site elevation: 4,309 ft

HEIGHT OF BURST: 300 ft

TYPE OF BURST AND PLACEMENT:
Tower burst over Nevada soil

CLOUD TOP HEIGHT: 41,000 ft MSL
CLOUD BOTTOM HEIGHT: Not available

REMARKS:

The on-site fallout pattern was obtained from readings of radiological survey teams from D-day through D+3 days along eight radial lines of numbered stakes, 300 feet apart. Although part of the contamination from this shot overlapped that resulting from the previous tower shot, the old contamination had a negligible influence on the dose rates. The survey readings were extrapolated to H+1 hour by using the $t^{-1.2}$ decay approximation. The off-site readings were obtained by ground mobile monitors of the Radiological Safety organization from D-day through D+2 days.

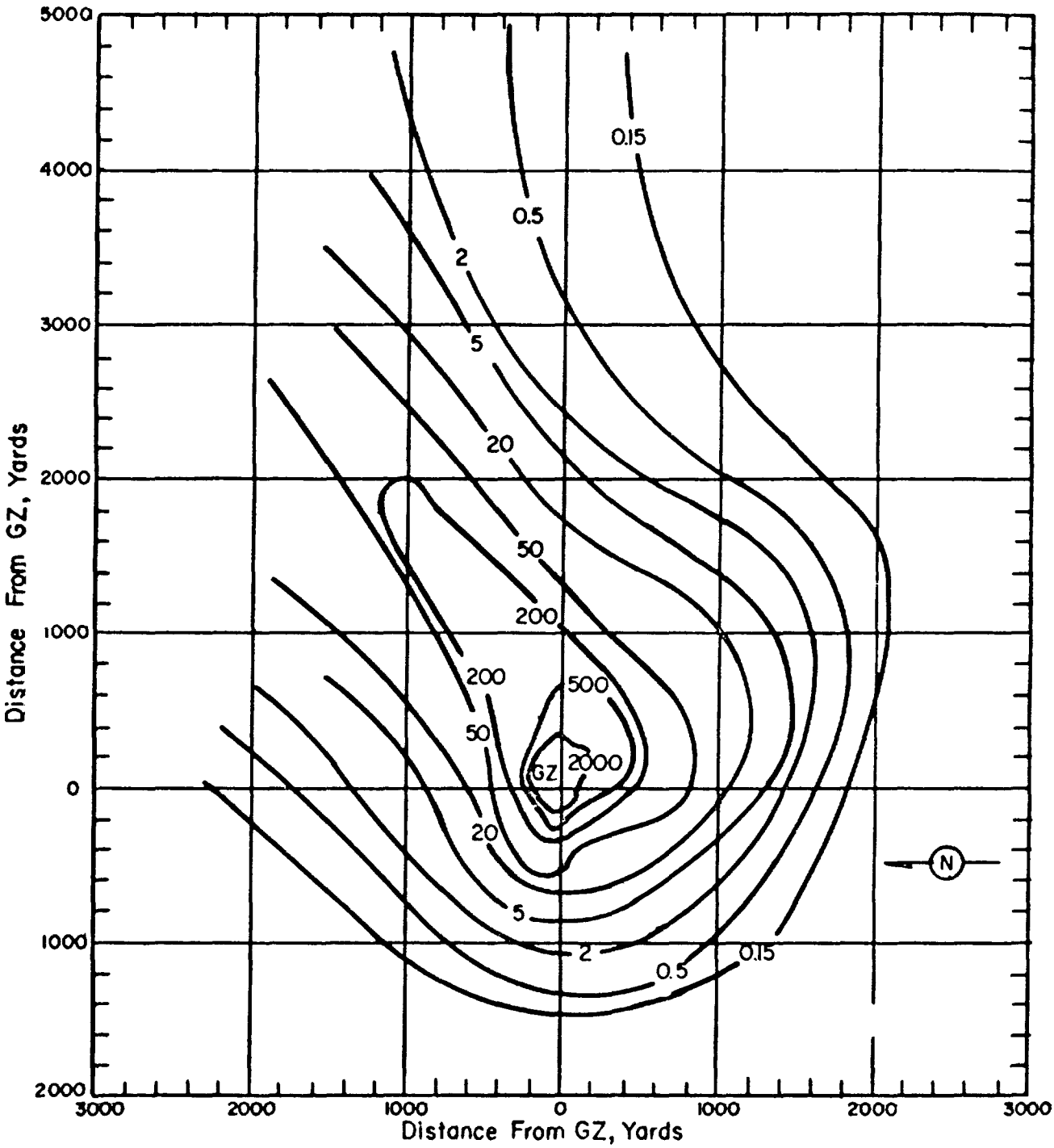


Figure 57. Operation TUMBLER-SNAPPER - FOX On-site dose rate contours in r/hr at H+1 hour.

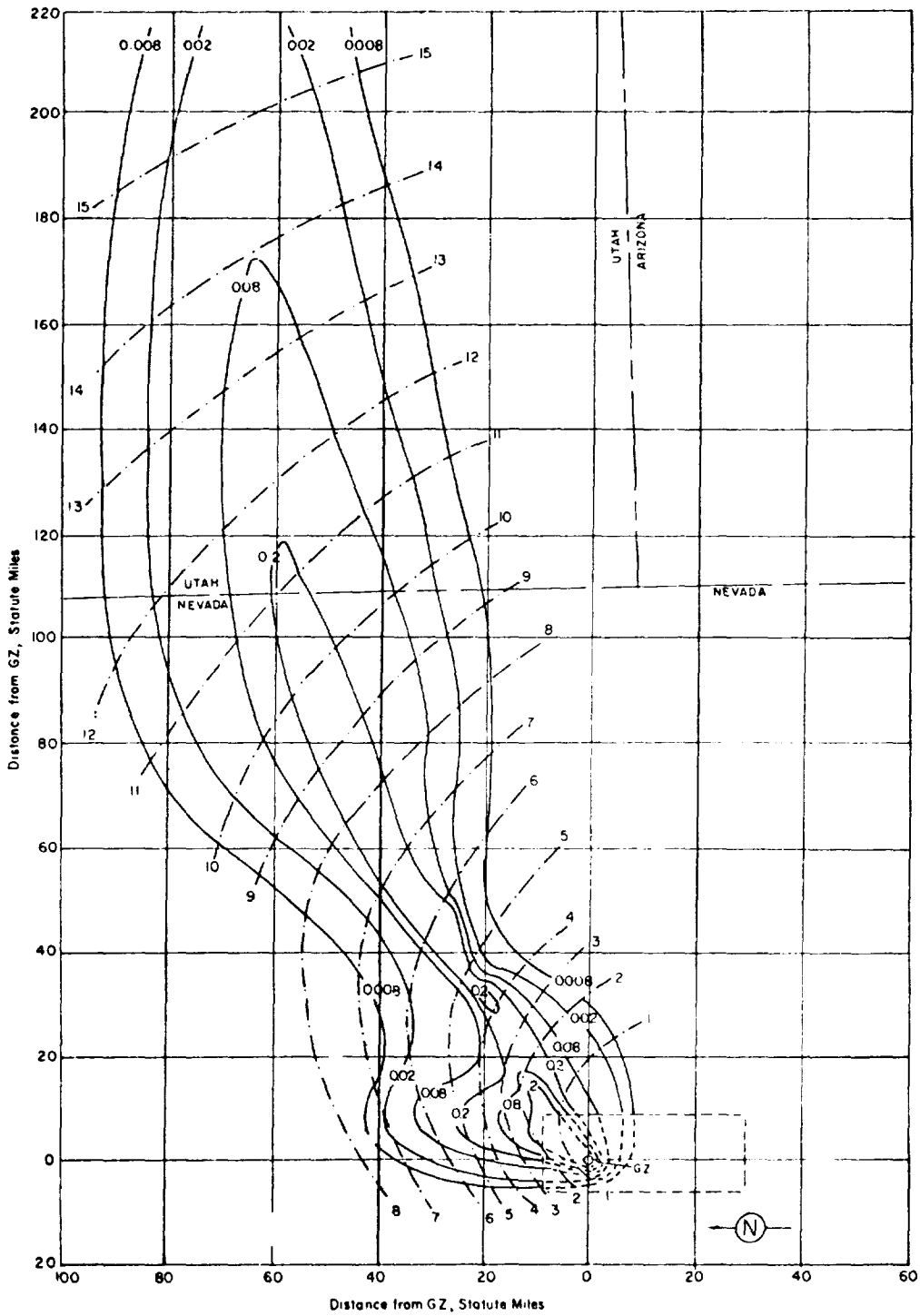


Figure 58. Operation TUMBLER-SNAPPER - FOX Off-site dose rate contours in r/hr at H+1 hour.

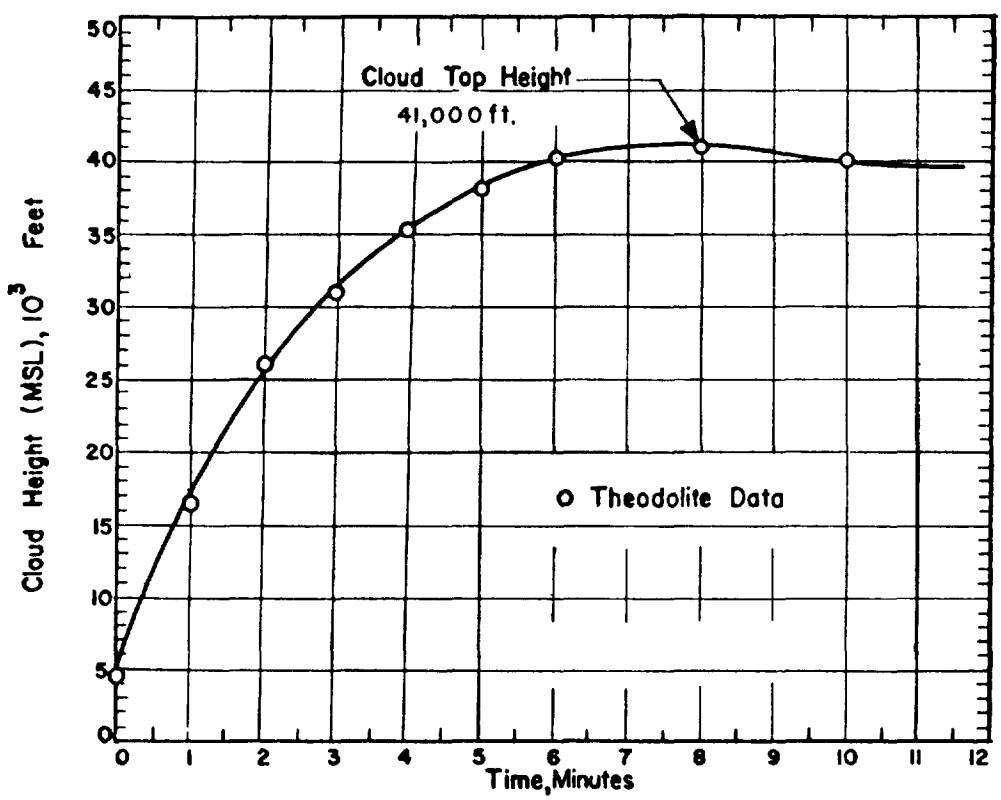


Figure 59. Cloud Dimensions: Operation TUMBLER-SNAPPER-FOX

TABLE 19 NEVADA WIND DATA FOR OPERATION TUMBLER-SNAPPER-FOX

Altitude (MSL)	H-hour Dir	H-hour Speed	Altitude (MSL)	H-hour Dir	H-hour Speed
feet	degrees	mph	feet	degrees	mph
Surface	Calm	Calm	14,000	200	07
5,000	210	02	15,000	150	05
6,000	210	09	16,000	120	07
7,000	220	13	18,000	140	10
8,000	220	13	20,000	220	09
9,000	220	13	25,000	240	26
10,000	220	12	30,000	230	29
12,000	210	10	35,000	240	40

NOTES:

1. Wind data was obtained by the Mercury Weather Station located at the C. P.
2. Tropopause height was 37,000 ft MSL.
3. At H-hour the pressure at ground zero was 868 mb, the temperature 57.1°F and the relative humidity 41%.

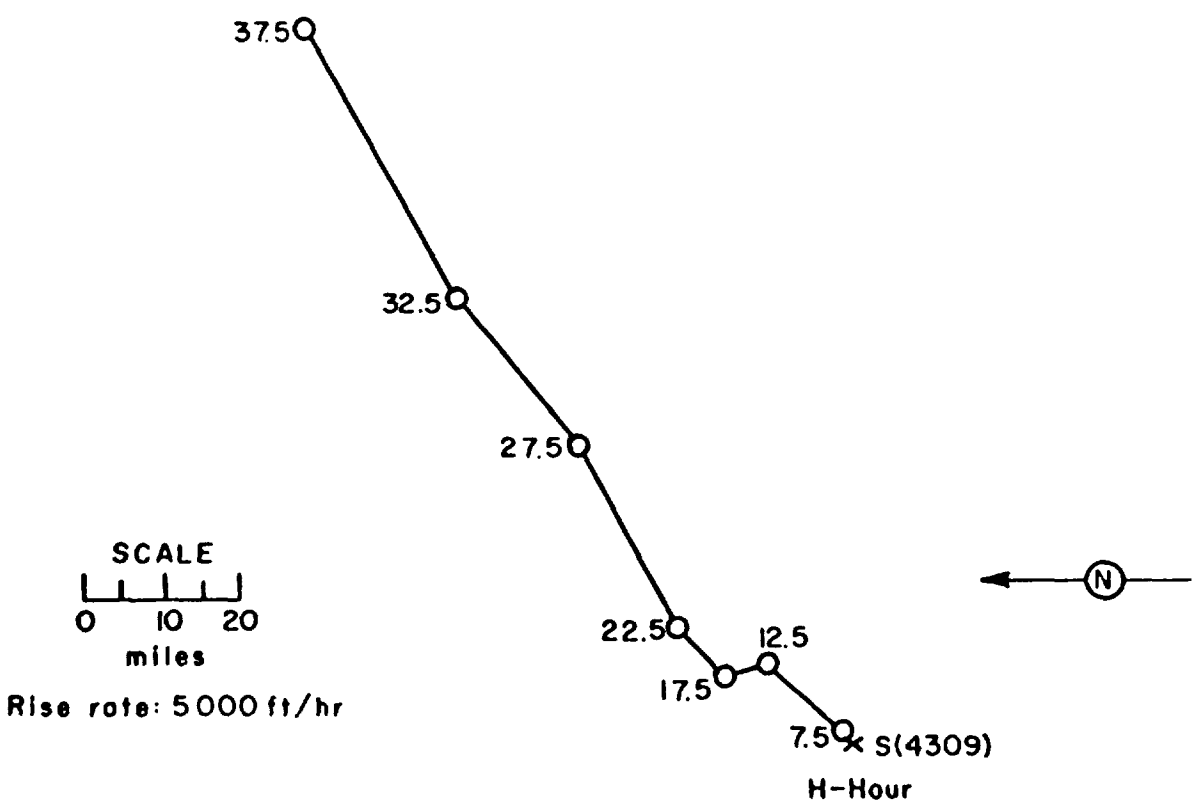


Figure 60. Hodograph for Operation TUMBLER-SNAPPER-FOX

OPERATION TUMBLER-SNAPPER—GEORGE

	PST	GMT
DATE:	1 Jun 1952	1 Jun 1952
TIME:	0355	1155

TOTAL YIELD: 15 kt

FIREBALL DATA:
Time to 1st minimum: 8.5 to 14.5 msec
Time to 2nd maximum: 120 msec
Radius at 2nd maximum: NM

CRATER DATA: No crater

Sponsor: LASL

SITE: NTS - Area 3
37° 02' 53" W
116° 01' 16" W
Site elevation: 4,027.56 ft

HEIGHT OF BURST: 300 ft

TYPE OF BURST AND PLACEMENT:
Tower burst over Nevada soil

CLOUD TOP HEIGHT: 37,000 ft MSL
CLOUD BOTTOM HEIGHT: Not available

REMARKS:

The on-site fallout pattern was obtained from readings of radiological survey teams from D-day through D+2 days along eight radial lines of numbered stakes 300 feet apart. These readings were extrapolated to H+1 hour by using the $t^{-1.2}$ decay approximation. The off-site fallout pattern was drawn from the readings taken by ground mobile monitors of the Radiological Safety organization on D-Day. The $t^{-1.2}$ decay approximation was used to extrapolate the dose-rate readings to H+1 hour.

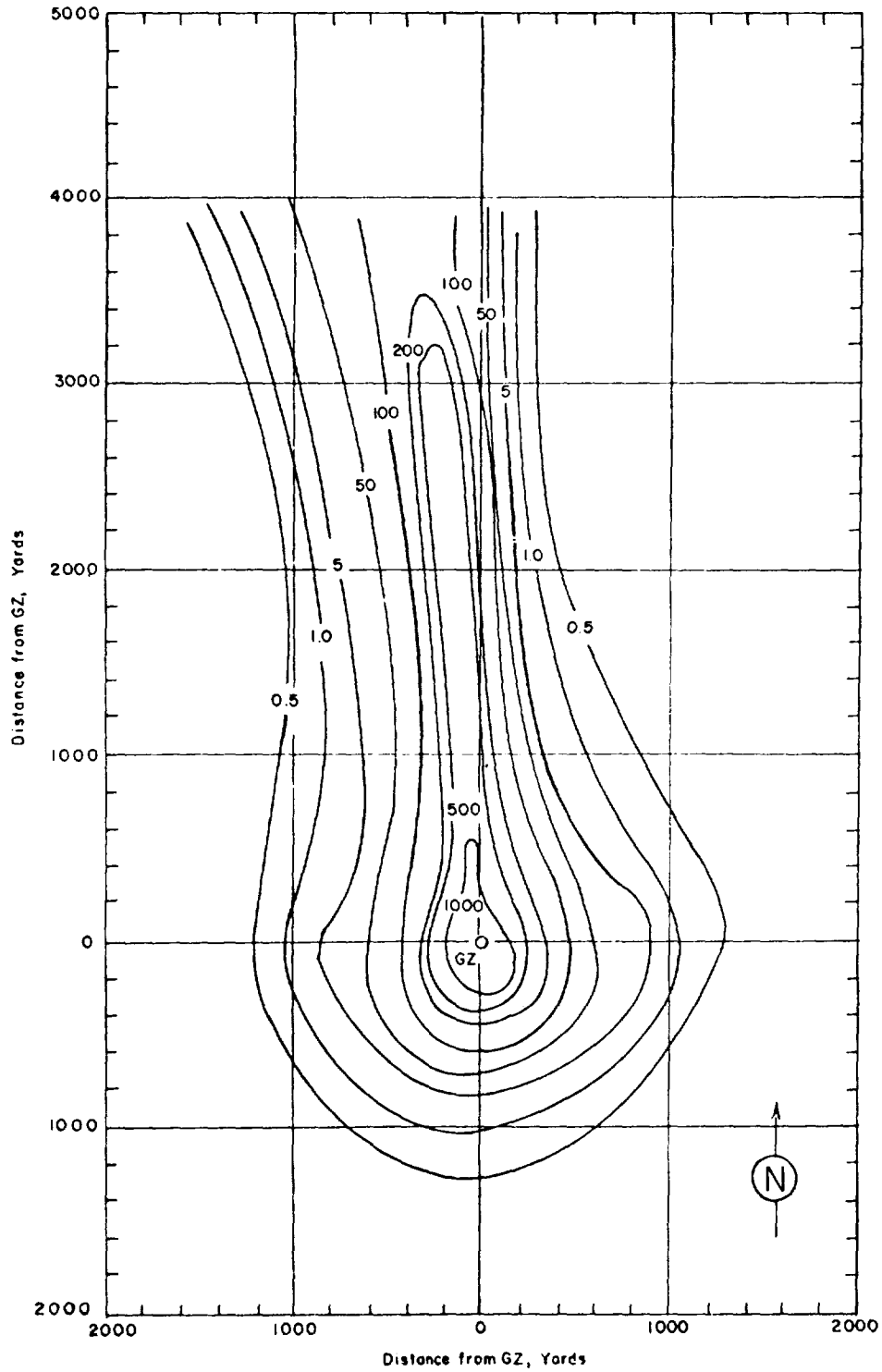


Figure 61. Operation TUMBLER-SNAPPER-GEORGE On-site dose rate contours in r/hr at H+1 hour.

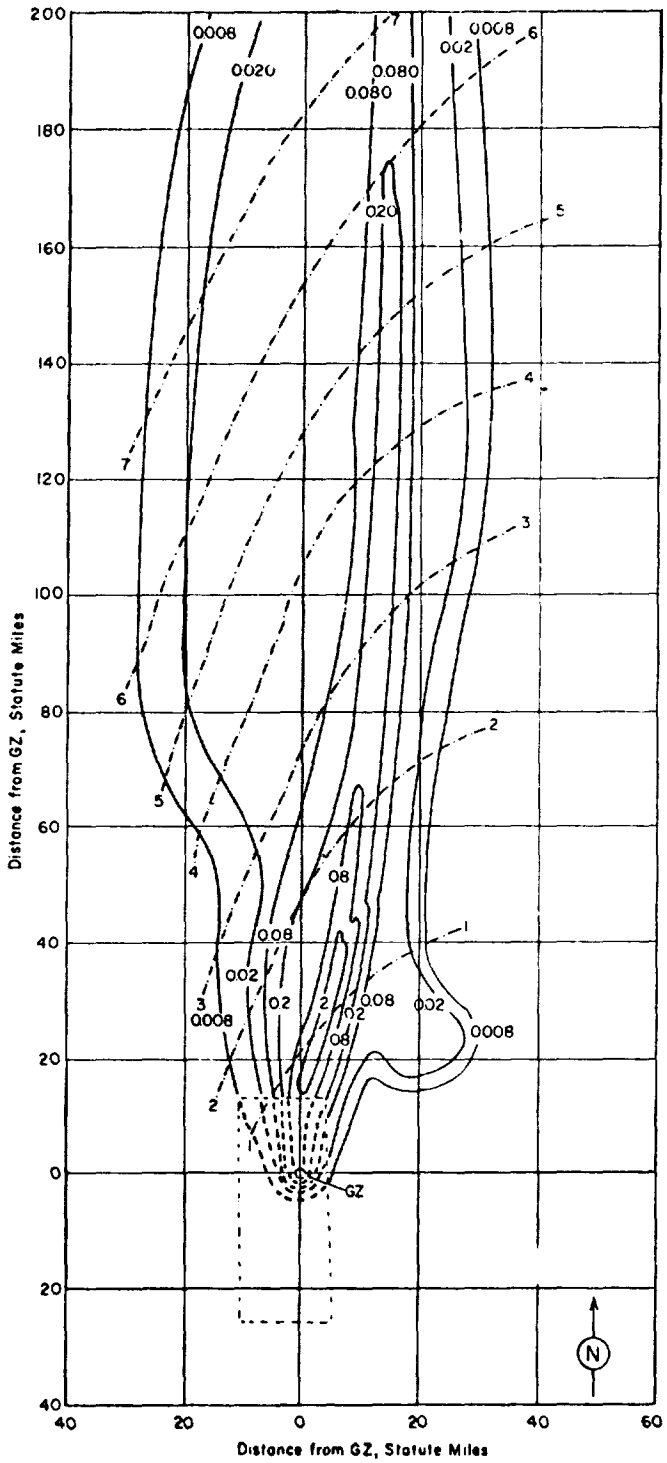


Figure 62. Operation TUMBLER-SNAPPER-GEORGE Off-site dose rate contours in r/hr at H+1 hour.

TABLE 20 NEVADA WIND DATA FOR OPERATION TUMBLER-SNAPPER-GEORGE

Altitude (MSL)	H-hour Dir	H-hour Speed	Altitude (MSL)	H-hour Dir	H-hour Speed
feet	degrees	mph	feet	degrees	mph
Surface	Calm	Calm	14,000	180	30
5,000	Calm	Calm	15,000	170	30
6,000	170	20	16,000	170	33
7,000	170	21	18,000	190	35
8,000	170	20	20,000	190	51
9,000	160	20	25,000	200	48
10,000	160	17	30,000	190	41
12,000	180	20			

NOTES:

1. Wind data was obtained by the Mercury Weather Station located at the C. P.
2. Tropopause height was 37,000 ft MSL.
3. At H-hour the pressure at ground zero was 872 mb, the temperature 52.6°F and the relative humidity 48%.

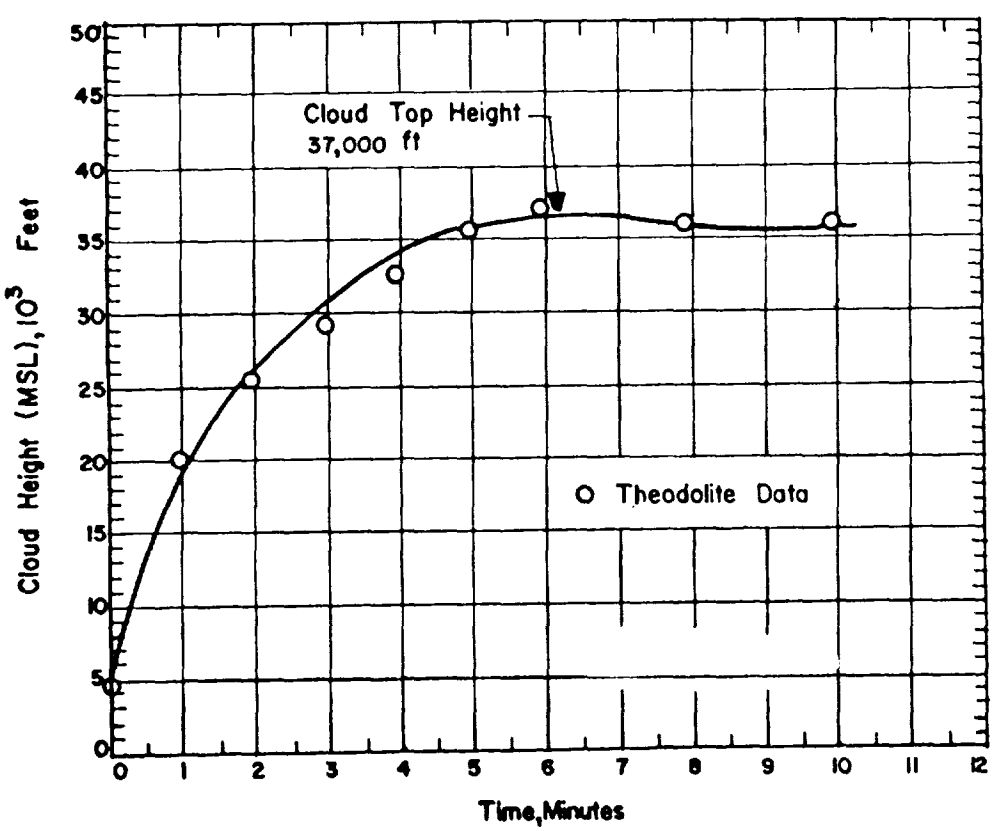


Figure 63. Cloud Dimensions: Operation TUMBLER-SNAPPER-GEORGE

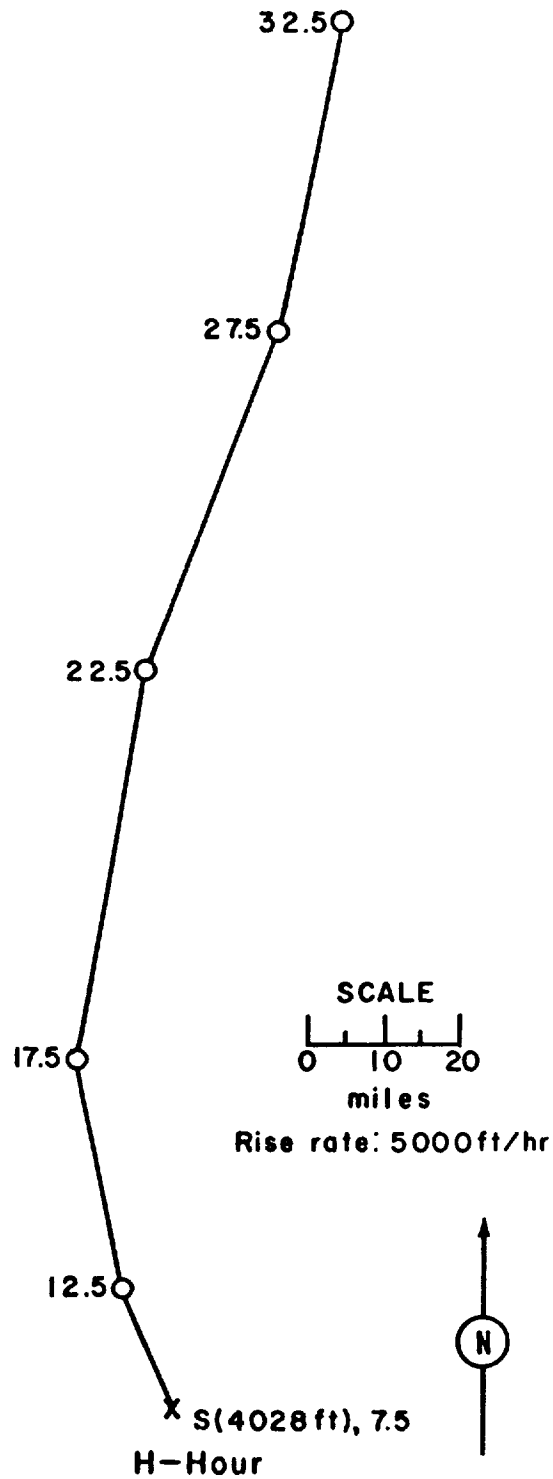


Figure 64. Hodograph for Operation TUMBLER-SNAPPER-GEORGE

OPERATION TUMBLER-SNAPPER - HOW

	PST	GMT
DATE:	5 Jun 1952	5 Jun 1952
TIME:	0355	1155

TOTAL YIELD: 14 kt

FIREBALL DATA:
Time to 1st minimum: 9 to 11 msec
Time to 2nd maximum: NM
Radius at 2nd maximum: NM

CRATER DATA: No crater

Sponsor: LASL

SITE: NTS - Area 2
37° 08' 19" N
116° 07' 04" W
Site elevation: 4,492 ft

HEIGHT OF BURST: 300 ft

TYPE OF BURST AND PLACEMENT:
Tower burst over Nevada soil

CLOUD TOP HEIGHT: 41,800 ft MSL
CLOUD BOTTOM HEIGHT: Not available

REMARKS:

The on-site fallout pattern was obtained from readings of radiological survey teams from D-day through D+4 days along radial lines of numbered stakes 300 feet apart. These readings were extrapolated to H+1 hour by using the $t^{-1.2}$ decay approximation. The close-in fallout was deposited in the mountains, and, therefore, the on-site isointensity lines were not closed. The off-site fallout pattern was drawn from the readings taken on D-day by ground mobile monitors of the Radiological Safety organization, using the $t^{-1.2}$ decay approximation to extrapolate to H+1 hour.

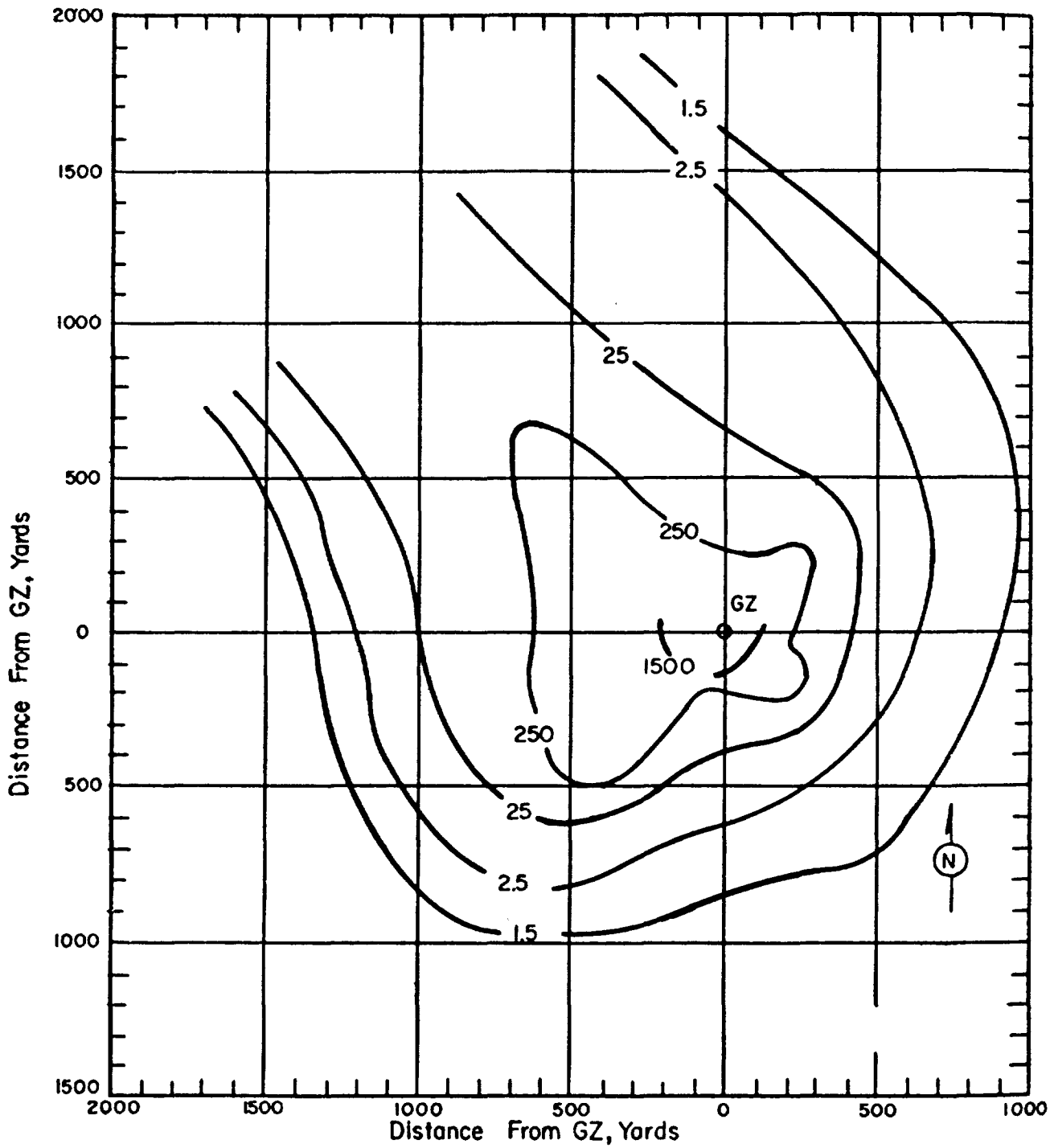


Figure 65. Operation TUMBLER-SNAPPER-HOW On-site dose rate contours in r/hr at H+1-hour.

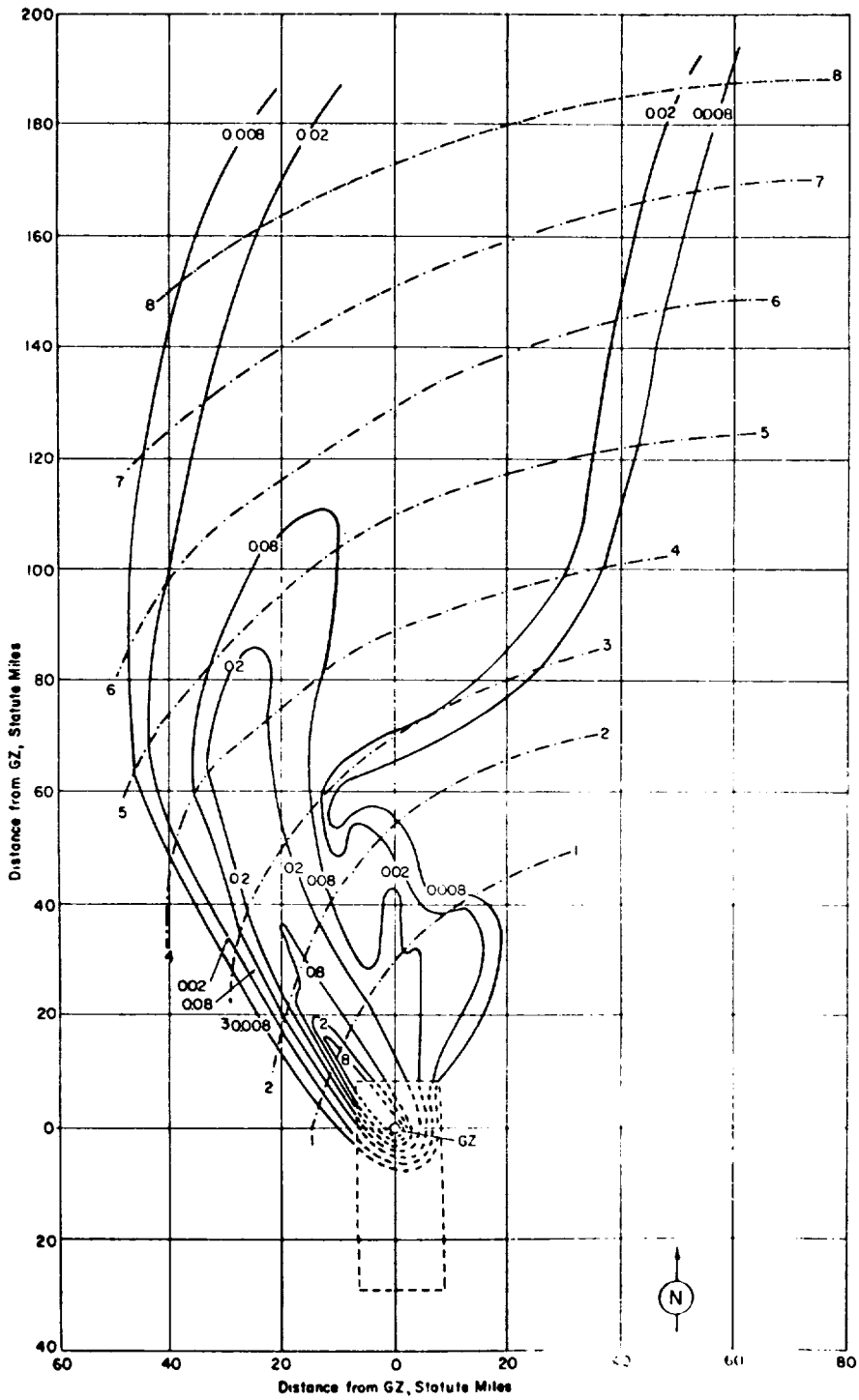


Figure 66. Operation TUMBLER-SNAPPER-HOW Off-site dose rate contours in r/hr at H+1 hour.

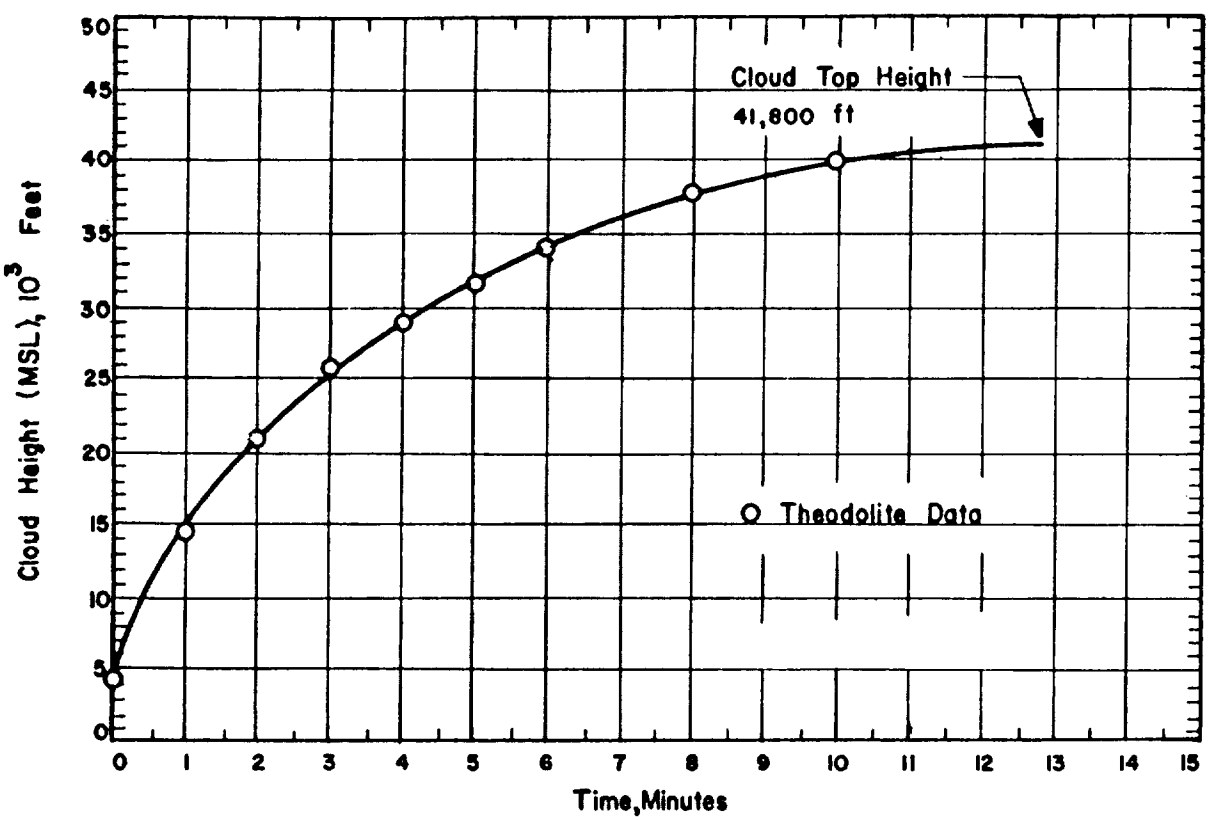


Figure 67. Cloud Dimensions: Operation TUMBLER-SNAPPER-HOW

TABLE 21 NEVADA WIND DATA FOR OPERATION TUMBLER-SNAPPER-HOW

Altitude (MSL)	H-hour Dir	H-hour Speed	Altitude (MSL)	H-hour Dir	H-hour Speed
feet	degrees	mph	feet	degrees	mph
Surface	Calm	Calm	14,000	120	29
5,000	Calm	Calm	15,000	120	28
6,000	210	06	16,000	120	25
7,000	170	07	18,000	150	22
8,000	150	07	20,000	150	17
9,000	140	13	25,000	160	25
10,000	140	15	30,000	150	29
12,000	130	20			

NOTES:

1. Wind data was obtained by the Mercury Weather Station located at the C. P.
2. Tropopause height was 40,000 ft MSL.
3. At H-hour the pressure at ground zero was 863 mb, the temperature 64.0°F and the relative humidity 45%.

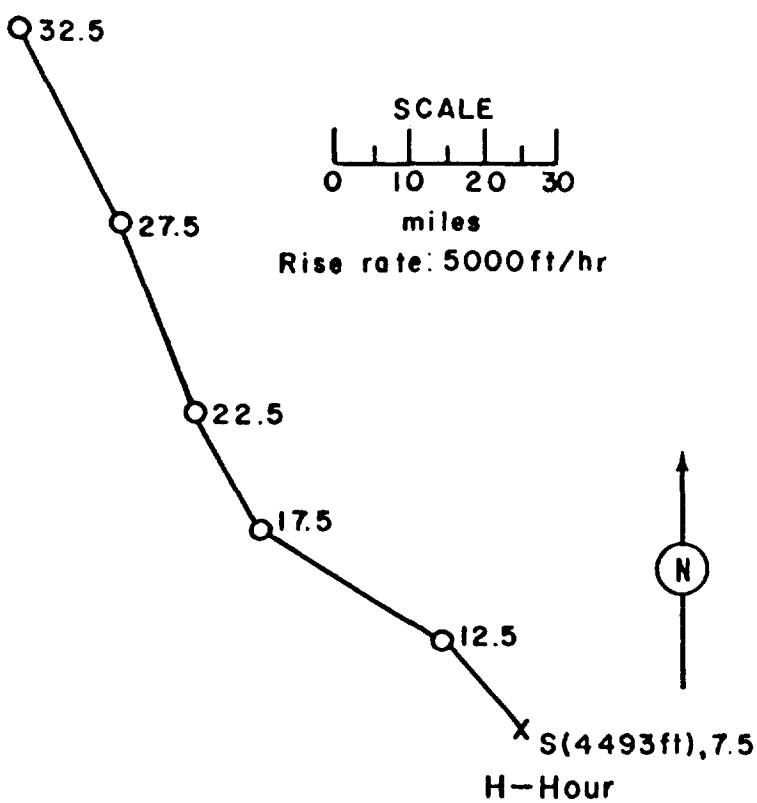
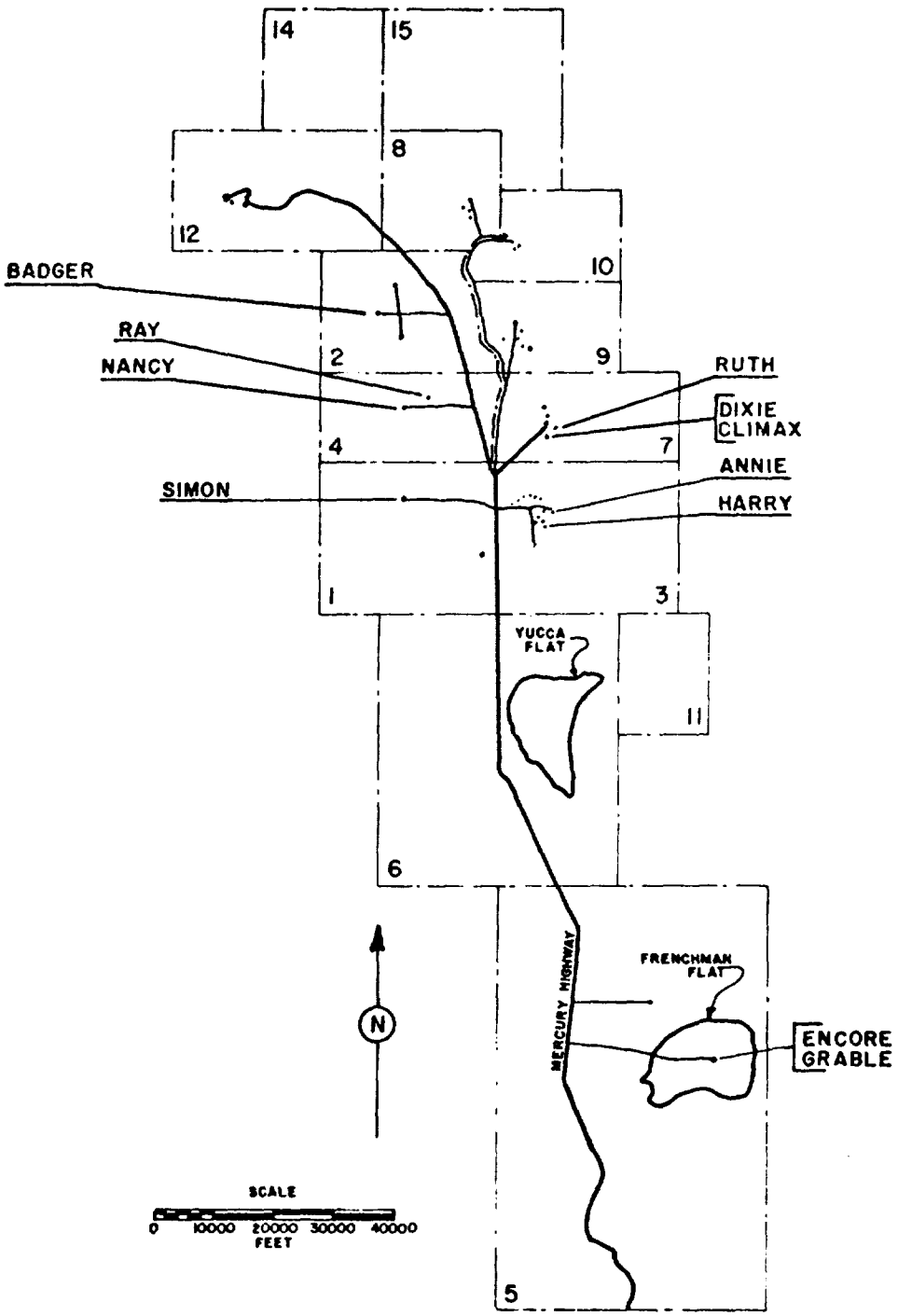


Figure 68. Hodograph for Operation TUMBLER-SNAPPER-HOW



NEVADA TEST SITE

Figure 69. Operation UPSHOT-KNOTHOLE, Shot Locations.

OPERATION UPSHOT-KNOTHOLE - Annie

	PST	GMT
DATE:	17 Mar 1953	17 Mar 1953
TIME:	0520	1320

TOTAL YIELD: 16 kt

FIREBALL DATA:
Time to 1st minimum: 14.3 to 14.5 msec
Time to 2nd maximum: 122 msec
Radius to 2nd maximum: NM

Sponsor: LASL

SITE: NTS - Area 3
37° 02' 52" N
116° 01' 16" W
Site elevation: 4,026 ft

HEIGHT OF BURST: 300 ft

TYPE OF BURST AND PLACEMENT:
Tower burst over Nevada soil

CLOUD TOP HEIGHT: 41,000 ft MSL
CLOUD BOTTOM HEIGHT: 28,000 ft MSL

CRATER DATA: No crater

REMARKS:

The on-site fallout pattern is based upon readings obtained by radiological ground survey teams from D-day to D+3 days. The locations of the points at which readings were taken were approximated. The off-site fallout pattern was drawn from readings on D-day through D+3 day by ground mobile monitors of the Radiological Safety organization. The $t^{-1.2}$ decay approximation was used to extrapolate both the on-site and off-site dose rates to H+1 hour.

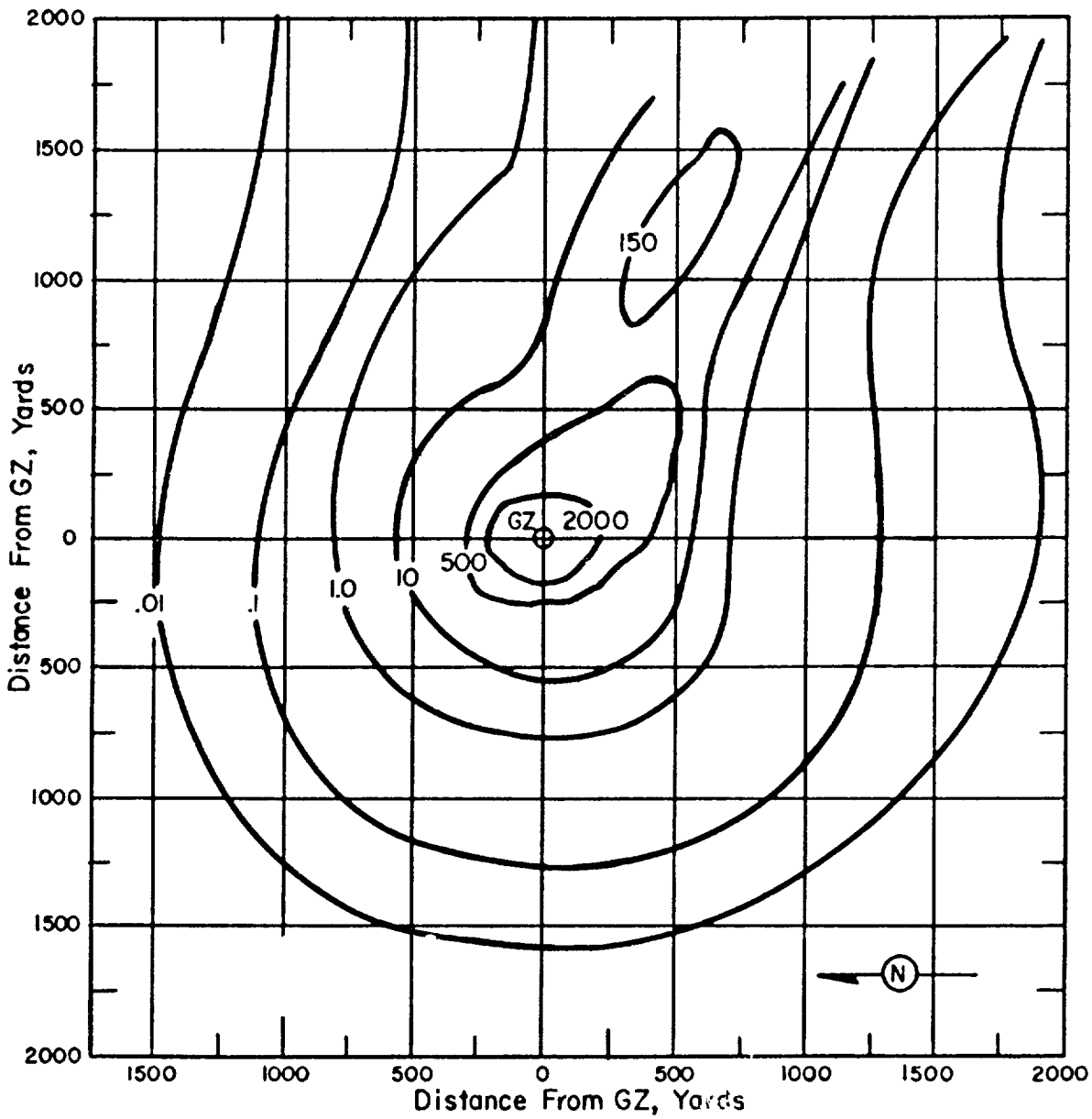


Figure 70. Operation UPSHOT-KNOTHOLE - Annie.
On-site dose rate contours in r/hr at H+1 hour.

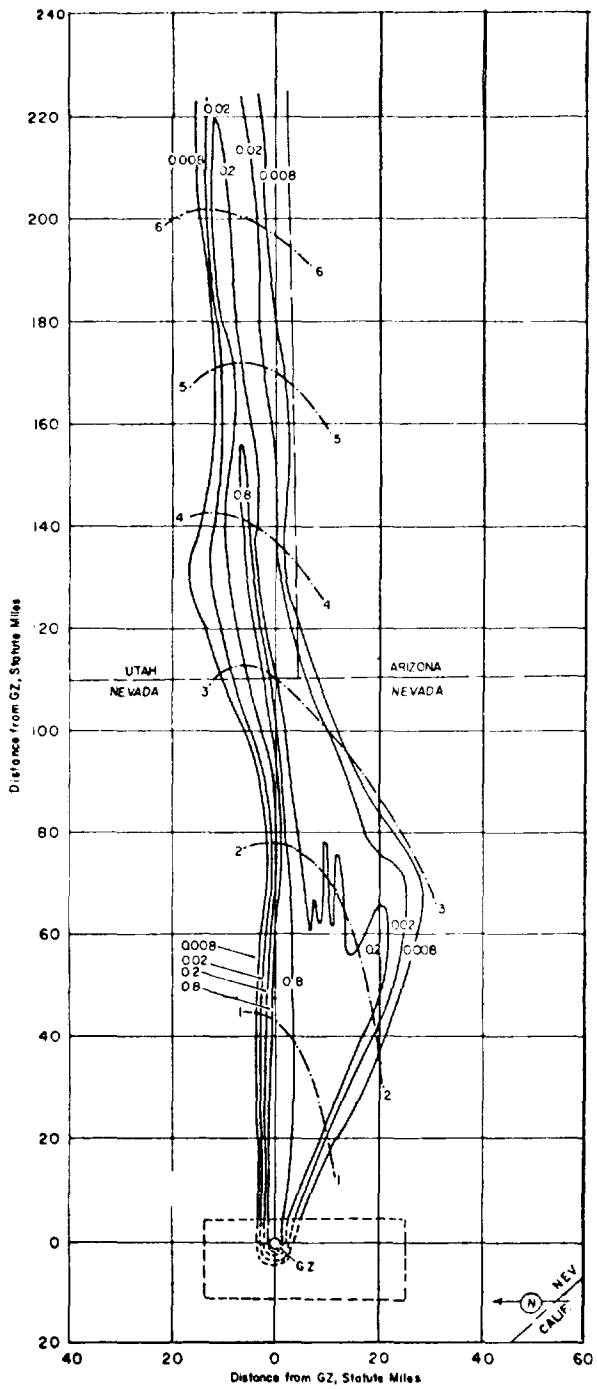


Figure 71. Operation UPSHOT-KNOTHOLE - Annie
Off-site dose rate contours in r/hr at H+1 hour.

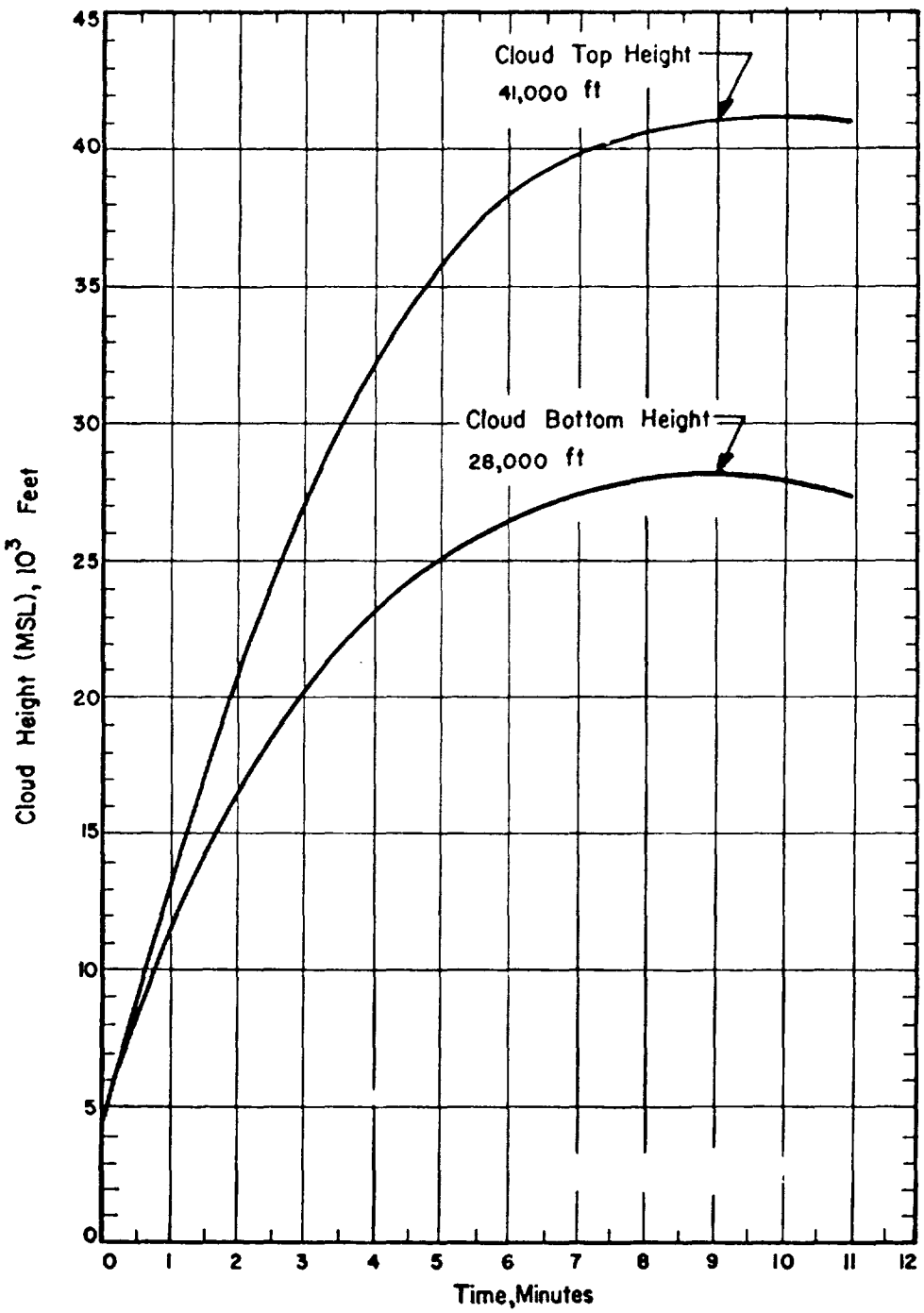


Figure 72. Cloud Dimensions: Operation UPSHOT-KNOTHOLE - Annie.

TABLE 22 NEVADA WIND DATA FOR OPERATION UPSHOT-KNOTHOLE - ANNIE

Altitude (MSL)	H-hour Dir	H-hour Speed	Altitude (MSL)	H-hour Dir	H-hour Speed
feet	degrees	mph	feet	degrees	mph
Surface	Variable	Light	27,000	270	57
Burst Height	250	02	28,000	270	60
5,000	250	05	29,000	270	69
6,000	290	09	30,000	270	78
7,000	270	10	31,000	270	76
8,000	280	07	32,000	270	74
9,000	270	28	33,000	270	69
10,000	270	29	34,000	260	64
11,000	270	29	35,000	260	61
12,000	270	29	36,000	260	69
13,000	270	26	37,000	260	75
14,000	270	24	38,000	260	81
15,000	280	37	39,000	260	92
16,000	280	39	40,000	260	102
17,000	280	44	41,000	260	90
18,000	270	48	42,000	260	84
19,000	270	55	43,000	260	80
20,000	270	62	44,000	260	76
21,000	270	57	45,000	260	72
22,000	270	53	46,000	260	70
23,000	270	49	47,000	250	69
24,000	270	46	48,000	250	68
25,000	270	54	49,000	240	66
26,000	270	54	50,000	240	66

NOTES:

1. Tropopause height was 37,000 ft MSL at H-hour.
2. Surface wind data were obtained at the Control Point. Upper air data were obtained from the rawinsonde section located on Yucca Lake.
3. At H-hour the pressure at ground zero was 876 mb, the temperature 2.7°C, the dew point -8.5°C and the relative humidity 43%.

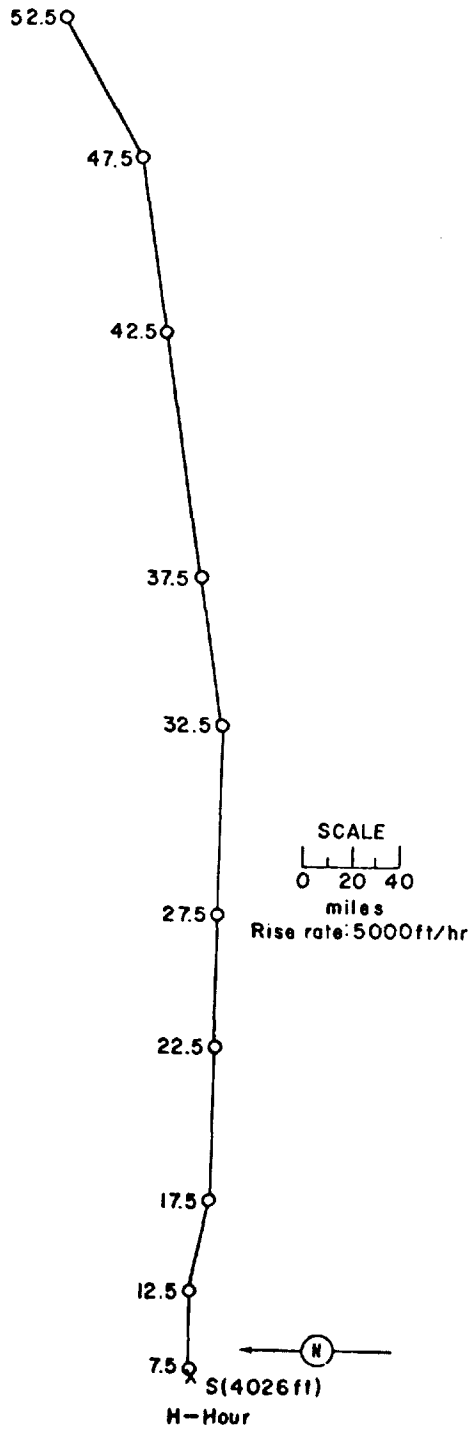


Figure 73. Hodograph for Operation UPSHOT-KNOTHOLE - Annie.

OPERATION UPSHOT-KNOTHOLE - Nancy

	PST	GMT
DATE:	24 Mar 1953	24 Mar 1953
TIME:	0510	1310

Sponsor: LASL

SITE: NTS - Area 4
37° 05' 44" N
116° 06' 10" W
Site elevation: 4,309 ft

TOTAL YIELD: 24 kt

HEIGHT OF BURST: 300 ft

TYPE OF BURST AND PLACEMENT:
Tower burst over Nevada soil

FIREBALL DATA:
Time to 1st minimum: 17.5 to 18.5 msec
Time to 2nd maximum: 166 msec
Radius at 2nd maximum: NM

CLOUD TOP HEIGHT: 41,500 ft MSL
CLOUD BOTTOM HEIGHT: 26,000 ft MSL

CRATER DATA: No crater

REMARKS:

The on-site fallout pattern is based upon readings obtained by radiological ground survey teams on D-day. The off-site fallout pattern was drawn from D-day ground surveys made by the Radiological Safety organization. The $t^{-1.2}$ decay approximation was used to extrapolate the dose rates to H+1 hour for both the on-site and off-site patterns.

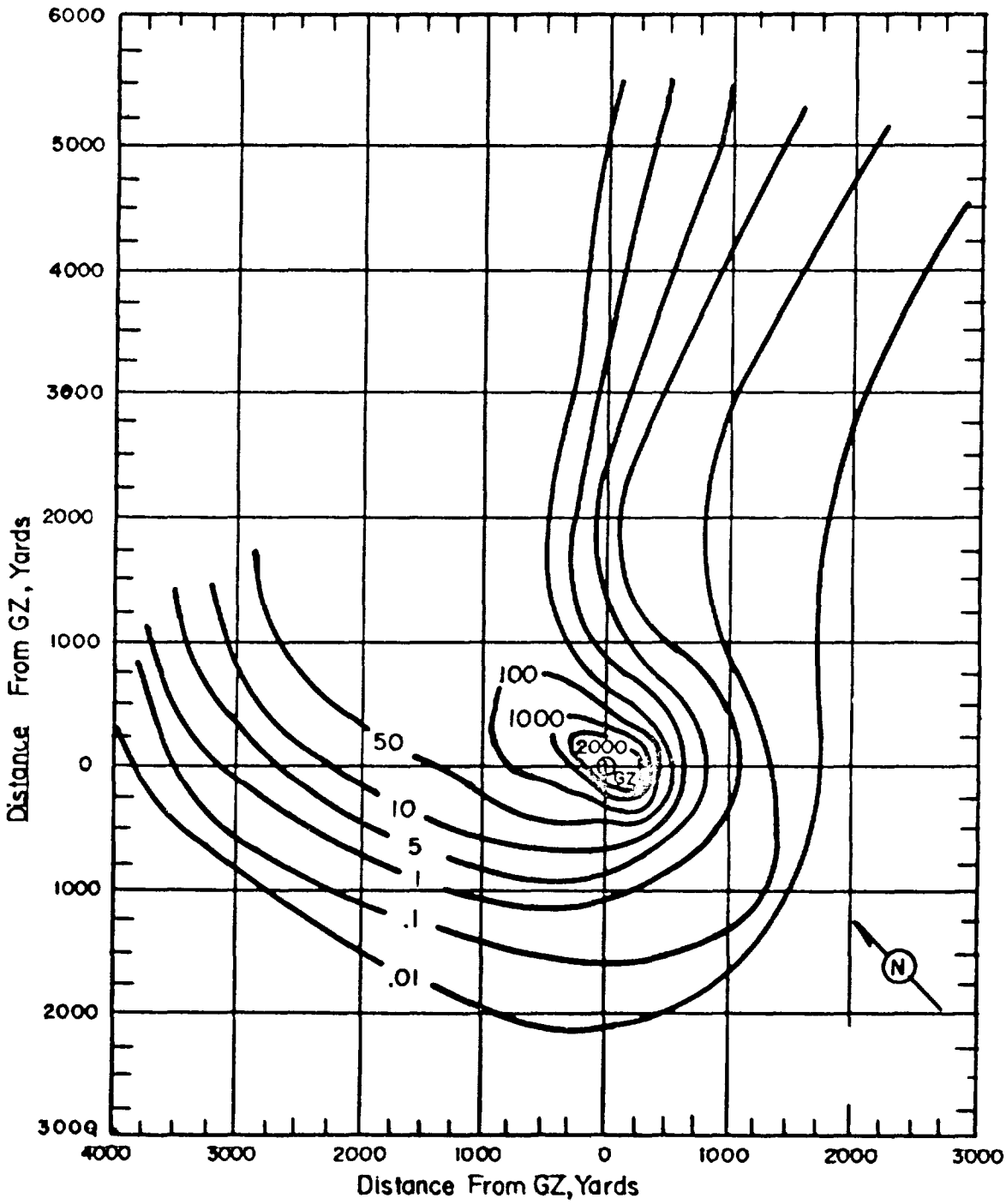


Figure 74. Operation UPSHOT-KNOTHOLE - Nancy.
On-site dose rate contours in r/hr at H+1 hour.

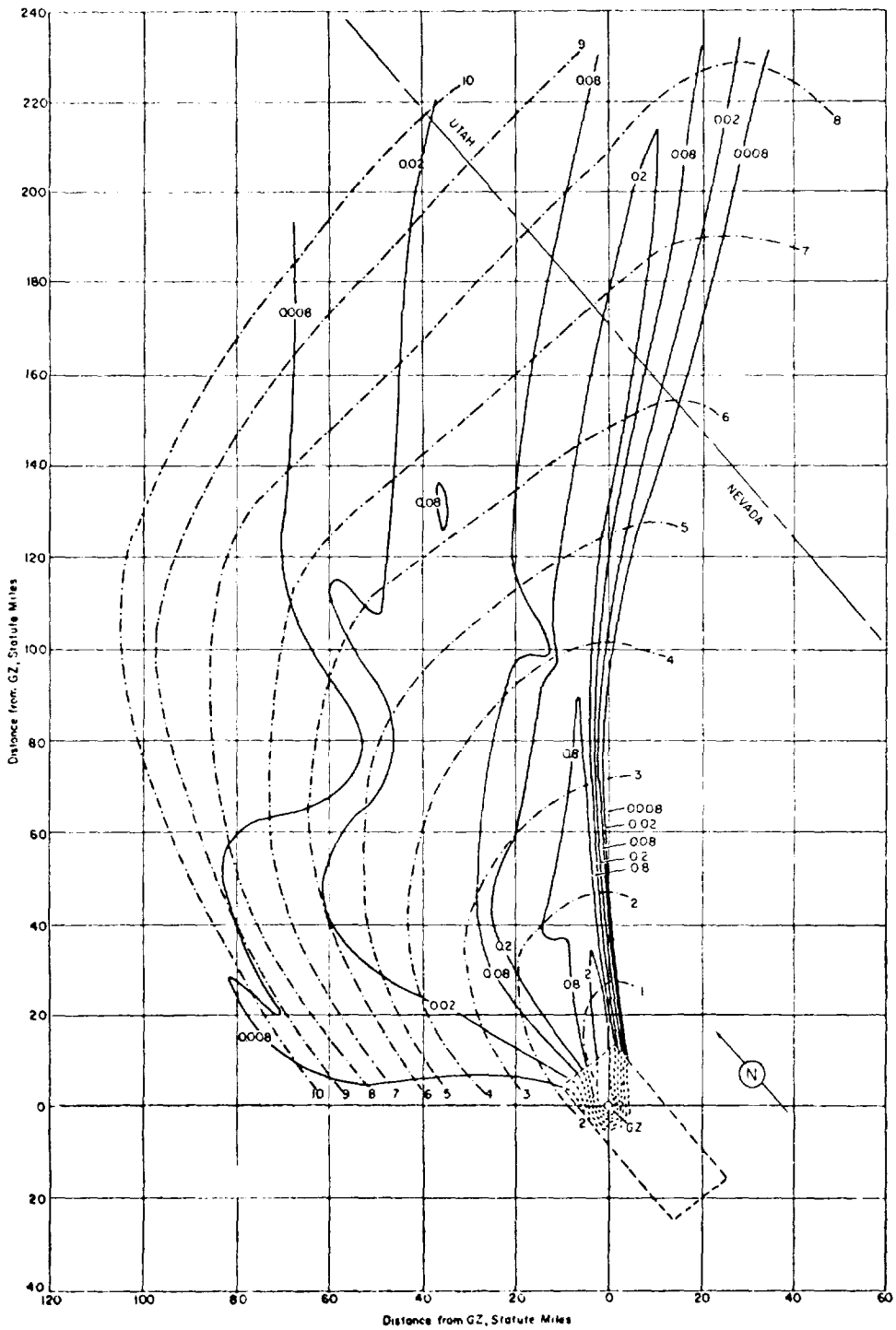


Figure 75. Operation UPSHOT-KNOTHOLE - Nancy.
Off-site dose rate contours in r/hr at H+1 hour.

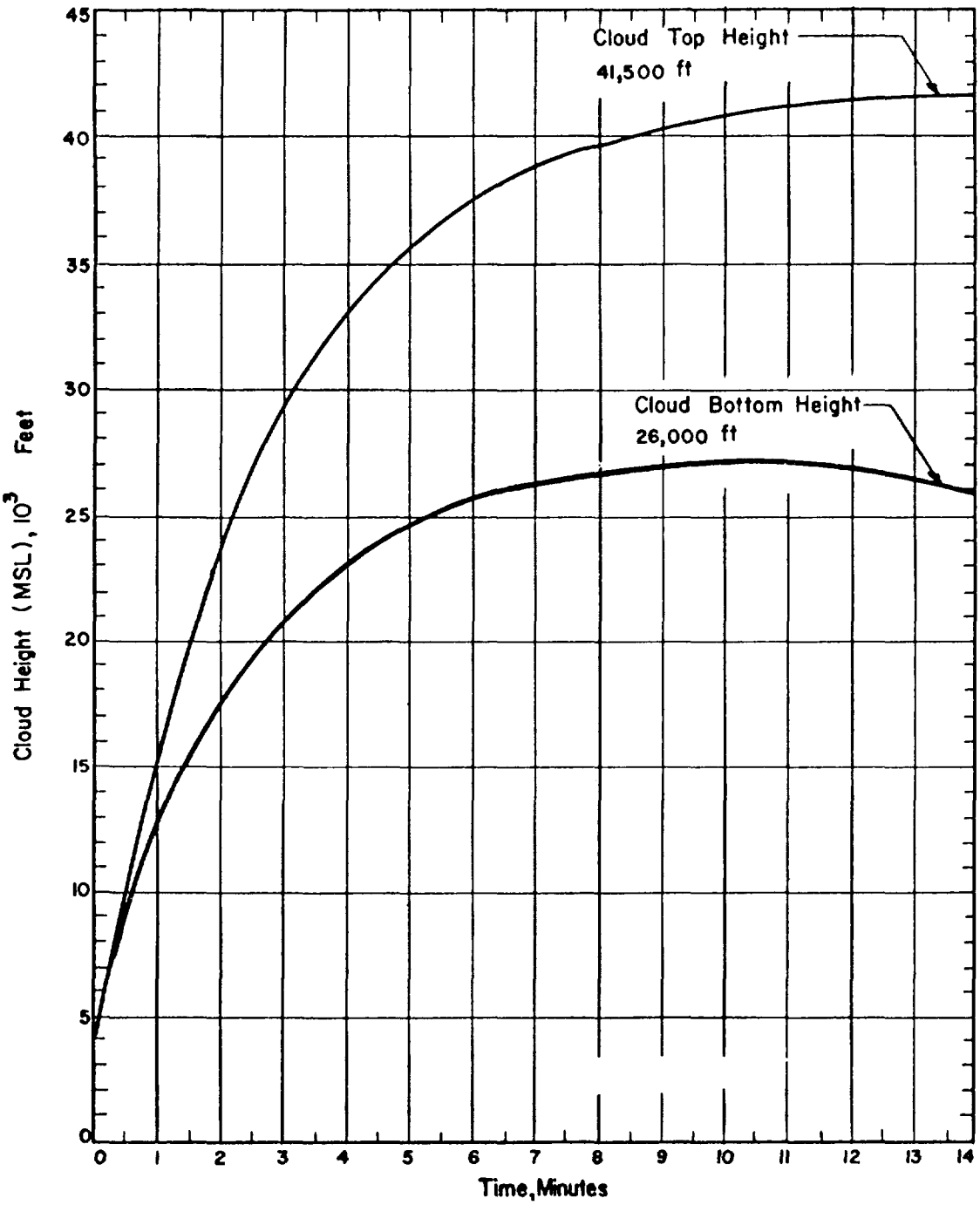


Figure 76 Cloud Dimensions: Operation UPSHOT-KNOTHOLE - Nancy.

TABLE 23 WIND DATA FOR OPERATION UPSHOT-KNOTHOLE - NANCY

Alt (MSL)	Test Site H-hour Dir	Test Site H-hour Speed	Warm Springs, Nev H+2 hours Dir	Warm Springs, Nev H+2 hours Speed	Alt (MSL)	Test Site H-hour Dir	Test Site H-hour Speed	Warm Springs, Nev H+2 hours Dir	Warm Springs, Nev H+2 hours Speed
feet	degrees	mph	degrees	mph	feet	degrees	mph	degrees	mph
Surface	310	02	Calm	Calm	27,000	220	29	---	--
Burst Height	Calm	Calm	---	--	28,000	210	32	210	37
5,000	Calm	Calm	---	--	29,000	230	29	---	--
6,000	210	18	Calm	Calm	30,000	220	36	220	37
7,000	150	14	180	09	31,000	230	39	---	--
8,000	150	18	160	17	32,000	230	34	---	--
9,000	150	14	---	--	33,000	220	33	---	--
10,000	150	14	150	26	34,000	220	36	---	--
11,000	160	15	160	31	35,000	210	31	210	50
12,000	170	10	180	29	36,000	210	32	---	--
13,000	200	21	---	--	37,000	220	31	---	--
14,000	200	21	200	32	38,000	220	35	---	--
15,000	220	14	200	31	39,000	220	37	---	--
16,000	210	18	200	30	40,000	220	37	210	50
17,000	210	14	---	--	41,000	220	37	---	--
18,000	190	13	200	26	42,000	220	43	---	--
19,000	180	17	---	--	43,000	220	45	---	--
20,000	210	23	200	35	44,000	220	36	---	--
21,000	220	29	---	--	45,000	220	42	220	50
22,000	220	28	190	35	46,000	220	40	---	--
23,000	230	29	---	--	47,000	220	47	220	52
24,000	210	29	200	44	48,000	230	35	---	--
25,000	210	29	200	41	49,000	230	31	---	--
26,000	210	29	---	--	50,000	230	29	---	--

NOTES:

1. Tropopause height was 39,300 ft MSL at H-hour.
2. H-hour surface wind data was obtained from the Control Point. H-hour upper air data was obtained from the rawinsonde section located on Yucca Lake. H+2 hour wind data was obtained from the pibal observation at Warm Springs.
3. At H-hour the pressure at ground zero was 870 mb, the temperature 9.9°C, the dew point -3.6°C and the relative humidity 39%.

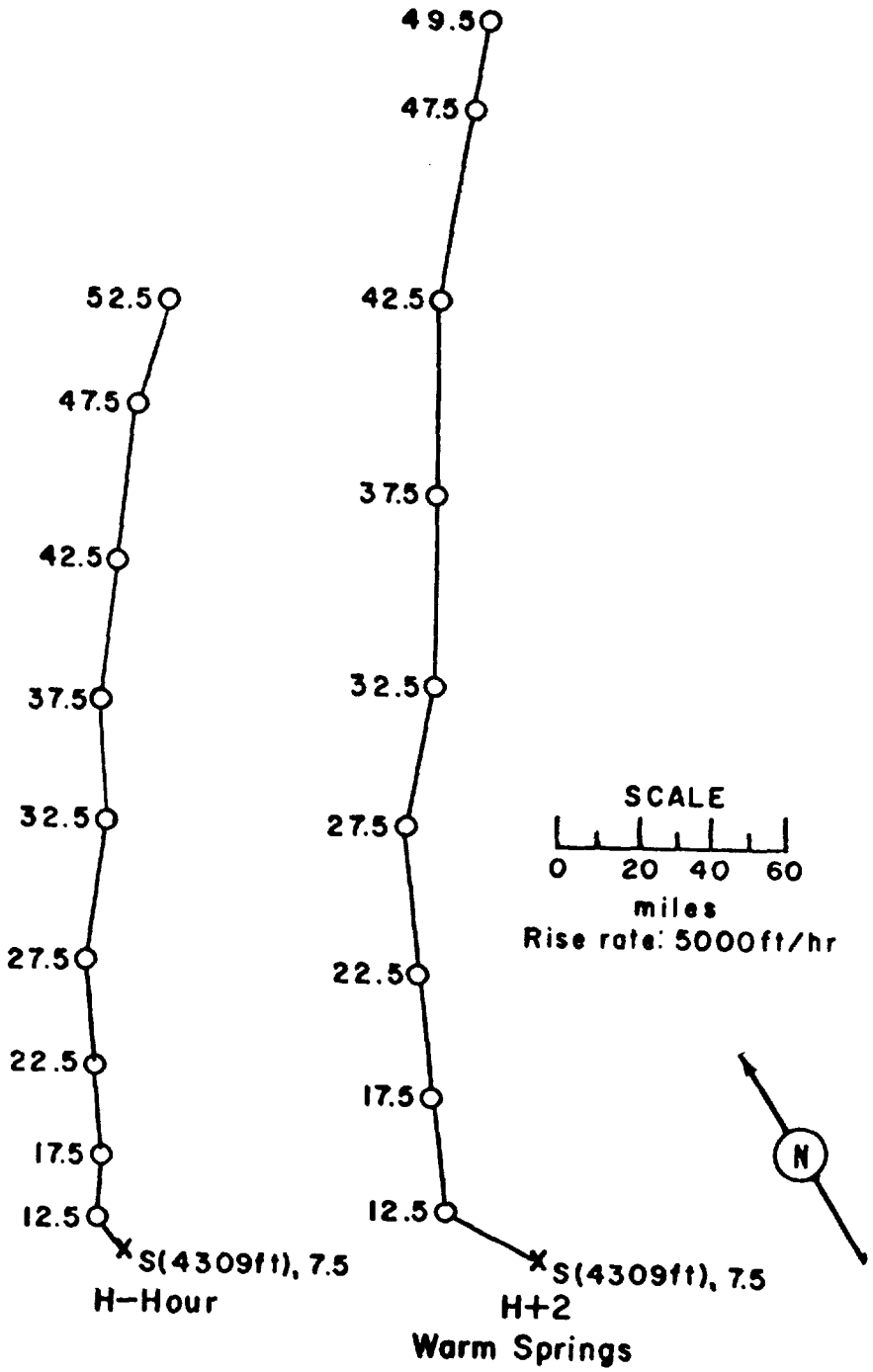


Figure 77. Hodographs for Operation UPSHOT-KNOTHOLE - Nancy.

OPERATION UPSHOT-KNOTHOLE - Ruth

	PST	GMT
DATE:	31 Mar 1953	31 Mar 1953
TIME:	0500	1300

TOTAL YIELD: 0.2 kt

FIREBALL DATA:
Time to 1st minimum: 7.0 msec
Time to 2nd maximum: 15 to 18 msec
Radius at 2nd maximum: NM

CRATER DATA: No crater

Sponsor: UCRL

SITE: NTS - Area 7 - 5a
37° 04' 58" N
116° 01' 26" W
Site elevation: 4,000 ft

HEIGHT OF BURST: 304.69 ft

TYPE OF BURST AND PLACEMENT:
Tower burst over Nevada soil

CLOUD TOP HEIGHT: 13,600 ft MSL
CLOUD BOTTOM HEIGHT: 10,700 ft MSL

REMARKS:

The on-site fallout pattern was obtained using H+1-hour readings of radiological survey teams. No decay correction was necessary. The off-site fallout pattern was drawn from D-day readings of mobile ground-survey teams of the Radiological Safety organization. The $t^{-1.2}$ decay approximation was used to extrapolate the off-site dose rates to H+1 hour.

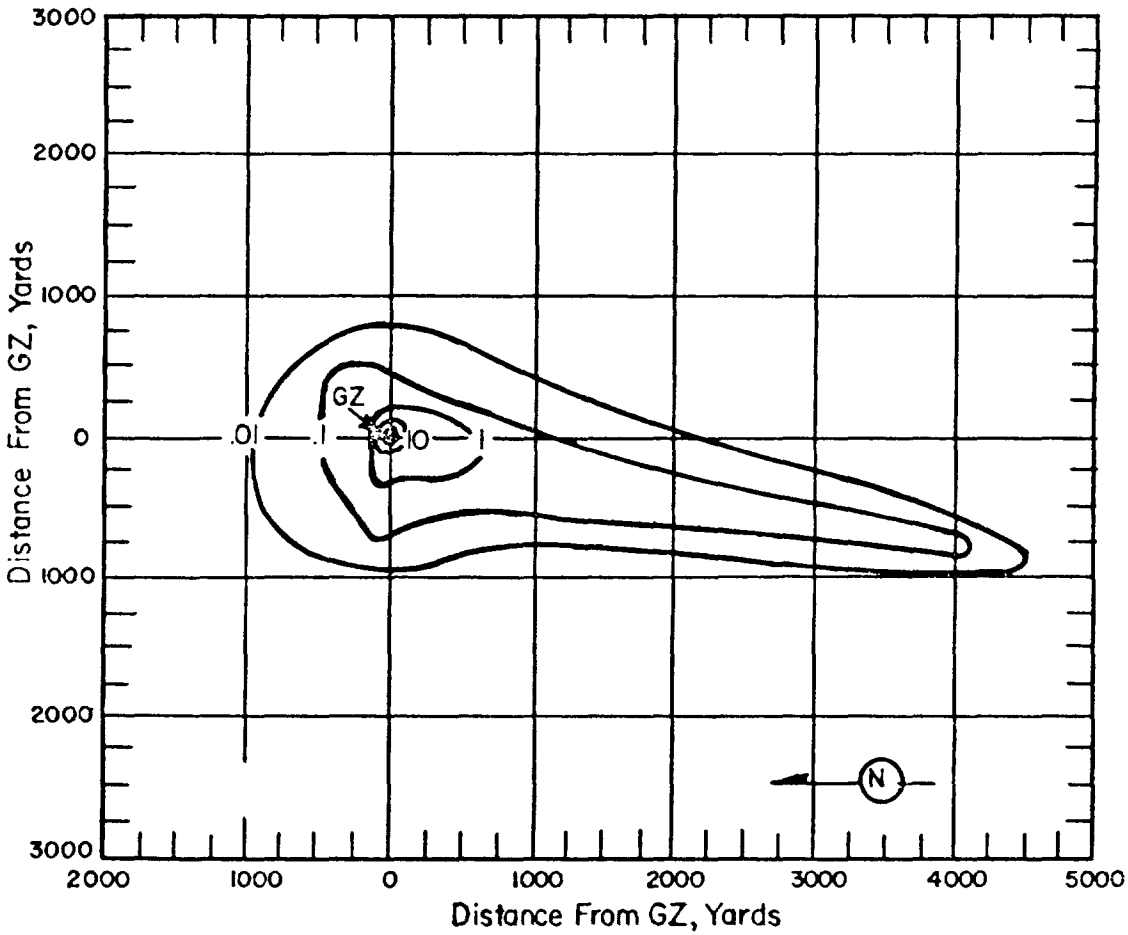


Figure 78. Operation UPSHOT-KNOTHOLE - Ruth.
On-site dose rate contours in r/hr at H+1 hour.

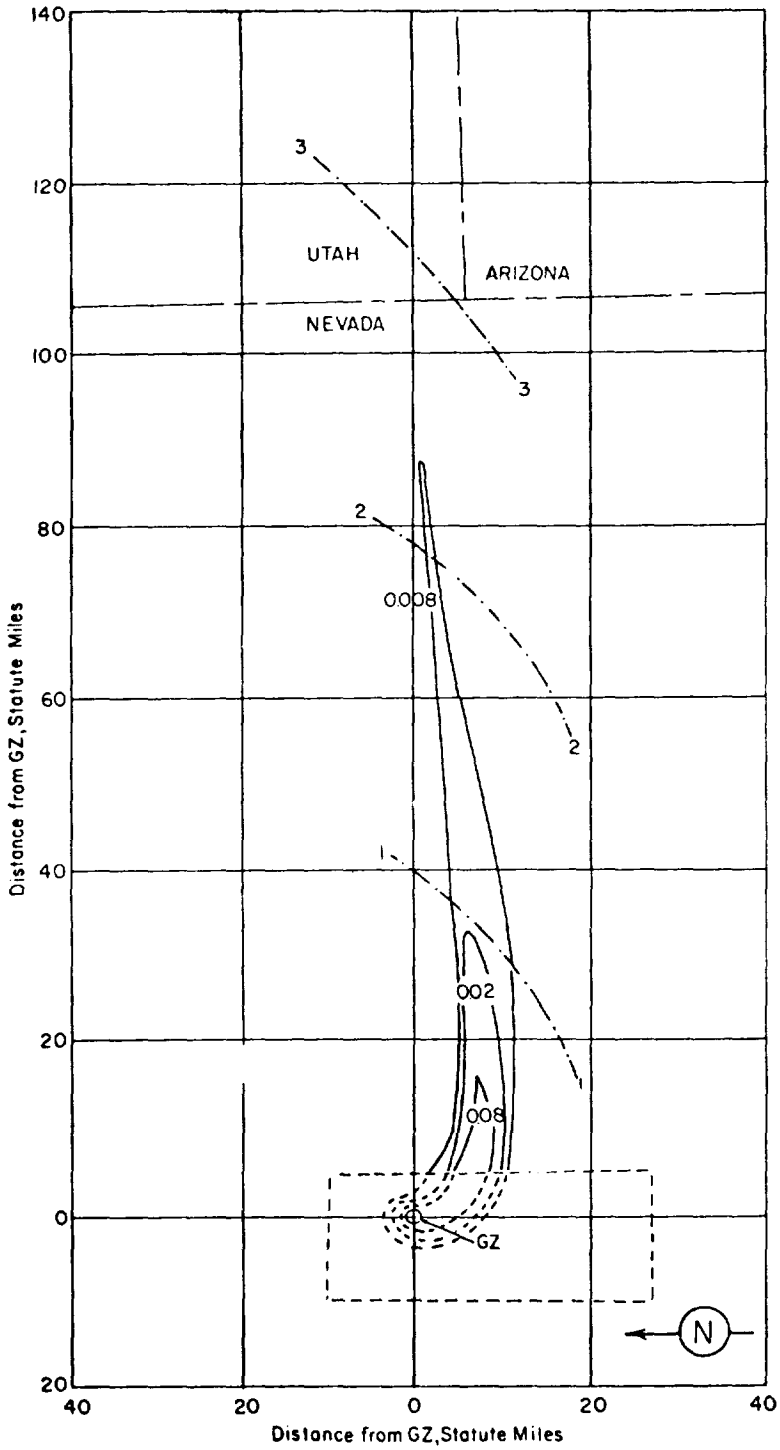


Figure 79. Operation UPSHOT-KNOTHOLE - Ruth.
Off-site dose rate contours in r/hr at H+1 hour.

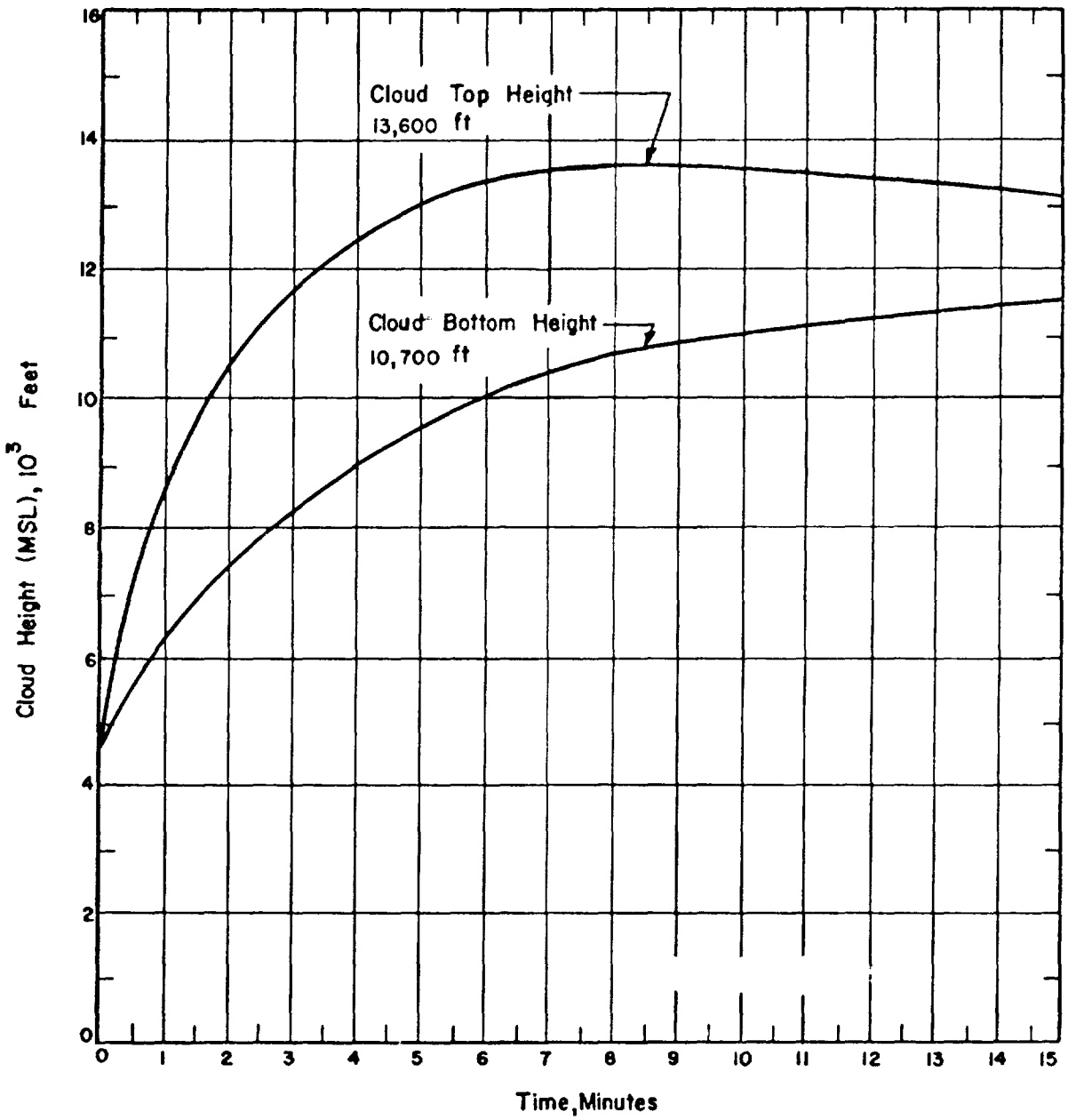


Figure 80. Cloud Dimensions: Operation UPSHOT-KNOTHOLE - Ruth.

TABLE 24 WIND DATA FOR OPERATION UPSHOT-KNOTHOLE- RUTH

Altitude (MSL)	Test Site St George, Nev. H-hour Dir	H-hour Speed	H+2 hours Dir	H+2 hours Speed	Altitude (MSL)	Test Site St George, Nev. H-hour Dir	H-hour Speed	H+2 hours Dir	H+2 hours Speed
feet	degrees	mph	degrees	mph	feet	degrees	mph	degrees	mph
Surface	360	05	Calm	Calm	27,000	330	39	---	--
Burst Height	020	08	---	--	28,000	330	39	210	39
5,000	020	10	280	05	29,000	330	41	---	--
6,000	010	14	280	10	30,000	330	44	320	41
7,000	360	14	280	12	31,000	330	44	---	--
8,000	350	15	310	12	32,000	330	39	---	--
9,000	330	14	---	--	33,000	320	48	---	--
10,000	310	21	320	10	34,000	320	51	---	--
11,000	300	18	---	--	35,000	320	55	320	71
12,000	310	18	300	17	36,000	320	59	320	75
13,000	320	18	---	--	37,000	310	53	---	--
14,000	320	23	290	26	38,000	300	43	---	--
15,000	300	25	300	28	39,000	300	47	---	--
16,000	330	28	300	28	40,000	290	67	---	--
17,000	330	30	---	--	41,000	290	55	---	--
18,000	320	35	300	35	42,000	290	47	---	--
19,000	320	32	---	--	43,000	290	47	---	--
20,000	310	33	310	24	44,000	290	47	---	--
21,000	310	36	---	--	45,000	290	46	---	--
22,000	320	36	310	31	46,000	290	46	---	--
23,000	320	41	---	--	47,000	290	40	---	--
24,000	320	45	310	31	48,000	280	39	---	--
25,000	310	35	310	33	49,000	280	39	---	--
26,000	330	41	310	46	50,000	280	39	---	--

NOTES:

1. Tropopause height was 35,500 ft MSL at H-hour.
2. H-hour surface wind data was obtained at the Control Point. H-hour upper air data was obtained from the rawinsonde section located on Yucca Lake. H+2 hours wind data was obtained from the pibal observation at St. George.
3. At H-hour the pressure at ground zero was 873 mb, the temperature 4.4°C, the dew point - 5.3°C and the relative humidity 48%.

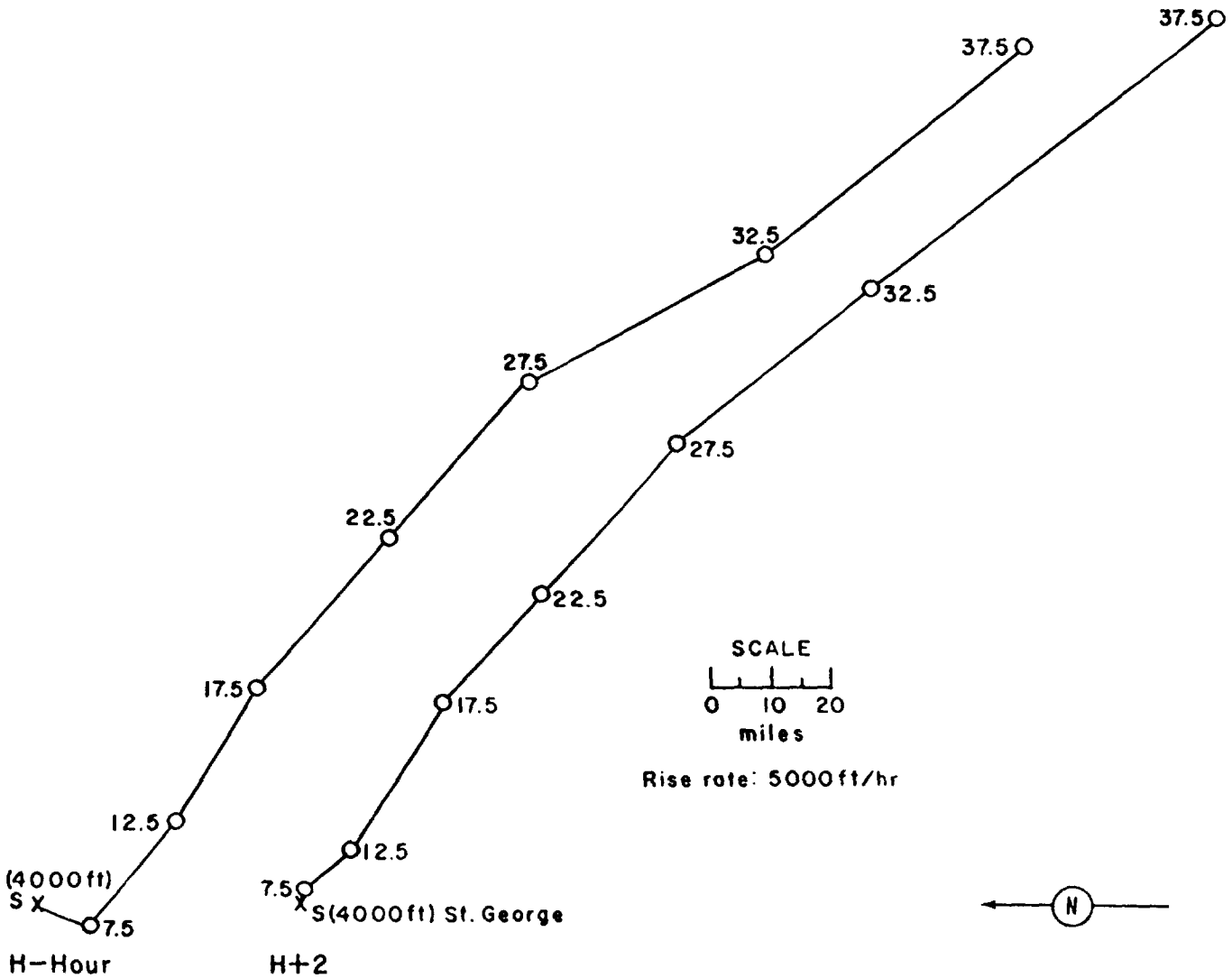


Figure 81. Hodographs for Operation UPSHOT-KNOTHOLE - Ruth.

OPERATION UPSHOT-KNOTHOLE - Dixie

	PST	GMT
DATE:	6 Apr 1953	6 Apr 1953
TIME:	0730	1530

Sponsor: LASL

SITE: NTS - Area 7 - 3
37° 05' 05" N
116° 01' 05" W
Site elevation: 4,025 ft

TOTAL YIELD: 11 kt

HEIGHT OF BURST: 6,022 ft

TYPE OF BURST AND PLACEMENT:
Air burst over Nevada soil

CLOUD TOP HEIGHT: 45,000 ft MSL
CLOUD BOTTOM HEIGHT: 33,000 ft MSL

FIREBALL DATA:
Time to 1st minimum: 10.5 to 11.2 msec
Time to 2nd maximum: 114 to 127 msec
Radius at 2nd maximum: NM

CRATER DATA: No crater

REMARKS:

The highest reading at ground zero was 1.5 mr/hr at H+1 hour.

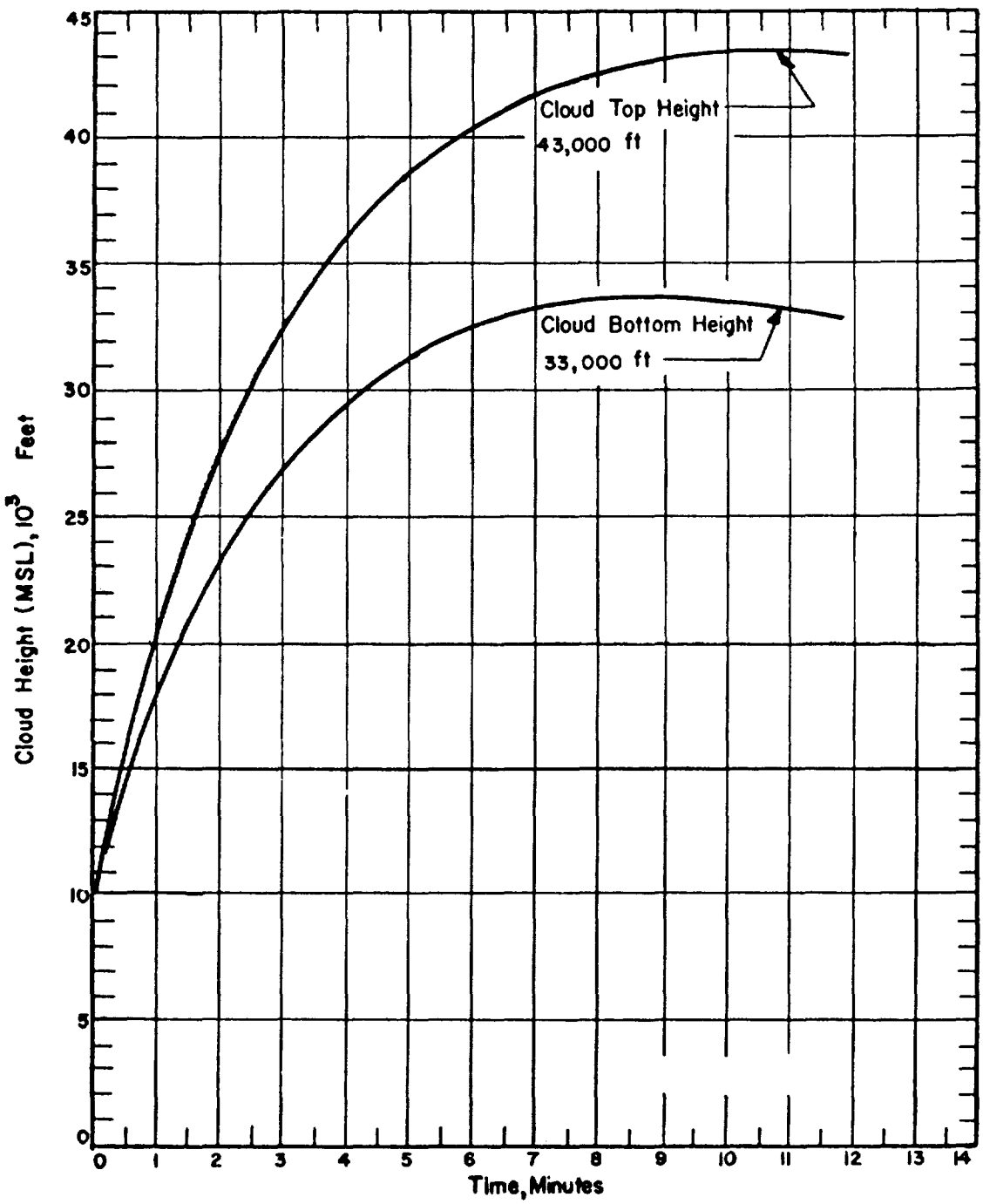


Figure 82. Cloud Dimensions: Operation UPSHOT-KNOTHOLE - Dixie.

TABLE 25 NEVADA WIND DATA FOR OPERATION UPSHOT-KNOTHOLE - DIXIE

Alt (MSL)	H-hour Dir	H-hour Speed	Alt (MSL)	H-hour Dir	H-hour Speed
feet	degrees	mph	feet	degrees	mph
Surface	015	08	27,000	290	69
5,000	030	02	28,000	290	95
6,000	300	03	29,000	290	108
7,000	310	12	30,000	290	106
8,000	310	15	31,000	290	111
9,000	280	24	32,000	290	122
10,000	280	32	33,000	290	92
Burst Height	280	33	34,000	290	82
11,000	280	36	35,000	290	78
12,000	280	38	36,000	290	74
13,000	280	52	37,000	290	84
14,000	280	55	38,000	290	145
15,000	280	36	39,000	290	138
16,000	280	39	40,000	290	140
17,000	280	42	41,000	290	140
18,000	290	73	42,000	290	138
19,000	290	83	43,000	290	131
20,000	290	83	44,000	290	141
21,000	290	90	45,000	290	137
22,000	290	92	46,000	290	119
23,000	290	84	47,000	290	102
24,000	290	84	48,000	290	93
25,000	290	78	49,000	290	90
26,000	290	65	50,000	290	90

NOTES:

1. Tropopause height was 38,500 ft MSL at H-hour.
2. Surface wind data was obtained at the Control Point. Upper air data was obtained from the rawinsonde section located on Yucca Lake.
3. At H-hour the pressure at ground zero was 861 mb, the temperature 15.5°C, the dew point -4.1°C and the relative humidity 25%.

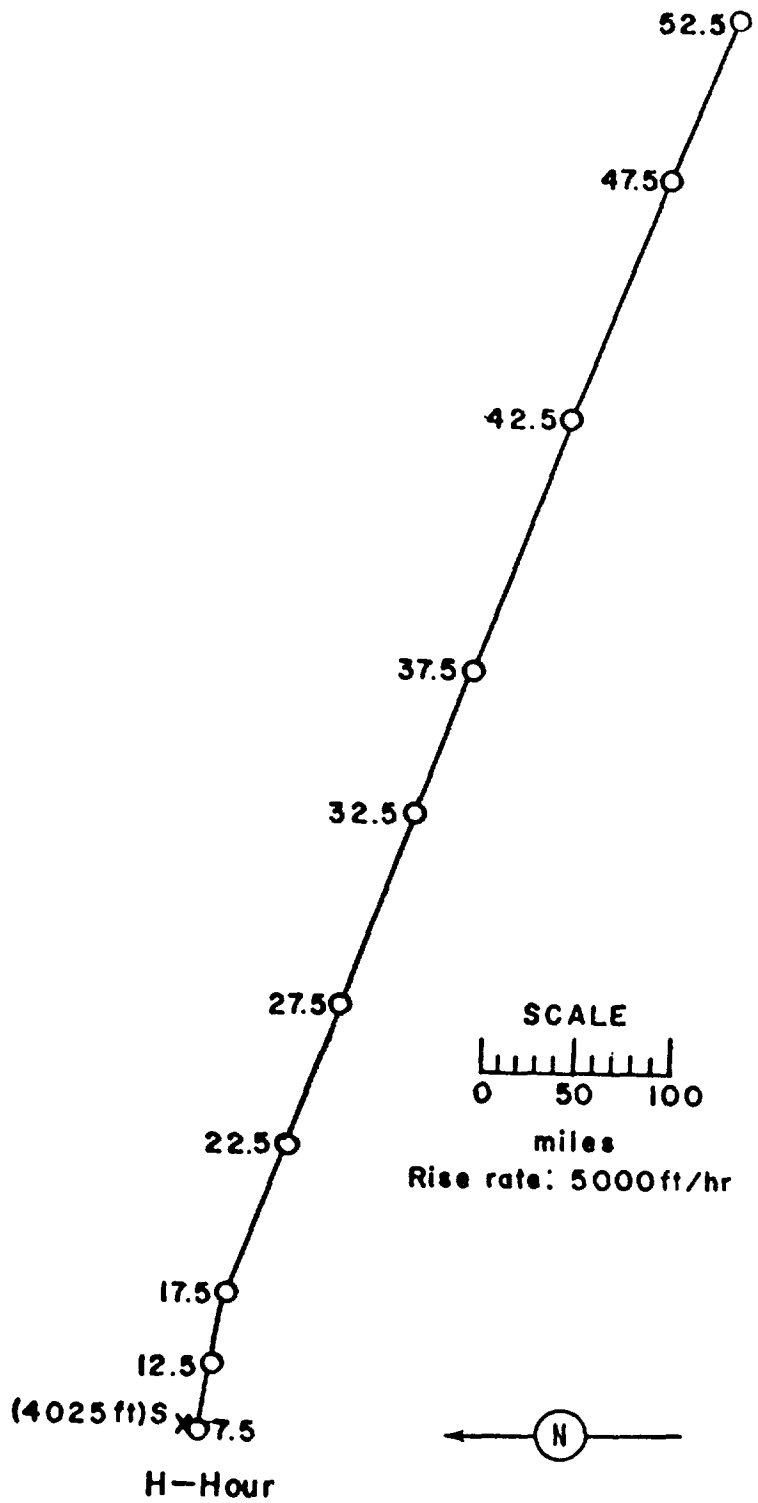


Figure 83. Hodograph for Operation UPSHOT-KNOTHOLE - Dixie

OPERATION UPSHOT-KNOTHOLE - Ray

	PST	GMT
DATE:	11 Apr 1953	11 Apr 1953
TIME:	0445	1245

TOTAL YIELD: 0.2 kt

FIREBALL DATA:
Time to 1st minimum: 18.2 msec
Time to 2nd maximum: 162 msec
Radius at 2nd maximum: NM

Sponsor: UCRL

SITE: NTS - Area 4a
37° 05' 56" N
116° 05' 33" W
Site elevation: 4,026 ft

HEIGHT OF BURST: 100 ft

TYPE OF BURST AND PLACEMENT:
Tower burst over Nevada soil

CLOUD TOP HEIGHT: 12,800 ft MSL
CLOUD BOTTOM HEIGHT: 7,700 ft MSL

CRATER DATA: No crater

REMARKS:

The on-site fallout pattern is based upon readings taken at H+1$\frac{3}{4}$ hours by radiological survey teams. The off-site fallout pattern was drawn from D-day readings of mobile ground-survey teams of the Radiological Safety organization. The $t^{-1.2}$ decay approximation was used to extrapolate the dose rates to H+1 hour. This shot is sometimes designated as UPSHOT-KNOTHOLE-6.

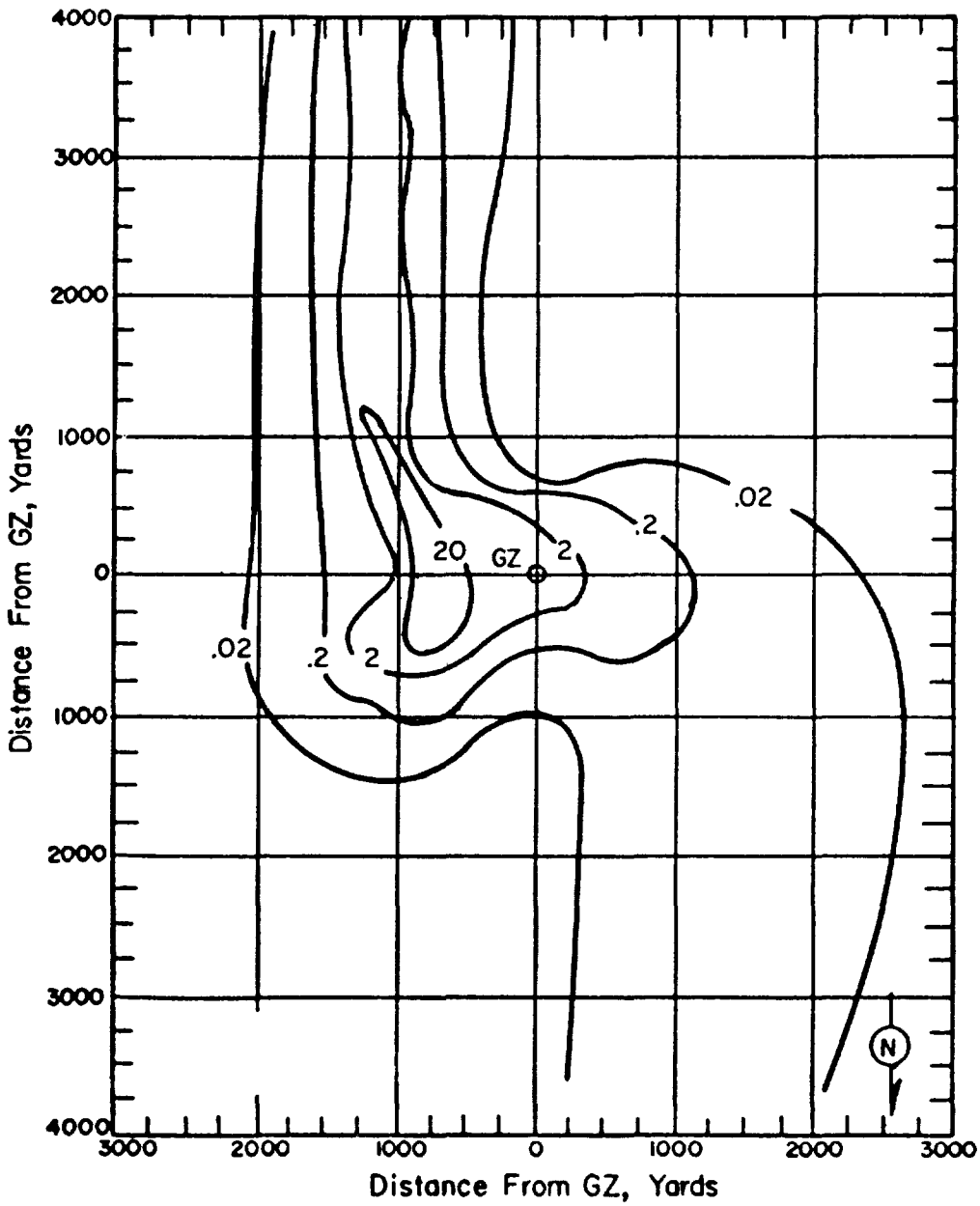


Figure 84. Operation UPSHOT-KNOTHOLE - Ray.
On-site dose rate contours in r/hr at H+1 hour.

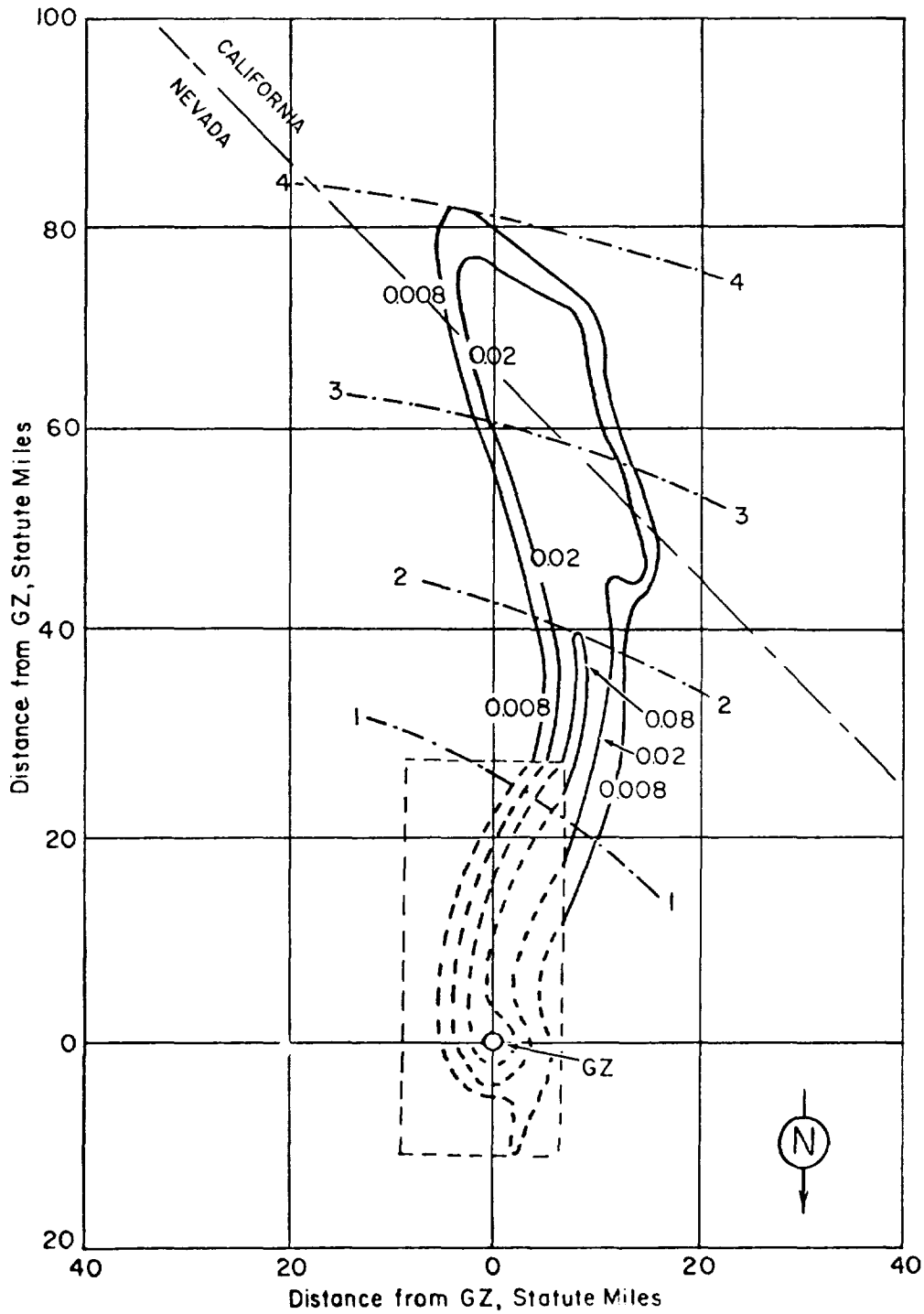


Figure 85. Operation UPSHOT-KNOTHOLE - Ray.
Off-site dose rate contours in r/hr at H+1 hour.

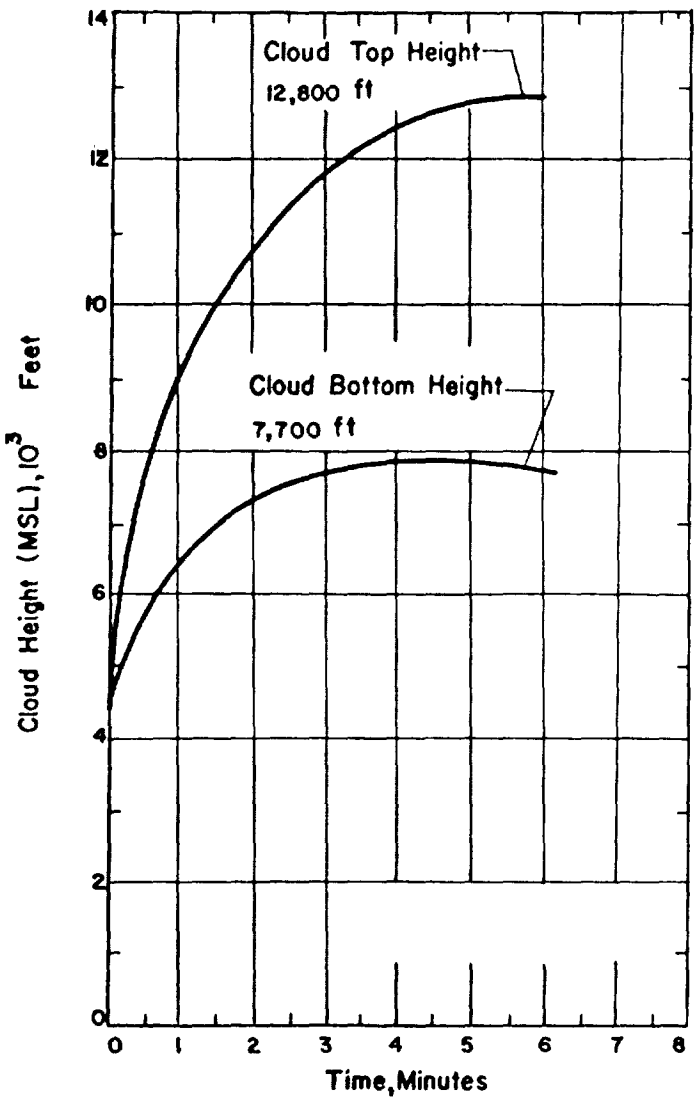


Figure 86. Cloud Dimensions: Operation UPSHOT-KNOTHOLE - Ray.

TABLE 26 WIND DATA FOR OPERATION UPSHOT-KNOTHOLE- RAY

Alt (MSL)	Test Site H-hour Dir	Test Site H-hour Speed	Beatty, Nev. H+2 hours Dir	Beatty, Nev. H+2 hours Speed	Alt (MSL)	Test Site H-hour Dir	Test Site H-hour Speed	Beatty, Nev. H+2 hours Dir	Beatty, Nev. H+2 hours Speed
feet	degrees	mph	degrees	mph	feet	degrees	mph	degrees	mph
Surface	045	06	010	15	27,000	290	155	---	--
Burst Height	030	08	---	--	28,000	290	173	---	--
5,000	010	17	360	16	29,000	290	207	---	--
6,000	360	21	360	22	30,000	260	212	---	--
7,000	360	26	360	25	31,000	280	158	---	--
8,000	360	36	360	23	32,000	280	135	---	--
9,000	360	41	350	21	33,000	290	132	---	--
10,000	360	36	340	20	34,000	290	138	---	--
11,000	360	26	---	--	35,000	280	154	---	--
12,000	360	26	330	18	36,000	270	166	---	--
13,000	350	30	---	--	37,000	270	175	---	--
14,000	350	26	330	24	38,000	270	161	---	--
15,000	310	32	320	29	39,000	260	153	---	--
16,000	300	38	330	35	40,000	260	159	---	--
17,000	300	56	---	--	41,000	260	155	---	--
18,000	300	56	310	46	42,000	250	133	---	--
19,000	300	53	---	--	43,000	270	121	---	--
20,000	300	51	300	63	44,000	270	115	---	--
21,000	300	72	---	--	45,000	260	132	---	--
22,000	300	95	300	92	46,000	280	170	---	--
23,000	300	109	---	--	47,000	280	195	---	--
24,000	300	122	---	--	48,000	280	212	---	--
25,000	300	129	290	112	49,000	280	224	---	--
26,000	290	139	290	112	50,000	280	234	---	--

NOTES:

1. Tropopause height was 38,330 ft MSL at H-hour.
2. H-hour surface wind da a was obtained at the Control Point. H-hour upper air data was obtained from the rawinsonde section located on Yucca Lake. H+2 hour wind data was obtained from the pibal observation at Beatty.
3. At H-hour the pressure at ground zero was 869 mb, the temperature -0.3°C, the dew point -11.3°C, and the relative humidity 43%.

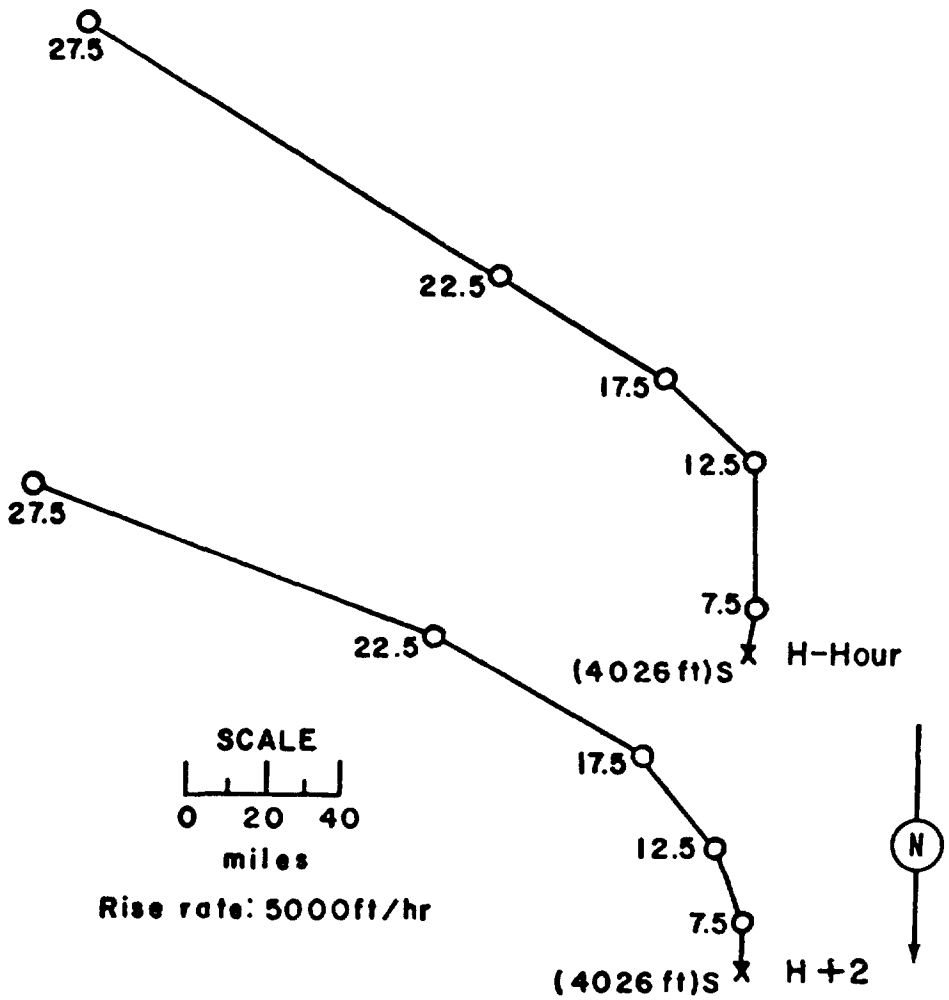


Figure 87. Hodographs for Operation UPSHOT-KNOTHOLE - Ray.

OPERATION UPSHOT-KNOTHOLE - Badger

	PST	GMT
DATE:	18 Apr 1953	18 Apr 1953
TIME:	0435	1235

TOTAL YIELD: 23 kt

FIREBALL DATA:
Time to 1st minimum: 5.6 to 17.75 msec
Time to 2nd maximum: NM
Radius at 2nd maximum: NM

CRATER DATA: No crater

Sponsor: LASL

SITE: NTS - Area 2
37° 08' 18" N
116° 07' 04" W
Site elevation: 4,491 ft

HEIGHT OF BURST: 300 ft

TYPE OF BURST AND PLACEMENT:
Tower burst over Nevada soil

CLOUD TOP HEIGHT: 36,000 ft MSL
CLOUD BOTTOM HEIGHT: 23,000 ft MSL

REMARKS:

The on-site fallout pattern is based upon readings made on D-day and D+1 day by radiological survey teams. Because of heavy contamination, the highway on the main access road to the shot area could not be used, and, therefore, it was difficult to pinpoint the exact location of the readings. The off-site fallout pattern was drawn from D-day readings of mobile ground survey teams of the Radiological Safety organization. The $t^{-1.2}$ decay approximation was used to extrapolate the dose rates to H+1 hour. This shot is sometimes designated as UPSHOT-KNOTHOLE-5.

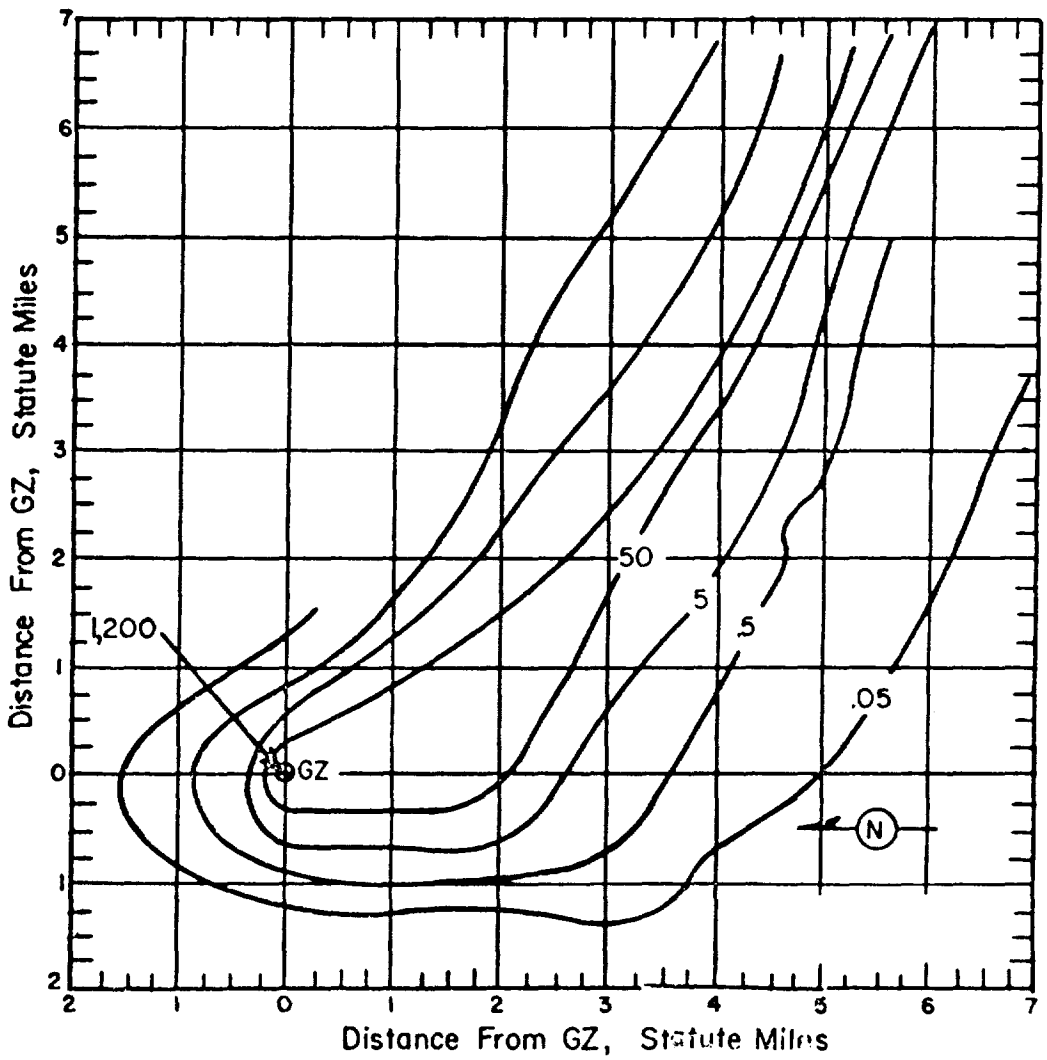


Figure 88. Operation UPSHOT-KNOTHOLE - Badger.
On-site dose rate contours in r/hr at H+1 hour.

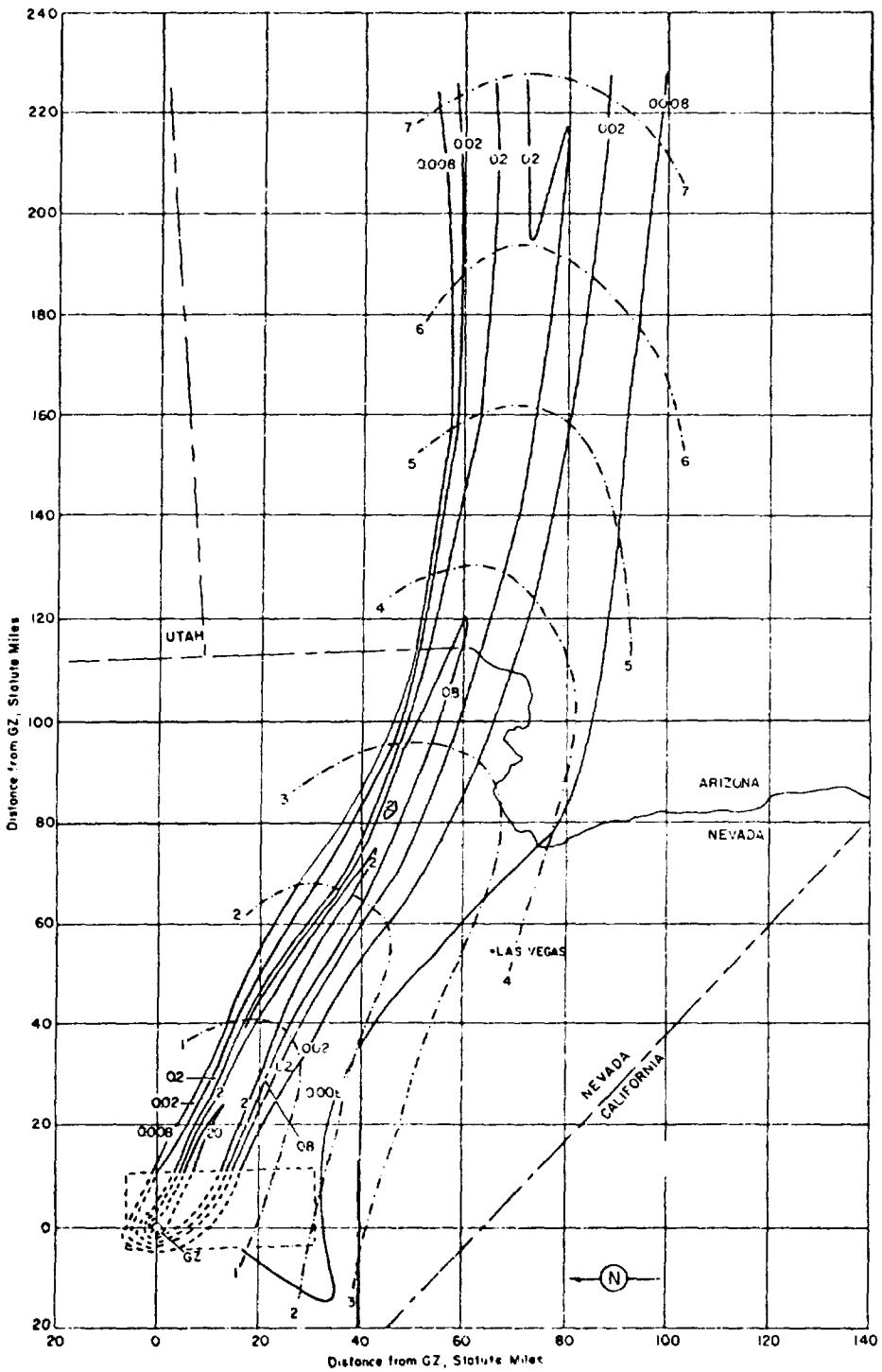


Figure 89. Operation UPSHOT-KNOTHOLE - Badger.
Off-site dose rate contours in r/hr at H+1 hour.

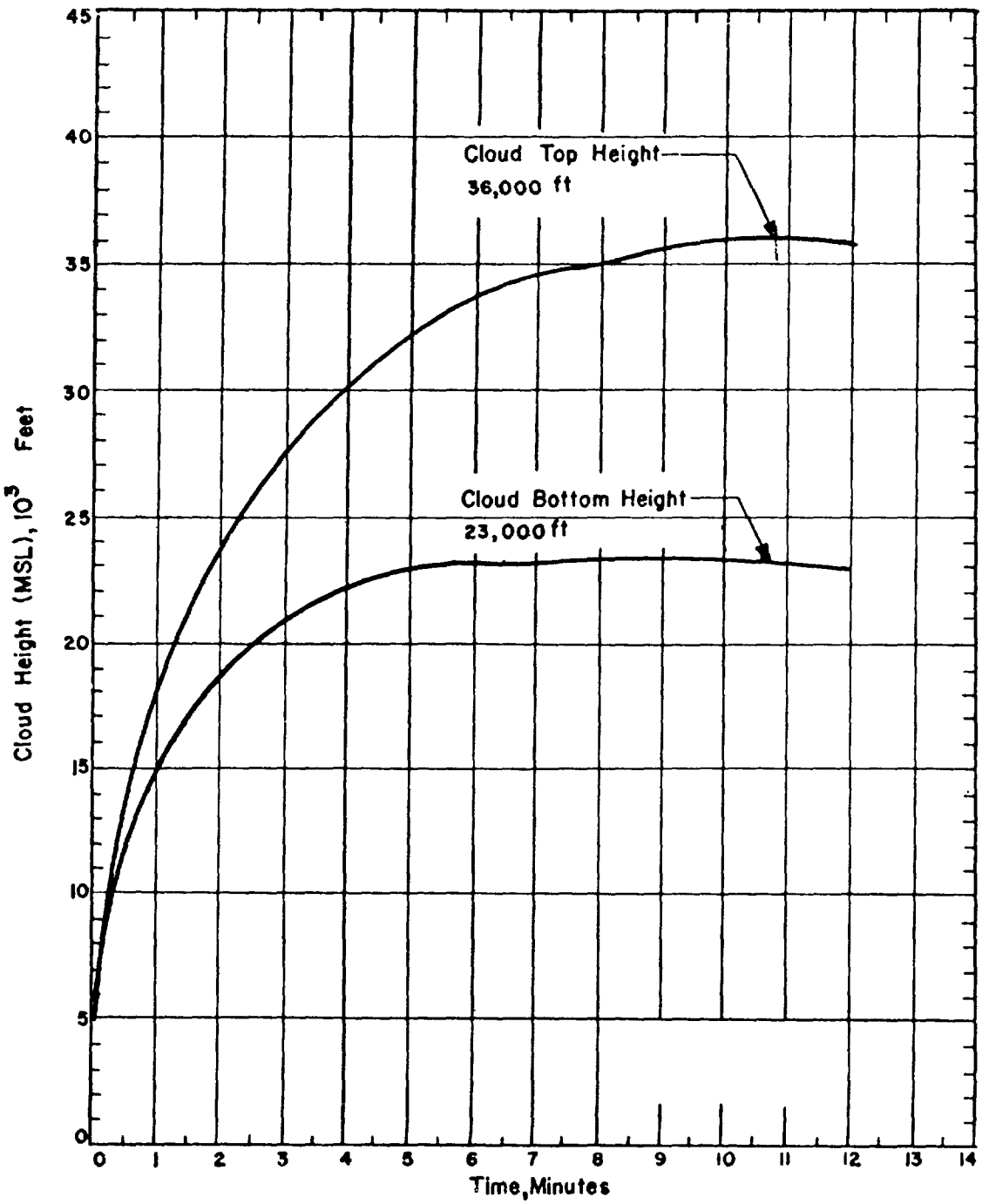


Figure 90 . Cloud Dimensions: Operation UPSHOT-KNOTHOLE - Badger.

TABLE 27 NEVADA WIND DATA FOR OPERATION UPSHOT-KNOTHOLE - BADGER

Altitude (MSL)	H-hour Dir	H-hour Speed	Altitude (MSL)	H-hour Dir	H-hour Speed
feet	degrees	mph	feet	degrees	mph
Surface	360	10	27,000	300	46
Burst Height	360	14	28,000	300	49
5,000	010	23	29,000	310	46
6,000	010	28	30,000	310	53
7,000	360	22	31,000	300	67
8,000	290	07	32,000	300	69
9,000	270	10	33,000	300	65
10,000	270	20	34,000	300	57
11,000	270	26	35,000	300	62
12,000	280	30	36,000	300	56
13,000	300	33	37,000	290	49
14,000	310	35	38,000	290	54
15,000	320	35	39,000	300	69
16,000	310	35	40,000	300	78
17,000	310	36	41,000	300	90
18,000	300	38	42,000	300	78
19,000	290	40	43,000	290	49
20,000	290	40	44,000	280	51
21,000	290	41	45,000	280	60
22,000	290	49	46,000	280	89
23,000	290	57	47,000	280	70
24,000	290	57	48,000	280	78
25,000	290	49	49,000	290	24
26,000	300	49	50,000	290	20

NOTES:

1. Tropopause height was 39,320 ft MSL at H-hour.
2. Surface wind data was obtained at the Control Point. Upper air data was obtained from the rawinsonde section located on Yucca Lake.
3. At H-hour the pressure at ground zero was 862 mb, the temperature 7.7°C, the dew point -3.9°C, and the relative humidity 40 %.

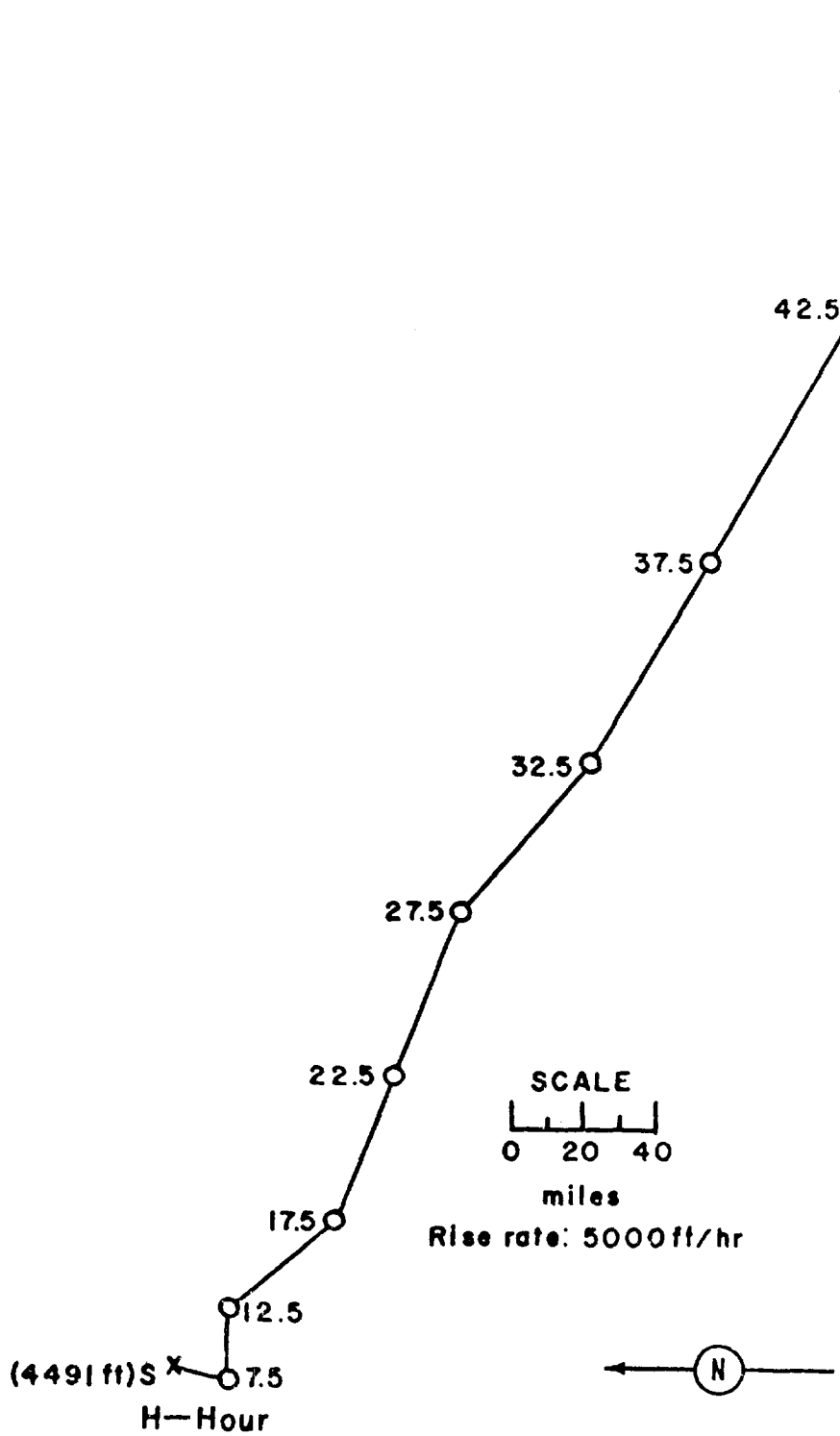


Figure 91. Hodograph for Operation UPSHOT-KNOTHOLE - Badger.

OPERATION UPSHOT-KNOTHOLE - Simon

	PST	GMT
DATE:	25 Apr 1953	25 Apr 1953
TIME:	0430	1230

Sponsor: LASL

SITE: NTS - Area 1
37° 03' 11" N
116° 06' 10" W
Site elevation: 4,239 ft

TOTAL YIELD: 43 kt

HEIGHT OF BURST: 300 ft

FIREBALL DATA:
Time to 1st minimum: 18.8 to 23.25 msec
Time to 2nd maximum: 176 msec
Radius at 2nd maximum: NM

CLOUD TOP HEIGHT: 44,000 ft MSL
CLOUD BOTTOM HEIGHT: 31,000 ft MSL

CRATER DATA: No crater

TYPE OF BURST AND PLACEMENT:
Tower burst over Nevada soil

REMARKS:

The on-site fallout pattern is based upon readings obtained at H+9½ hours by radiological survey teams. The off-site fallout pattern was drawn from D-day readings of mobile ground-survey teams of the Radiological Safety organization. The changes in the anticipated fallout pattern necessitated movement of mobile personnel and equipment. This caused difficulties in pinpointing the exact location of the readings. The $t^{-1.2}$ decay approximation was used to extrapolate the dose rates to H+1 hour for both the on-site and off-site patterns.

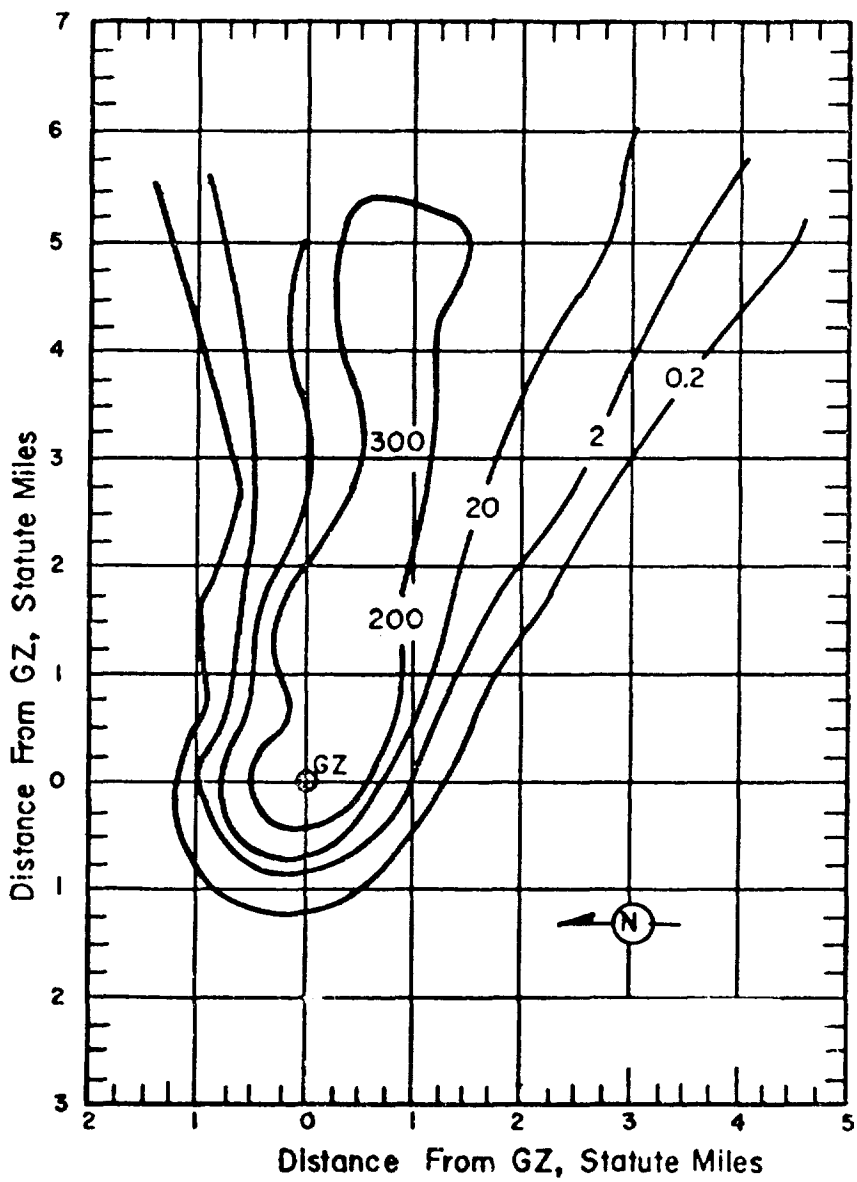


Figure 92. Operation UPSHOT-KNOTHOLE - Simon.
On-site dose rate contours in r/hr at H+1 hour.

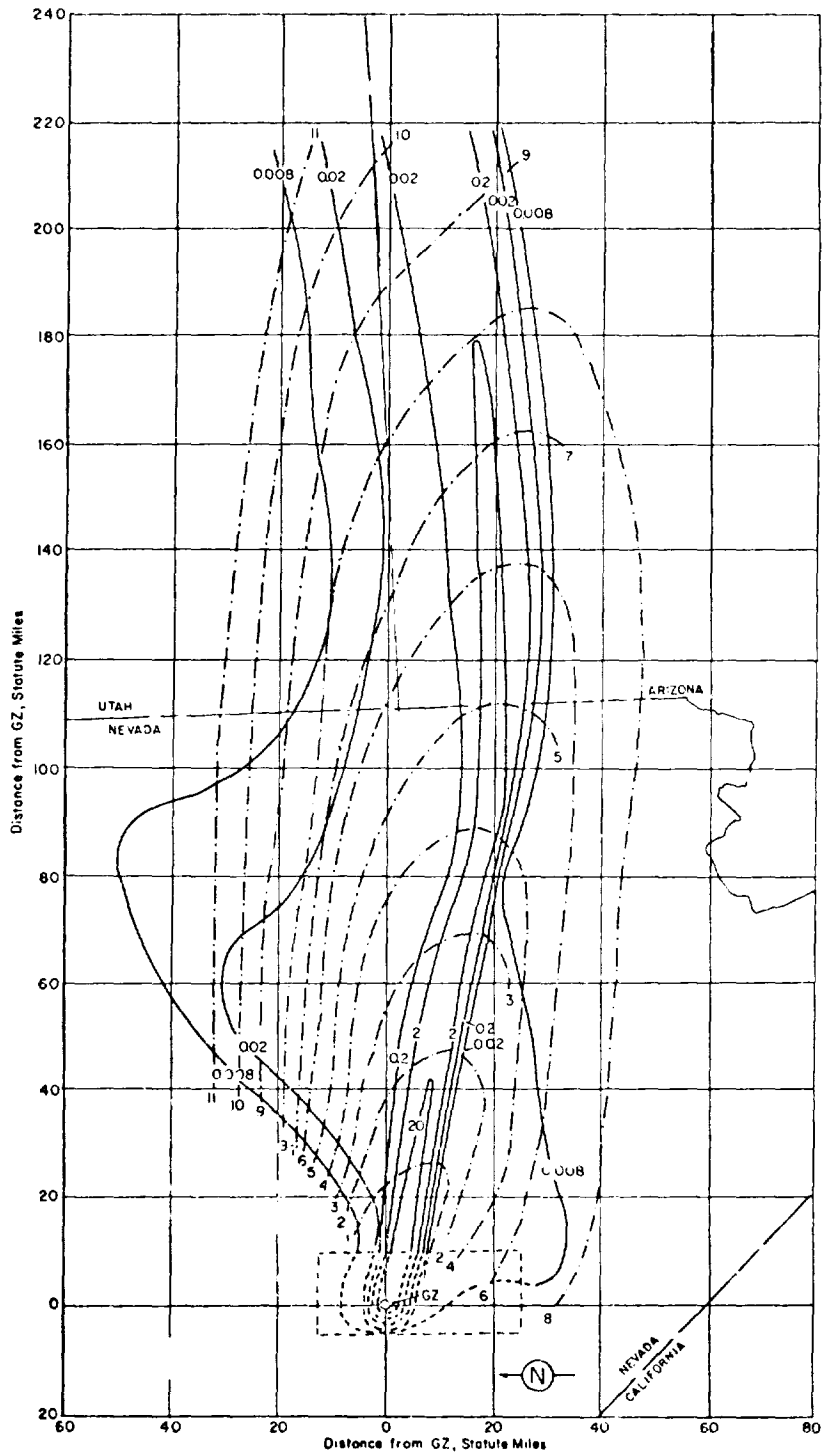


Figure 93. Operation UPSHOT-KNOTHOLE - Simon
Off-site dose rate contours in r/hr at H+1 hour.

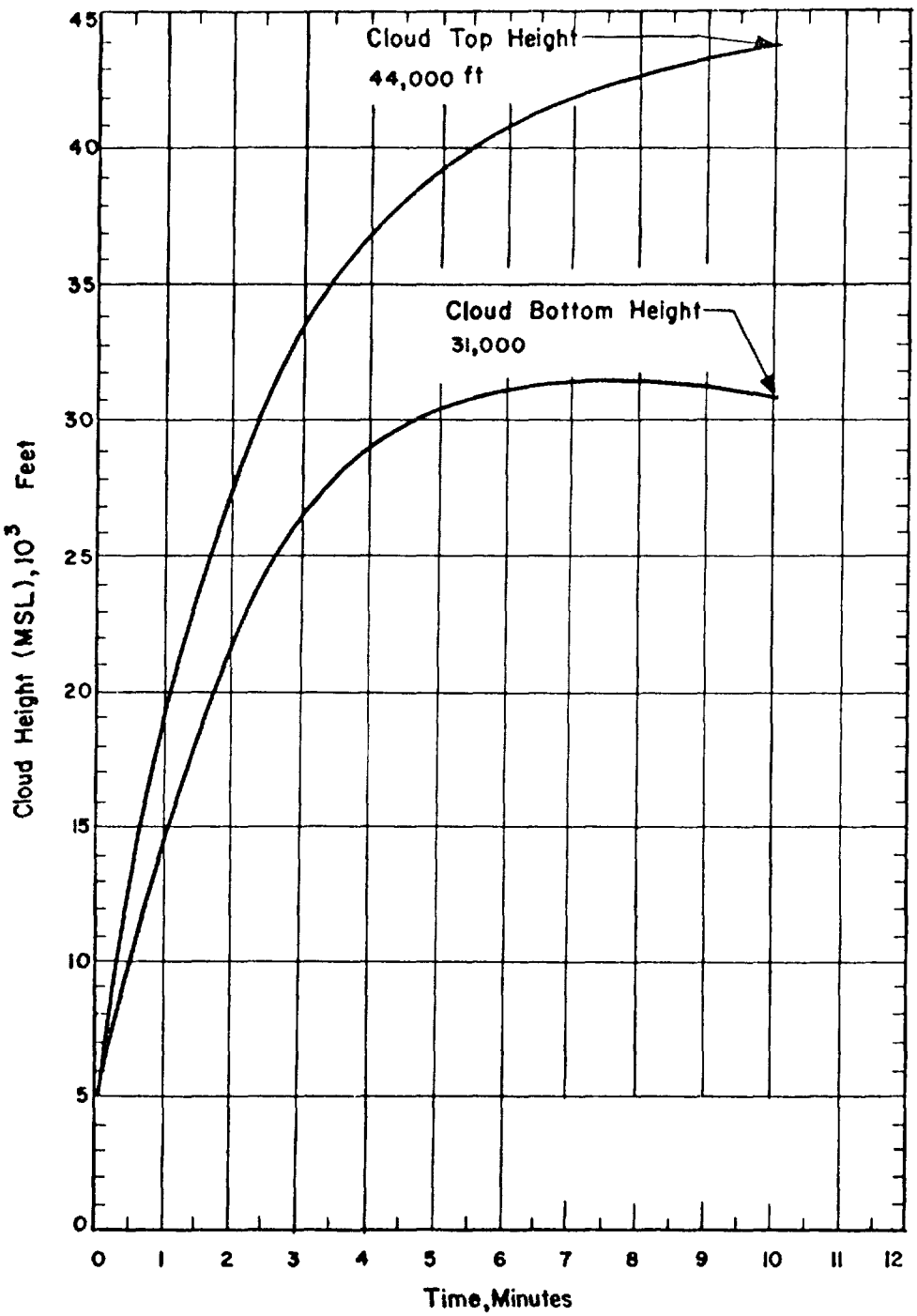


Figure 94. Cloud Dimensions: Operation UPSHOT-KNOTHOLE - Simon.

TABLE 28 WIND DATA FOR OPERATION UPSHOT-KNOTHOLE - SIMON

Altitude (MSL)	H-hour Dir	H-hour Speed
feet	degrees	mph
Surface	340	06
Burst Height	040	08
5,000	010	09
6,000	030	09
7,000	040	05
8,000	070	03
9,000	180	05
10,000	200	10
11,000	270	13
12,000	280	14
13,000	270	17
14,000	270	13
15,000	290	10
16,000	280	09
17,000	270	10
18,000	270	30
19,000	280	14
20,000	280	30
21,000	280	35
22,000	280	26
23,000	280	29
24,000	280	25
25,000	280	24
26,000	280	26
27,000	280	33
28,000	280	36
29,000	270	32
30,000	280	47
31,000	280	46
32,000	280	45
33,000	280	48
34,000	280	46
35,000	280	41
36,000	270	45
37,000	270	47
38,000	270	49
39,000	270	48
40,000	270	55
41,000	270	57
42,000	270	55
43,000	270	48
44,000	270	30
45,000	270	35
46,000	270	28
47,000	270	25
48,000	270	25
49,000	270	25
50,000	270	28
54,000	---	--

NOTES:

1. Tropopause height was 39,350 ft MSL at H-hour.
2. H-hour surface wind data was obtained at the Control Point. H-hour upper air data was obtained from the rawinsonde section located on Yucca Lake.
3. At H-hour the pressure at ground zero was 870 mb, the temperature 11.7°C, the dew point -7.3°C and the relative humidity 26%.

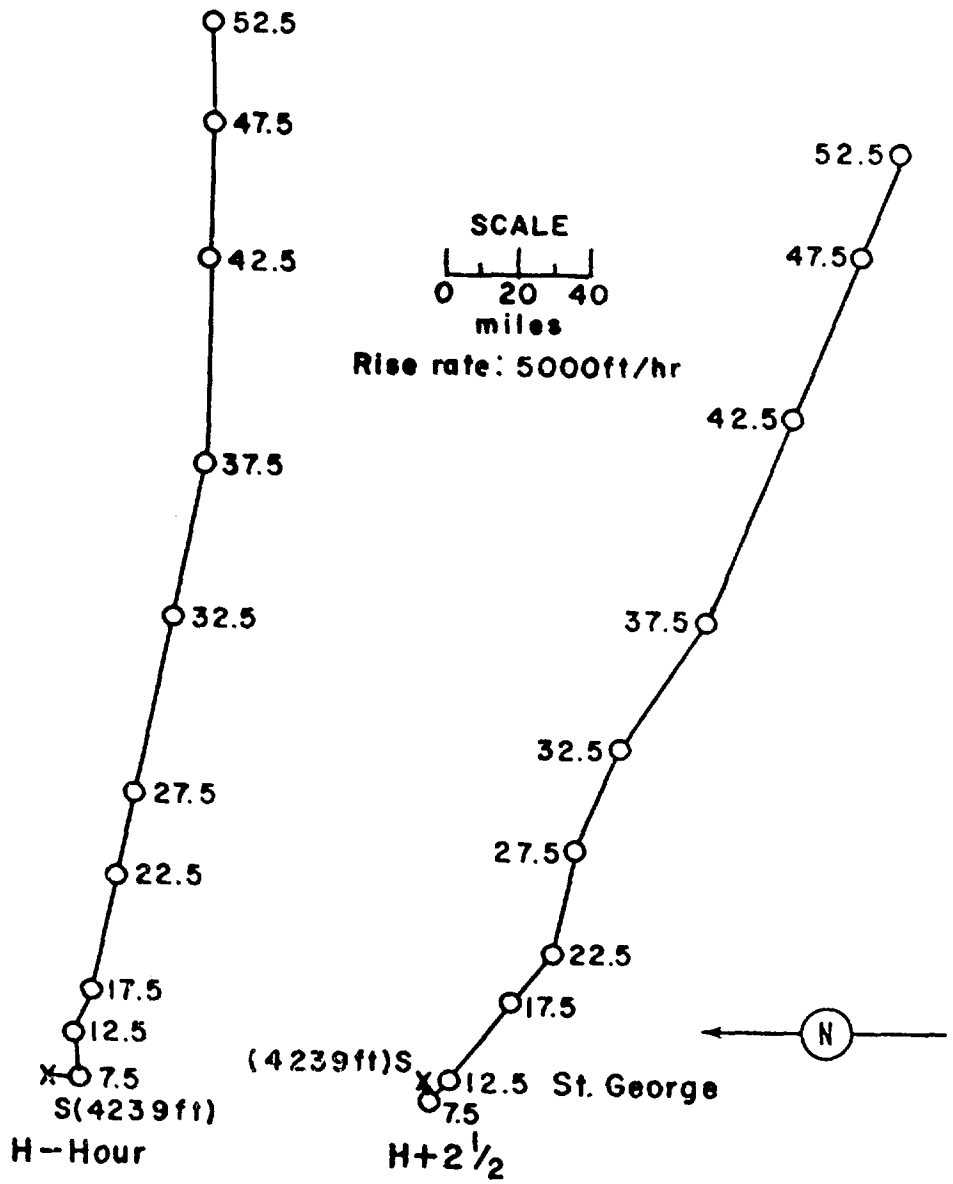


Figure 95 . Hodographs for Operation UPSHOT-KNOTHOLE - Simon.

OPERATION UPSHOT-KNOTHOLE - Encore

	PST	GMT
DATE:	8 May 1953	8 May 1953
TIME:	0730	1530

TOTAL YIELD: 27 kt

FIREBALL DATA:
Time to 1st minimum: 16.8 to 17.8 msec
Time to 2nd maximum: 150 to 179 msec
Radius at 2nd maximum: 623.2

Sponsor: DOD-LASL

SITE: NTS - Frenchman Flat
36° 30' 00" N
115° 55' 44" W
Site elevation: 3,077 ft

HEIGHT OF BURST: 2,423 ft

CLOUD TOP HEIGHT: 42,000 ft MSL
CLOUD BOTTOM HEIGHT: 28,000 ft MSL

CRATER DATA: No crater

TYPE OF BURST AND PLACEMENT:
Air burst over Nevada soil

REMARKS:

This shot is sometimes designated as UPSHOT-KNOTHOLE - 9. There was no local fallout. The induced-activity pattern was constructed from readings taken at H+$\frac{1}{2}$ hour and extrapolated to H+1 hour, using the generalized field dose rate decay curve for Nevada soil

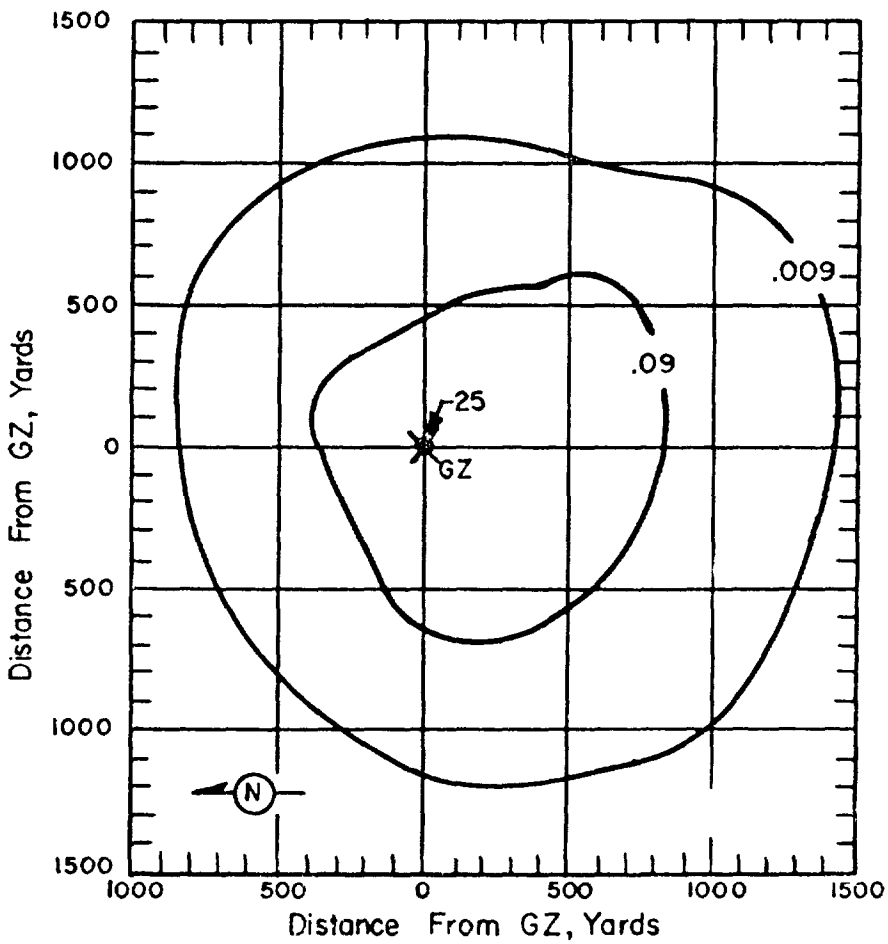


Figure 96. Operation UPSHOT-KNOTHOLE - Encore. On-site dose rate contours in r/hr at H+1 hour.

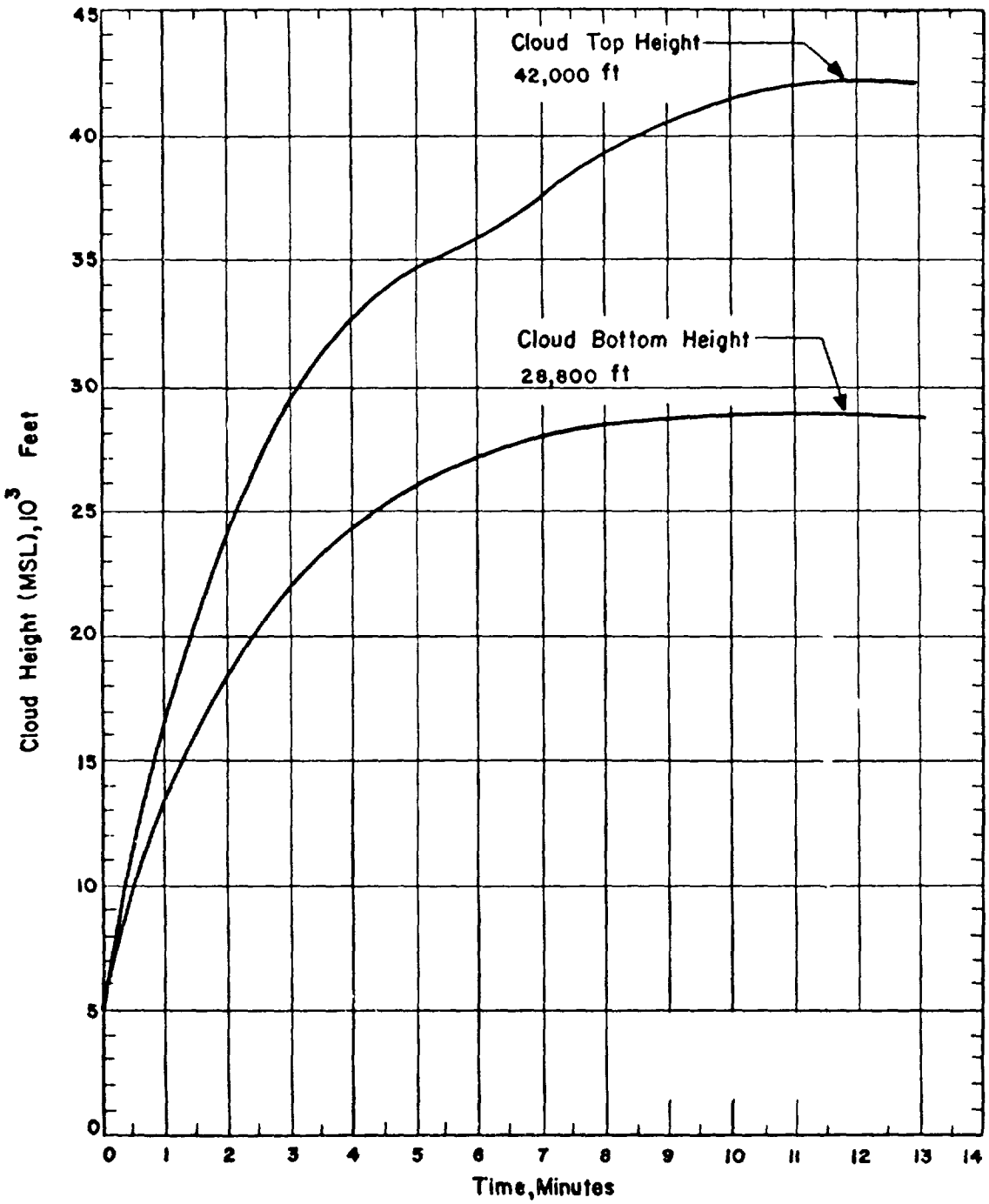


Figure 97. Cloud Dimensions: Operation UPSHOT-KNOTHOLE - Encore.

TABLE 29 NEVADA WIND DATA FOR OPERATION UPSHOT-KNOTHOLE - ENCORE

Altitude (MSL)	H-hour Dir	Speed	Altitude (MSL)	H-hour Dir	Speed
feet	degrees	mph	feet	degrees	mph
Surface	190	06	23,000	250	71
Burst Height	250	06	24,000	250	78
5,000	230	07	25,000	250	90
6,000	270	06	26,000	250	90
7,000	310	12	27,000	250	95
8,000	320	12	28,000	250	115
9,000	300	12	29,000	250	125
10,000	260	14	30,000	240	118
11,000	250	23	31,000	240	115
12,000	250	30	32,000	240	117
13,000	260	35	33,000	240	128
14,000	260	40	34,000	240	146
15,000	260	50	35,000	240	195
16,000	250	55	36,000	240	193
17,000	250	61	37,000	240	165
18.000	250	66	38,000	240	160
19,000	250	64	39,000	240	163
20,000	250	65	40,000	240	168
21,000	250	58	41,000	240	173
22,000	250	59			

NOTES:

1. Tropopause height was 39,000 ft MSL at H-hour.
2. Surface wind data was obtained at the Control Point. Upper air data was obtained from the rawinsonde section located on Yucca Lake.
3. At H-hour the pressure at ground zero was 900 mb, the temperature 16.7°C, the dew point - 7.0°C and the relative humidity 19%.

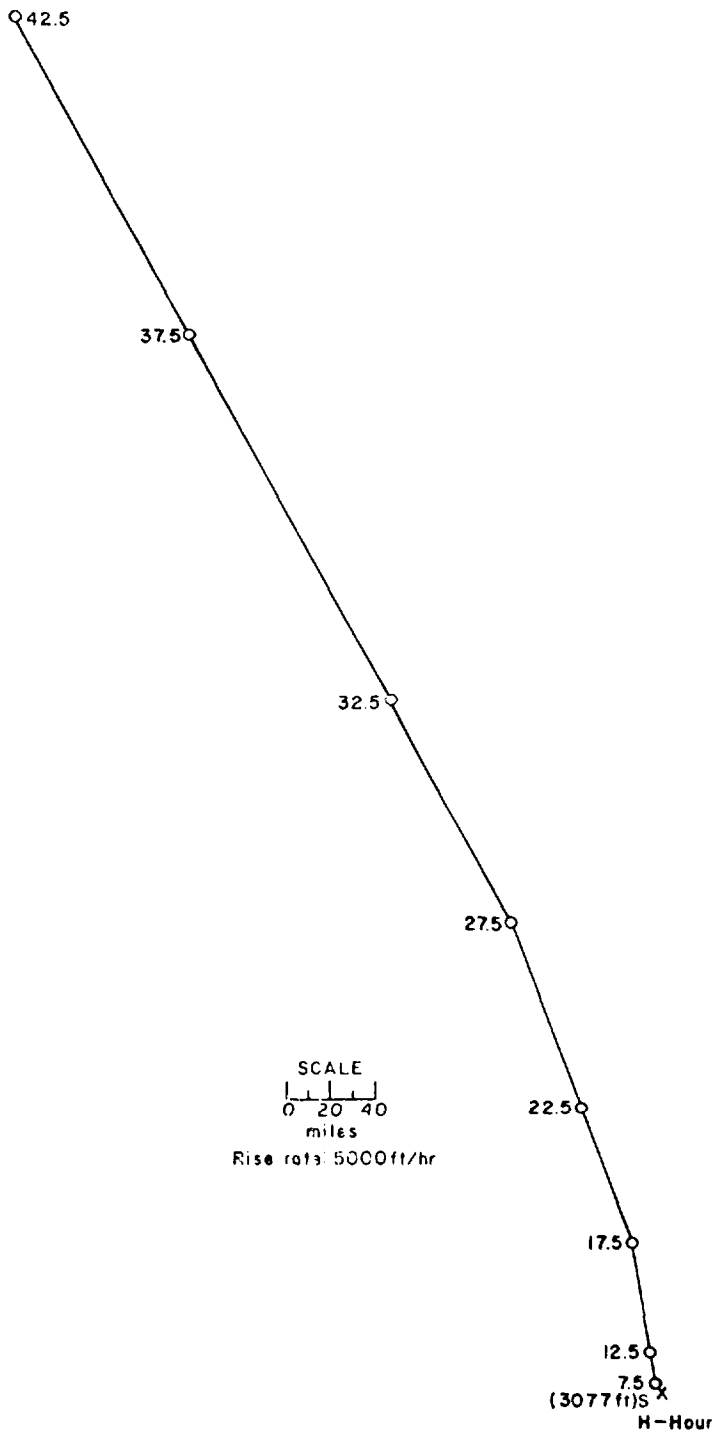


Figure 98. Hodograph for Operation UPSHOT-KNOTHOLE - Encore.

OPERATION UPSHOT-KNOTHOLE - Harry

	PST	GMT
DATE:	19 May 1953	19 May 1953
TIME:	0405	1205

TOTAL YIELD: 32 kt

FIREBALL DATA:
Time to 1st minimum: 16.8 to 19.2 msec
Time to 2nd maximum: 155 msec
Radius at 2nd maximum: NM

Sponsor: LASL

SITE: NTS - Area 3a
37° 02' 25" N
116° 01' 31" W
Site elevation: 4,006 ft

HEIGHT OF BURST: 300 ft

TYPE OF BURST AND PLACEMENT:
Tower burst over Nevada soil

CLOUD TOP HEIGHT: 42,500 ft MSL
CLOUD BOTTOM HEIGHT: 27,500 ft MSL

CRATER DATA: No crater

REMARKS:

The on-site fallout pattern was obtained from readings at H+1 hour. No decay corrections were necessary. The off-site fallout pattern was drawn from D-day readings of mobile ground-survey teams of the Radiological Safety organization. This shot is sometimes designated as Upshot-Knothole-Shot 8.

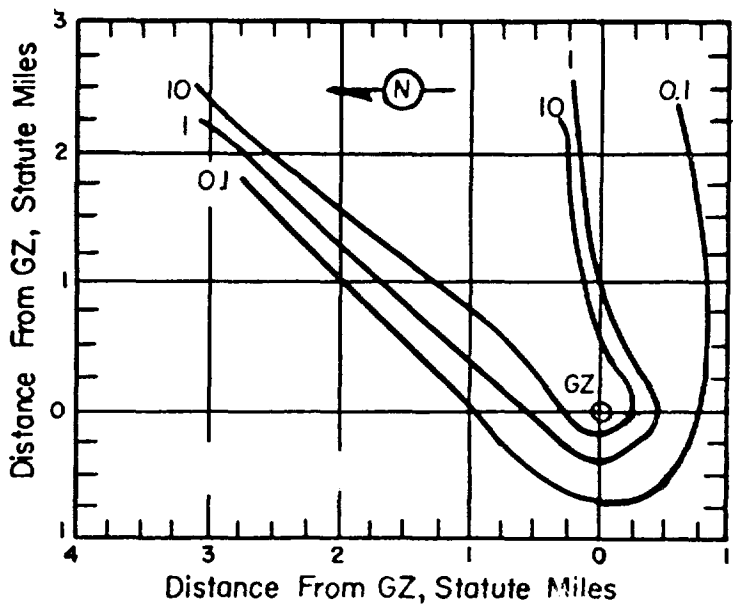


Figure 99. Operation UPSHOT-KNOTHOLE - Harry.
On-site dose rate contours in r/hr at H+1 hour.

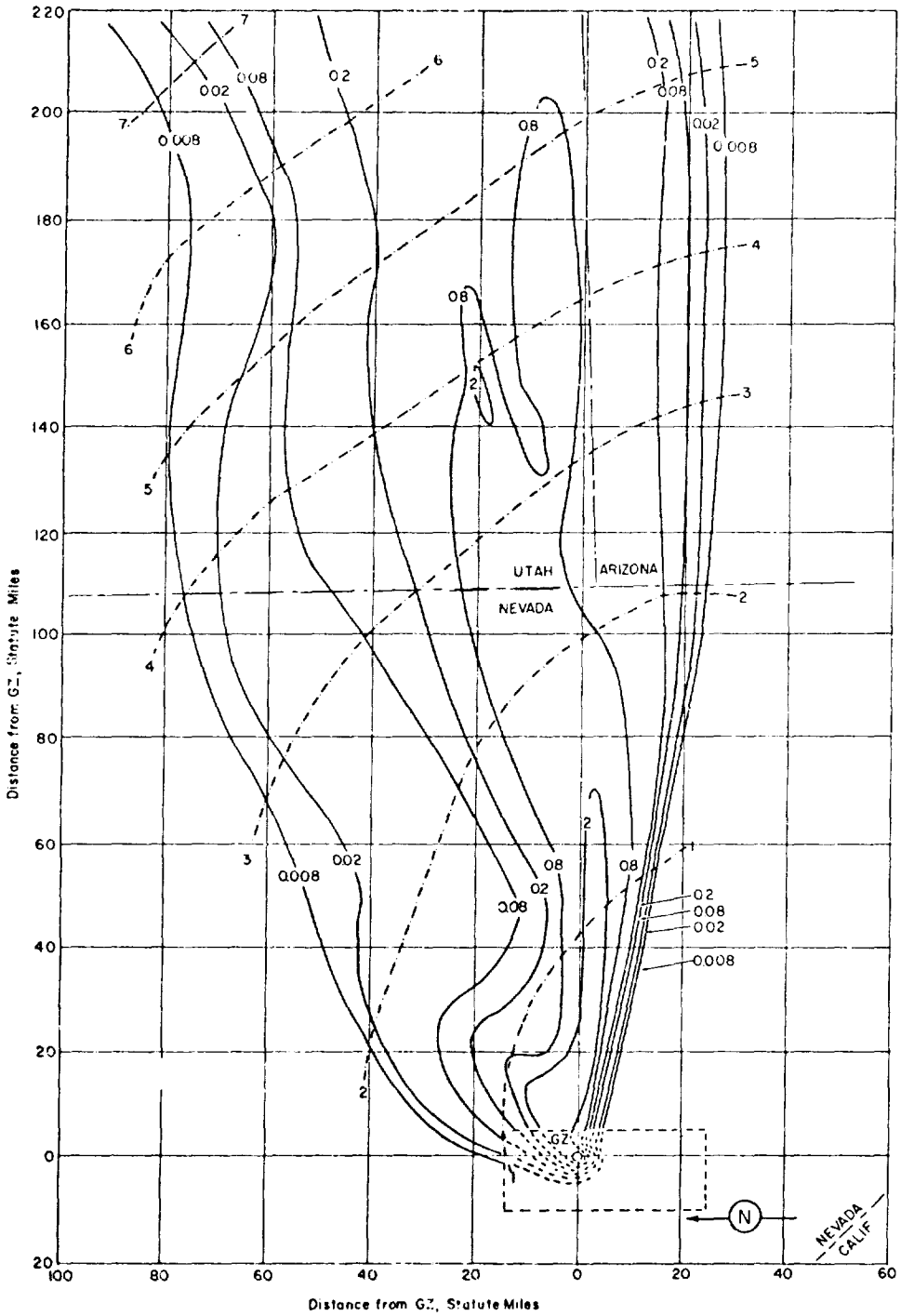


Figure 100. Operation UPSHOT-KNOTHOLE - Harry.
Off-site dose rate contours in r/hr at H+1 hour.

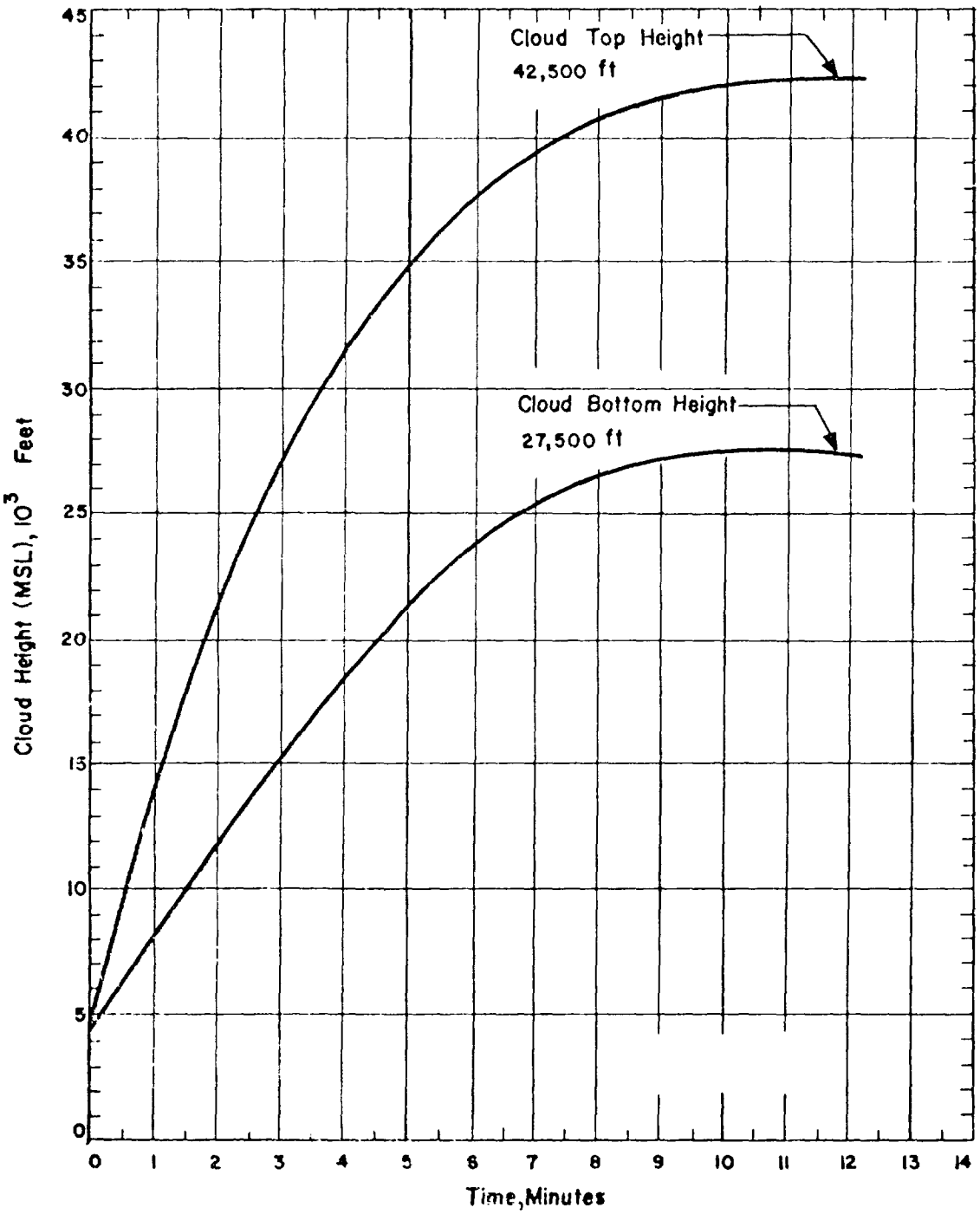


Figure 101. Cloud Dimensions: Operation UPSHOT-KNOTHOLE - Harry.

TABLE 30 WIND DATA FOR OPERATION UPSHOT-KNOTHOLE - HARRY

Altitude (MSL)	H-hour Dir	H-hour Speed	Altitude (MSL)	H-hour Dir	H-hour Speed
feet	degrees	mph	feet	degrees	mph
Surface	020	06	27,000	290	53
Burst Height	200	06	28,000	280	51
5,000	200	12	29,000	280	57
6,000	200	24	30,000	290	69
7,000	200	29	31,000	290	81
8,000	200	30	32,000	290	77
9,000	210	26	33,000	290	74
10,000	210	21	34,000	290	74
11,000	210	17	35,000	290	72
12,000	200	17	36,000	290	74
13,000	210	17	37,000	290	77
14,000	220	20	38,000	290	74
15,000	230	24	39,000	300	69
16,000	260	35	40,000	300	77
17,000	270	40	41,000	300	85
18,000	270	43	42,000	300	91
19,000	270	43	43,000	280	90
20,000	280	44	44,000	280	87
21,000	280	48	45,000	280	89
22,000	280	55	46,000	280	86
23,000	280	57	47,000	280	87
24,000	280	63	48,000	280	92
25,000	280	62	49,000	280	84
26,000	290	57	50,000	280	72

NOTES:

1. Tropopause height was 40,500 ft MSL at H-hour.
2. H-hour surface wind data was obtained at the Control Point. H-hour upper air data was obtained from the rawinsonde section located on Yucca Lake. H+3 hour wind data was obtained from pibal observation at St. George.
3. At H-hour the pressure at ground zero was 874 mb, the temperature 14.3°C, the dew point -0.6°C, and the relative humidity 35%.

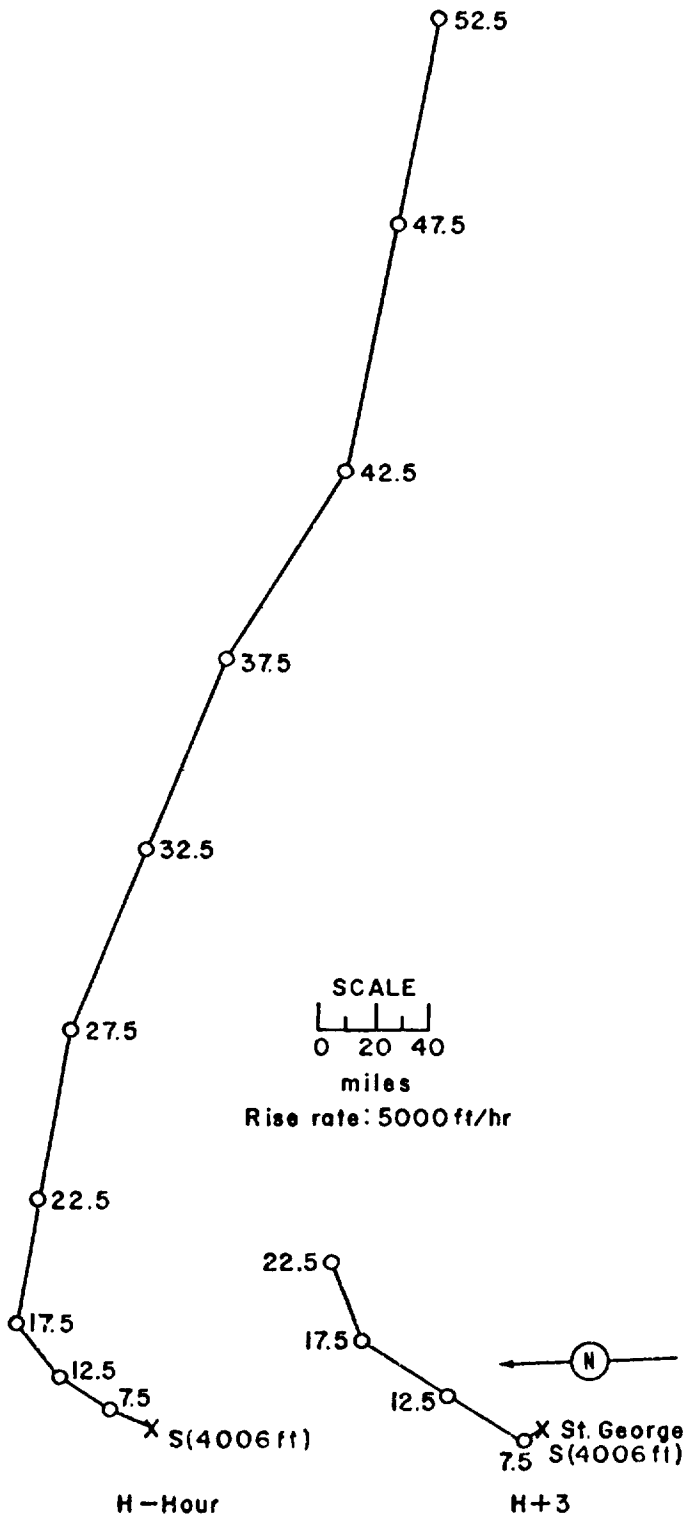


Figure 102. Hodographs for Operation UPSHOT-KNOTHOLE - Harry.

OPERATION UPSHOT-KNOTHOLE - Grable

	PST	GMT
DATE:	25 May 1953	25 May 1953
TIME:	0730	1530

TOTAL YIELD: 15 kt

FIREBALL DATA:
Time to 1st minimum: 13.3 to 14.9 msec
Time to 2nd maximum: 122 to 138 msec
Radius at 2nd maximum: 557.6

Sponsor: LASL

SITE: NTS - Frenchman Flat
36° 47' 35" N
115° 54' 53" W
Site elevation: 3,077 ft

HEIGHT OF BURST: 524 ft

TYPE OF BURST AND PLACEMENT:
Airburst of guntype weapon over Nevada soil

CLOUD TOP HEIGHT: 35,000 ft MSL
CLOUD BOTTOM HEIGHT: 23,000 ft MSL

CRATER DATA: No crater

REMARKS:

The on-site fallout pattern is due primarily to neutron induced activity and was obtained by the Radiological Safety organization from ground-survey measurements between H+$\frac{1}{4}$ hour and H+1$\frac{1}{4}$ hours. No decay corrections were necessary. The off-site fallout pattern was drawn from D-day readings of mobile ground-survey teams of the Radiological Safety organization.

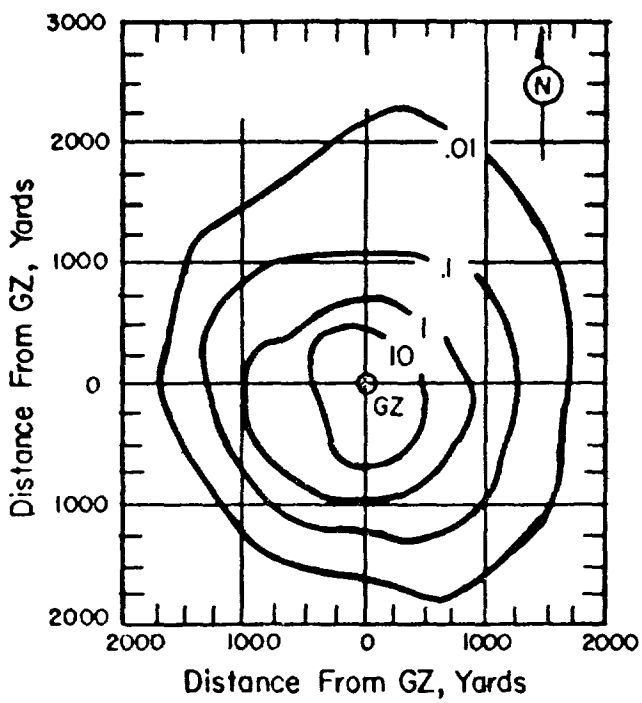


Figure 103. Operation UPSHOT-KNOTHOLE - Grable.
On-site dose rate contours in r/hr at H+1 hour.

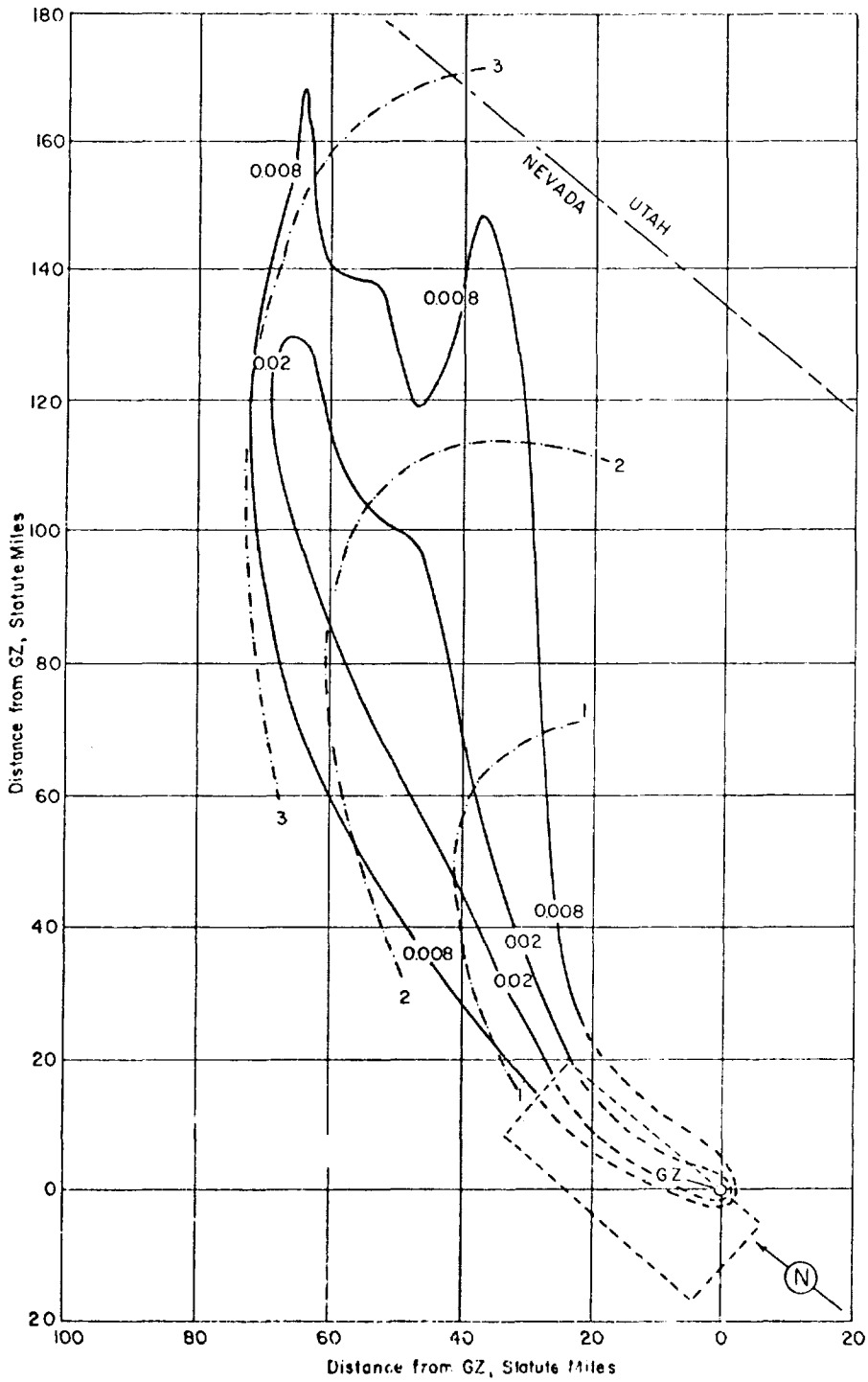


Figure 104. Operation UPSHOT-KNOTHOLE - Grable.
Off-site dose rate contours in r/hr at H+1 hour.

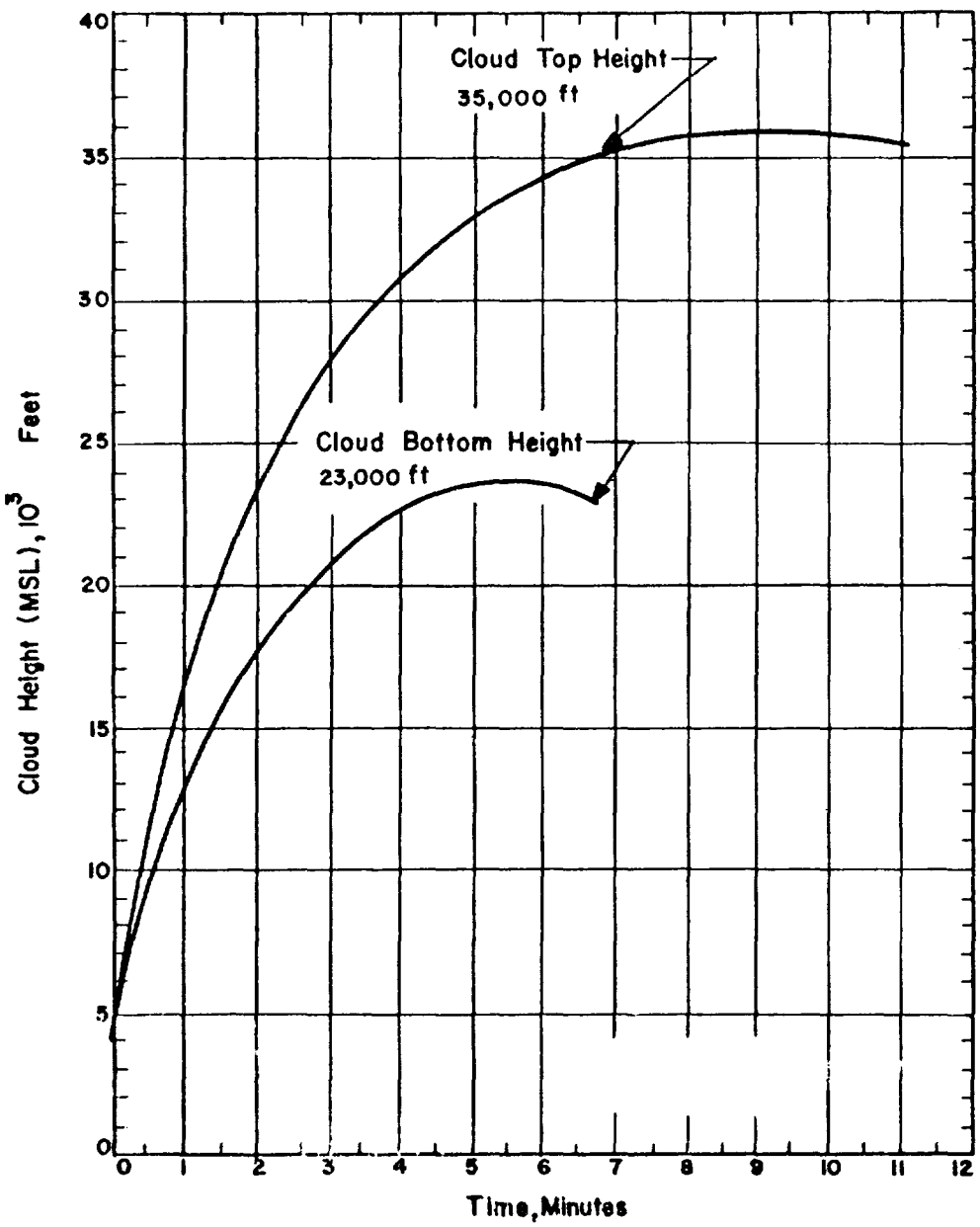


Figure 105. Cloud Dimensions: Operation UPSHOT-KNOTHOLE - Grable.

TABLE 31 NEVADA WIND DATA FOR OPERATION UPSHOT-KNOTHOLE - GRABLE

Altitude (MSL)	H-hour Dir	Speed
feet	degrees	mph
Surface	360	05
Burst Height	220	08
4,000	220	12
5,000	220	16
6,000	190	24
7,000	180	35
8,000	190	24
9,000	190	24
10,000	200	35
11,000	200	35
12,000	200	36
13,000	200	37
14,000	200	38
15,000	200	40
16,000	200	55
17,000	210	63
18,000	210	85
19,000	210	85
20,000	220	85
21,000	220	86
22,000	220	87
23,000	220	94
24,000	220	101
25,000	220	75
26,000	220	63

Altitude (MSL)	H-hour Dir	Speed
feet	degrees	mph
27,000	220	102
28,000	220	102
29,000	220	92
30,000	220	98
31,000	220	124
32,000	220	126
33,000	220	125
34,000	220	120
35,000	220	138
36,000	220	140
37,000	220	100
38,000	220	103
39,000	220	95
40,000	220	75
41,000	220	85
42,000	220	91
43,000	220	72
44,000	220	61
45,000	220	65
46,000	220	64
47,000	220	63
48,000	220	77
49,000	220	60
50,000	220	38

NOTES:

1. Tropopause height was 35,400 ft MSL at H-hour.
2. Surface and lower level wind data was obtained at the Control Point. Upper air data was obtained from the rawinsonde section located on Yucca Lake.
3. At H-hour the pressure at ground zero was 901 mb, the temperature 14.8°C, the dew point -3.8°C and the relative humidity 32%.

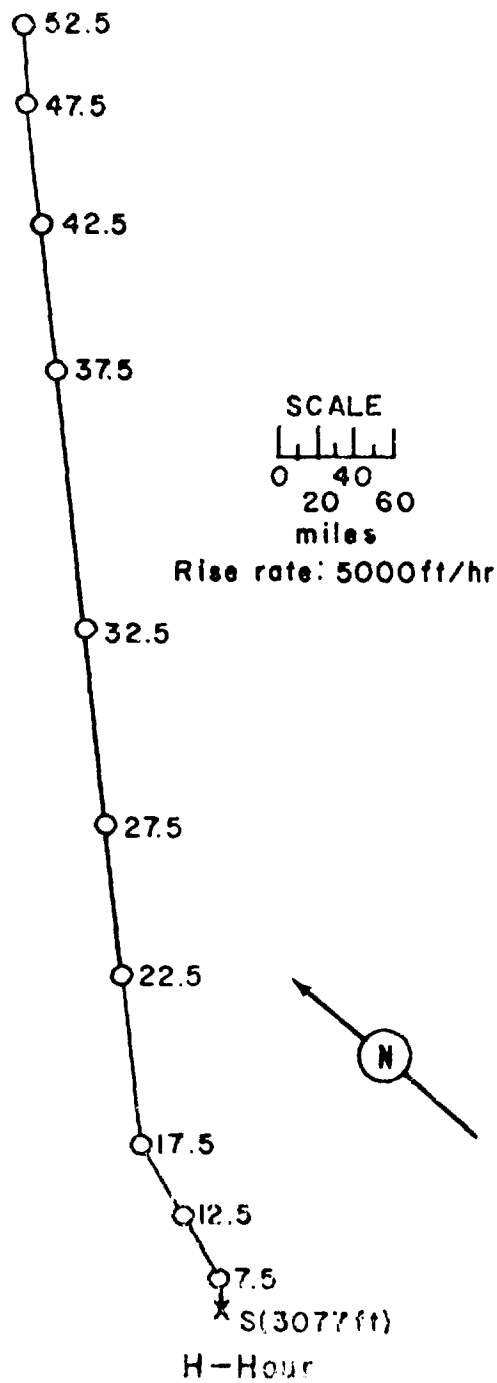


Figure 106. Hodograph for Operation UPSHOT-KNOTHOLE - Grable

OPERATION UPSHOT-KNOTHOLE - Climax

	PST	GMT
DATE:	4 Jun 1953	4 Jun 1953
TIME:	0315	1115

Sponsor: LASL

SITE: NTS - Area 7 - 3
37° 05' 15" N
116° 01' 06" W
Site elevation: 4,025 ft

TOTAL YIELD: 61 kt

HEIGHT OF BURST: 1,334 ft

FIREBALL DATA:
Time to 1st minimum: 27.0 to 27.2 msec
Time to 2nd maximum: 250 to 257 msec
Radius at 2nd maximum: 918.4 ft

TYPE OF BURST AND PLACEMENT:
Air burst over Nevada soil

CLOUD TOP HEIGHT: 42,700 ft MSL
CLOUD BOTTOM HEIGHT: 35,000 ft MSL

CRATER DATA: No crater

REMARKS:

The contamination was due primarily to neutron-induced activity. The on-site pattern was drawn from H+1-hour readings. No decay corrections were necessary. Little fallout was detected within the 200-mile zone. All downwind readings were only slightly above normal background.

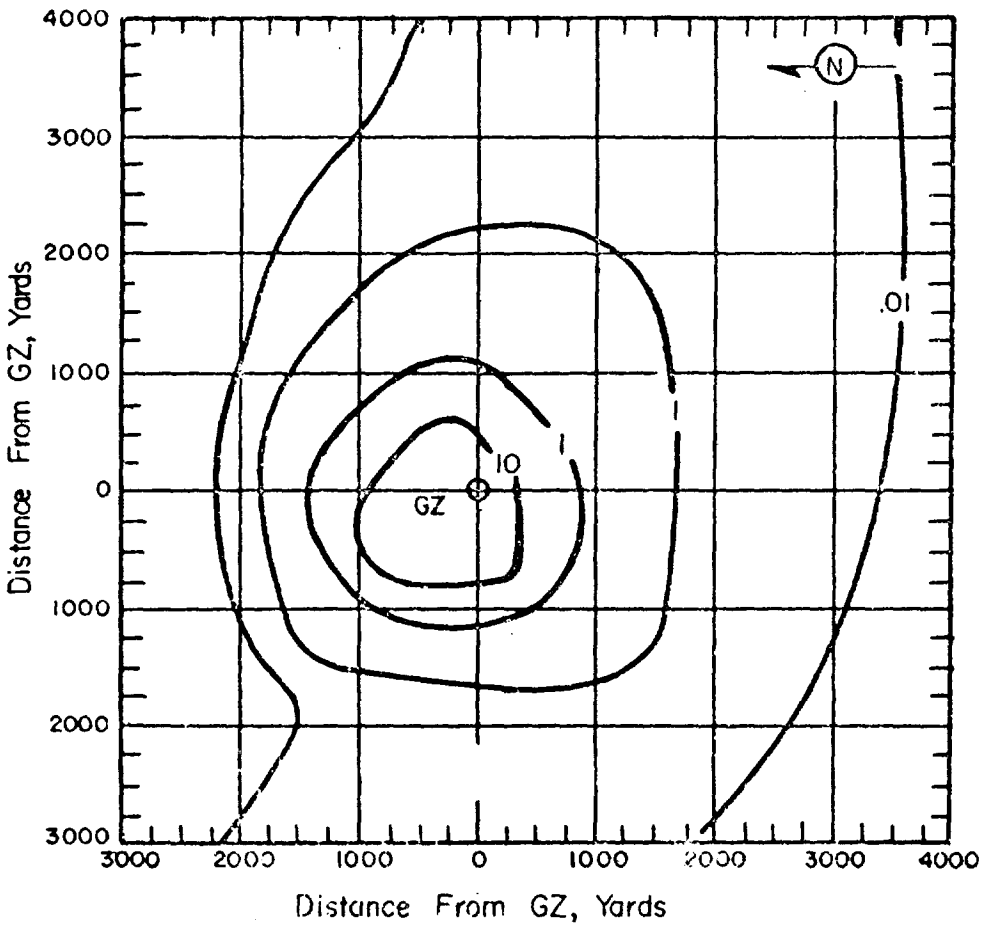


Figure 107. Operation UPSHOT-KNOTHOLE - Climax.
On-site dose rate contours in r/hr at H+1 hour.

TABLE 32 WIND DATA FOR OPERATION UPSHOT-KNOTHOLE- CLIMAX

Altitude (MSL)	H-hour Dir	H-hour Speed	Altitude (MSL)	H-hour Dir	H-hour Speed
feet	degrees	mph	feet	degrees	mph
Surface	045	03	27,000	310	28
Burst Height	010	09	28,000	310	32
5,000	010	12	29,000	310	28
6,000	360	07	30,000	310	32
7,000	010	09	31,000	310	32
8,000	020	07	32,000	310	30
9,000	020	12	33,000	300	28
10,000	140	03	34,000	280	23
11,000	220	05	35,000	270	20
12,000	200	03	36,000	260	18
13,000	190	07	37,000	250	22
14,000	170	09	38,000	260	24
15,000	170	07	39,000	280	25
16,000	210	05	40,000	250	28
17,000	250	12	41,000	250	26
18,000	270	17	42,000	240	32
19,000	270	18	43,000	260	28
20,000	280	15	44,000	270	18
21,000	280	18	45,000	280	14
22,000	310	21	46,000	270	14
23,000	320	20	47,000	270	23
24,000	310	23	48,000	270	25
25,000	310	22	49,000	270	21
26,000	310	28	50,000	270	13

NOTES:

1. Tropopause height was 39,060 ft MSL at H-hour.
2. H-hour surface and lower level wind data was obtained at the Control Point. H-hour upper air data was obtained from the rawinsonde section located on Yucca Lake.
3. At H-hour the pressure at ground zero was 867 mb, the temperature 13.3°C, the dew point -3.9° and the relative humidity 30%.

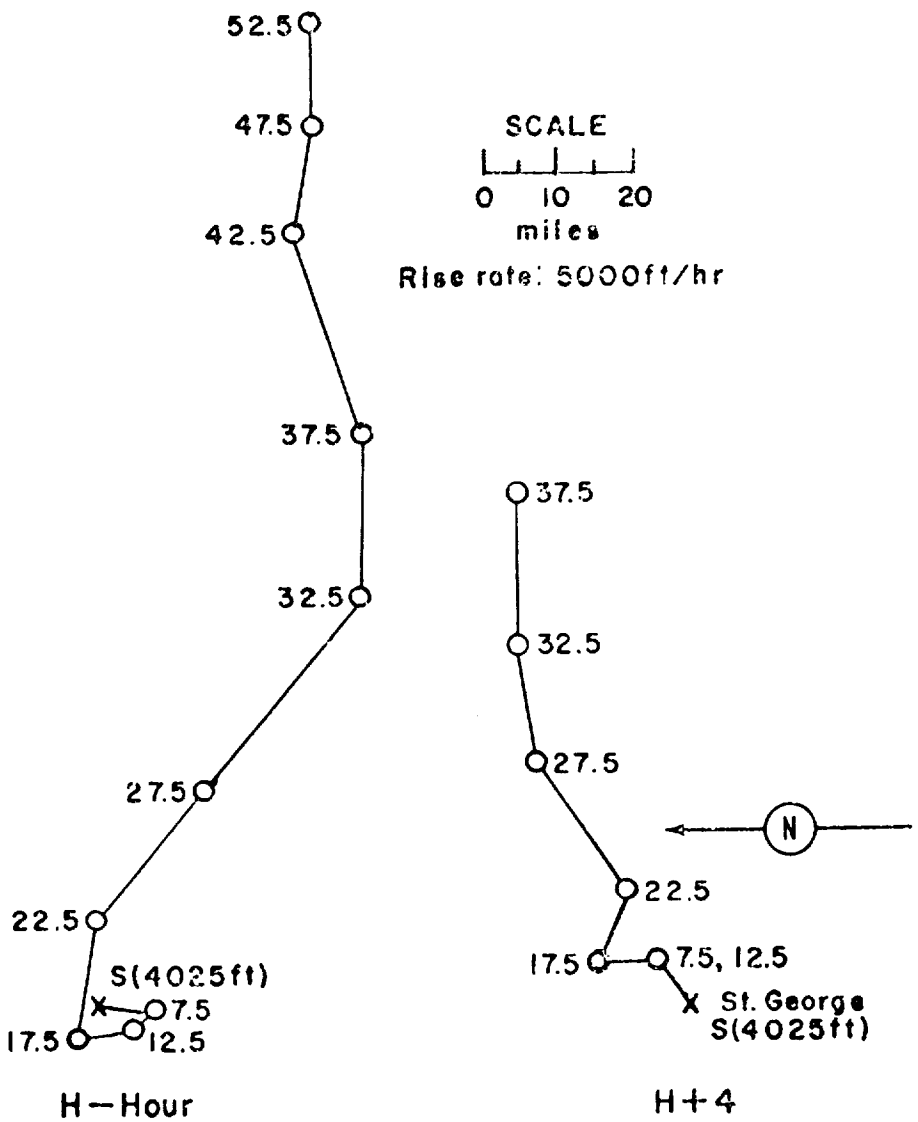
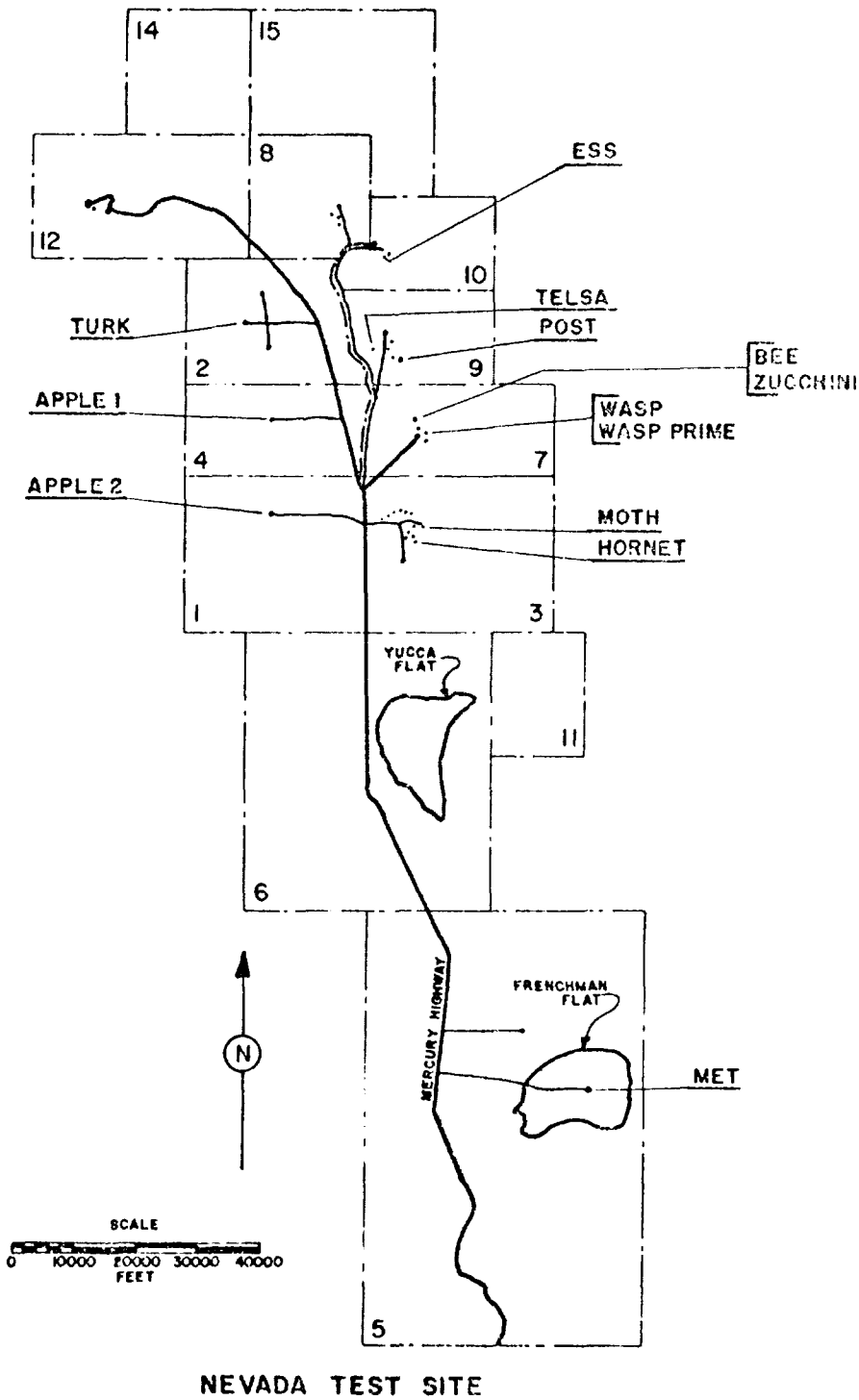


Figure 108. Hodographs for Operation UPSHOT-KNOTHOLE - Climax.



NEVADA TEST SITE

Figure 109. Operation TEAPOT, Shot Locations.

OPERATION TEAPOT - *Wasp*

	PST	GMT
DATE:	18 Feb 1955	18 Feb 1955
TIME:	1200	2000

TOTAL YIELD: 1 kt

TYPE OF BURST AND PLACEMENT:
Air burst over Nevada soil

FIREBALL DATA:
Time to 1st minimum: 3.3 to 4 msec
Time to 2nd maximum: 44 to 48 msec
Radius at 2nd maximum: 196.8 ft

Sponsor: LASL

SITE: NTS - Area T-7-4
37° 05' 12" N
116° 01' 19" W
Site elevation: 4,195 ft

HEIGHT OF BURST: 762 ft

CLOUD TOP HEIGHT: 21,500 ft MSL
CLOUD BOTTOM HEIGHT: 14,500 ft MSL

CRATER DATA: No crater

REMARKS:

The contours resulting from this shot were due primarily to neutron-induced activity. The on-site pattern was obtained from Rad-Safe readings at H+1 hour. No decay corrections were necessary. No off-site pattern is presented because of the low activity levels encountered.

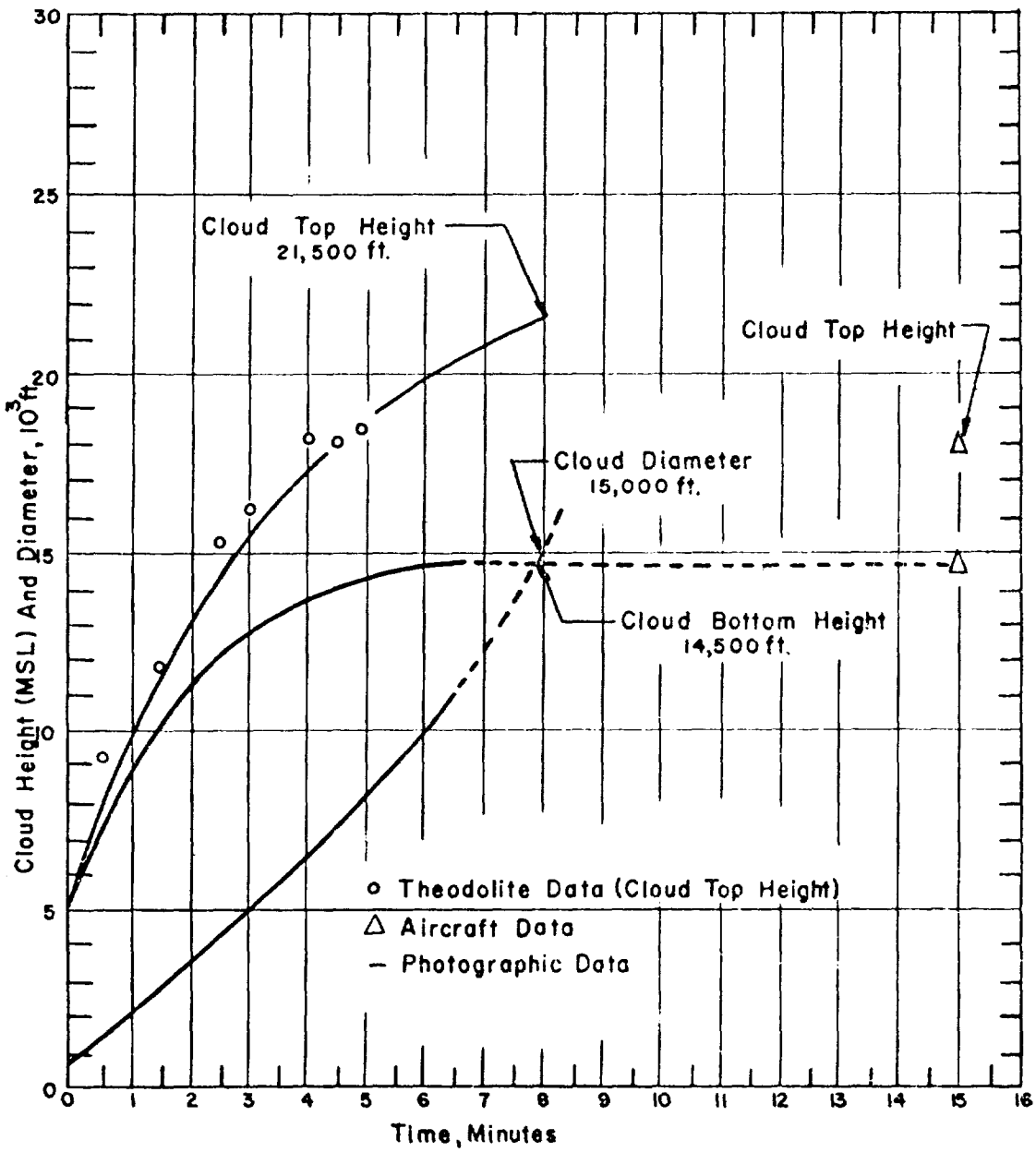


Figure 110. Operation TEAPOT - Wasp.
On-site dose rate contours in r/hr at H+1 hour.

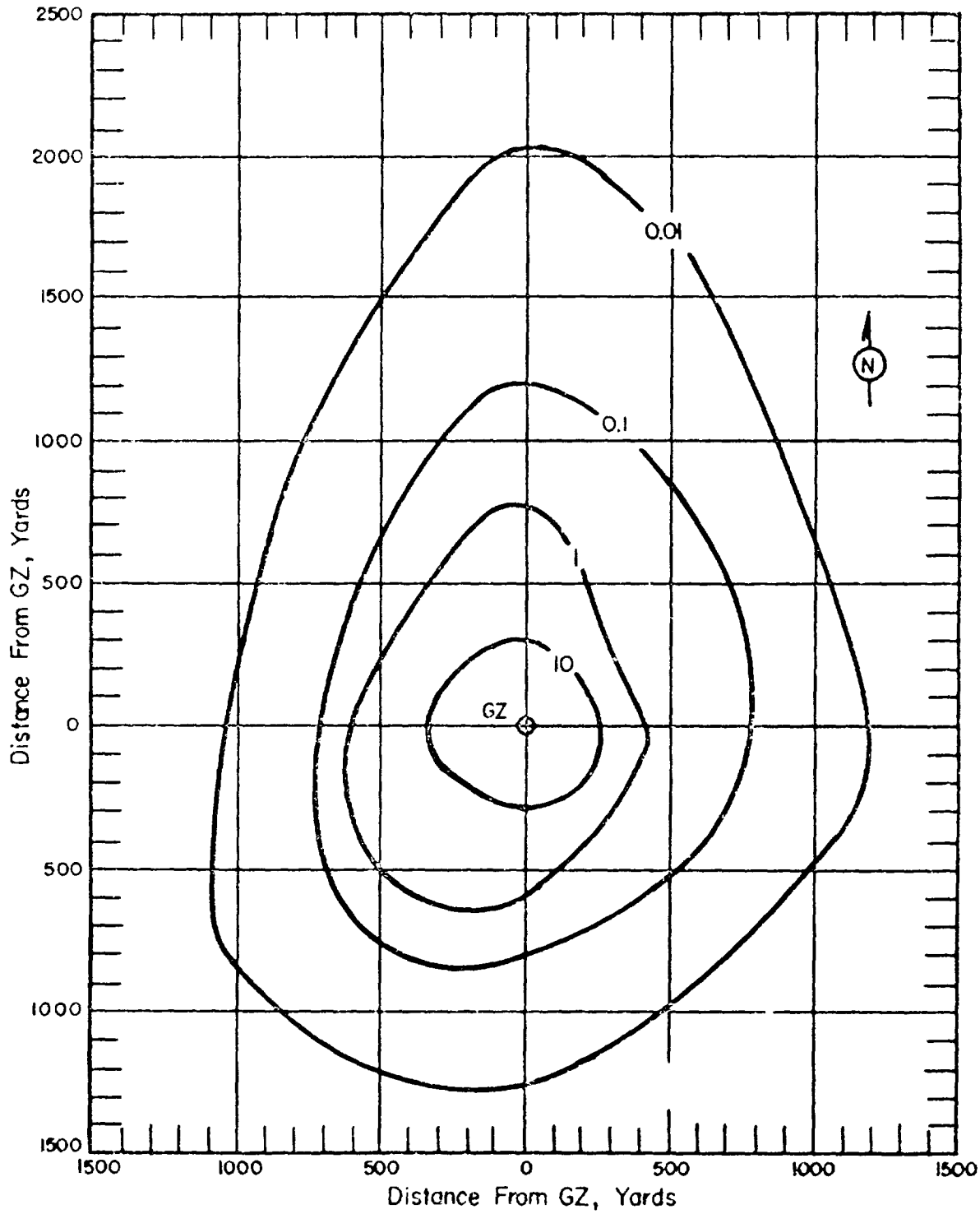


Figure 111. Cloud Dimensions: Operation TEAPOT - Wasp.

TABLE 33 NEVADA WIND DATA FOR OPERATION TEAPOT— WASP

Altitude (MSL)	H-hour	
	Dir	Speed
feet	degrees	mph
Surface	330	26
5,000	360	29
6,000	010	23
7,000	360	24
8,000	330	29
9,000	330	35
10,000	350	39
12,000	340	42
14,000	330	49
15,000	330	51
16,000	330	50
18,000	320	76
20,000	320	110
23,000	310	104
25,000	310	107

NOTE:

1. H-hour winds were estimated
2. At shot height the temperature was -5.5°C, the pressure 846 mb.

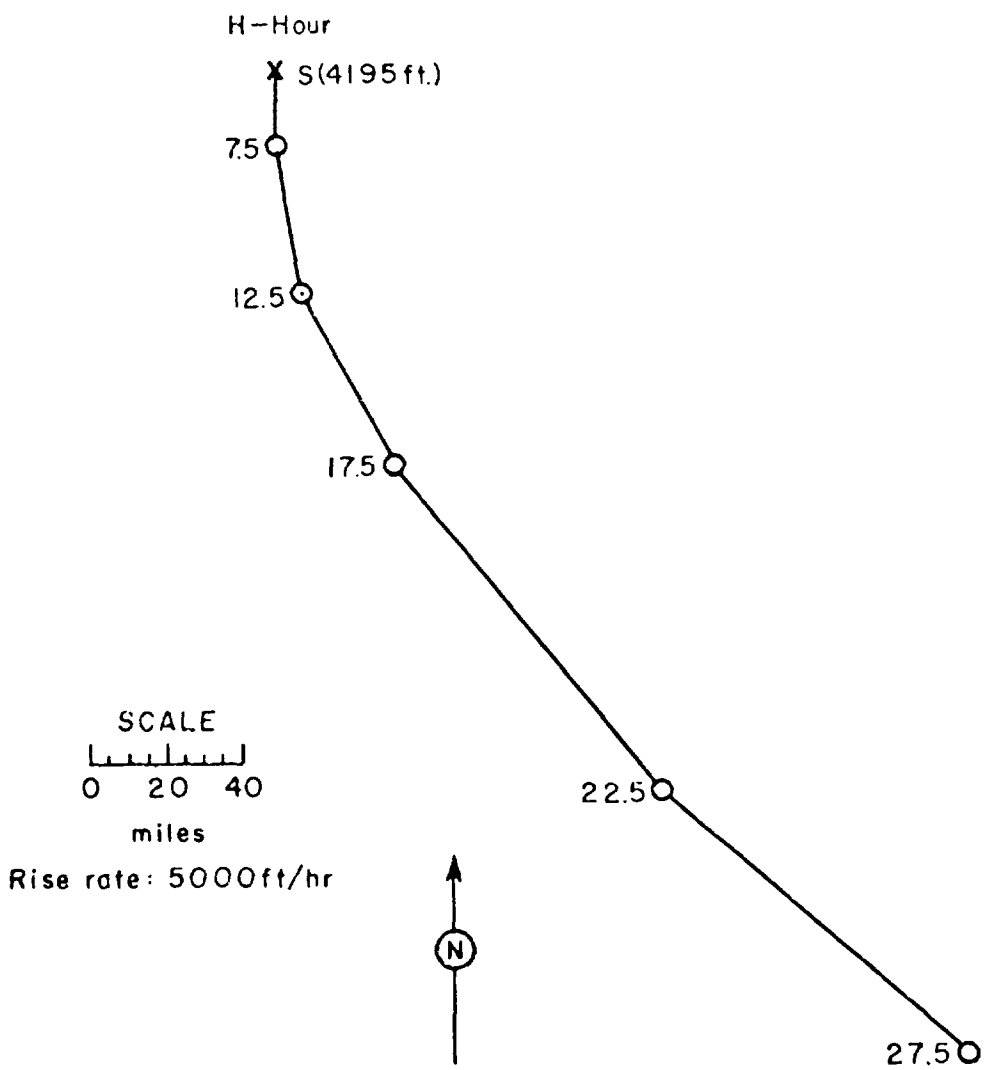


Figure 112. Hodograph for Operation TEAPOT - Wasp.

OPERATION TEAPOT - Moth

	PST	GMT
DATE:	22 Feb 1955	22 Feb 1955
TIME:	0545	1345

TOTAL YIELD: 2 kt

FIREBALL DATA:
Time to 1st minimum: 5.0 to 6.0 msec
Time to 2nd maximum: 68 to 80 msec
Radius at 2nd maximum: 229.6 ft

Sponsor: LASL

SITE: NTS - Area 3
37° 02' 52" N
116° 01' 16" W
Site elevation: 4,026 ft

HEIGHT OF BURST: 300 ft

TYPE OF BURST AND PLACEMENT:
Tower burst over Nevada soil

CLOUD TOP HEIGHT: 24,200 ft MSL
CLOUD BOTTOM HEIGHT: 15,900 ft MSL

CRATER DATA: No crater

REMARKS:

The on-site fallout pattern was constructed from data resulting from six different ground surveys performed by the Rad-Safe organization from H+$\frac{1}{2}$ hour to D+15 days. AN/PDR-39 instruments were used. Nine stake lines (approximately radial) along existing roads around ground zero aided the survey teams in locating their position. The off-site fallout pattern was drawn from ground-survey readings taken by the off-site Radiological Safety organization. The $t^{-1.2}$ decay approximation was used to extrapolate the dose-rate readings to H+1 hour for both on-site and off-site patterns.

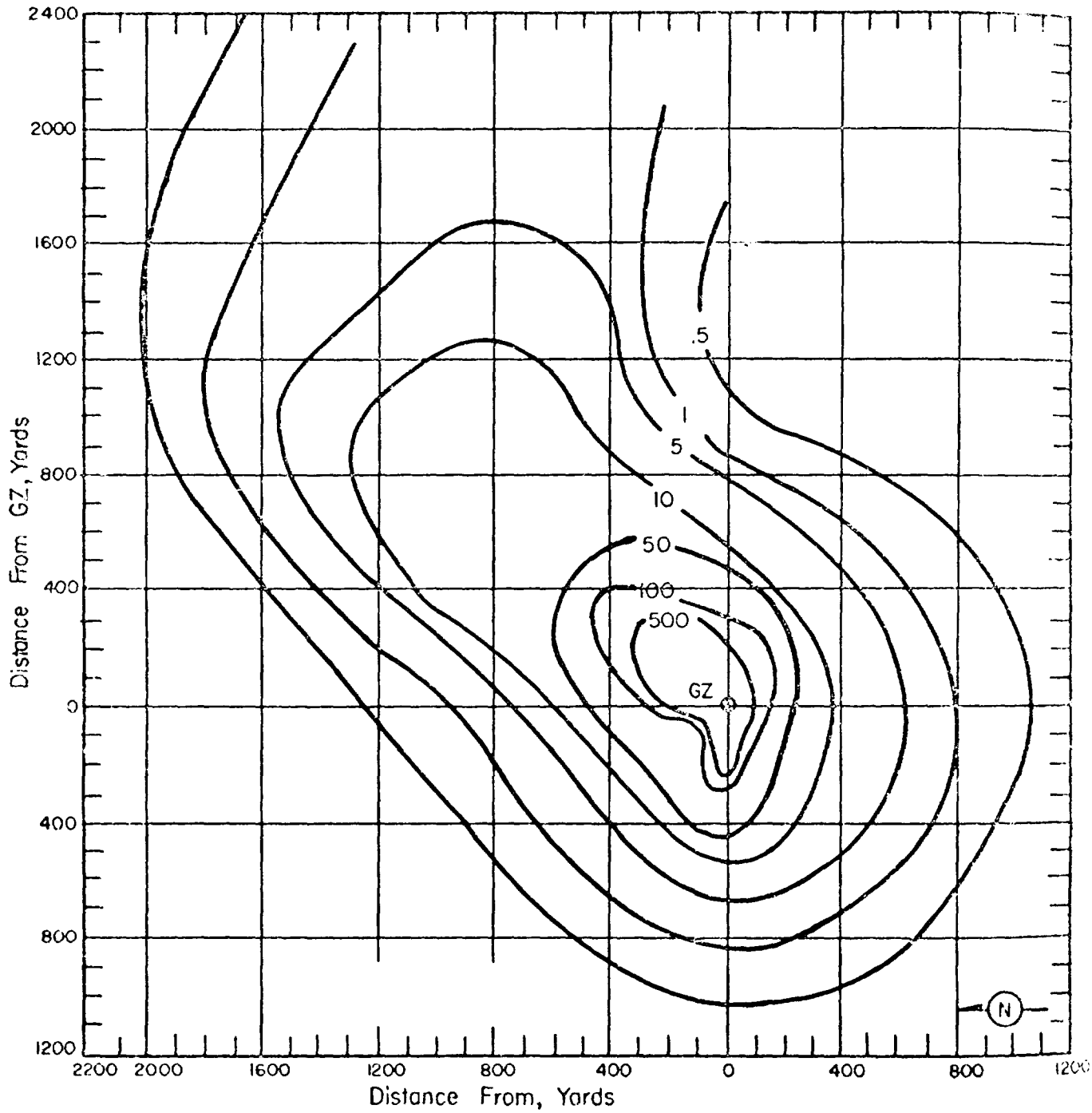


Figure 113. Operation TEAPOT - Moth.
On-site dose rate contours in r/hr at H+1 hour.

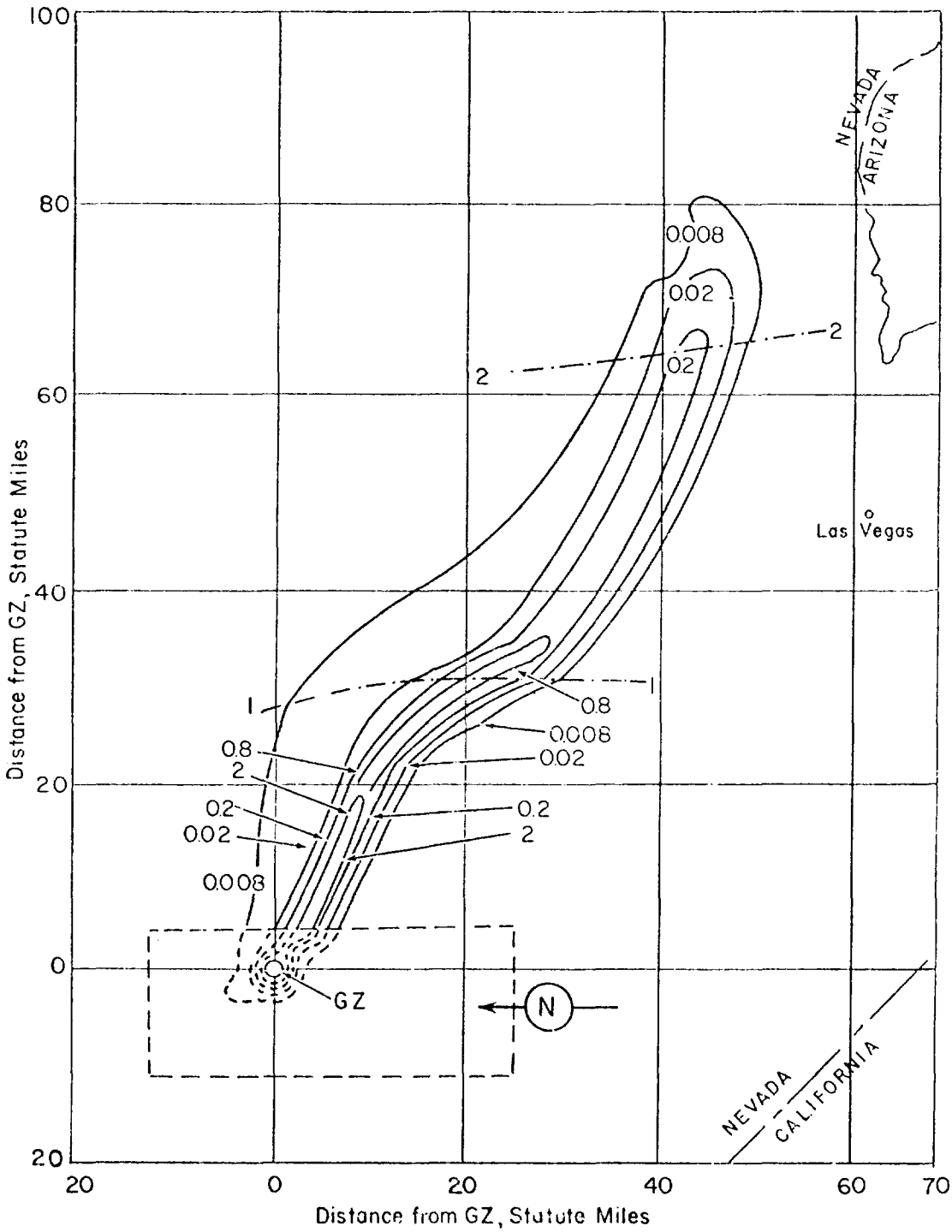


Figure 114. Operation TEAPOT - Moth.
Off-site dose rate contours in r/hr at H+1 hour.

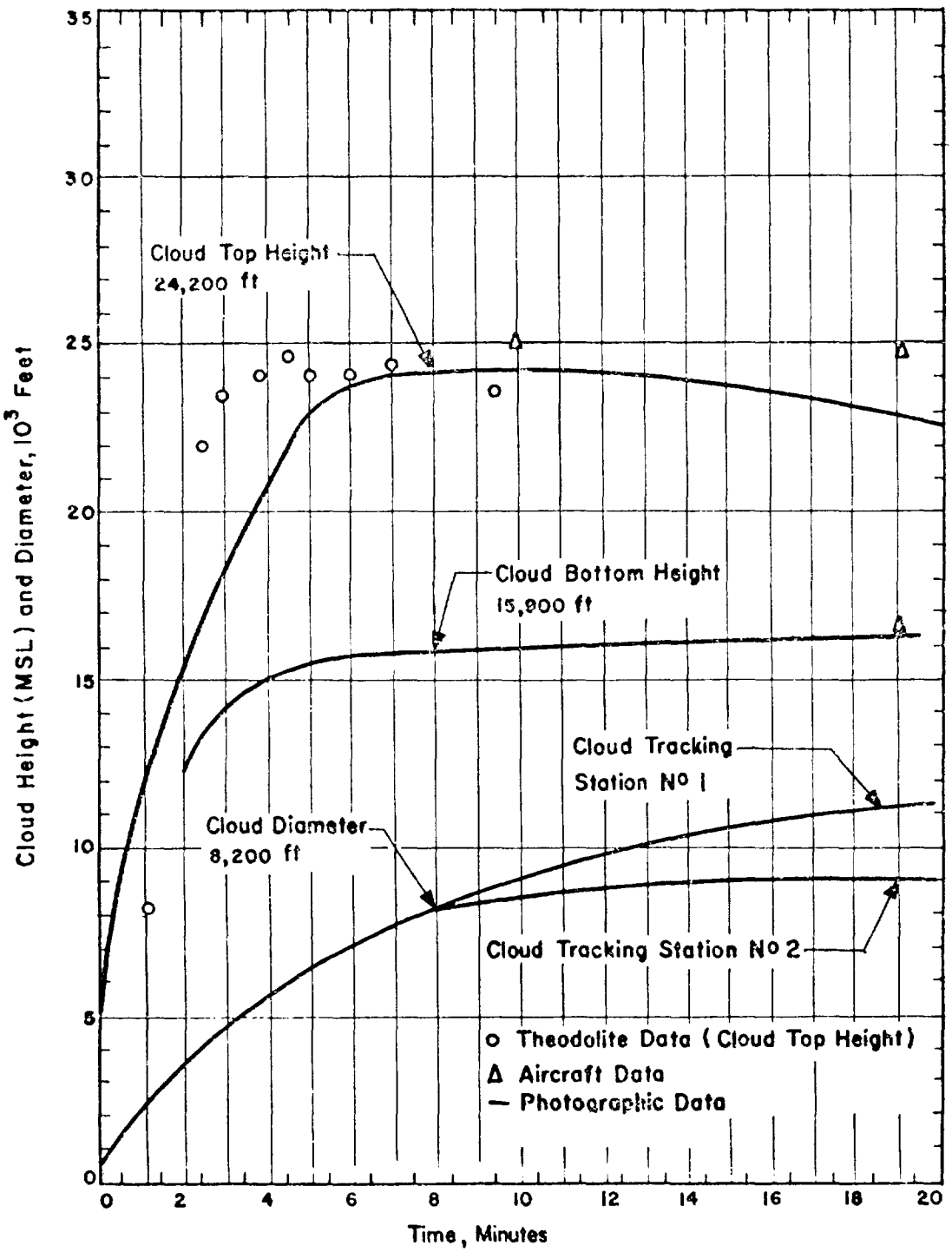


Figure 115. Cloud Dimensions: Operation TEAPOT - Moth. (Tracking Station No. 1 located 48 miles SE of C. P. and Tracking Station No. 2 located 50 miles SW of C.P.)

TABLE 34 NEVADA WIND DATA FOR OPERATION TEAPOT - MOTH

Altitude (MSL)	H-hour Dir	H-hour Speed	Altitude (MSL)	H-hour Dir	H-hour Speed
feet	degrees	mph	feet	degrees	mph
Surface	Calm	Calm	27,000	310	86
5,000	220	06	28,000	310	88
6,000	230	12	29,000	310	90
7,000	260	18	30,000	310	83
8,000	290	20	31,000	300	78
9,000	310	29	32,000	300	82
10,000	310	36	33,000	310	86
11,000	310	38	34,000	310	91
12,000	310	37	35,000	310	91
13,000	310	39	36,000	300	86
14,000	310	40	37,000	300	82
15,000	300	45	38,000	300	77
16,000	300	48	39,000	300	63
17,000	300	52	40,000	300	64
18,000	300	56	41,000	300	61
19,000	300	63	42,000	290	63
20,000	300	62	43,000	290	67
21,000	300	63	44,000	300	68
22,000	300	69	45,000	300	67
23,000	300	69	46,000	300	66
24,000	310	75	47,000	300	60
25,000	310	71	48,000	300	51
26,000	310	77	49,000	300	43
			50,000	300	40

NOTE: At shot height the temperature was -3.9°C and the pressure 871 mb.

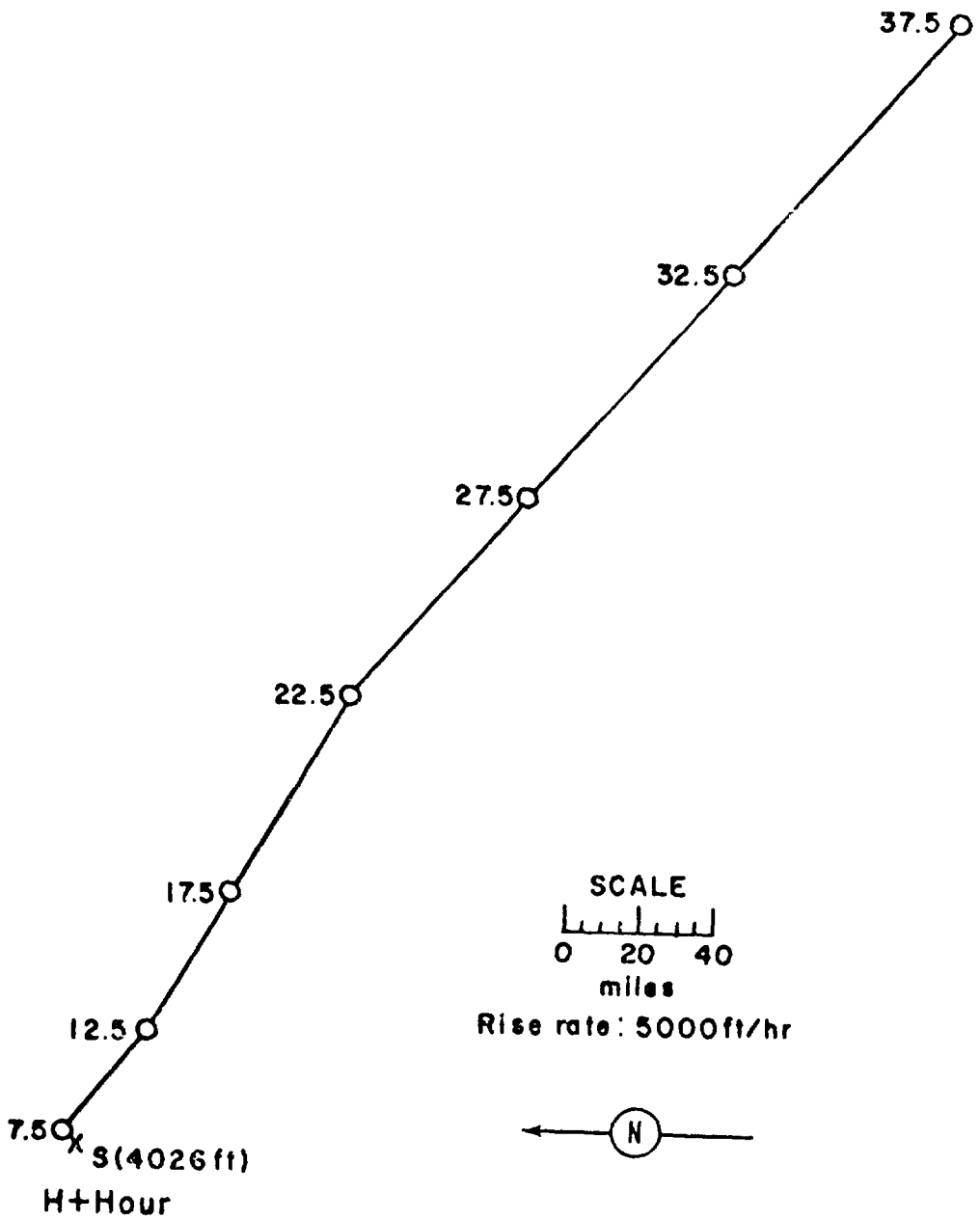


Figure 116. Hodograph for Operation TEAPOT - Moth.

OPERATION TEAPOT - Tesla

	PST	GMT
DATE:	1 Mar 1955	1 Mar 1955
TIME:	0530	1330

TOTAL YIELD: 7 kt

FIREBALL DATA:
Time to 1st minimum: 7.0 to 8.8 msec
Time to 2nd minimum: 85 msec
Radius at 2nd maximum: 367.4 ft

Sponsor: UCRL

SITE: NTS - Area 9b
37° 07' 32" N
116° 07' 51" W
Site elevation: 4,021 ft

HEIGHT OF BURST: 300 ft

TYPE OF BURST AND PLACEMENT:
Tower burst over Nevada soil

CLOUD TOP HEIGHT: 30,000 ft MSL
CLOUD BOTTOM HEIGHT: 18,300 ft MSL

CRATER DATA: No crater

REMARKS:

The on-site fallout pattern was constructed from data resulting from seven different ground surveys performed by the Radiological Safety organization from H+½ hour to D+64 days. AN/PDR-39 instruments were used. Eight radial stake lines along existing roads around ground zero aided the survey teams in locating their position. The off-site fallout pattern was drawn from ground-survey readings taken by the off-site radiological safety organization. The $t^{-1.2}$ decay approximation was used to extrapolate the dose-rate readings to H+1 hour for both on-site and off-site patterns.

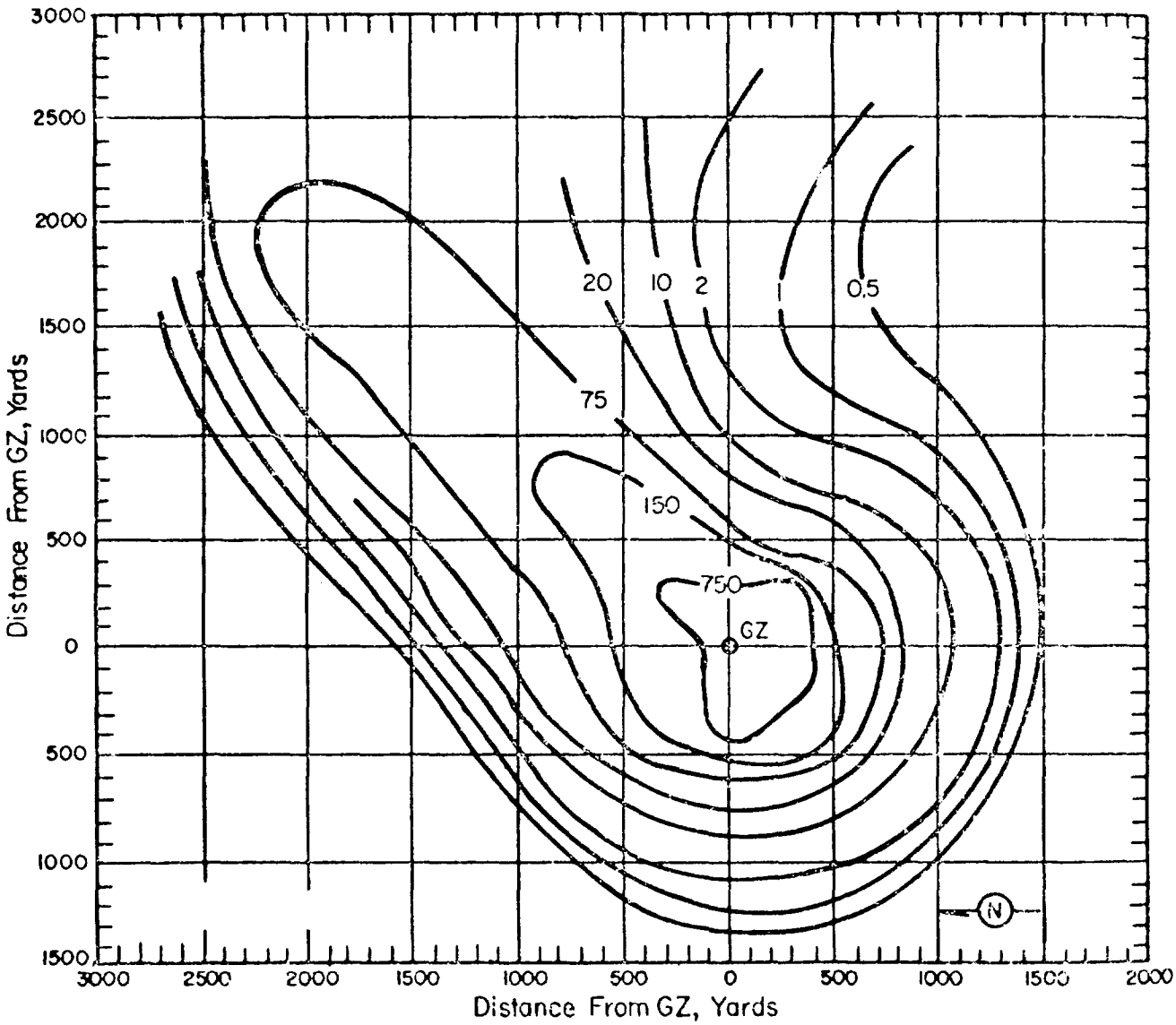


Figure 117. Operation TEAPOT - Tesla. On-site dose rate contours in r/hr at H+1 hour.

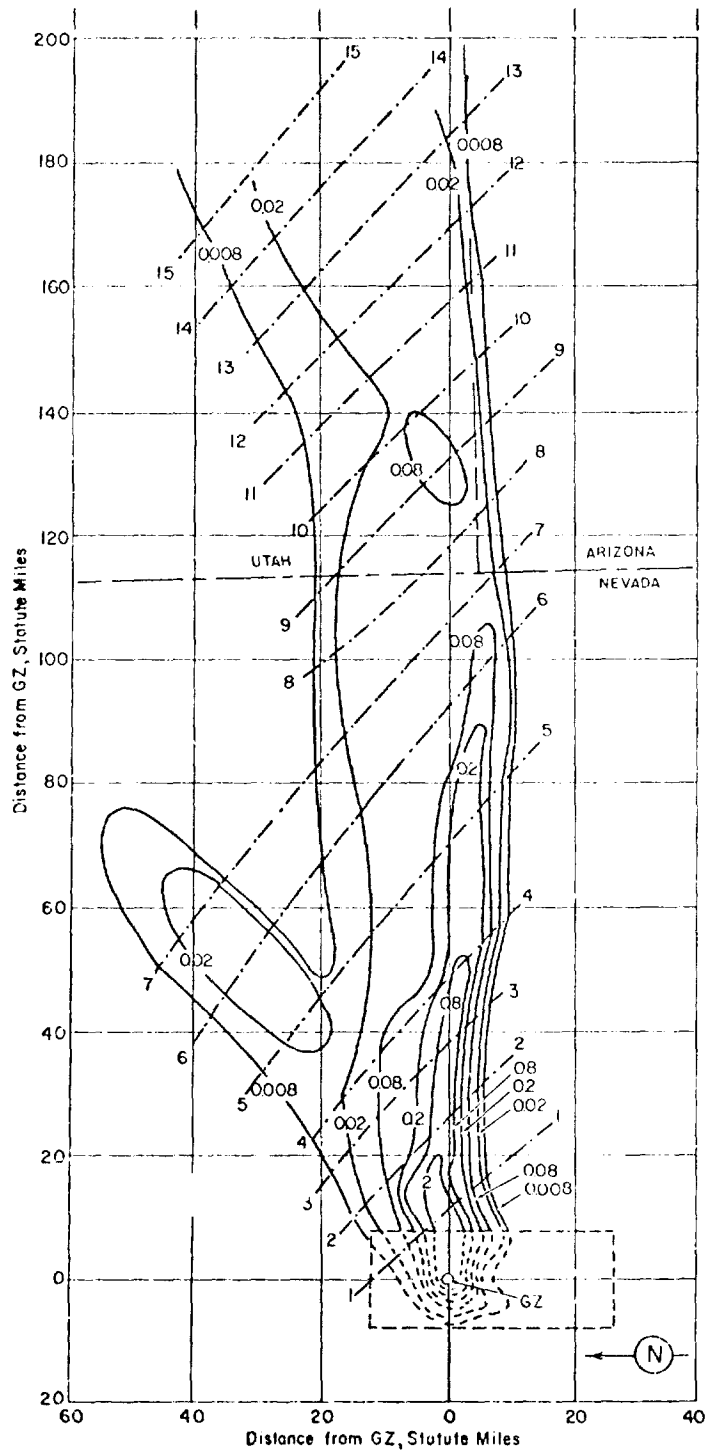


Figure 118. Operation TEAPOT - Tesla.
Off-site dose rate contours in r/hr at H+1 hour.

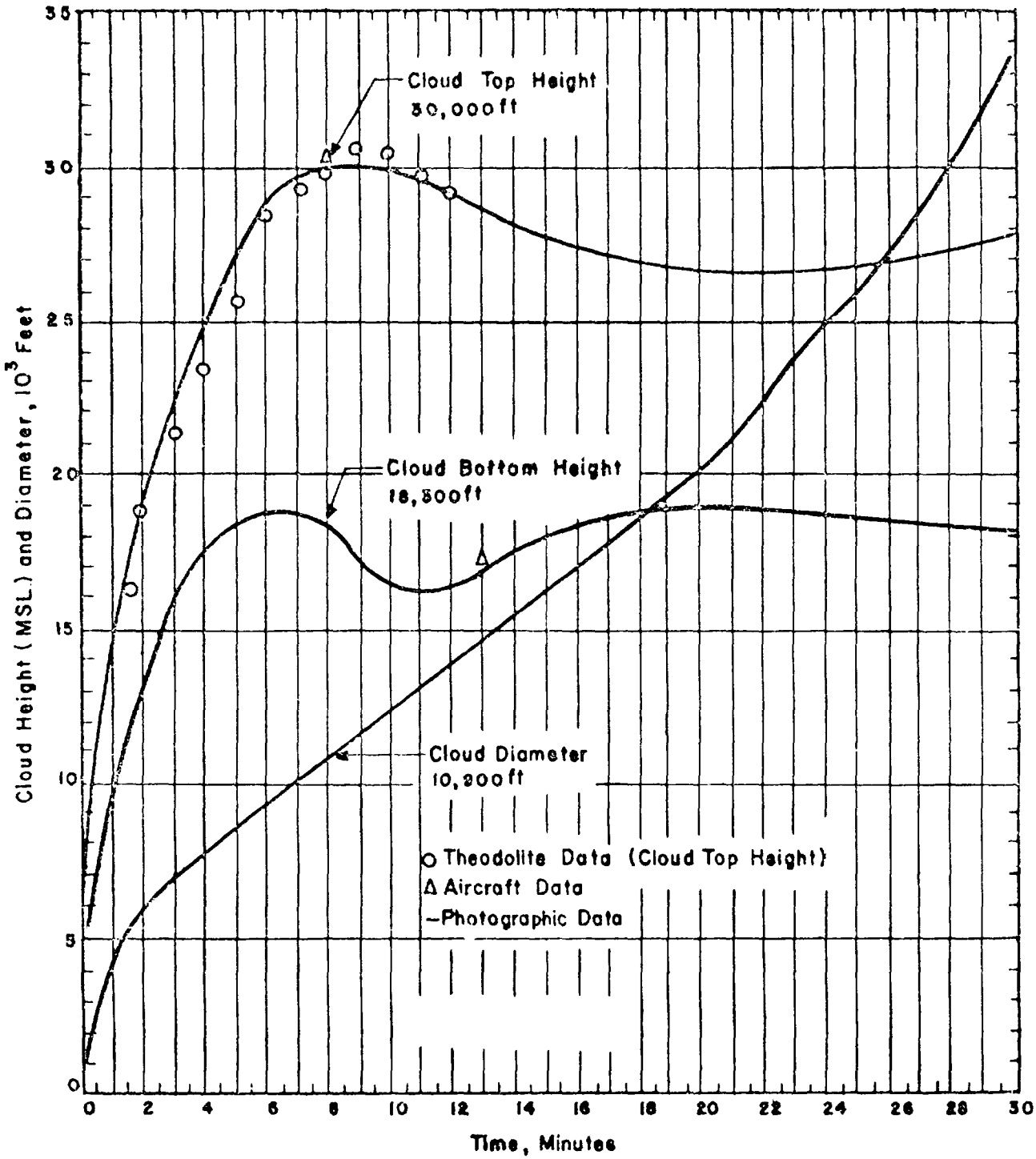


Figure 119. Cloud Dimensions: Operation TEAPOT - Tesla.

TABLE 35 NEVADA WIND DATA FOR OPERATION TEAPOT- TESLA

Altitude (MSL)	H-hour		Altitude (MSL)	H-hour	
	Dir	Speed		Dir	Speed
feet	degrees	mph	feet	degrees	mph
Surface	Calm	Calm	23,000	280	32
5,000	Calm	Calm	24,000	280	33
6,000	Calm	Calm	25,000	270	33
7,000	Calm	Calm	26,000	270	32
8,000	220	12	27,000	270	30
9,000	220	14	28,000	270	30
10,000	230	12	29,000	270	29
11,000	280	12	30,000	280	29
12,000	300	15	31,000	280	29
13,000	290	16	32,000	280	31
14,000	290	16	33,000	280	35
15,000	280	15	34,000	280	35
16,000	270	14	35,000	280	36
17,000	270	17	36,000	270	36
18,000	270	23	37,000	260	40
19,000	280	28	38,000	260	41
20,000	280	30	39,000	260	52
21,000	270	31	40,000	260	58
22,000	270	30			

NOTES:

1. Tropopause height was 38,000 ft MSL.
2. At shot height the temperature was -0.50°C and the pressure 864 mb.

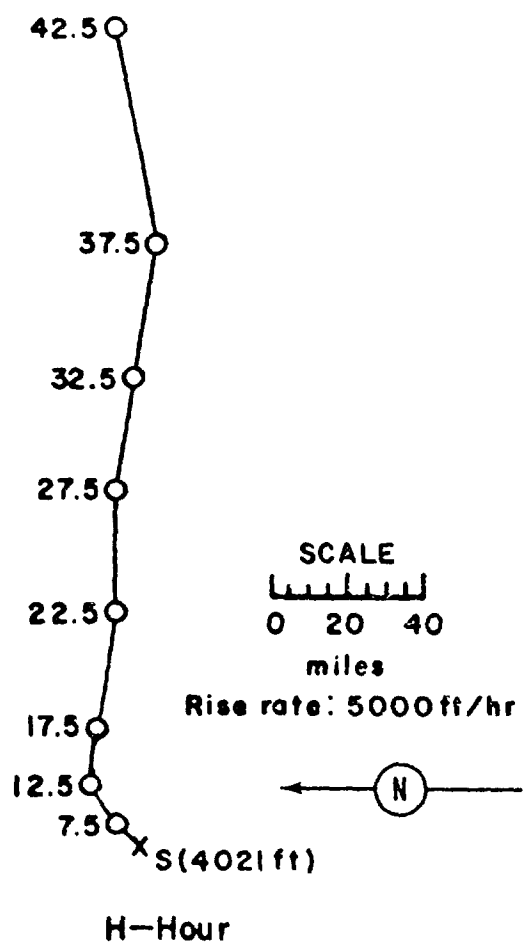


Figure 120. Hodograph for Operation TEAPOT - Tesla.

OPERATION TEAPOT - Turk

	PST	GMT
DATE:	7 Mar 1955	7 Mar 1955
TIME:	0520	1320

TOTAL YIELD: 43 kt

FIREBALL DATA:
Time to 1st minimum: 22 msec
Time to 2nd maximum: 202 msec
Radius at 2nd maximum: NM

Sponsor: UCRL

SITE: NTS - Area 2
37° 08' 18" N
116° 07' 03" W
Site elevation: 4,491 ft

HEIGHT OF BURST: 500 ft

TYPE OF BURST AND PLACEMENT:
Tower burst over Nevada soil

CLOUD TOP HEIGHT: 44,700 ft MSL
CLOUD BOTTOM HEIGHT: 35,100 ft MSL

CRATER DATA: No crater

REMARKS:

The on-site fallout pattern was constructed from data resulting from eight different ground surveys performed by the Rad-Safe organization from H+1½ hour to D+58 days. AN/PDR-39 instruments were used. Eight stake lines (approximately radial) along existing roads around ground zero aided the survey teams in locating their position. The off-site fallout pattern was drawn from ground survey readings taken by the off-site Radiological Safety organization. The $t^{-1.2}$ decay approximation was used to extrapolate the dose-rate readings to H+1 hour for both on-site and off-site patterns. The portion of the pattern East of the test site is primarily residual contamination from Teapot Shots 2 and 3.

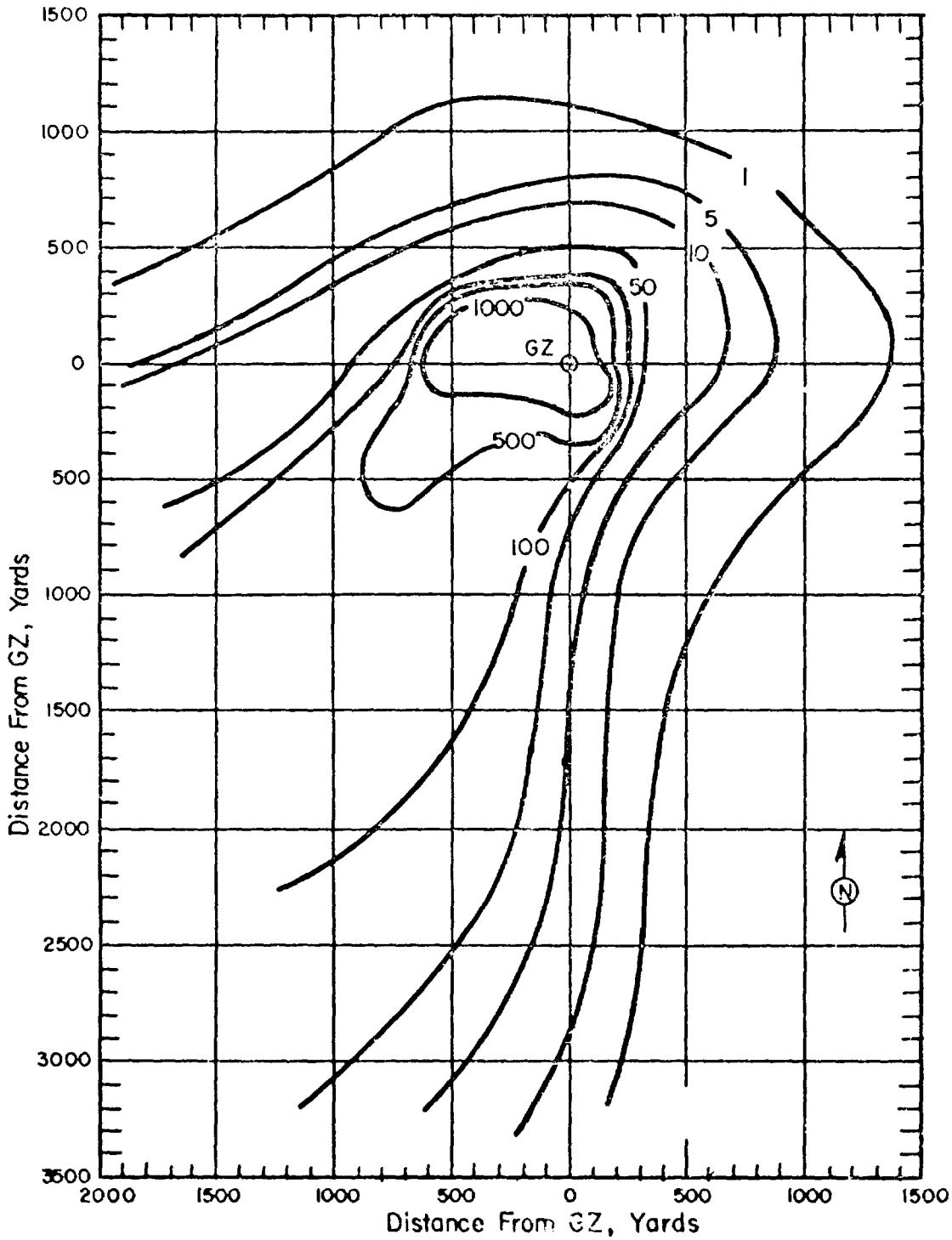


Figure 121. Operation TEAPOT - Turk.
On-site dose rate contours in r/hr at H+1 hour.

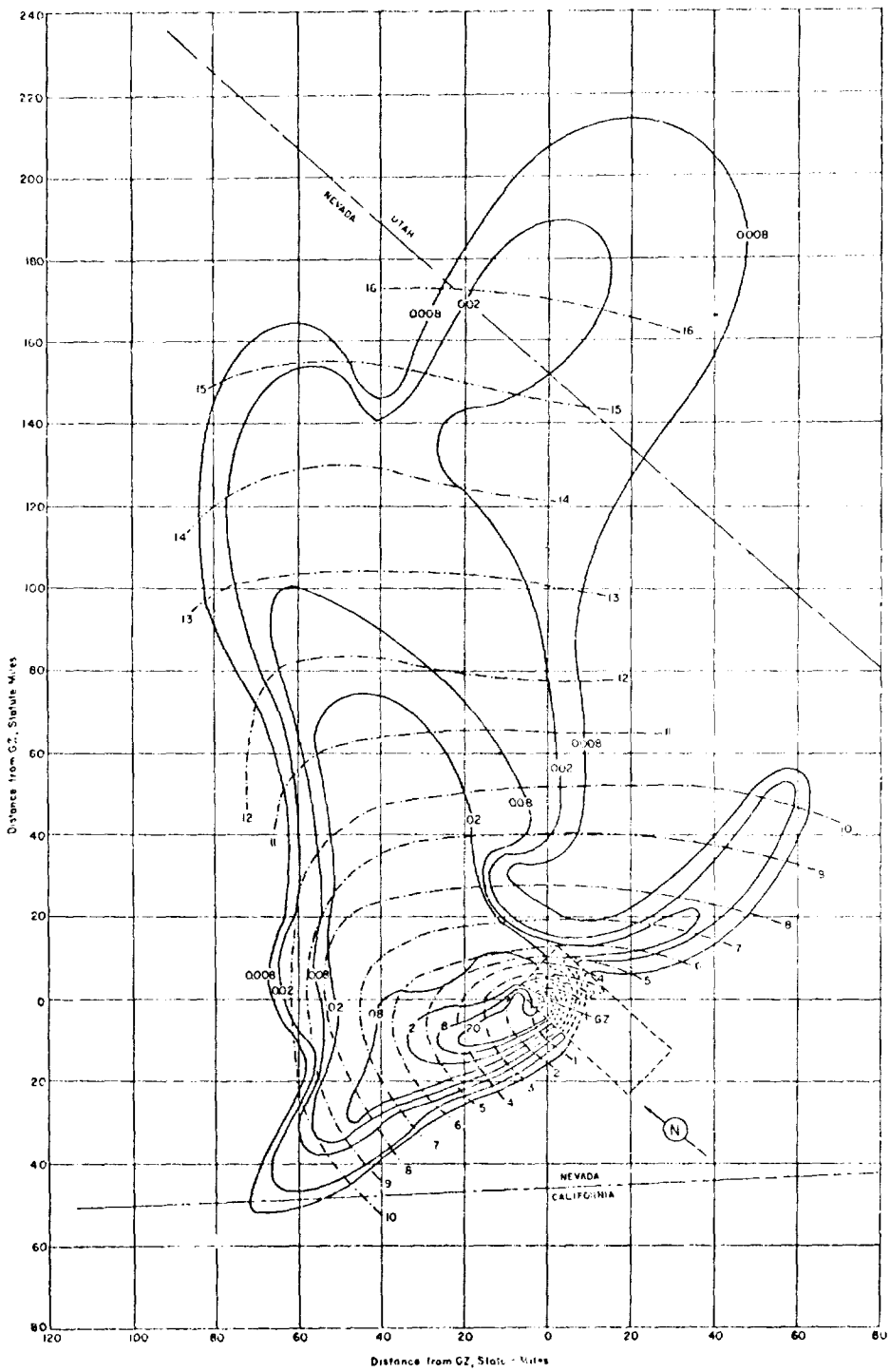


Figure 122. Operation TEAPOT - Turk.
Off-site dose rate contours in r/hr at H+1 hour.

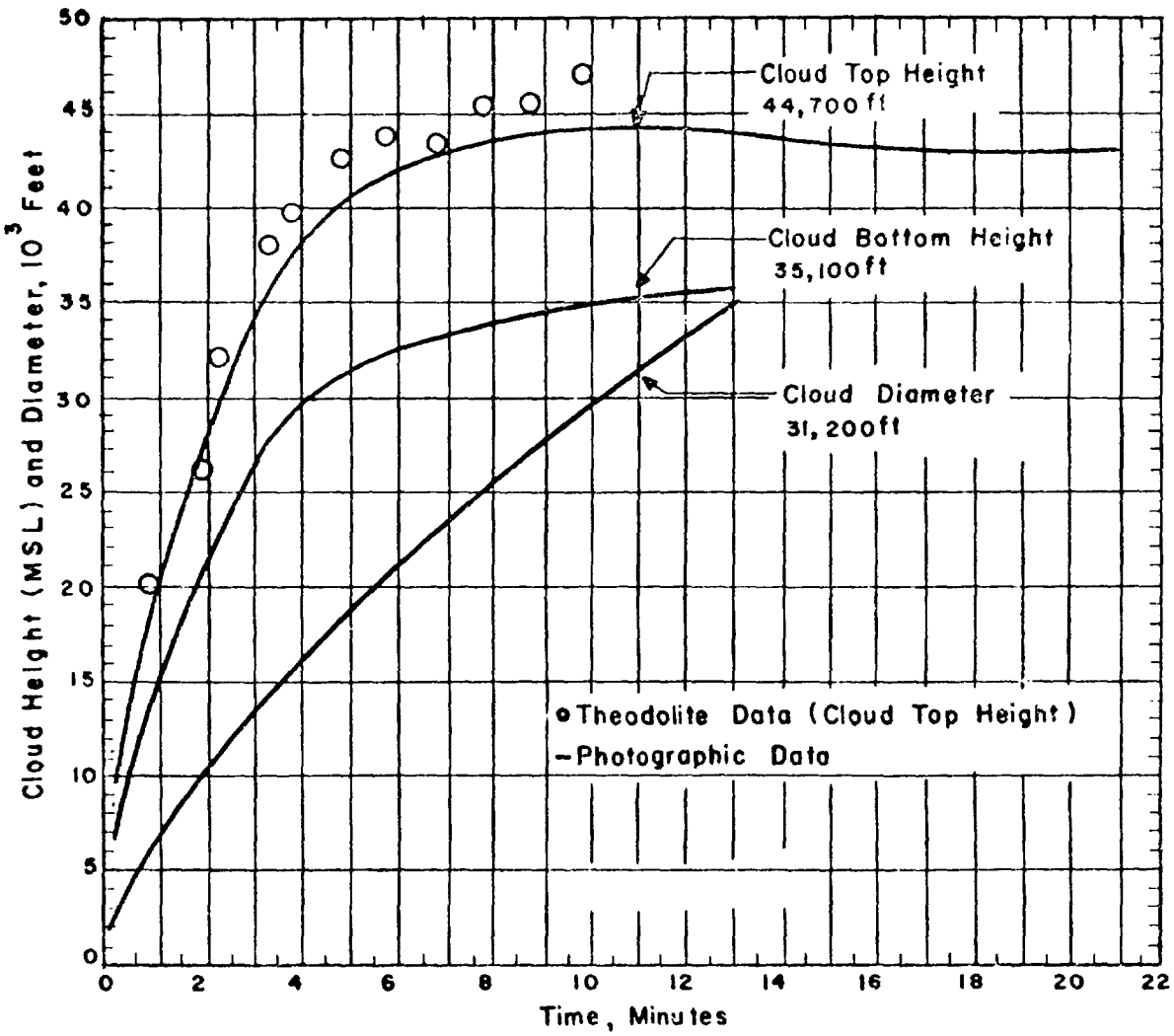


Figure 123. Cloud Dimensions: Operation TEAPOT - Turk.

TABLE 36 NEVADA WIND DATA FOR OPERATION TEAPOT- TUNK

Altitude (MSL)	H-hour		Altitude (MSL)	H-hour	
	Dir	Speed		Dir	Speed
feet	degrees	mph	feet	degrees	mph
Surface	310	12	27,000	110	10
5,000	010	22	28,000	130	10
6,000	030	24	29,000	150	09
7,000	030	23	30,000	150	08
8,000	050	17	31,000	150	06
9,000	030	08	32,000	130	05
10,000	350	02	33,000	260	07
11,000	310	03	34,000	260	10
12,000	130	05	35,000	260	13
13,000	140	06	36,000	270	12
14,000	130	08	37,000	280	12
15,000	140	07	38,000	290	12
16,000	090	06	39,000	270	29
17,000	070	07	40,000	260	18
18,000	070	09	41,000	---	--
19,000	050	15	42,000	Calm	Calm
20,000	050	16	43,000	---	--
21,000	050	12	44,000	270	47
22,000	060	10	45,000	270	54
23,000	070	09	46,000	270	56
24,000	080	08	47,000	270	57
25,000	090	07	48,000	270	62
26,000	100	08	49,000	270	63
			50,000	270	61

NOTES:

1. Tropopause height was 40,000 ft MSL at H-hour.
2. At shot height the temperature was 5.6°C and the pressure 855 mb.

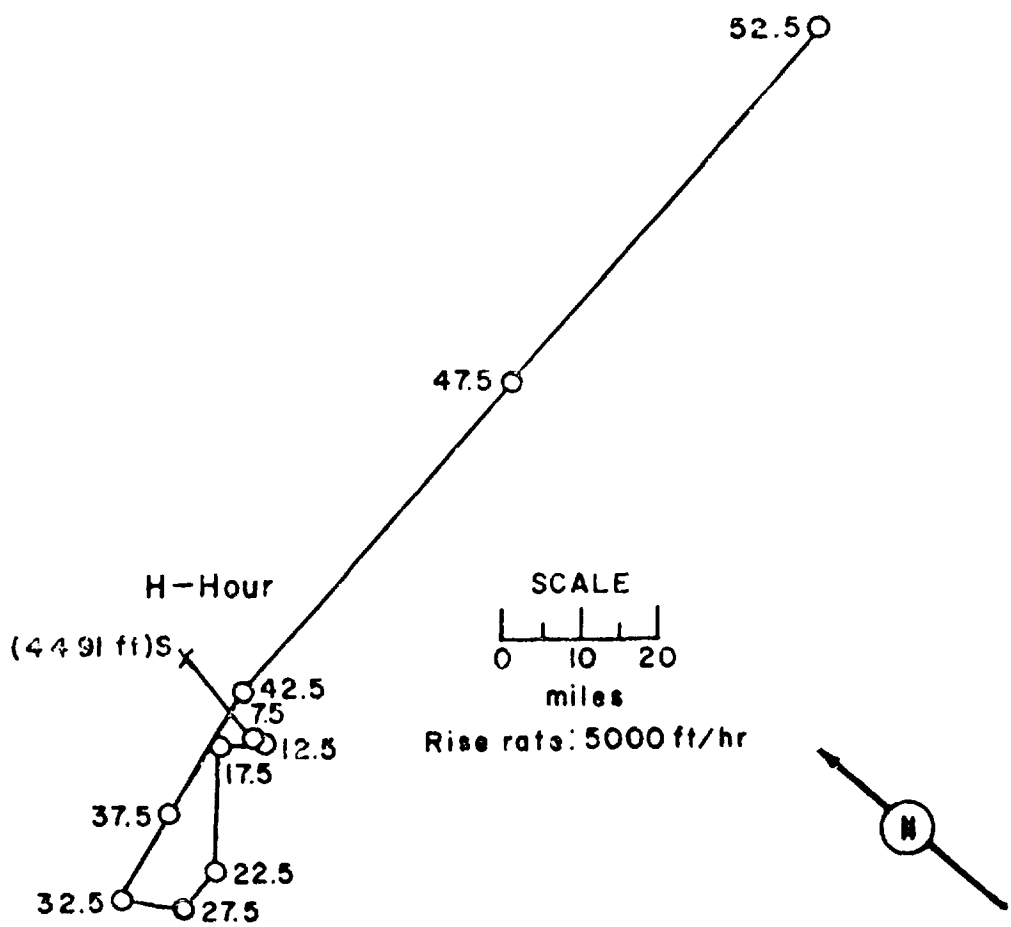


Figure 124. Hodograph for Operation TEAPOT - Turk

OPERATION TEAPOT - Hornet

	PST	GMT
DATE:	12 Mar 1955	12 Mar 1955
TIME:	0520	1320

TOTAL YIELD: 4 kt

FIREBALL DATA:
Time to 1st minimum: 5.5 to 6.6 msec
Time to 2nd maximum: 66 to 71 msec
Radius at 2nd maximum: NM

Sponsor: LASL

SITE: NTS - Area 3a
37° 02' 25" N
116° 01' 31" W
Site elevation: 4,007 ft

HEIGHT OF BURST: 300 ft

TYPE OF BURST AND PLACEMENT:
Tower burst over Nevada soil

CLOUD TOP HEIGHT: 37,000 ft MSL
CLOUD BOTTOM HEIGHT: 27,800 ft MSL

CRATER DATA: No crater

REMARKS:

The on-site fallout pattern was constructed from data resulting from seven different ground surveys performed by the Rad-Safe organization from H+½ hour to D+53 days. AN/PDR-39 instruments were used. Eight stake lines (approximately radial) along existing roads around ground zero aided the survey teams in locating their position; many individual readings off the roads were also utilized in drawing the patterns for this shot.

The off-site fallout pattern was drawn from ground-survey readings taken by the off-site Radiological Safety organization. The $t^{-1.2}$ decay approximation was used to extrapolate the dose-rate readings to H+1 hour for both on-site and off-site patterns.

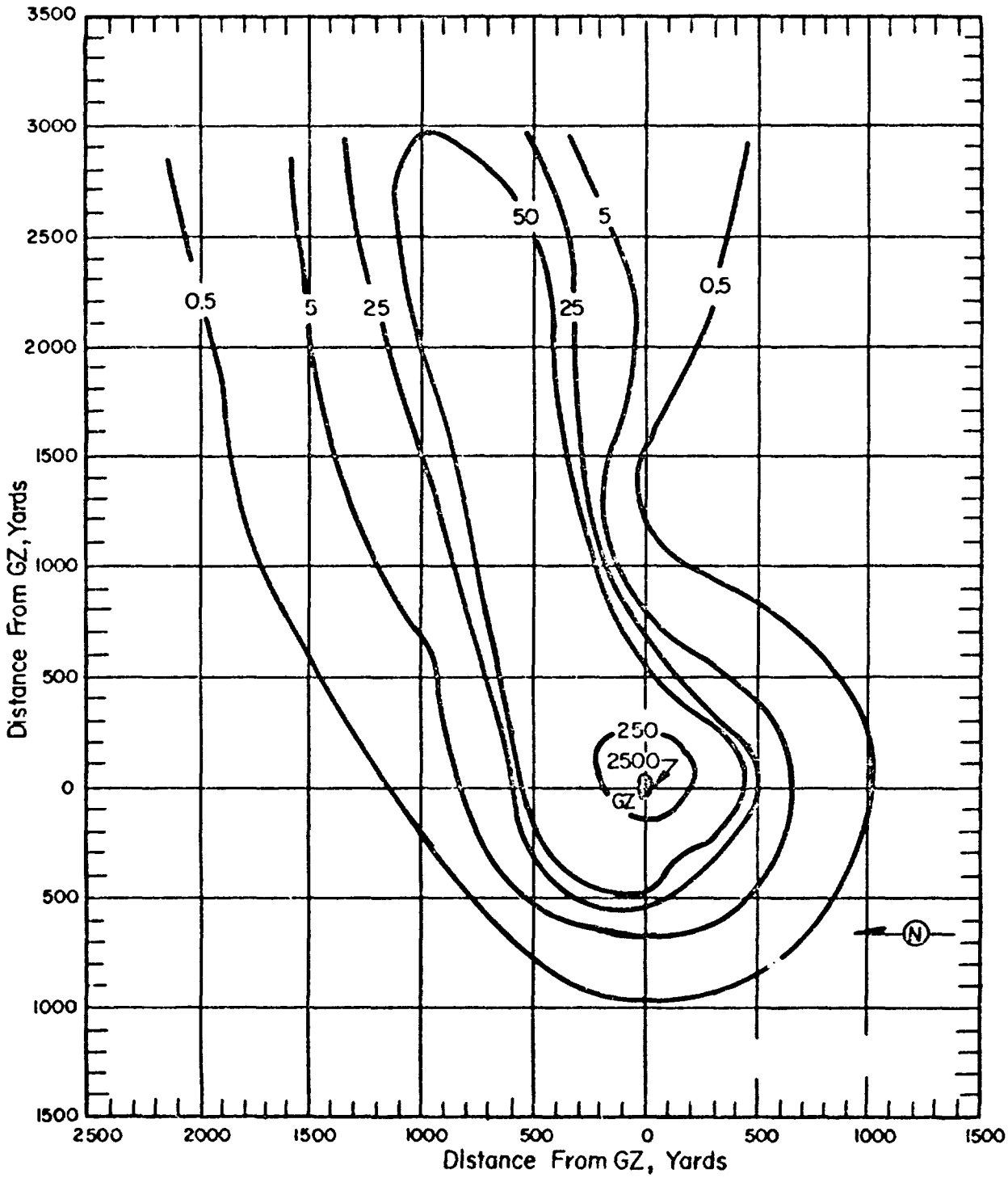


Figure 125. Operation TEAPOT - Hornet. On-site dose rate contours in r/hr at H+1 hour.

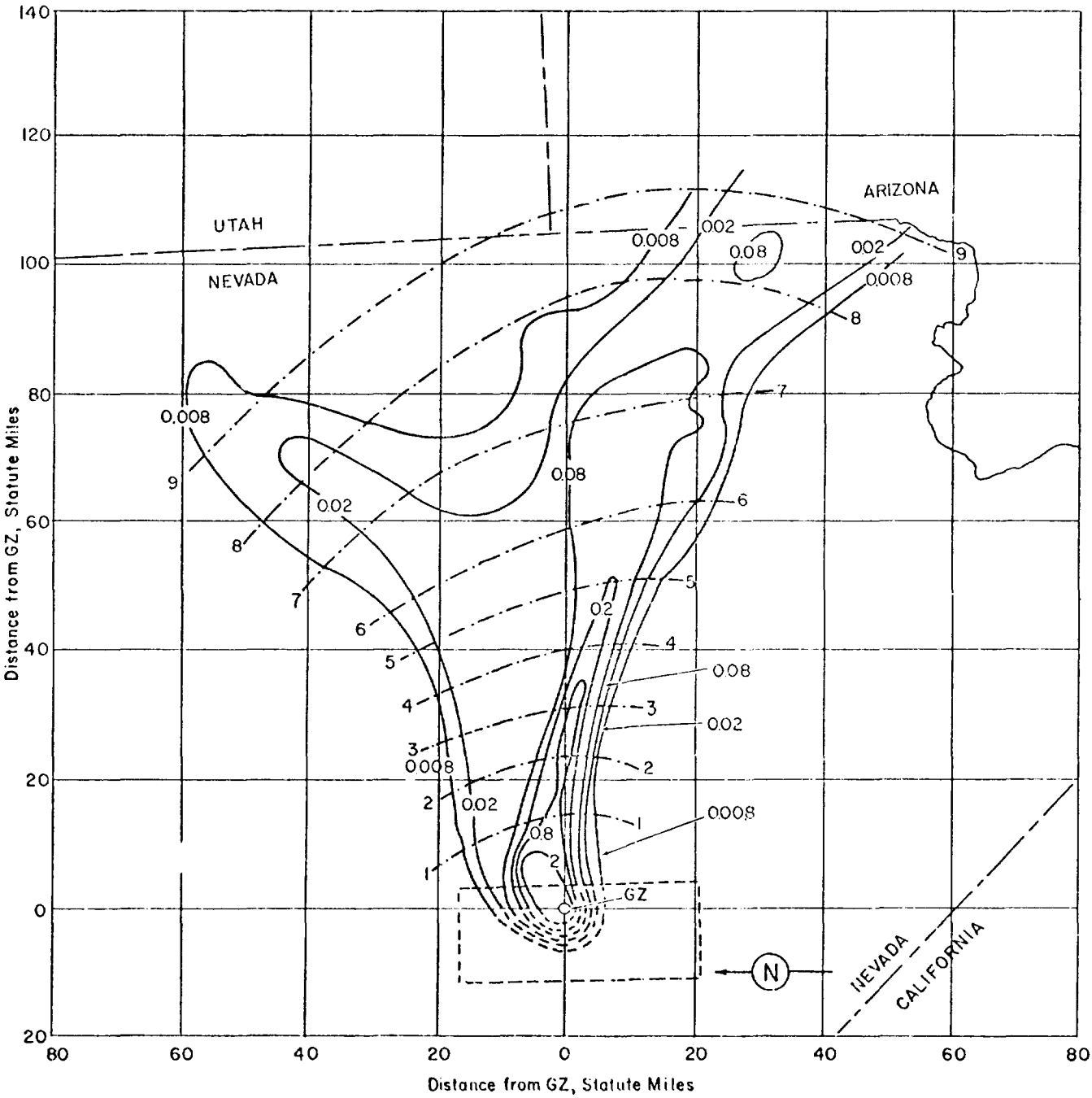


Figure 126. Operation TEAPOT - Hornet. Off-site dose rate contours in r/hr at H+1 hour.

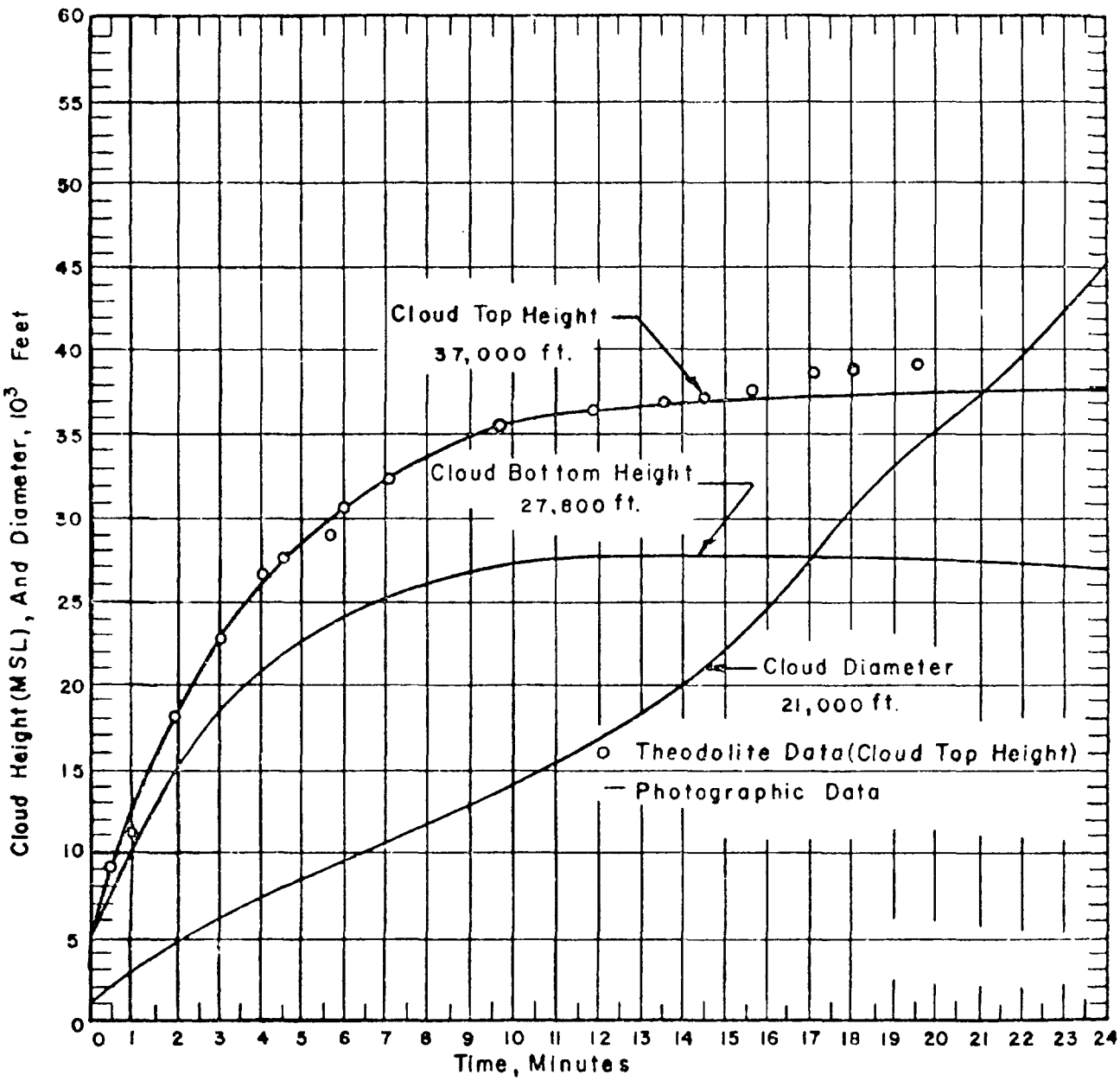


Figure 127. Cloud Dimensions: Operation TEAPOT - Hornet.

TABLE 37 NEVADA WIND DATA FOR OPERATION TEAPOT- HORNET

Altitude (MSL)	H-hour Dir	H-hour Speed	Altitude (MSL)	H-hour Dir	H-hour Speed
feet	degrees	mph	feet	degrees	mph
Surface	220	01	27,000	290	39
5,000	220	07	28,000	290	40
6,000	220	12	29,000	290	40
7,000	230	08	30,000	290	40
8,000	260	07	31,000	290	40
9,000	260	07	32,000	280	40
10,000	260	07	33,000	280	43
11,000	260	08	34,000	280	46
12,000	270	12	35,000	280	48
13,000	300	12	36,000	280	48
14,000	300	12	37,000	270	51
15,000	280	17	38,000	270	53
16,000	280	20	39,000	270	56
17,000	290	18	40,000	270	61
18,000	300	20	41,000	270	60
19,000	300	25	42,000	270	59
20,000	300	28	43,000	260	53
21,000	290	30	44,000	250	51
22,000	290	33	45,000	250	52
23,000	280	33	46,000	260	58
24,000	280	31	47,000	260	59
25,000	280	31	48,000	260	58
26,000	280	36	49,000	260	58
			50,000	260	51

NOTES:

1. Tropopause height was 38,000 ft MSL.
2. At shot height the temperature was 2.0°C and the pressure 874 mb.

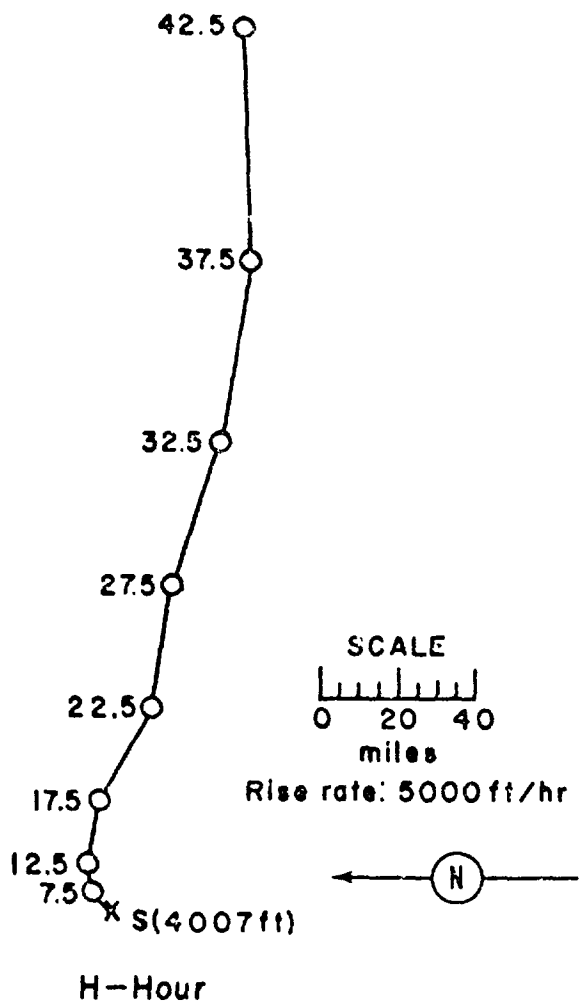


Figure 128. Hodograph for Operation TEAPOT- Hornet.

OPERATION TEAPOT - Ree

	PST	GMT
DATE:	22 Mar 1955	22 Mar 1955
TIME:	0505	1305

TOTAL YIELD: 8 kt

FIREBALL DATA:

Time to 1st minimum: 7.0 to 9 msec
Time to 2nd maximum: 101 msec
Radius at 2nd maximum: 410 ft

Sponsor: LASL

SITE: NTS - Area 7-1a
37° 05' 41" N
116° 01' 26" W
Site elevation: 4,245 ft

HEIGHT OF BURST: 500 ft

TYPE OF BURST AND PLACEMENT:
Tower burst over Nevada soil

CLOUD TOP HEIGHT: 39,700 ft MSL
CLOUD BOTTOM HEIGHT: 29,500 ft MSL

CRATER DATA: No crater

REMARKS:

The on-site pattern was constructed from data resulting from four different ground surveys performed by the Radiological Safety organization from H+½ hour to D+6 days. AN/PDR-39 instruments were used. Seven stake lines (approximately radial) along existing roads around ground zero aided the survey teams in locating their position. The off-site fallout pattern was drawn from ground-survey readings taken by the off-site Radiological Safety organization. The $t^{-1.2}$ decay approximation was used to extrapolate the dose-rate readings to H+1 hour for both on-site and off-site patterns.

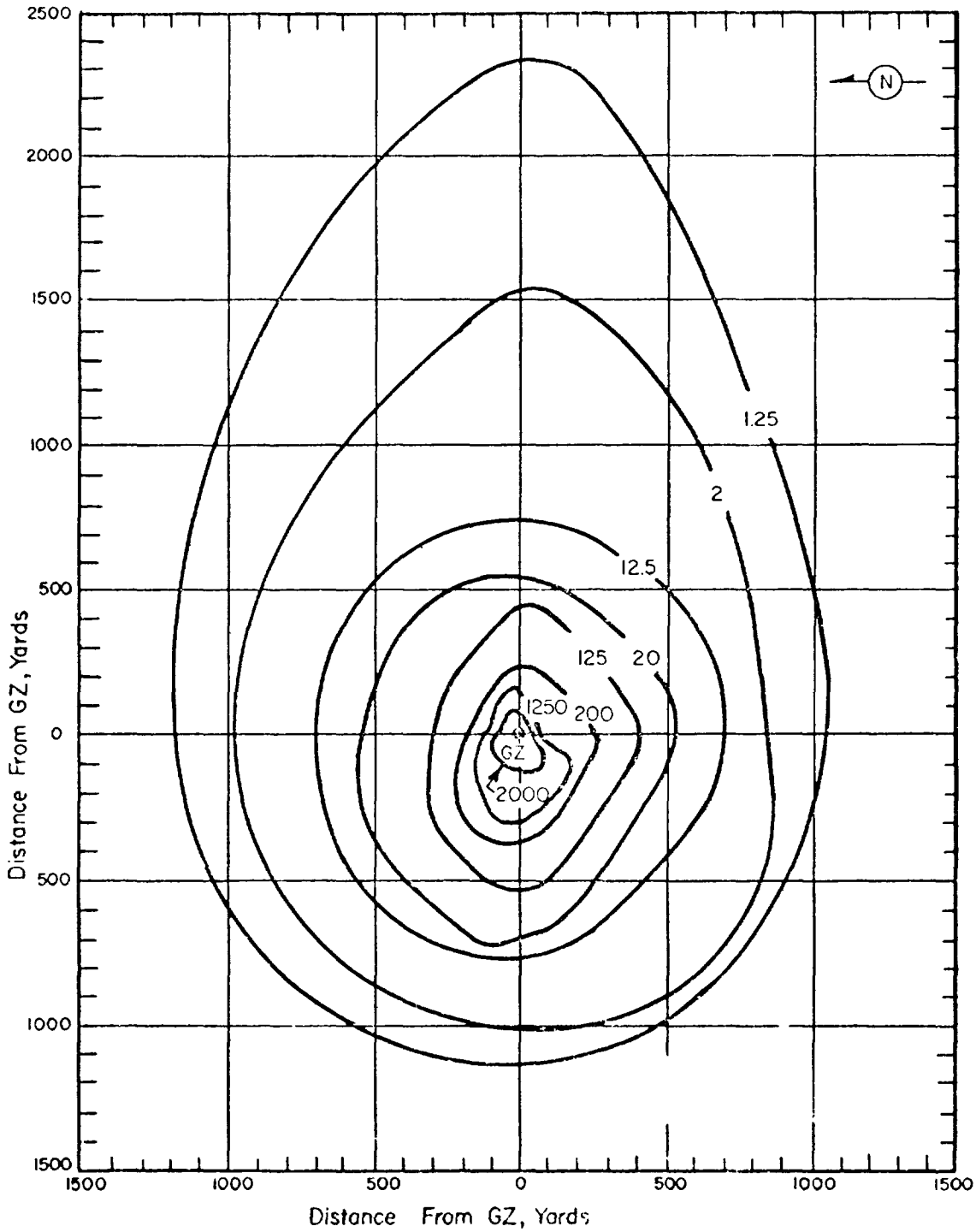


Figure 129. Operation TEAPOT - Bee. On-site dose rate contours in r/hr at H+1 hour.

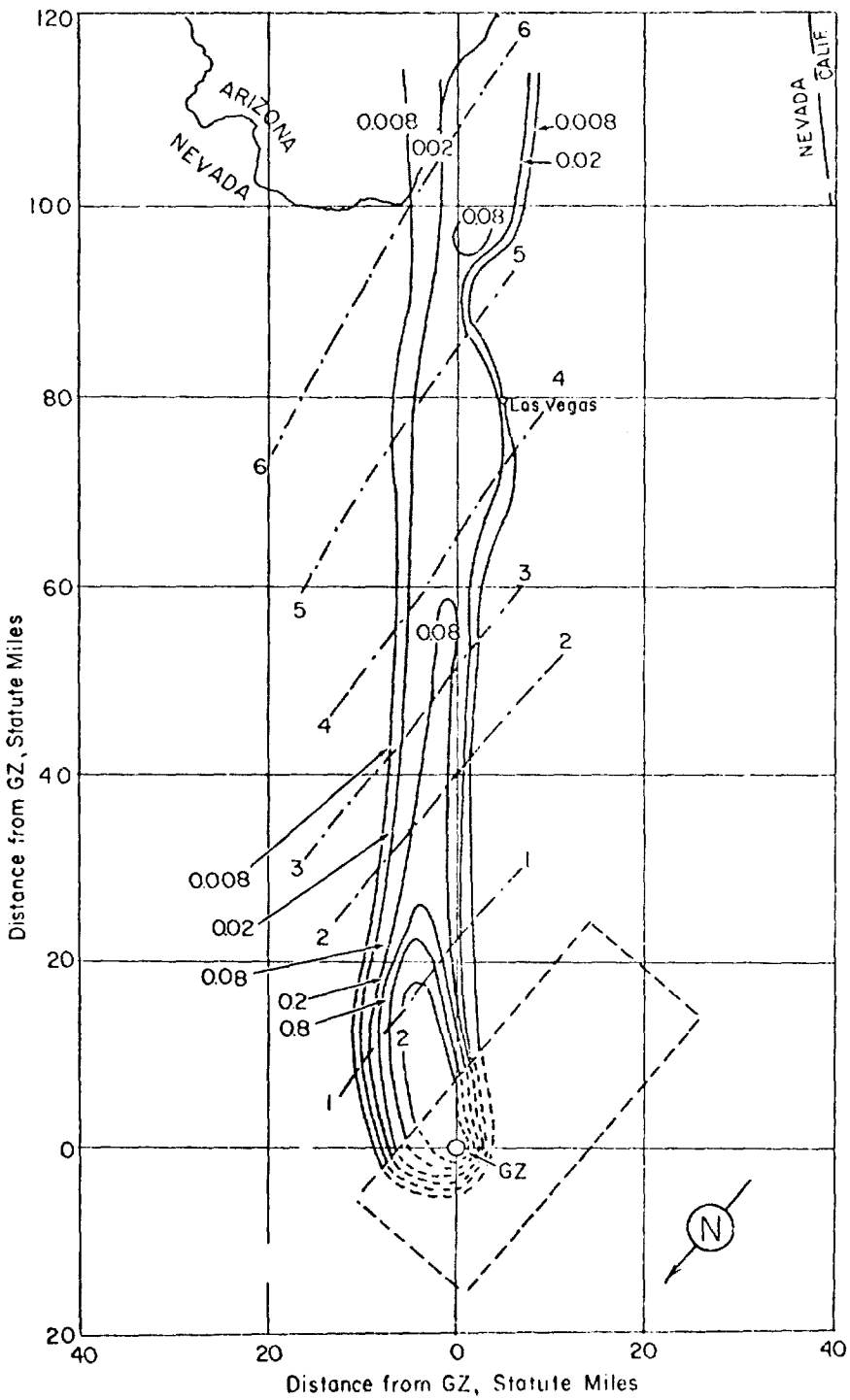


Figure 130. Operation TEAPOT - Bee. Off-site dose rate contours in r/hr at H+1 hour.

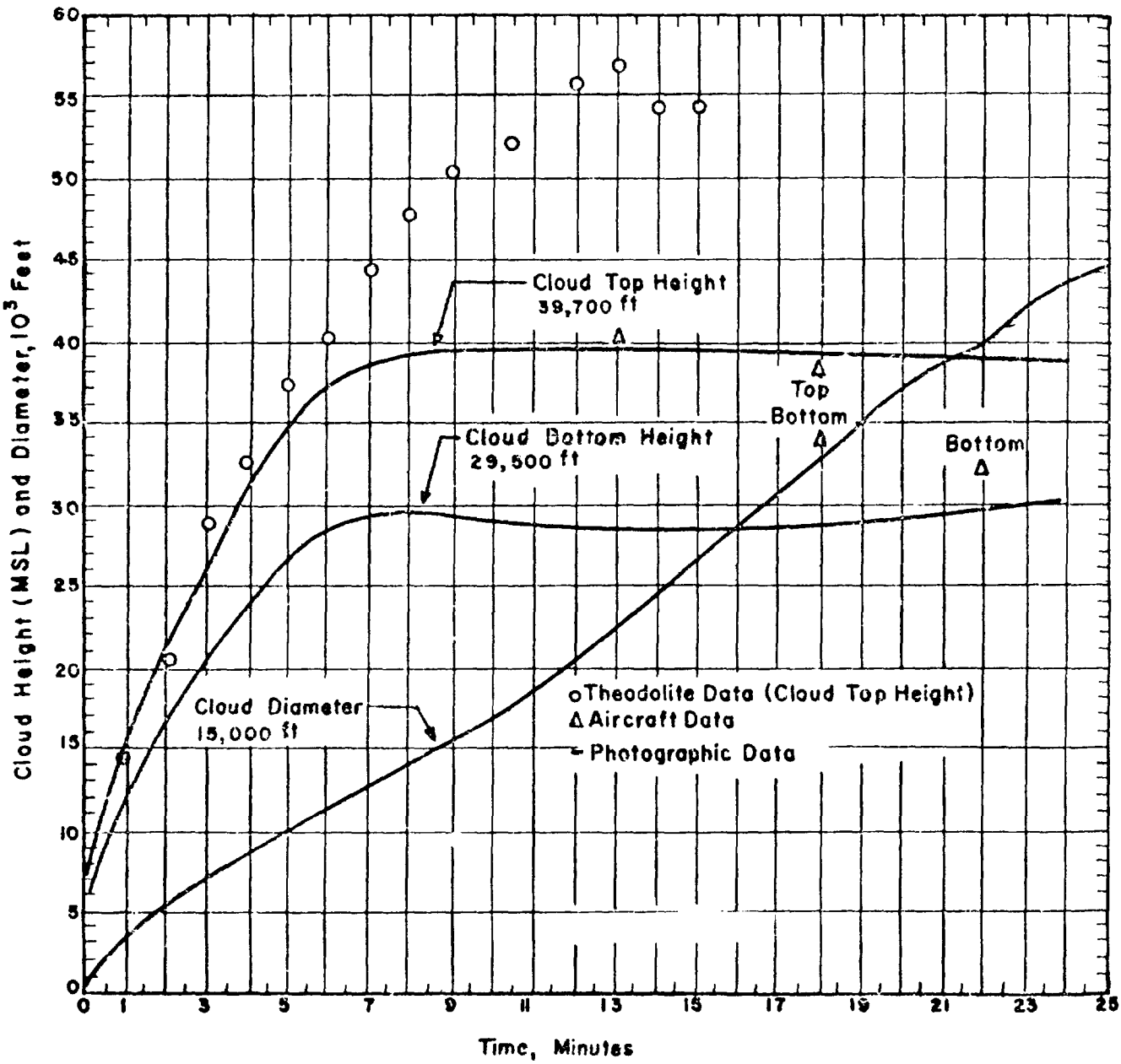


Figure 131. Cloud Dimensions: Operation TEAPOT - Bee.

TABLE 38 NEVADA WIND DATA FOR OPERATION TEAPOT- BEE

Altitude (MSL)	H-hour Dir	H-hour Speed	Altitude (MSL)	H-hour Dir	H-hour Speed
feet	degrees	mph	feet	degrees	mph
Surface	Calm	Calm	27,000	320	48
5,000	260	02	28,000	320	48
6,000	260	07	29,000	320	48
7,000	260	09	30,000	320	48
8,000	260	09	31,000	320	48
9,000	280	15	32,000	320	48
10,000	300	21	33,000	320	47
11,000	310	22	34,000	310	47
12,000	320	29	35,000	310	47
13,000	320	31	36,000	300	48
14,000	330	33	37,000	300	49
15,000	330	36	38,000	300	49
16,000	320	38	39,000	300	48
17,000	320	39	40,000	300	45
18,000	320	44	41,000	300	45
19,000	320	47	42,000	300	45
20,000	320	49	43,000	290	45
21,000	320	45	44,000	290	45
22,000	320	45	45,000	280	45
23,000	320	45	46,000	280	45
24,000	320	45	47,000	280	51
25,000	320	45	48,000	280	53
26,000	320	47			

NOTES:

1. Tropopause height was 36,500 ft MSL at H-hour.
2. At shot height the temperature was 4.5°C and the pressure 860 mb.

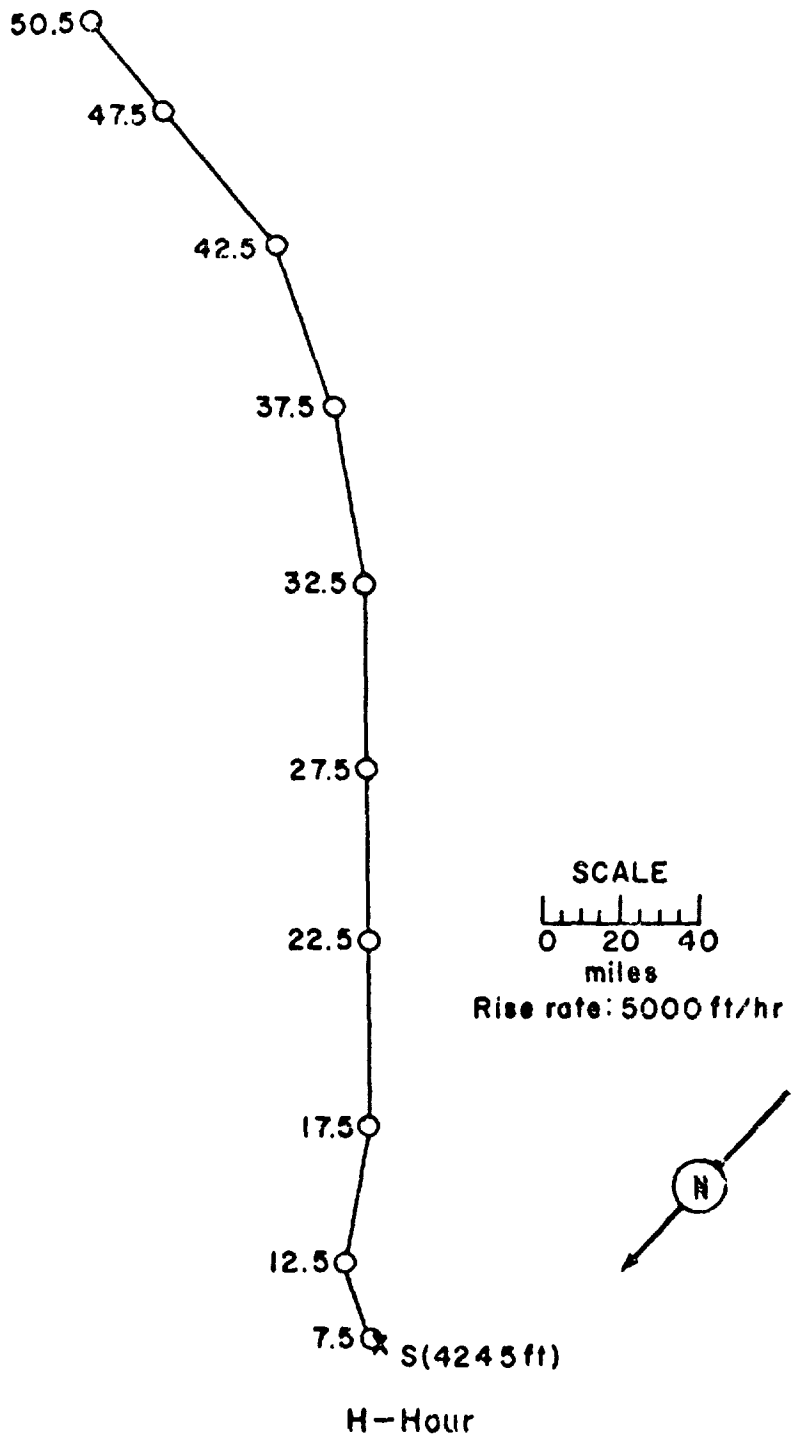


Figure 132 . Hodograph for Operation TEAPOT - Bee.

OPERATION TEAPOT - Ess

	PST	GMT
DATE:	23 Mar 1955	23 Mar 1955
TIME:	1230	2030

TOTAL YIELD: 1 kt

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

CRATER DATA: Diameter: 292 ft
Depth: 96 ft
Maximum Dose Rate: 6000 r/hr at H+1 hour at crater lip (extrapolated from readings taken at H+2 hours)

Sponsor: DOD-LASL

SITE: NTS - Area T-10a
37° 10' 06" N
116° 02' 38" W
Site elevation: 4,288 ft

TYPE OF BURST AND PLACEMENT:
Subsurface burst in filled shaft

HEIGHT OF BURST: -67 ft

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

REMARKS:

The close-in and on-site fallout patterns were constructed from extensive and detailed ground and aerial survey readings of scientific projects and are considered to be accurate.

The off-site fallout pattern was drawn from ground-survey readings taken by the off-site Radiological Safety organization. The $t^{-1.2}$ decay approximation was used to extrapolate the dose-rate readings to H+1 hour for both on-site and off-site patterns. Some residual contamination from Shot 6 - Bee is included in the readings.

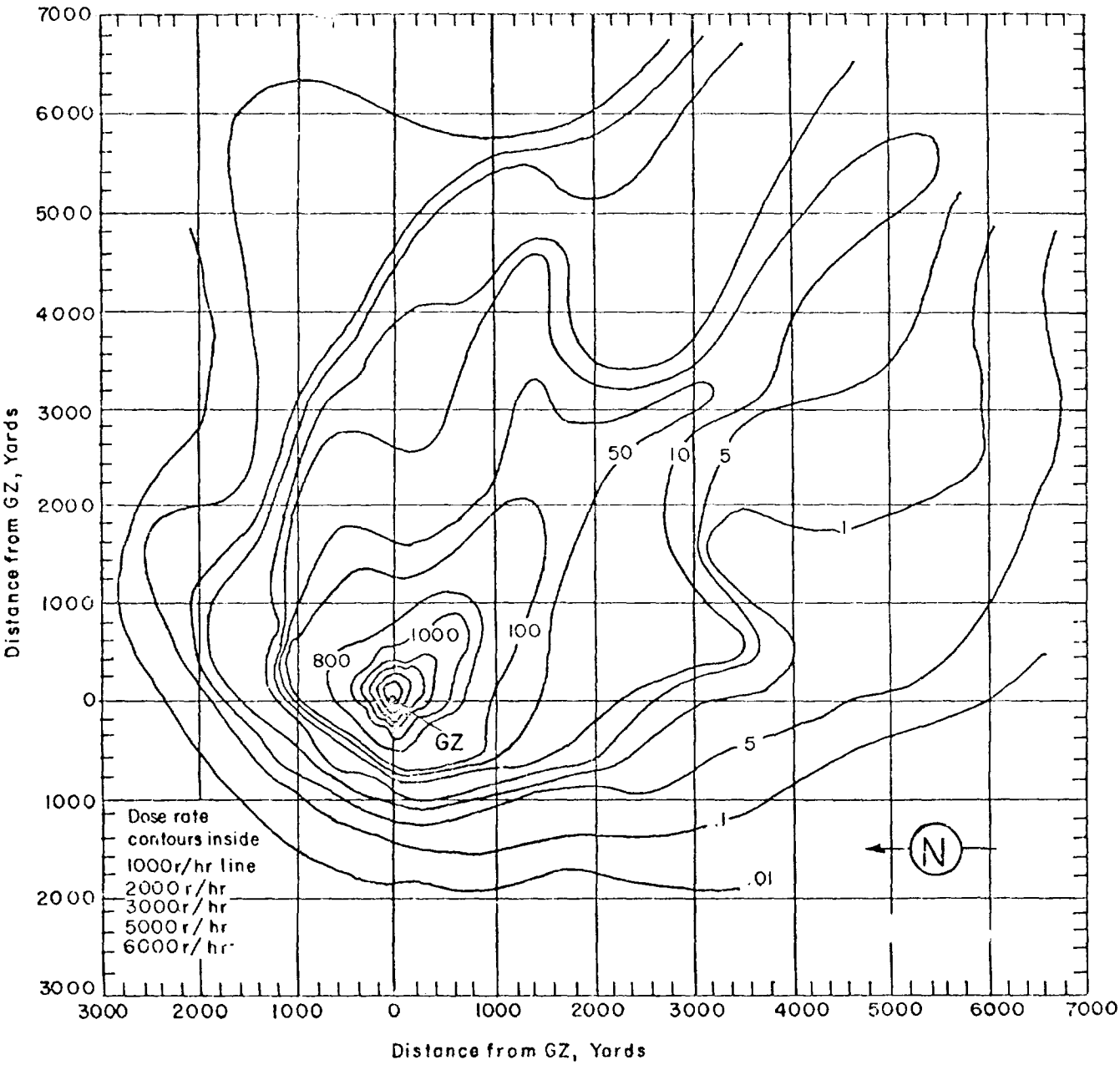


Figure 133. Operation TEAPOT - Ess.
Close-in dose rate contours in r/hr at H+1 hour.

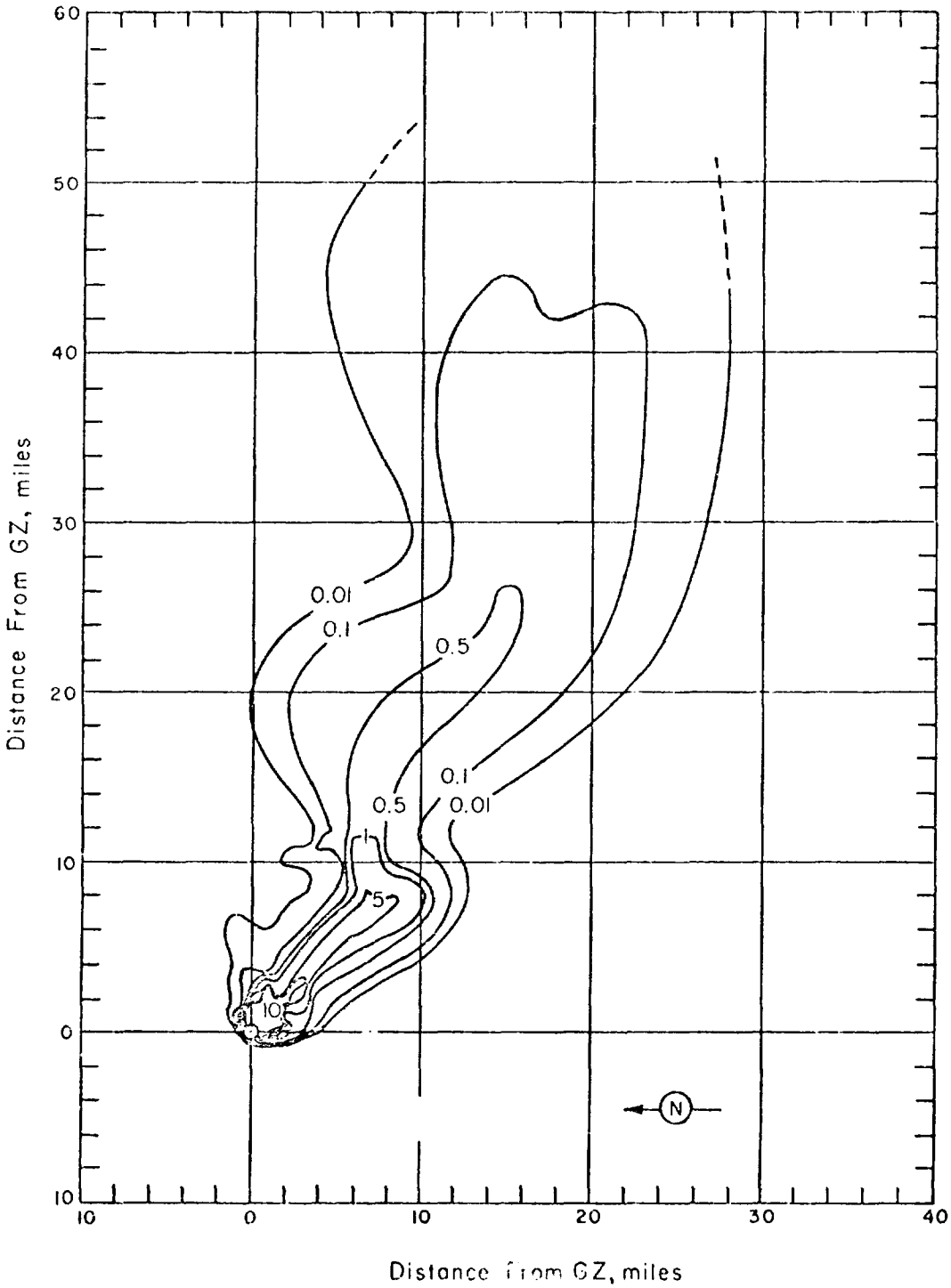


Figure 134. Operation TEAPOT - Ess.
On-site dose rate contours in r/hr at H+1 hour.

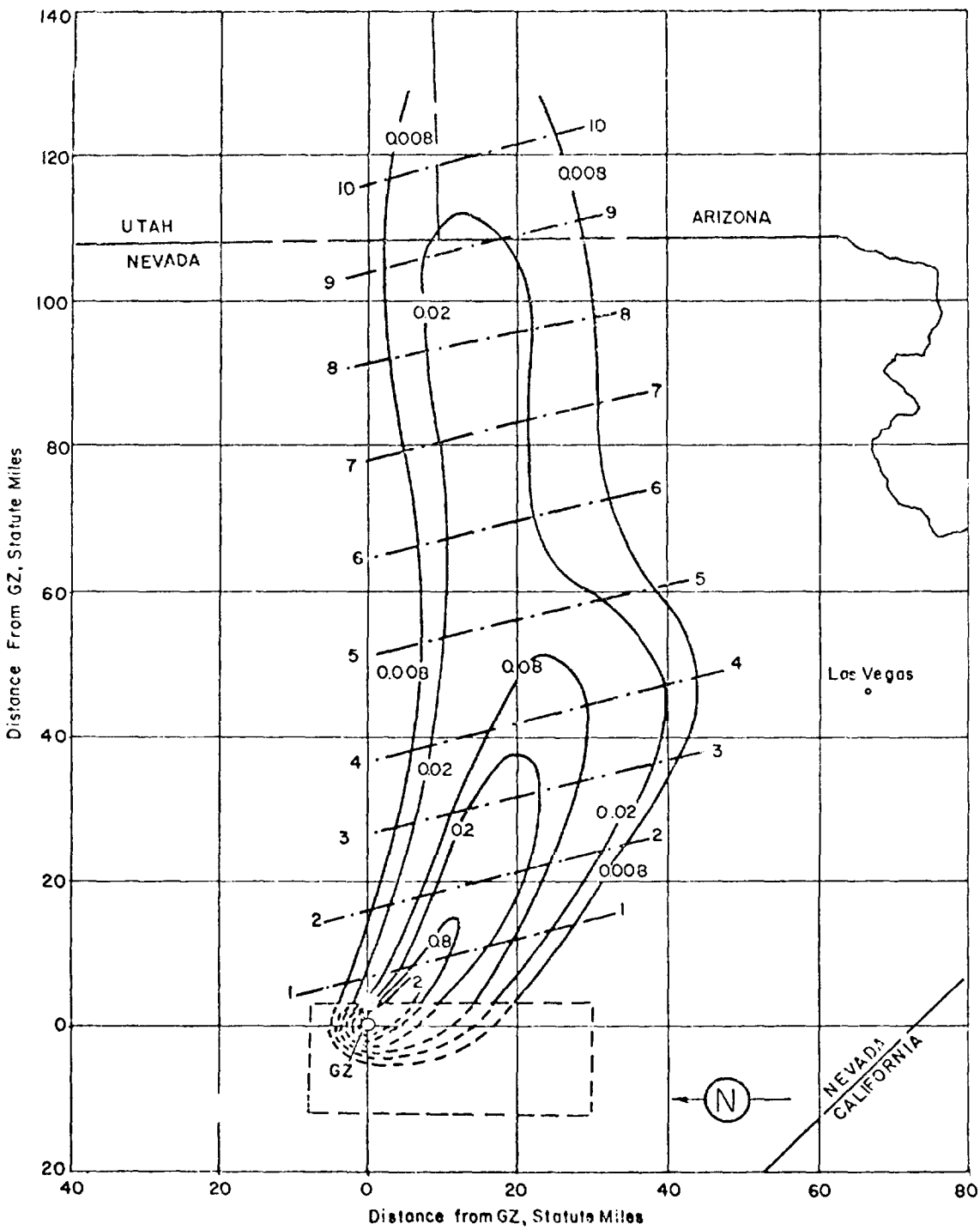


Figure 135. Operation TEAPOT - Ess.
Off-site dose rate contours in r/hr at H+1 hour.

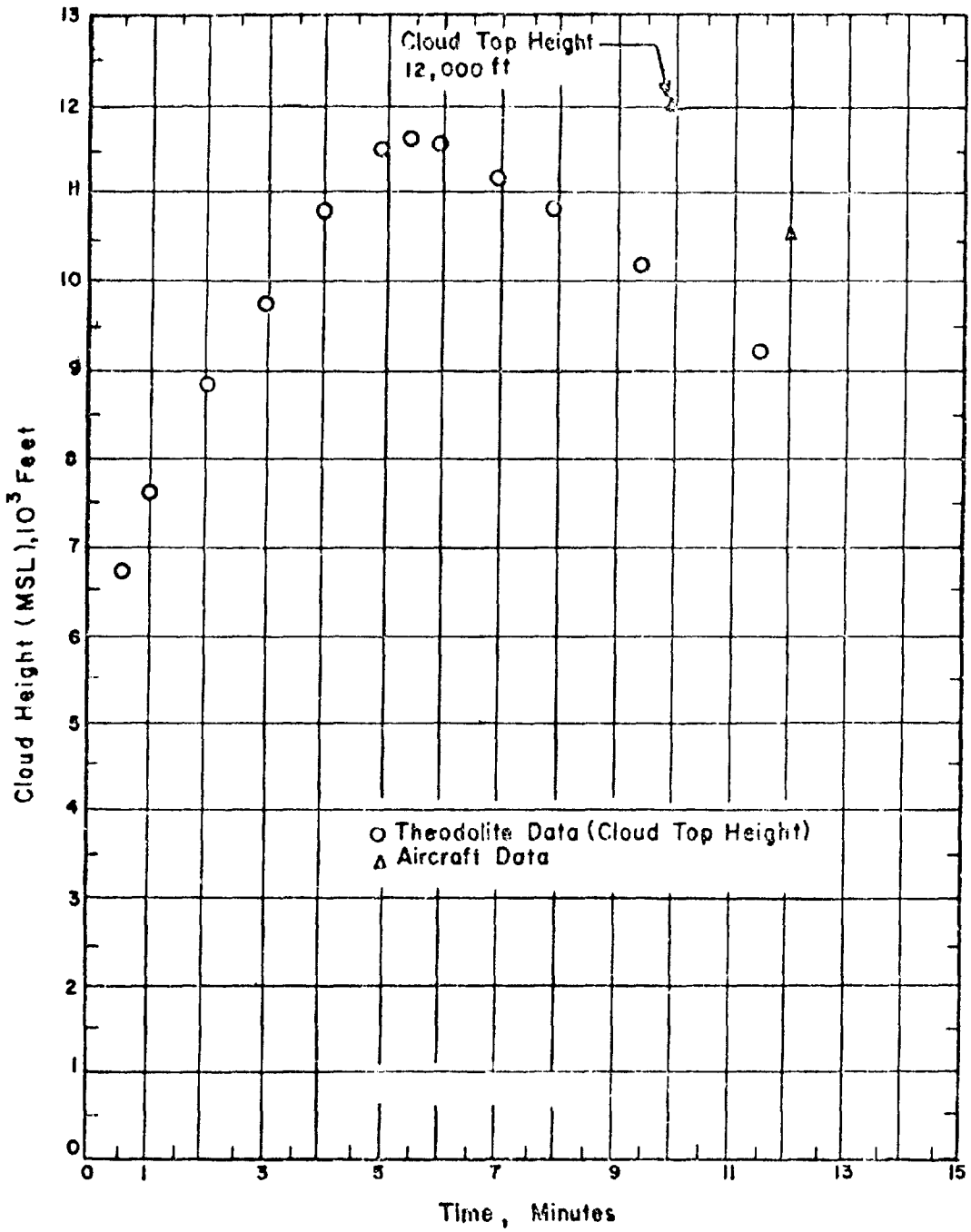


Figure 136. Cloud Dimensions: Operation TEAPOT - Ess.

TABLE 39 NEVADA WIND DATA FOR OPERATION TEAPOT-ESS

Altitude (MSL)	H-hour	
	Dir	Speed
feet	degrees	mph
Surface	310	12
5,000	310	14
6,000	310	17
7,000	320	17
8,000	320	18
9,000	330	23
10,000	340	29
11,000	350	26
12,000	360	29
13,000	340	26
14,000	330	29
15,000	330	36
16,000	310	39
17,000	300	40
18,000	290	41
19,000	290	40
20,000	290	43
21,000	290	43
22,000	290	46
23,000	290	50
24,000	290	55
25,000	290	54
30,000	290	66
35,000	300	59

NOTES:

1. Tropopause height was 39,000 ft MSL.
2. At the surface the temperature was 18.0°C and the pressure 883 mb.

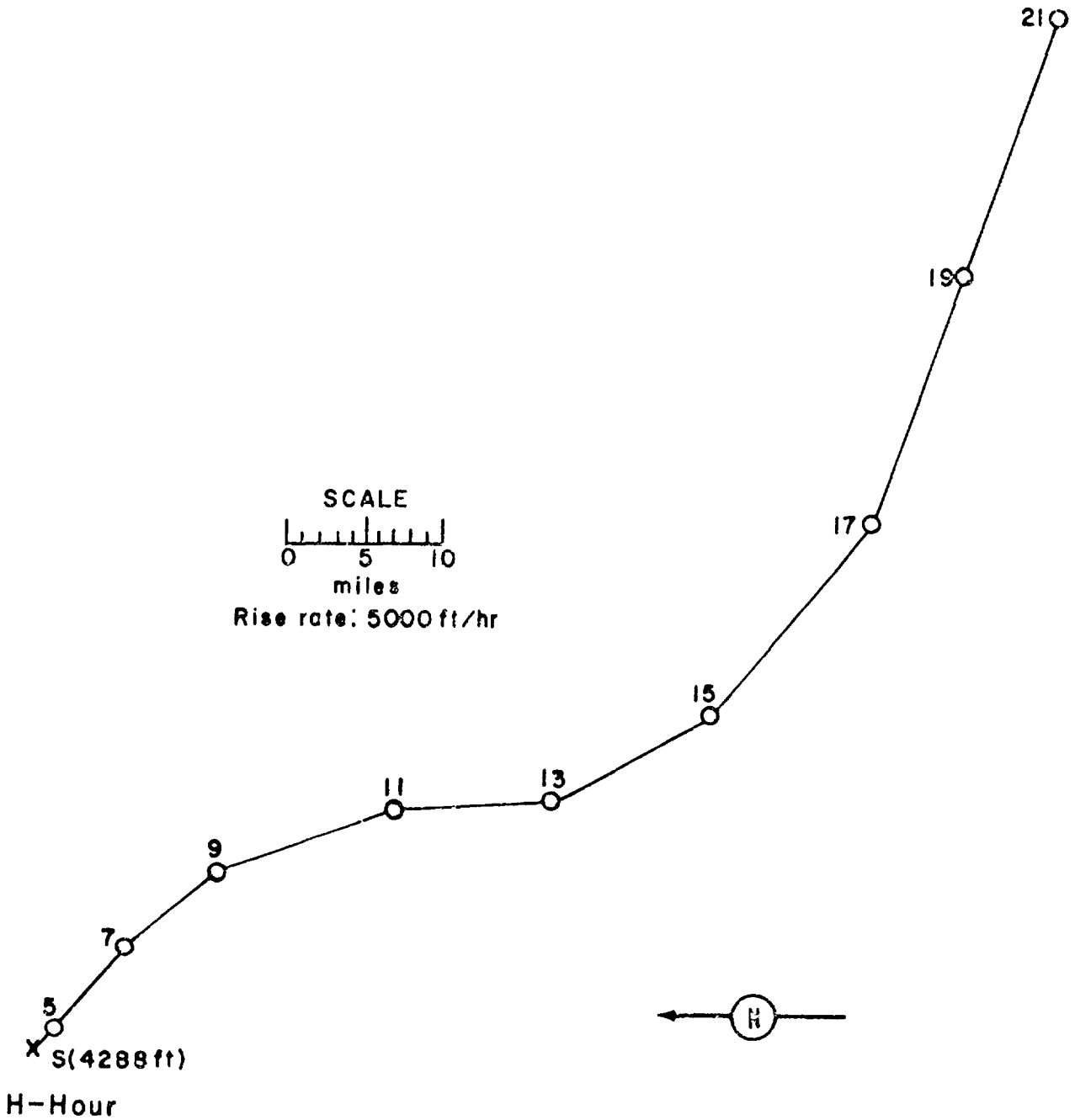


Figure 137. Hodograph for Operation TEAPOT - Ess.

OPERATION TUMBLER - Apple 1

	PST	GMT
DATE:	29 Mar 1955	29 Mar 1955
TIME:	0455	1255

TOTAL YIELD: 14 kt

FIREBALL DATA:
Time to 1st minimum: 12.7 to 13.3 msec
Time to 2nd maximum: 165.0 msec
Radius at 2nd maximum: NM

CRATER DATA: No crater

Sponsor: LASL

SITE: NTS - Area 4
37° 05' 44" N
116° 06' 10" W
Site elevation: 4,309 ft

HEIGHT OF BURST: 500 ft

TYPE OF BURST AND PLACEMENT:
Tower burst over Nevada soil

CLOUD TOP HEIGHT: 32,000 ft MSL
CLOUD BOTTOM HEIGHT: 22,600 ft MSL

REMARKS:

The on-site fallout pattern was constructed from six different ground surveys performed by the Rad-Safe organization from H+$\frac{1}{2}$ hour to D+36 days. AN/PDR-39 instruments were used. Seven stake lines (approx. radial) along existing roads around ground zero aided the survey teams in locating their position. The off-site fallout pattern was drawn from ground-survey readings taken by the off-site Radiological Safety organization. The $t^{-1.2}$ decay approximation was used to extrapolate the dose-rate readings to H+1 hour for both on-site and off-site patterns.

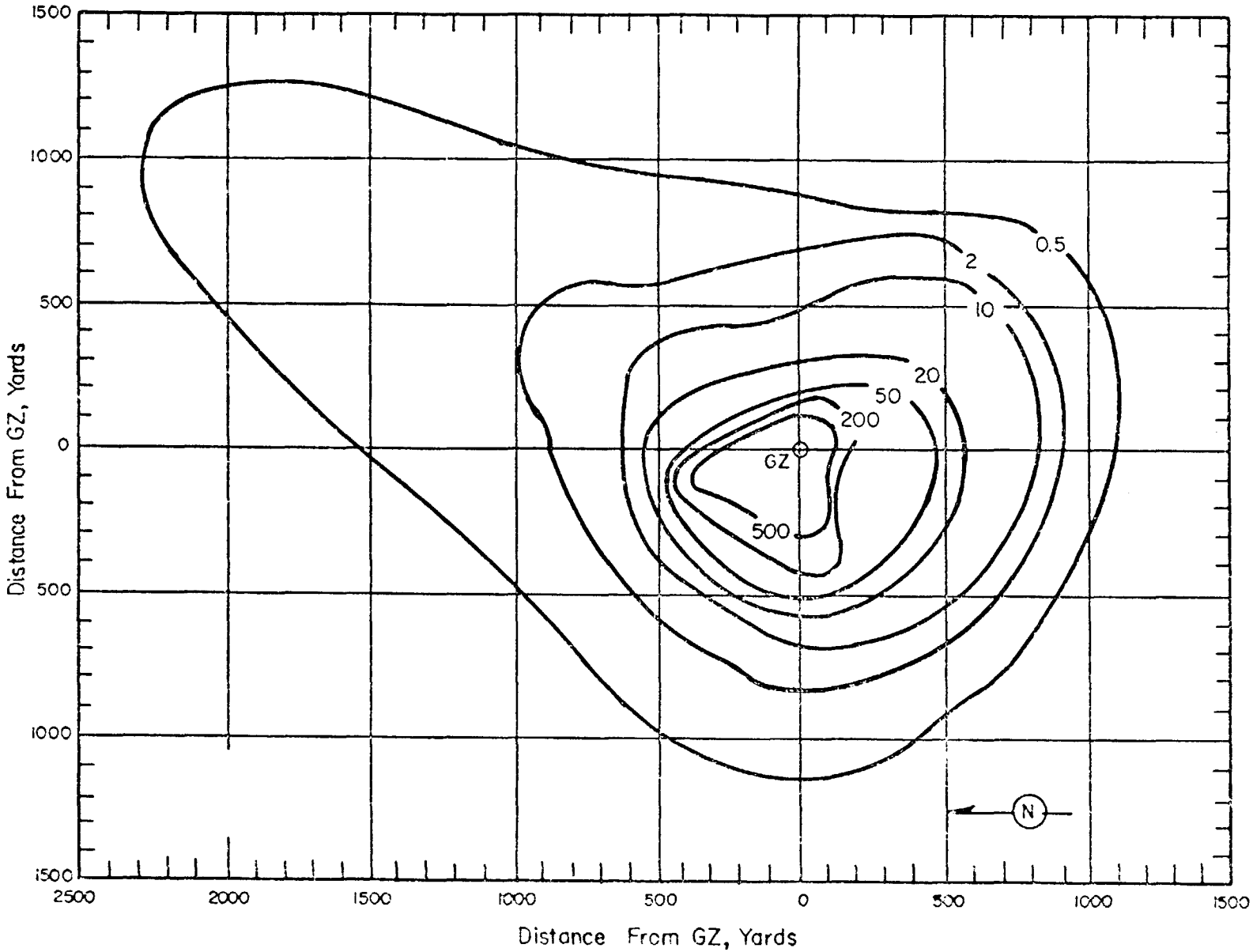


Figure 138. Operation TEAPOT - Apple I. On-site dose rate contours in r/hr at H+1 hour.

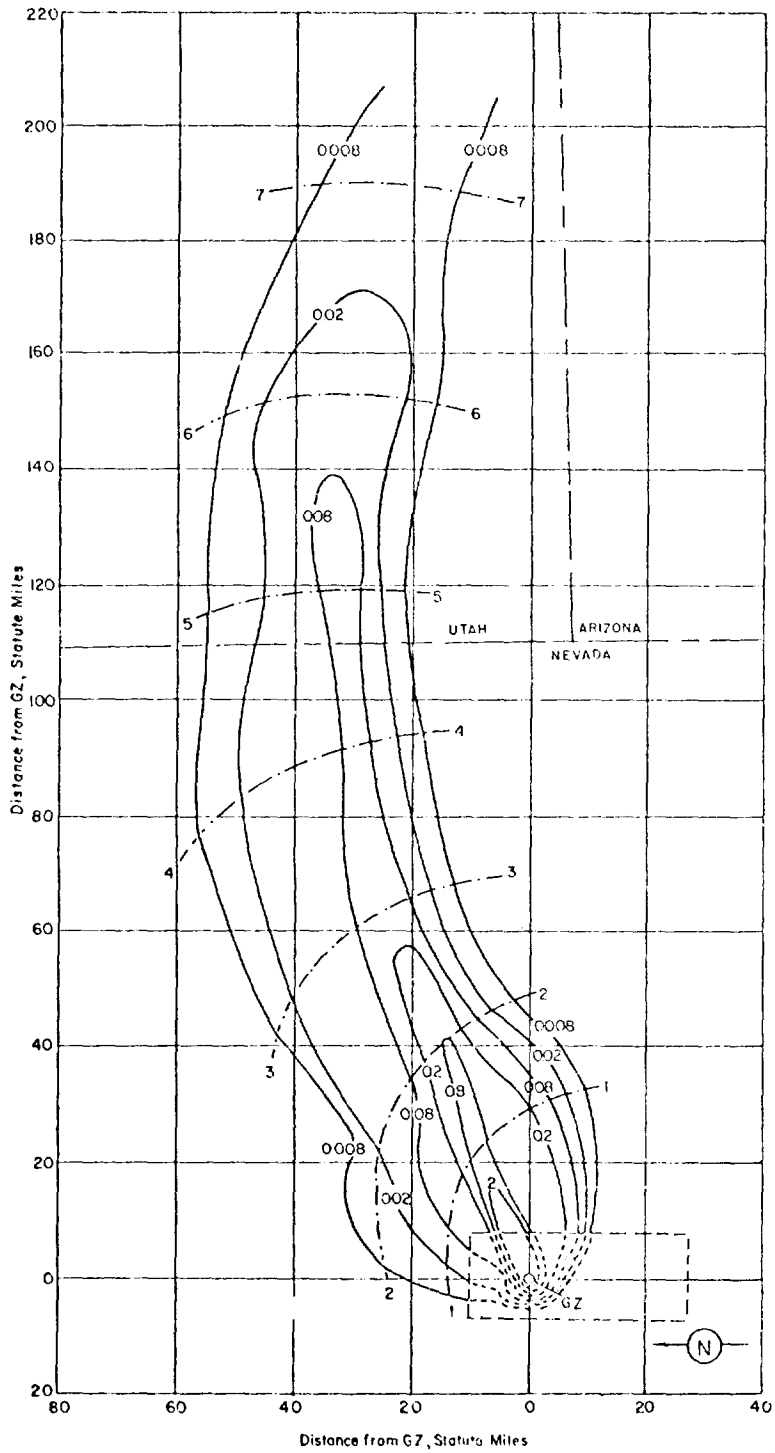


Figure 139. Operation TEAPOT - Apple I. Off-site dose rate contours in r/hr at H+1 hour.

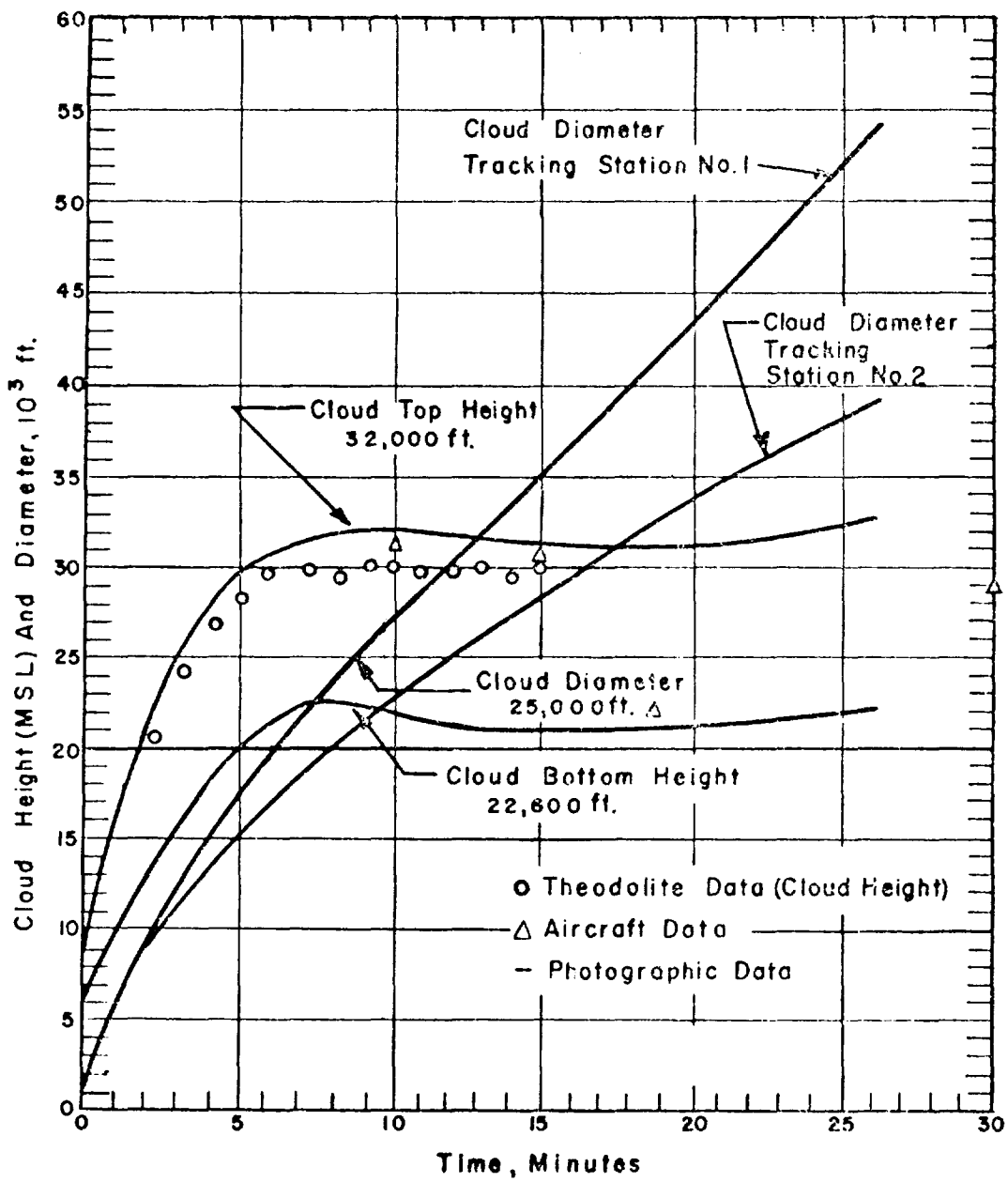


Figure 140. Cloud Dimensions: Operation TEAPOT - Apple I. (Tracking Station No. 1 located 48 miles SE of C. P. and Tracking Station No. 2 50 miles SW of C. P.)

TABLE 40 NEVADA WIND DATA FOR OPERATION TEAPOT- APPLE I

Altitude (MSL)	H-hour		H+5 hours		Altitude (MSL)	H-hour		H+5 hours	
	Dir	Speed	Dir	Speed		Dir	Speed	Dir	Speed
feet	degrees	mph	degrees	mph	feet	degrees	mph	degrees	mph
Surface	260	03	200	18	27,000	260	47	---	--
5,000	200	10	190	19	28,000	260	52	---	--
6,000	180	14	---	--	29,000	270	53	---	--
7,000	190	18	---	--	30,000	270	53	250	73
8,000	190	23	---	--	31,000	270	53	---	--
9,000	190	25	---	--	32,000	270	54	---	--
10,000	190	22	230	29	33,000	270	54	---	--
11,000	200	17	---	--	34,000	270	55	---	--
12,000	240	17	---	--	35,000	270	55	250	68
13,000	260	24	---	--	36,000	270	55	---	--
14,000	260	26	---	--	37,000	270	54	---	--
15,000	260	22	240	44	38,000	270	54	---	--
16,000	260	23	---	--	39,000	270	57	---	--
17,000	260	29	---	--	40,000	270	58	250	68
18,000	260	31	---	--	41,000	270	58	---	--
19,000	270	36	---	--	42,000	270	57	---	--
20,000	270	39	250	52	43,000	270	57	---	--
21,000	270	41	---	--	44,000	260	59	---	--
22,000	270	41	---	--	45,000	260	62	---	--
23,000	270	44	---	--	46,000	260	64	---	--
24,000	270	39	---	--	47,000	260	66	---	--
25,000	270	44	260	61	48,000	260	67	---	--
26,000	260	47	---	--	49,000	260	66	---	--
					50,000	260	64	---	--

NOTES:

1. Tropopause height was 39,000 ft MSL.
2. At shot height the temperature was 9.3°C and the pressure 852 mb.

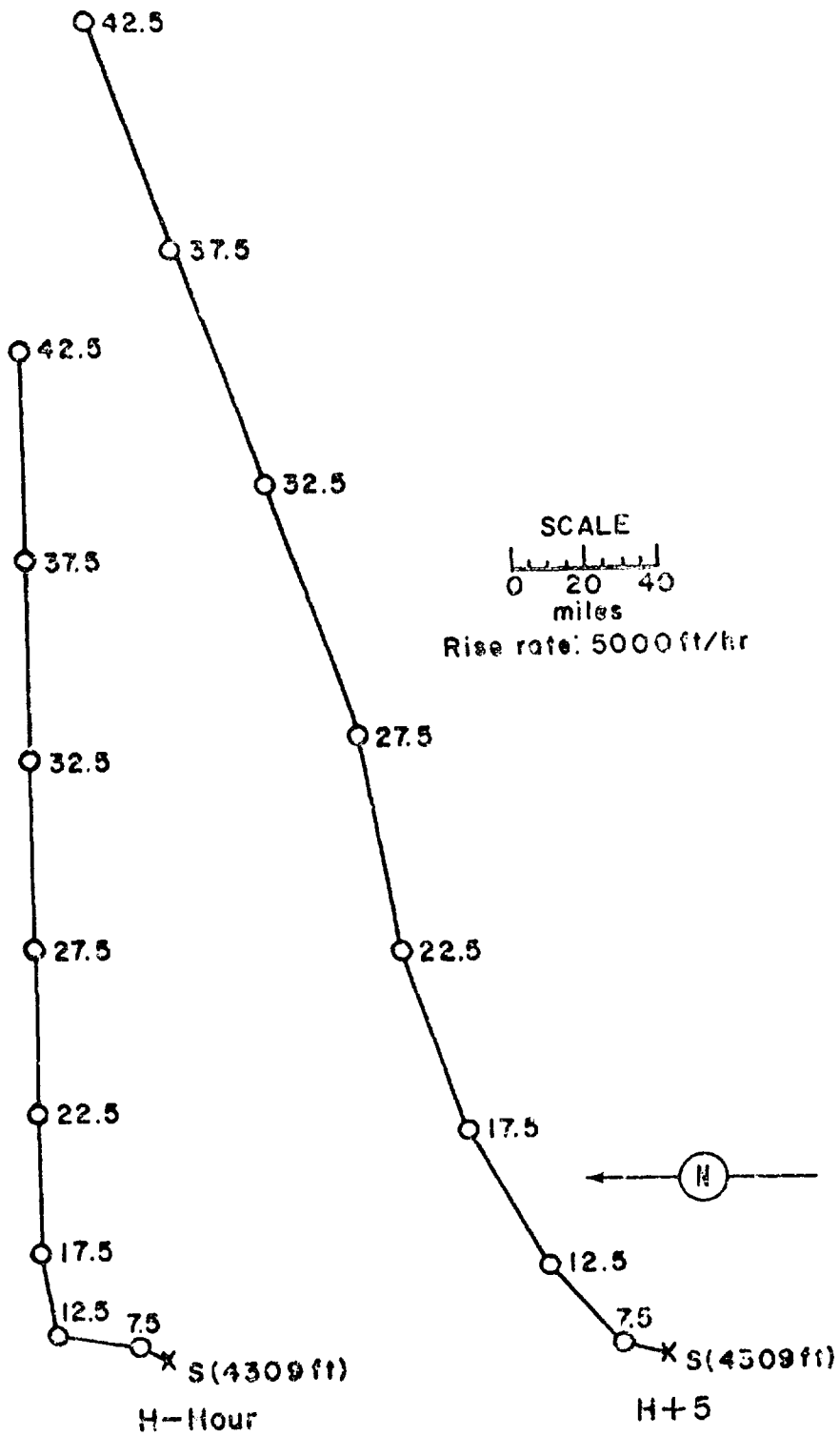


Figure 141. Hodographs for Operation TEAPOT - Apple I.

OPERATION TEAPOT - Wasp Prime

	PST	GMT
DATE:	29 Mar 1955	29 Mar 1955
TIME:	1000	1800

TOTAL YIELD: 3 kt

FIREBALL DATA:
Time to 1st minimum: 5.0 to 6.2 msec
Time to 2nd maximum: 69 to 73 msec
Radius at 2nd maximum: NM

CRATER DATA: No crater

Sponsor: LASL

SITE: NTS - Area T-7-4
37° 05' 12" N
116° 03' 28" W
Site elevation: 4,194 ft

HEIGHT OF BURST: 739 ft

TYPE OF BURST AND PLACEMENT:
Air burst over Nevada soil

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

REMARKS:

The contours resulting from this shot were due primarily to neutron-induced activity. The local fallout pattern was drawn from ground-survey readings taken at H+1 hour by the Rad-Safe organization with AN/PDR 39 and MX-5 instruments. No decay corrections were necessary.

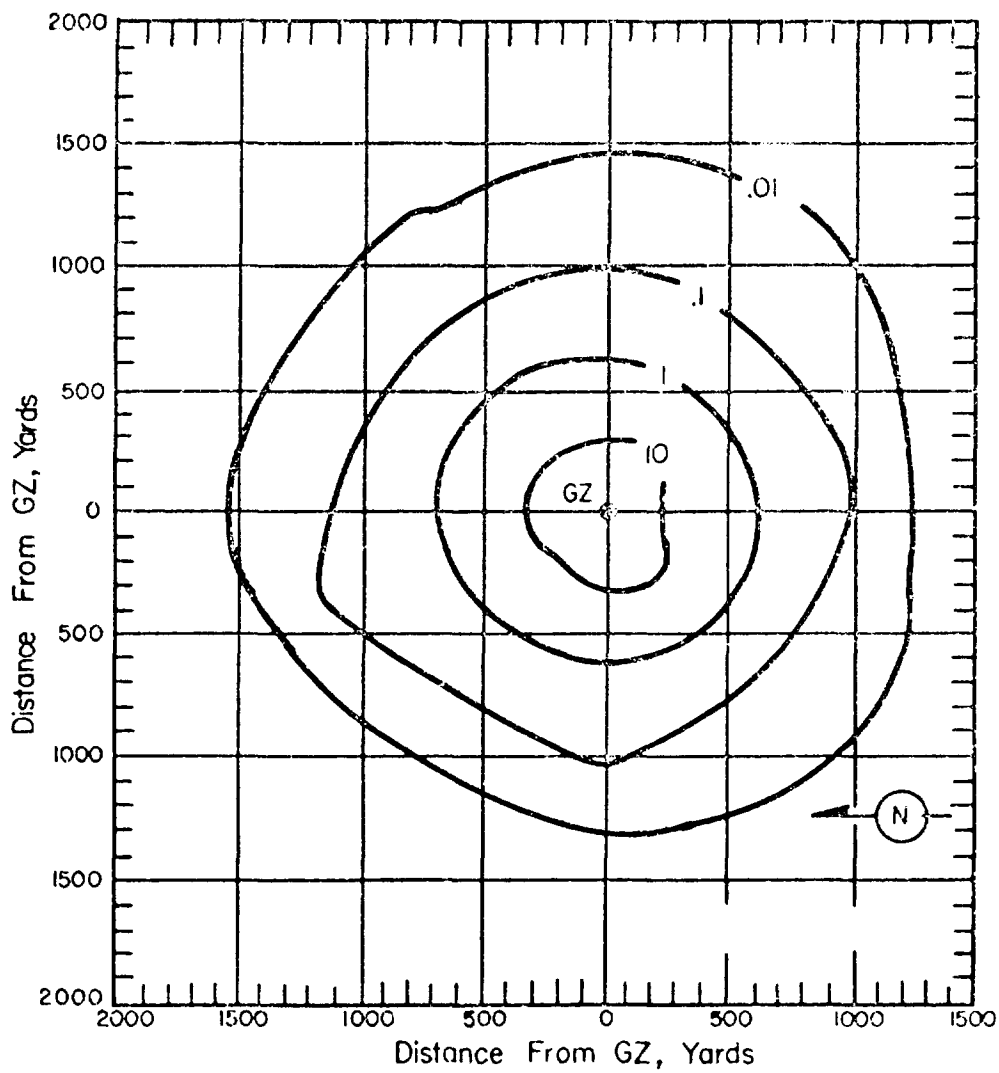


Figure 142. Operation TEAPOT - Wasp Prime.
On-site dose rate contours in r/hr at H+1 hour.

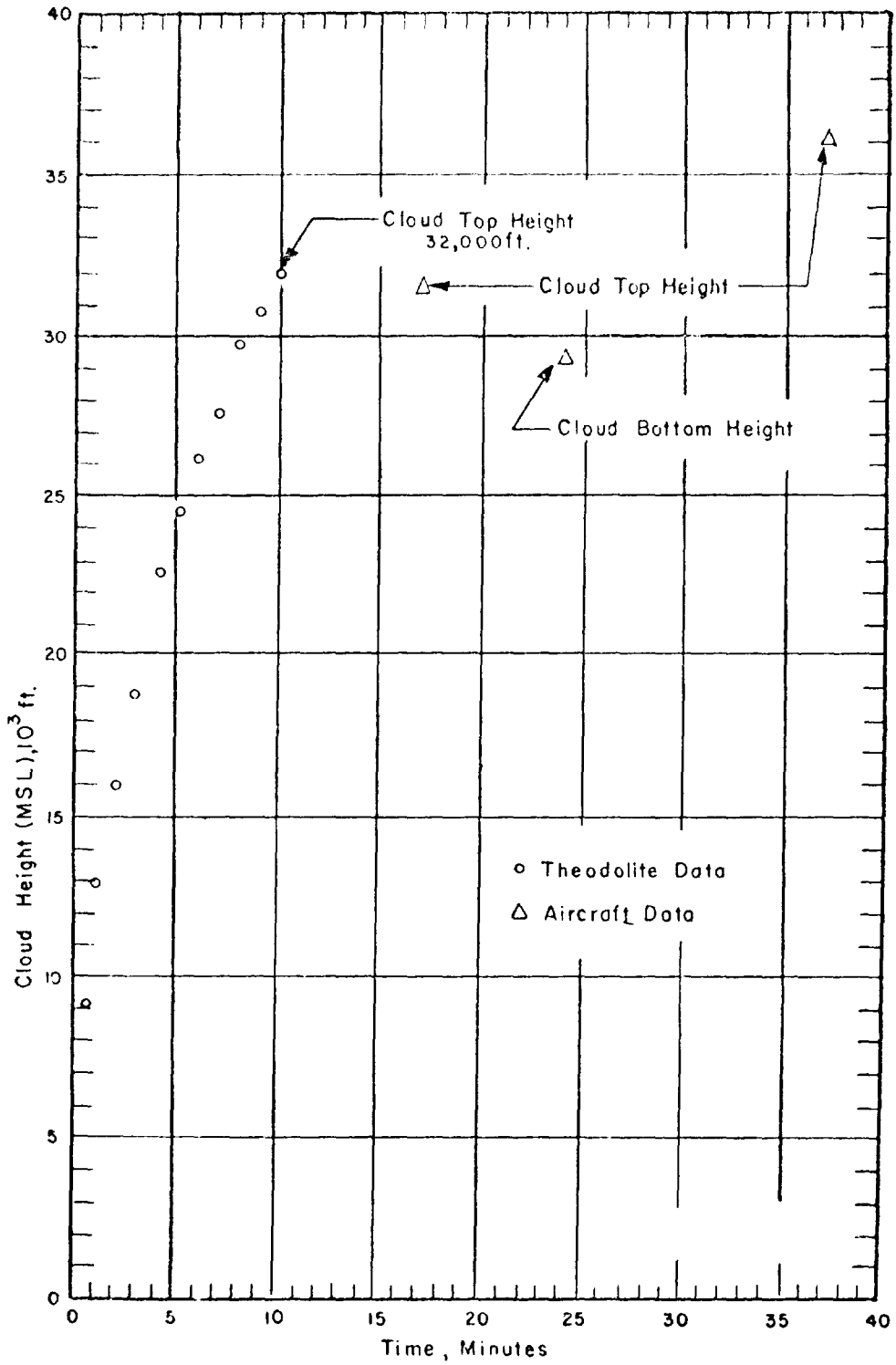


Figure 143. Cloud Dimensions: Operation TEAPOT - Wasp Prime.

TABLE 41 NEVADA WIND DATA FOR OPERATION TEAPOT- WASP PRIME

Altitude (MSL)	H-hour Dir	H-hour Speed
feet	degrees	mph
Surface	200	18
5,000	190	19
6,000	190	21
7,000	190	23
8,000	200	33
9,000	210	33
10,000	230	29
11,000	240	36
12,000	240	41
13,000	240	42
14,000	240	44
15,000	240	44
16,000	240	40
17,000	240	38
18,000	250	43
19,000	250	48
20,000	250	52
21,000	260	54
22,000	260	50
23,000	260	52
24,000	260	54
25,000	260	61
26,000	250	66
27,000	250	69
28,000	250	75
29,000	250	75
30,000	250	73
31,000	250	69
32,000	250	69
33,000	250	67
34,000	250	67
35,000	250	68
36,000	250	70
37,000	250	72
38,000	250	72
39,000	250	69
40,000	250	68
41,000	250	65
42,000	250	65
43,000	250	69
44,000	250	71
45,000	250	69
46,000	250	61
47,000	250	52
48,000	250	46
49,000	240	41
50,000	240	48

NOTES:

1. Tropopause height was 40,000 ft MSL.
2. At shot height the temperature was 12.4°C and the pressure 845 mb.

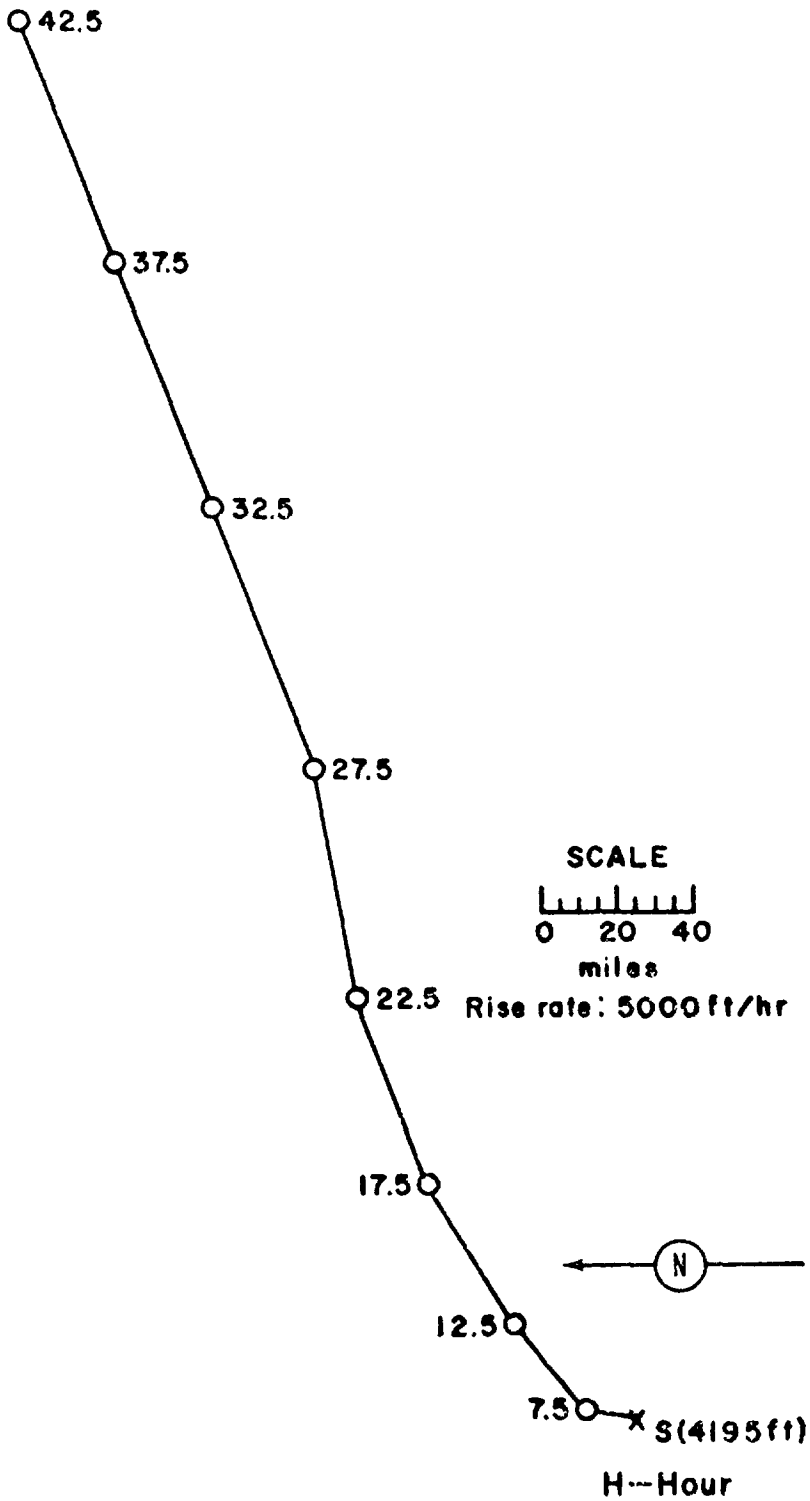


Figure 144. Hodograph for Operation TEAPOT - Wasp Prime.

OPERATION TEAPOT - HA

	PST	GMT
DATE:	6 Apr 1955	6 Apr 1955
TIME:	1000	1800

TOTAL YIELD: 3 kt

FIREBALL DATA:
Time to 1st minimum: 4.5 to 5.6 msec
Time to 2nd maximum: 42.5 to 60 msec
Radius at 2nd maximum: NM

Sponsor: DOD

SITE: NTS - Area T-5
37° 01' 43" N
116° 03' 28" W
Site elevation: 4,038 ft

HEIGHT OF BURST: 32,582 ± 100 ft
Air burst over Nevada soil

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

CRATER DATA: No crater

REMARKS:

No significant fallout or induced activity was observed.

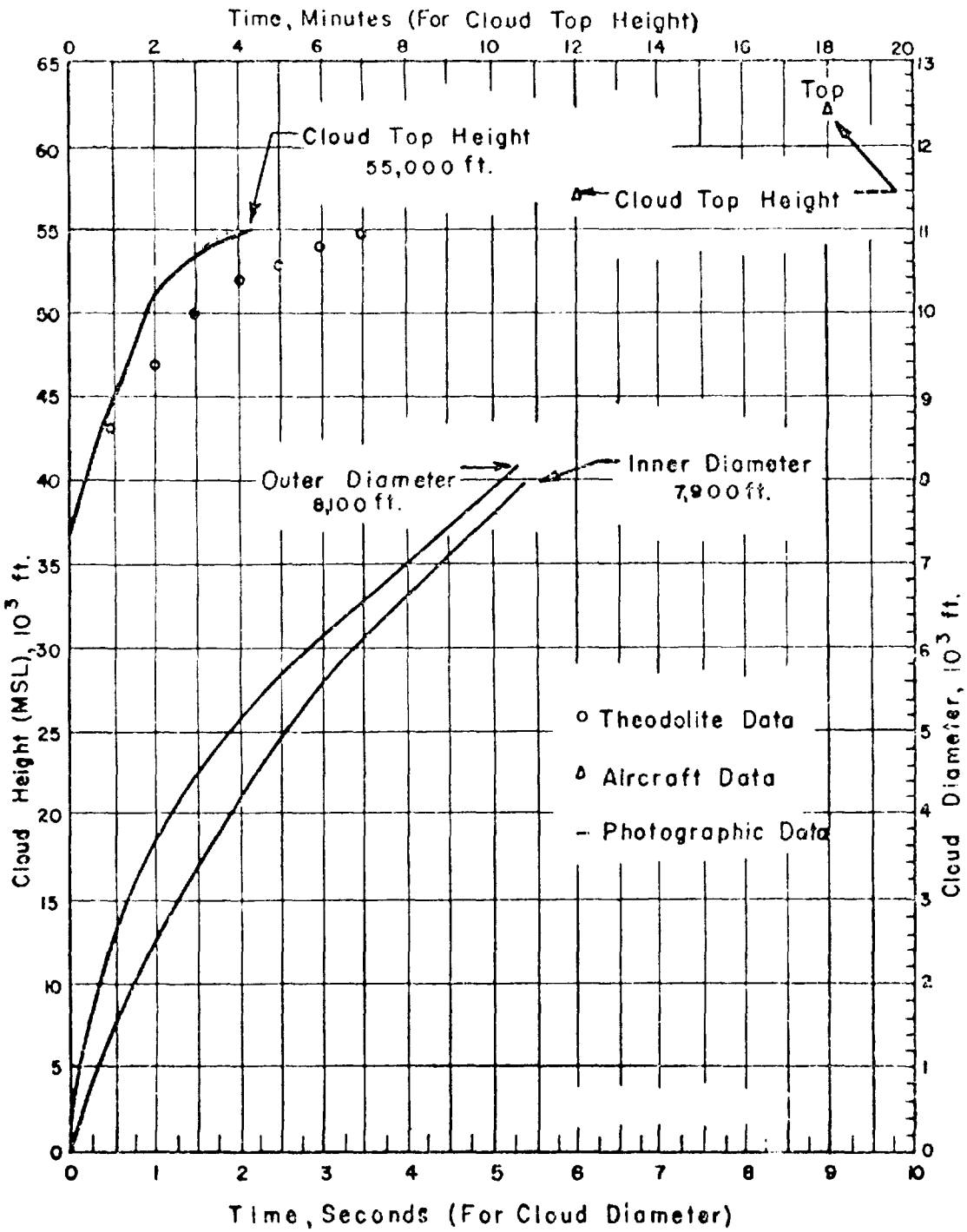


Figure 145 . Cloud Dimensions: Operation TEAPOT - HA.

TABLE 42 NEVADA WIND DATA FOR OPERATION TEAPOT - HA

Altitude (MSL)	H-hour Dir	H-hour Speed	Altitude (MSL)	H-hour Dir	H-hour Speed
feet	degrees	mph	feet	degrees	mph
20,000	010	21	46,000	300	46
21,000	360	23	47,000	290	44
22,000	360	28	48,000	290	35
23,000	010	22	49,000	290	33
24,000	360	23	50,000	290	33
25,000	350	21	51,000	280	33
26,000	340	22	52,000	270	31
27,000	340	29	53,000	270	31
28,000	340	30	54,000	270	33
29,000	320	29	55,000	270	33
30,000	310	31	56,000	280	32
31,000	310	35	57,000	290	29
32,000	310	36	58,000	300	25
33,000	320	35	59,000	300	18
34,000	320	33	60,000	310	13
35,000	320	31	61,000	320	10
36,000	300	32	62,000	340	06
37,000	300	33	63,000	010	05
38,000	300	36	64,000	030	05
39,000	300	44	65,000	030	06
40,000	290	50	66,000	090	06
41,000	290	52	67,000	100	08
42,000	290	54	68,000	140	08
43,000	290	53	69,000	180	09
44,000	300	52	70,000	180	09
45,000	300	50			

NOTES:

1. Tropopause height was 31,000 ft MSL.
2. At shot height the temperature was -47.7°C and the pressure 222 mb.

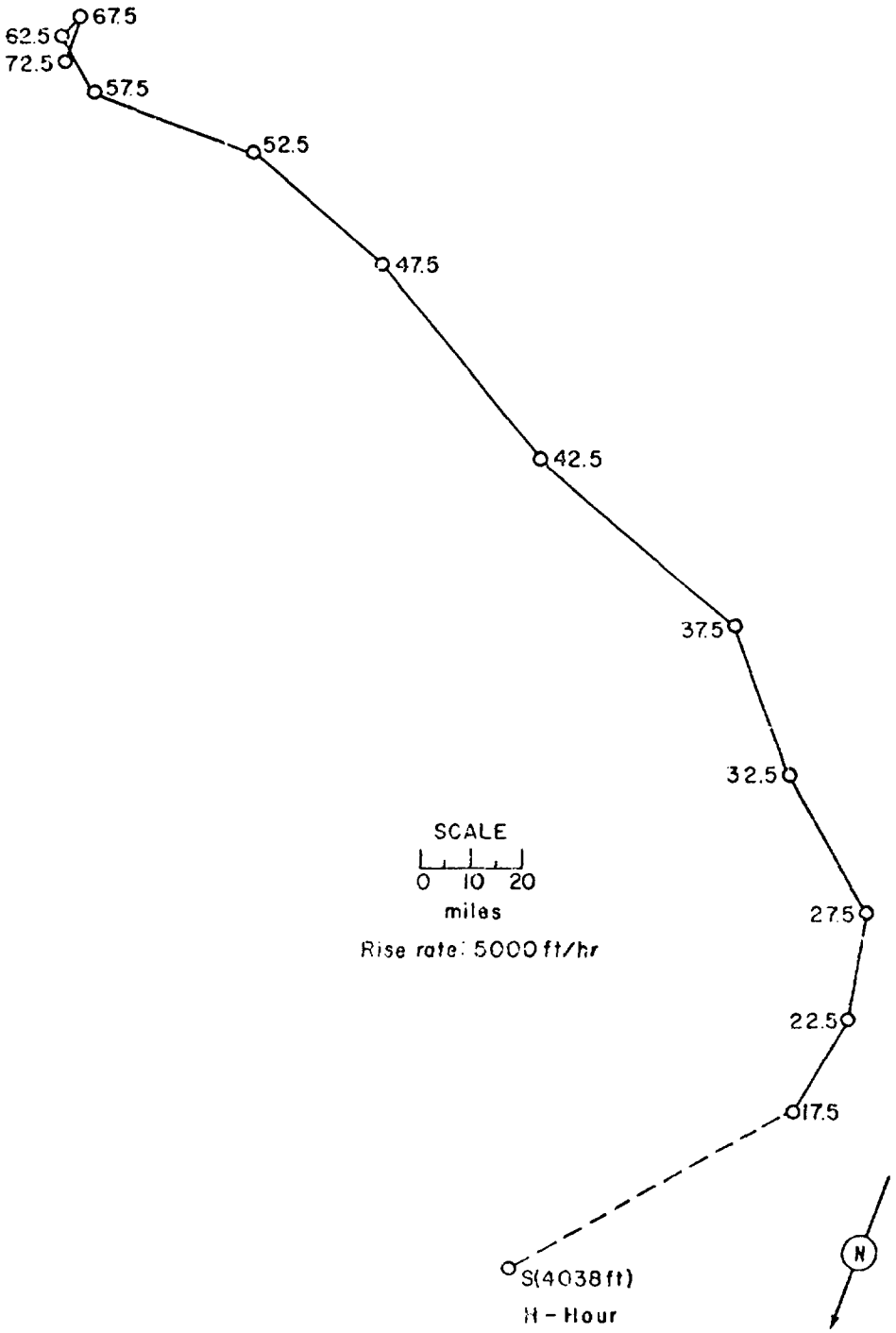


Figure 146. Hodograph for Operation TEAPOT - HA.

OPERATION TEAPOT - Post

	PST	GMT
DATE:	9 Apr 1955	9 Apr 1955
TIME:	0430	1230

TOTAL YIELD: 2 kt

FIREBALL DATA:
Time to 1st minimum: 3.9 msec
Time to 2nd maximum: 40.3 msec
Radius at 2nd maximum: NM

CRATER DATA: No crater

Sponsor: UCRL

SITE: NTS - Area - 9c
37° 07' 20" N
116° 02' 04" W
Site elevation: 4,236 ft

HEIGHT OF BURST: 300 ft

TYPE OF BURST AND PLACEMENT:
Tower burst over Nevada soil

CLOUD TOP HEIGHT: 15,500 ft MSL
CLOUD BOTTOM HEIGHT: 12,000 ft MSL

REMARKS:

The on-site contamination was due primarily to neutron-induced activity. The pattern was drawn from four different ground surveys made by the Rad-Safe organization between H+1 hour and D+2 days. The general decay curve for Nevada soil was used to extrapolate the data to H+1 hour. The off-site fallout pattern was drawn from ground-survey readings taken by the off-site Radiological Safety organization. The $t^{-1.2}$ decay approximation was used to extrapolate the dose-rate readings to H+1 hour.

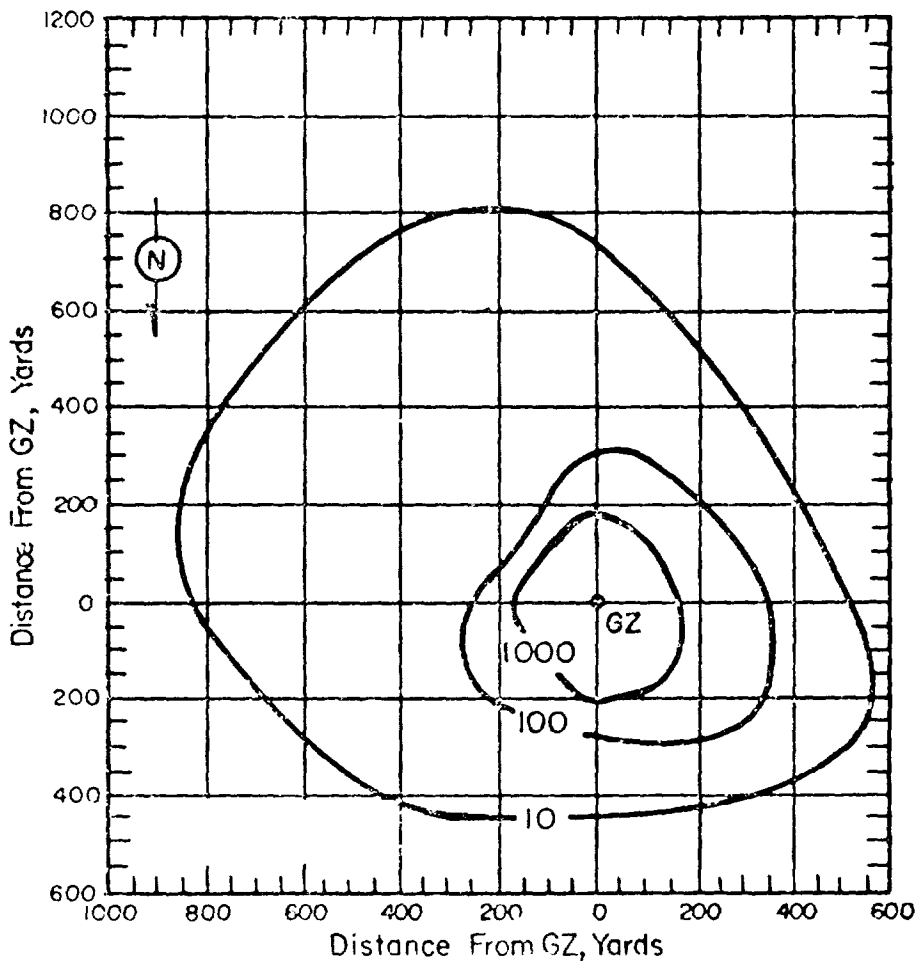


Figure 147 . Operation TEAPOT - Post. On-site dose rate contours in r/hr at H+1 hour.

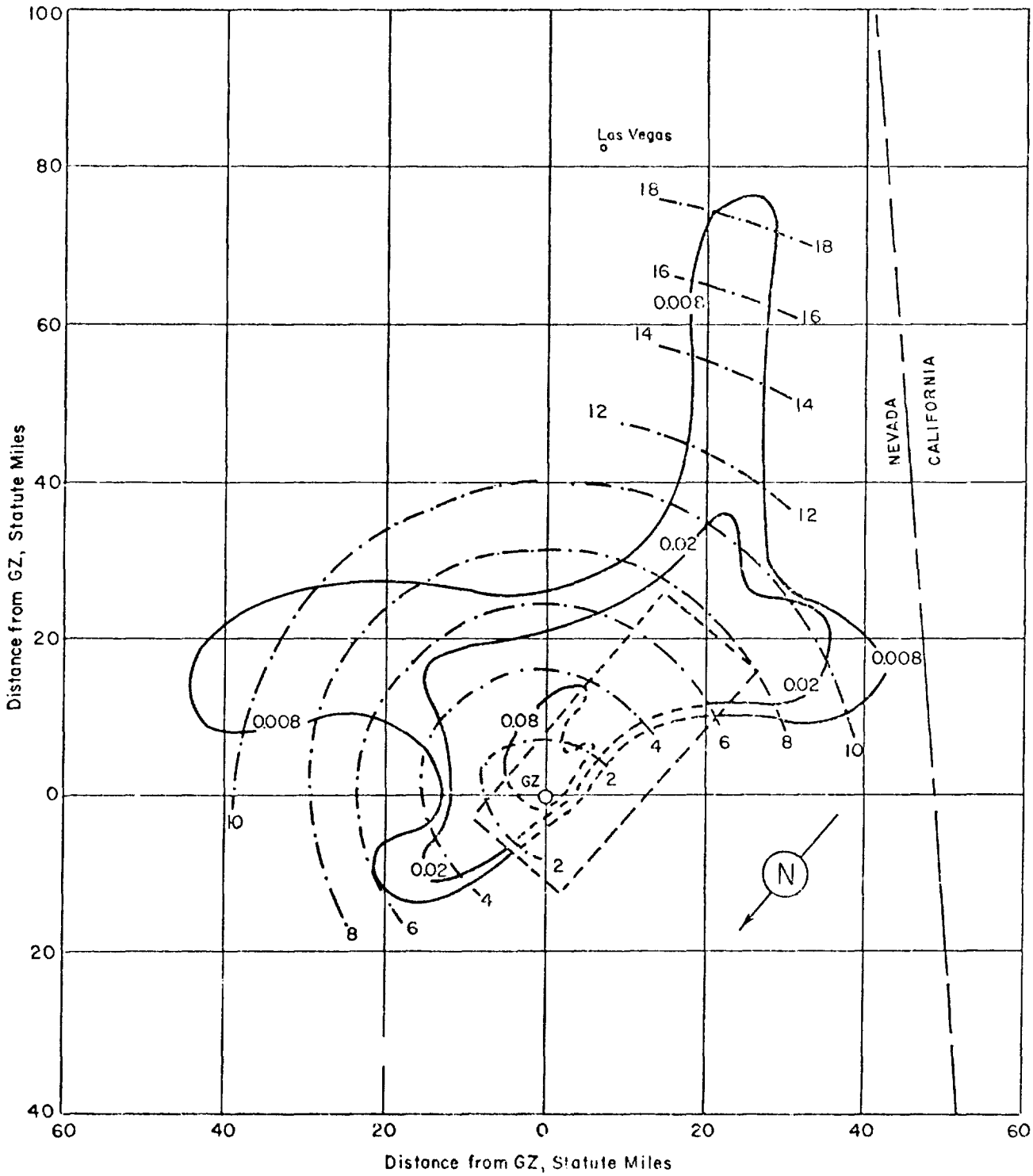


Figure 148. OPERATION TEAPOT - Post. Off-site dose rate contours in r/hr at H+1 hour.

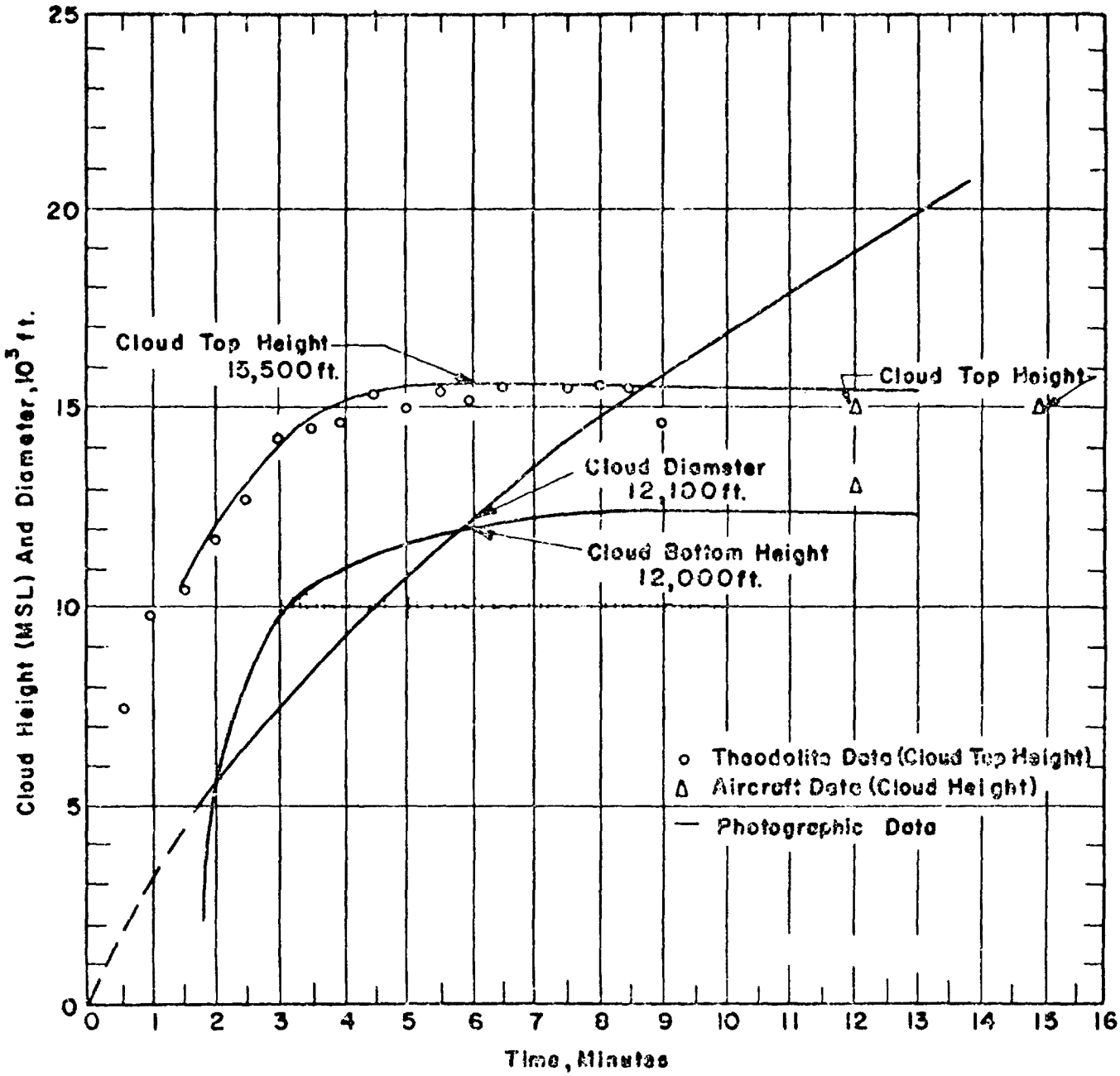


Figure 149. Cloud Dimensions: Operation TEAPOT - Post.

TABLE 43 NEVADA WIND DATA FOR OPERATION TEAPOT- POST

Altitude (MSL)	H-hour		Altitude (MSL)	H-hour	
	Dir	Speed		Dir	Speed
feet	degrees	mph	feet	degrees	mph
Surface	Calm	Calm	14,000	350	08
5,000	Calm	Calm	16,000	330	09
6,000	Calm	Calm	18,000	330	14
7,000	Calm	Calm	20,000	350	15
8,000	Calm	Calm	23,000	010	23
9,000	Calm	Calm	25,000	350	29
10,000	Calm	Calm	30,000	350	31
11,000	Calm	Calm	35,000	010	41
12,000	Calm	Calm	40,000	360	40
13,000	Calm	Calm	45,000	320	24
			50,000	250	29

NOTE: At burst height the temperature was 4.5°C and the pressure 867 mb.

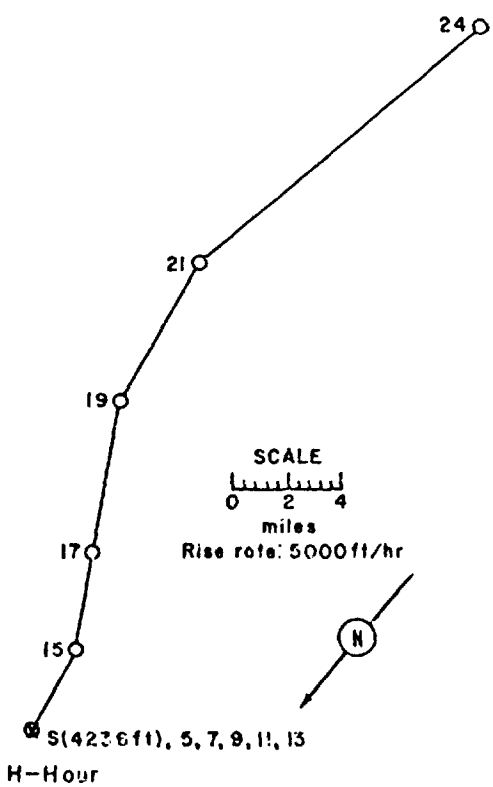


Figure 150. Hodograph for Operation TEAPOT - Post.

OPERATION TEAPOT - Met

	PST	GMT
DATE:	15 April 1955	15 April 1955
TIME:	1115	1915

TOTAL YIELD: 22 kt

FIREBALL DATA:
Time to 1st minimum: 17.2 msec
Time to 2nd maximum: NM
Radius at 2nd maximum: NM

CRATER DATA: No crater

Sponsor: DOD - LASL

SITE: NTS - Area FF
36 ° 47' 53" N
115 ° 55' 44" W
Sit elevation: 3,078 ft

HEIGHT OF BURST: 400 ft

TYPE OF BURST AND PLACEMENT:
Tower burst over Nevada soil

CLOUD TOP HEIGHT: 40,300 ft MSL
CLOUD BOTTOM HEIGHT: 31,800 ft MSL

REMARKS:

The on-site fallout pattern was constructed from surveys performed by Rad-Safe organization between H+$\frac{1}{2}$ hour and H+2$\frac{1}{2}$ hours. AN/PDR-39 instruments were used. Eight stake lines (approximately radial) along existing roads around ground zero aided the survey teams in locating their position. No decay corrections were made. The off-site fallout pattern was drawn from ground-survey readings taken by the off-site radiological safety organization. The $t^{-1.2}$ decay approximation was used to extrapolate the dose-rate readings to H+1 hour.

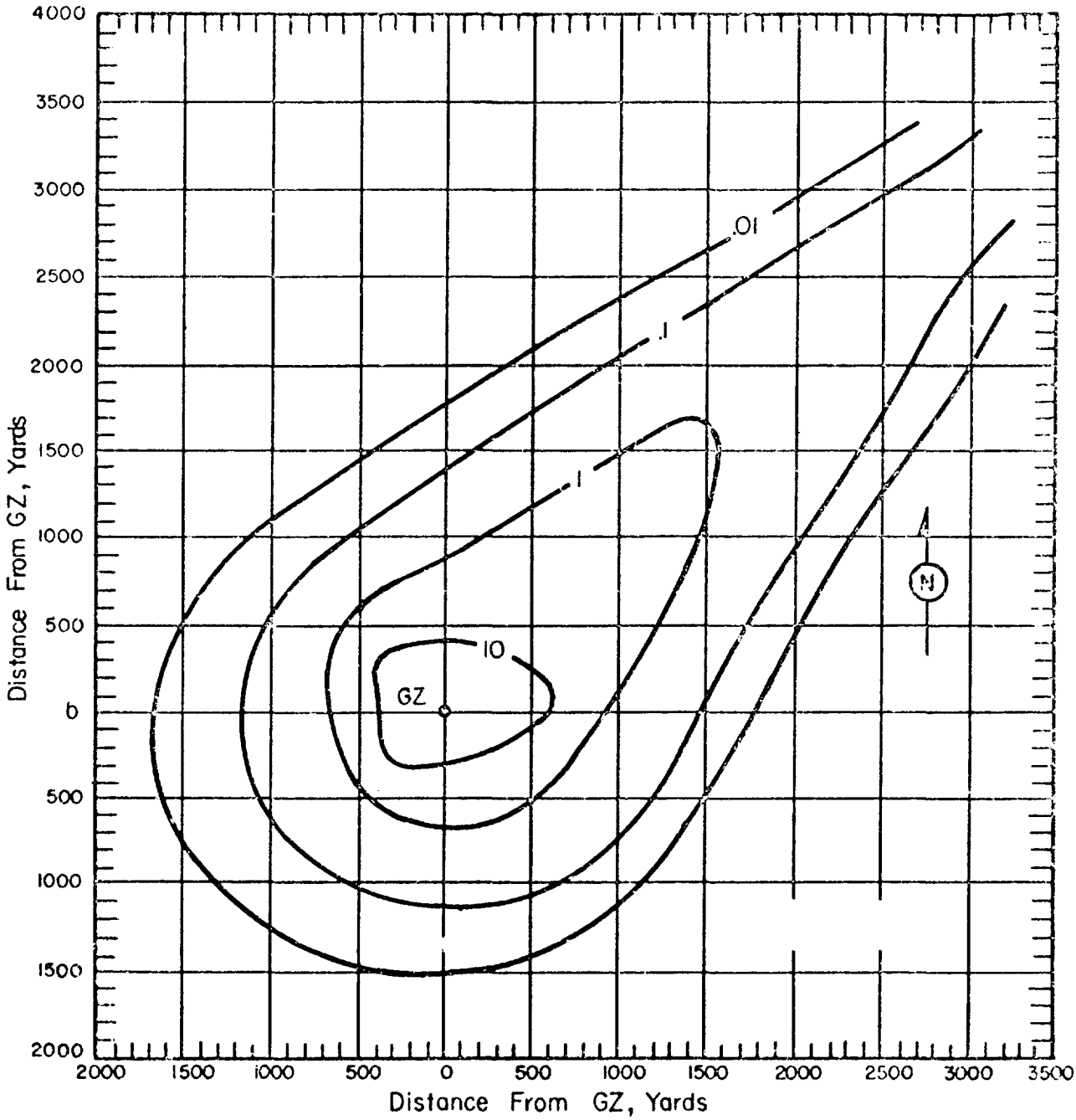


Figure 151. Operation TEAPOT - Met. On-site dose rate contours in r/hr at H+1 hours.

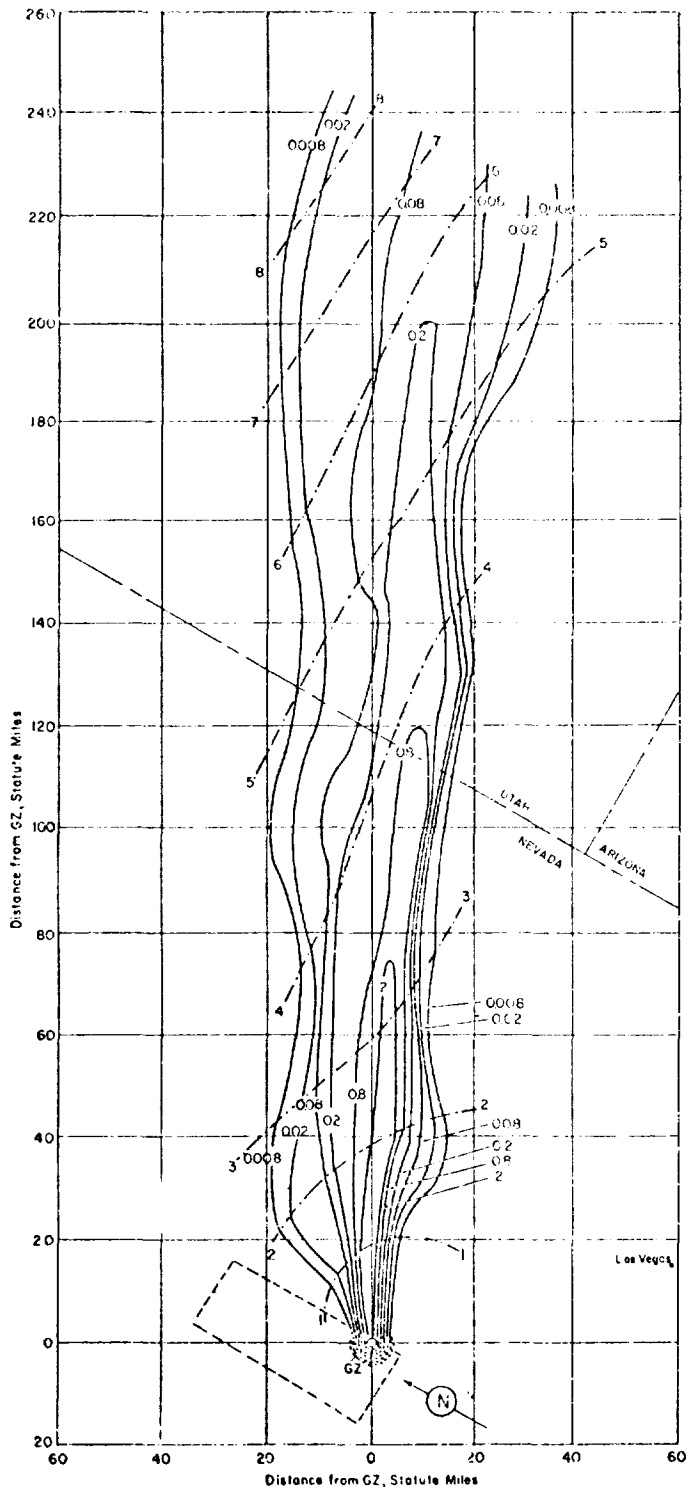


Figure 152. Operation TEAPOT - Met. Off-site dose rate contours in r/hr at H+1 hour.

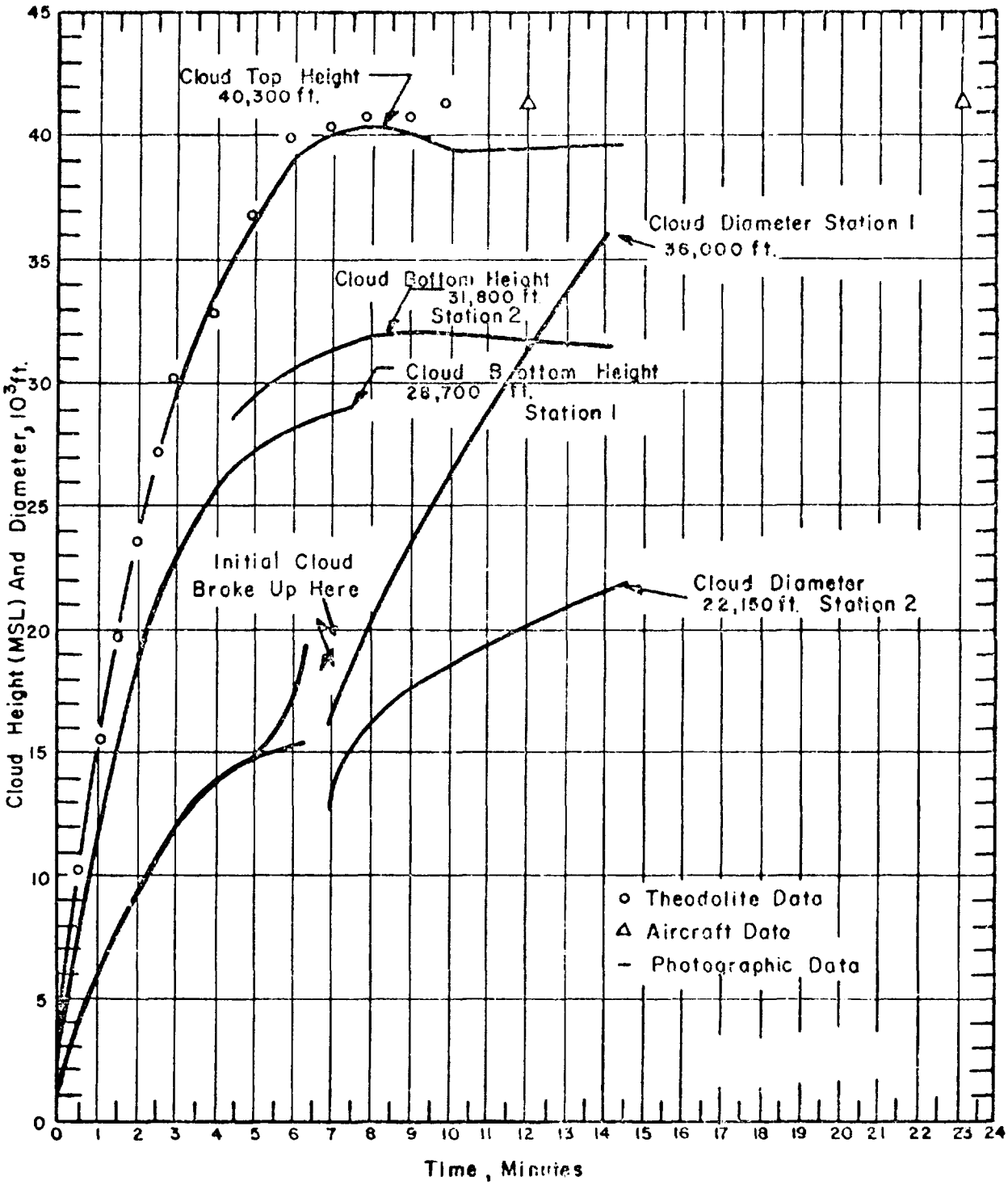


Figure 153. Cloud Dimensions: Operation TEAPOT - Met. (Station No. 1 located 48 miles SE of C. P. and Station No. 2 located 50 miles SW of C. P.).

TABLE 44 NEVADA WIND DATA FOR OPERATION TEAPOT - MET

Altitude (MSL)	H-hour Dir	H-hour Speed
feet	degrees	mph
Surface	200	16
5,000	210	09
6,000	210	11
7,000	210	15
8,000	210	18
9,000	220	16
10,000	240	17
11,000	250	23
12,000	260	24
13,000	270	32
14,000	260	29
15,000	250	35
16,000	240	38
17,000	240	40
18,000	240	37
19,000	240	33
20,000	240	37
21,000	240	40
22,000	250	46
23,000	250	54
24,000	250	62
25,000	250	64
26,000	250	67
27,000	250	69
28,000	250	70
29,000	250	71
30,000	250	73
31,000	250	73
32,000	250	73
33,000	240	76
34,000	240	80
35,000	240	84
36,000	240	86
37,000	240	87
38,000	240	87
39,000	240	86
40,000	240	84
41,000	240	82
42,000	240	80
43,000	240	78
44,000	240	76
45,000	240	77
46,000	240	83
47,000	240	85
48,000	240	87
49,000	240	90
50,000	240	88

NOTES:

1. Tropopause height was 37,000 ft MSL.
2. At shot height the temperature was 18.5°C and the pressure 880 mb.

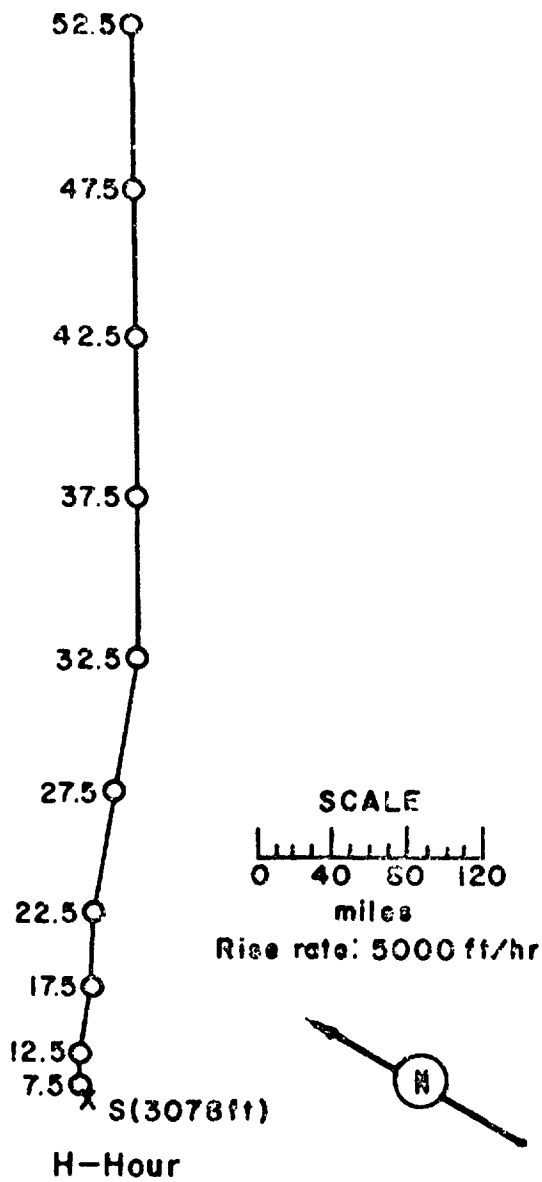


Figure 154 . Hodograph for Operation TEAPOT - Met.

OPERATION TEAPOT - Apple II

	PDT	GMT
DATE:	5 May 1955	5 May 1955
TIME:	0510	1210

TOTAL YIELD: 29 kt

FIREBALL DATA:
Time to 1st minimum: 17.7 - 18.3 msec
Time to 2nd maximum: NM
Radius at 2nd maximum: NM

Sponsor: LASL

SITE: NTS - Area - 1
36° 03' 11" N
116° 06' 09" W
Site elevation: 4,236 ft

HEIGHT OF BURST: 500 ft

TYPE OF BURST AND PLACEMENT:
Tower burst over Nevada soil

CLOUD TOP HEIGHT: 51,000 ft MSL
CLOUD BOTTOM HEIGHT: 34,500 ft MSL

REMARKS:

The on-site fallout pattern was constructed from three different ground surveys performed by the Rad-Safe organization between H+½ hour and D+4 days. AN/PDR-39 instruments were used. Eight stake lines (approximately radial) along existing roads around ground zero aided the survey teams in locating their position. The off-site fallout pattern was drawn from ground-survey readings taken by the off-site Radiological Safety organization. The $t^{-1.2}$ decay approximation was used to extrapolate the dose-rate readings to H+1 hour for both on-site and off-site patterns.

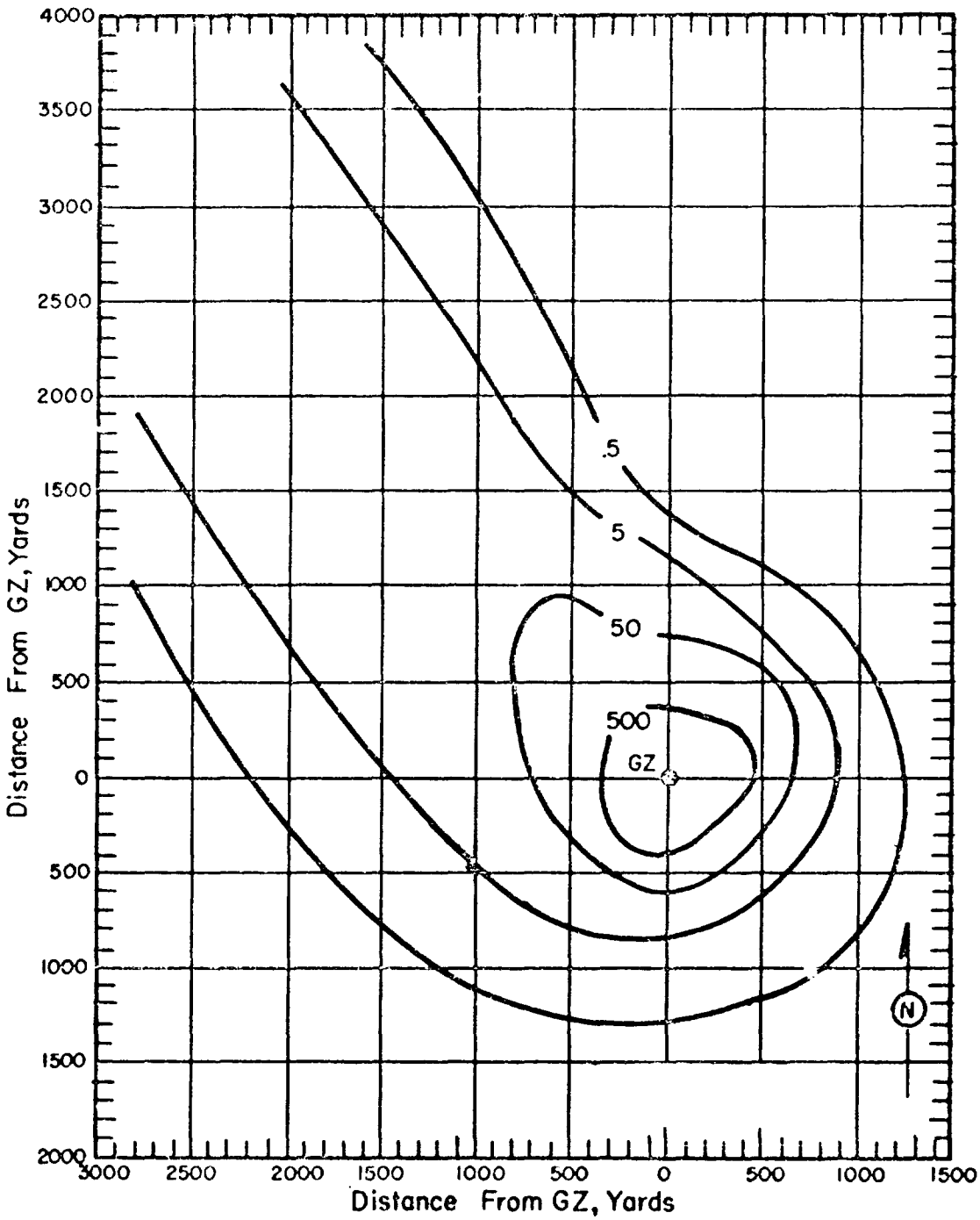


Figure 155. Operation TEAPOT - Apple II On-site dose rate contours in r/hr at H+1 hour.

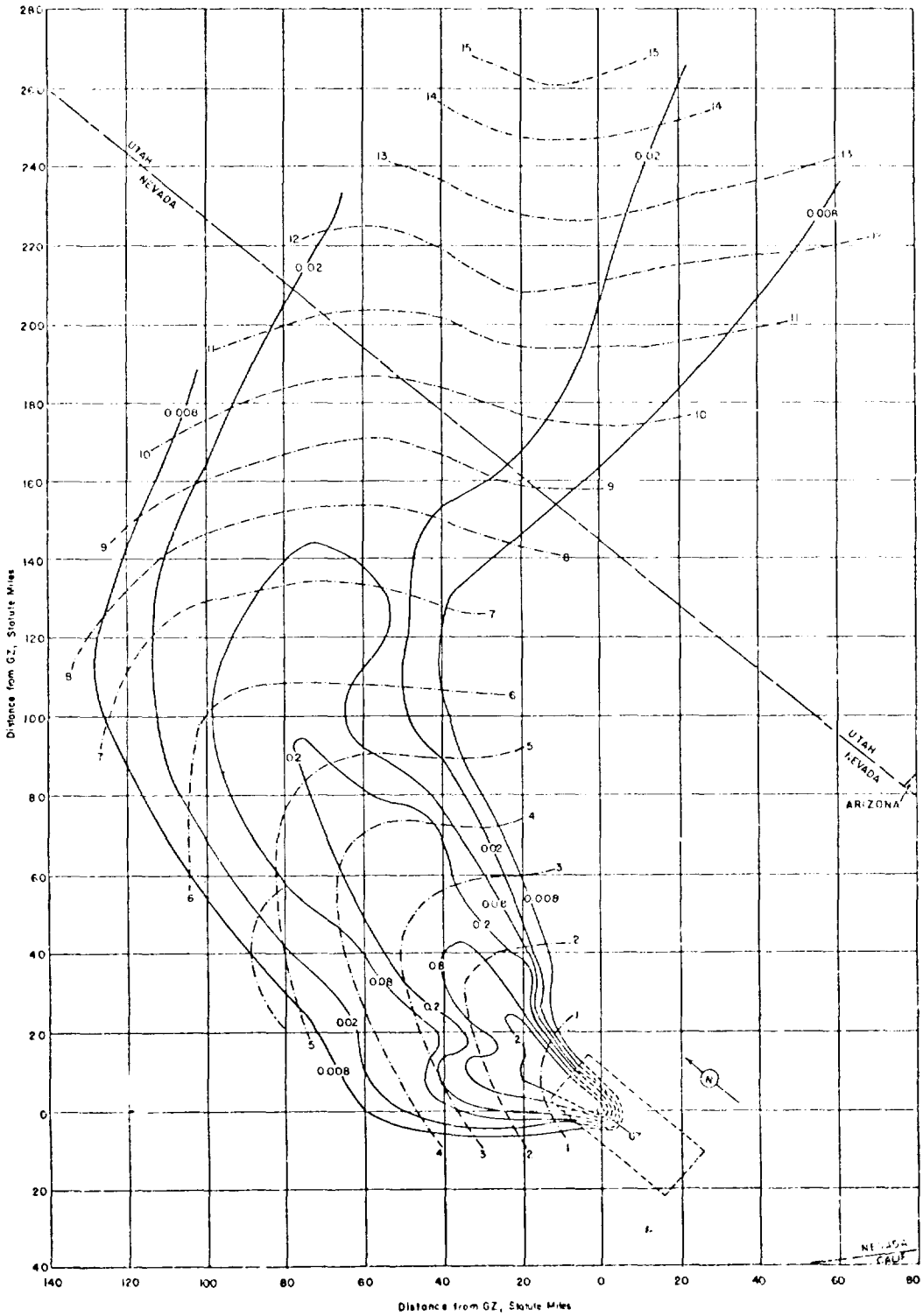


Figure 156. Operation TEAPOT - Apple II.
Off-site dose rate contours in r/hr at H+1 hour.

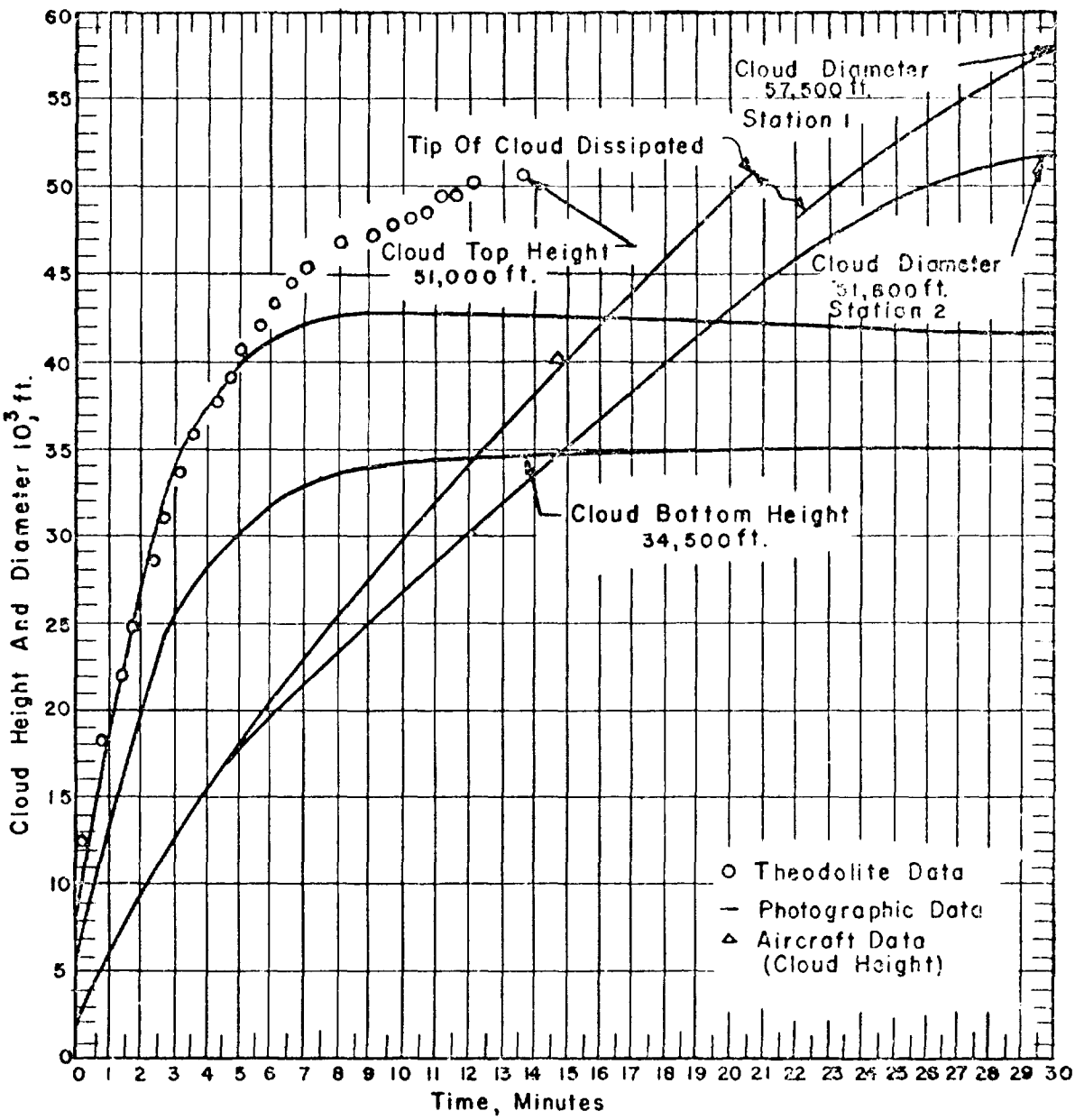


Figure 157. Cloud Dimensions: Operation TEAPOT - Apple II. (Tracking Station No. 1 located 48 miles SE of C. P. and Tracking Station No. 2 50 miles SW of C. P.).

TABLE 45 NEVADA WIND DATA FOR OPERATION TEAPOT- APPLE II

Altitude (MSL)	H-hour Dir	H-hour Speed	Altitude (MSL)	H-hour Dir	H-hour Speed
feet	degrees	mph	feet	degrees	mph
Surface	Calm	Calm	27,000	200	23
5,000	Calm	Calm	28,000	210	24
6,000	Calm	Calm	29,000	210	25
7,000	120	06	30,000	210	25
8,000	130	08	31,000	220	23
9,000	140	14	32,000	230	22
10,000	150	16	33,000	230	24
11,000	150	14	34,000	230	28
12,000	160	17	35,000	230	30
13,000	160	25	36,000	230	32
14,000	170	35	37,000	230	35
15,000	170	37	38,000	230	36
16,000	170	38	39,000	230	36
17,000	180	38	40,000	220	33
18,000	180	35	41,000	220	32
19,000	180	36	42,000	210	31
20,000	180	36	43,000	210	29
21,000	180	36	44,000	210	31
22,000	180	36	45,000	210	32
23,000	180	32	46,000	210	33
24,000	190	30	47,000	210	37
25,000	190	26	48,000	210	38
26,000	200	23	49,000	210	39
			50,000	220	41

NOTES:

1 Tropopause height was 41,000 ft MSL at H-hour.

2. At shot height the temperature was 15.6°C and the pressure 855 mb.

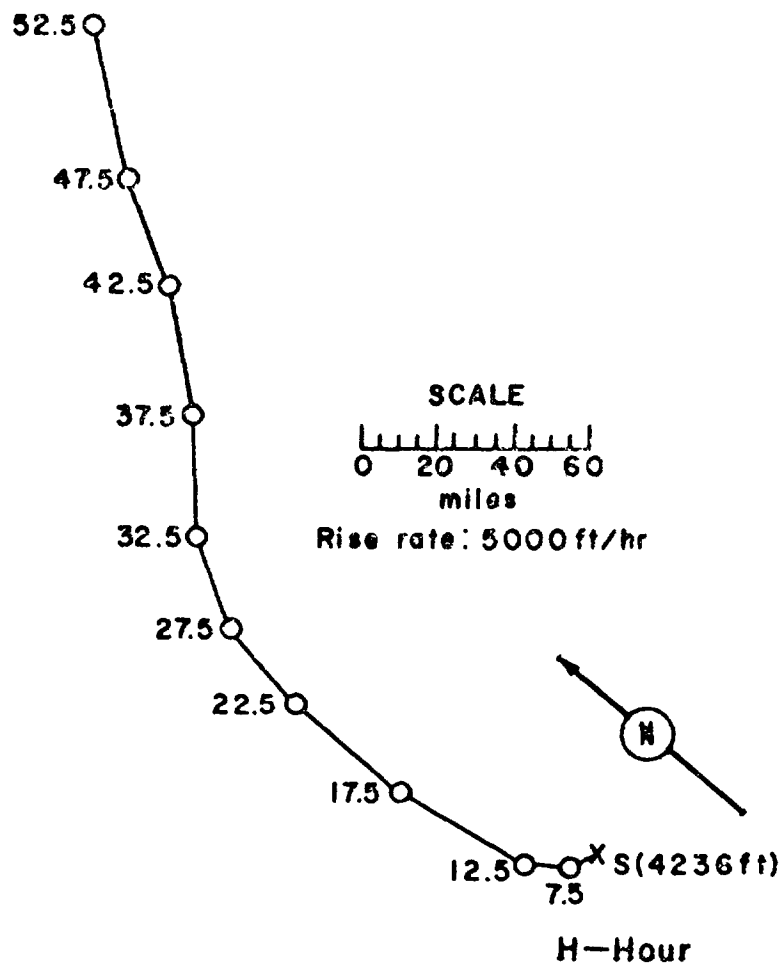


Figure 158. Hodograph for Operation TEAPOT - Apple II.

OPERATION TEAPOT - Zucchini

	PDT	GMT
DATE:	15 May 1955	15 May 1955
TIME:	0500	1200

TOTAL YIELD: 28 kt

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

CRATER DATA: No crater

Sponsor: LASL

SITE: NTS - Area 7-1a
37° 05' 41" N
116° 01' 26" W
Site elevation: 4,245 ft

HEIGHT OF BURST: 500 ft

TYPE OF BURST AND PLACEMENT:
Tower burst over Nevada soil

CLOUD TOP HEIGHT: 40,000 ft MSL
CLOUD BOTTOM HEIGHT: 25,200 ft MSL

REMARKS:

The on-site fallout pattern was constructed from two different ground surveys performed by the Rad-Safe organization between H+½ hour and D+1 day. AN/PDR-39 instruments were used. Seven stake lines (approximately radial) along existing roads around ground zero aided the survey teams in locating their position. The off-site fallout pattern was drawn from ground-survey readings taken by the off-site Radiological Safety organization. The $t^{-1.2}$ decay approximation was used to extrapolate the dose-rate readings to H+1 hour for both on-site and off-site patterns.

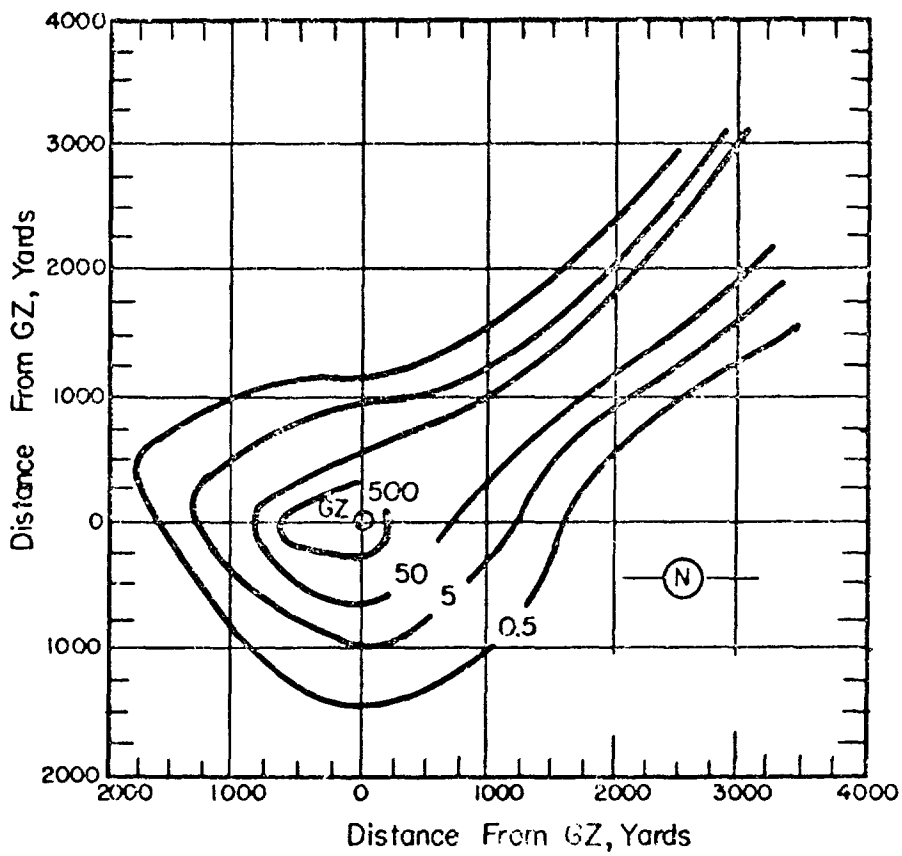


Figure 159. Operation TEAPOT - Zucchini.
On-site dose rate contours in r/hr at H+1 hour.

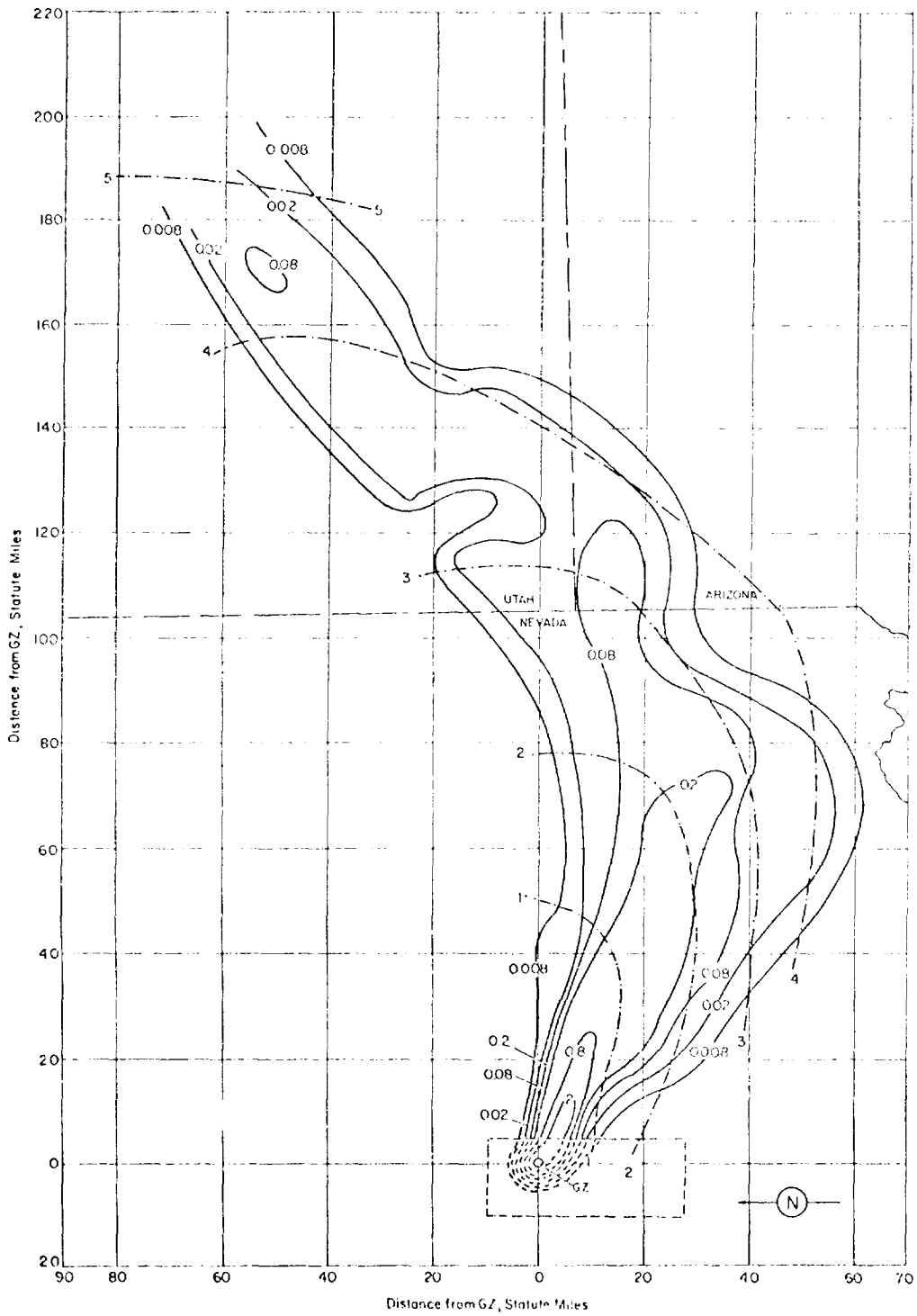


Figure 160. Operation TEAPOT - Zucchini. Off-site dose rate contours in r/hr at H+1 hour.

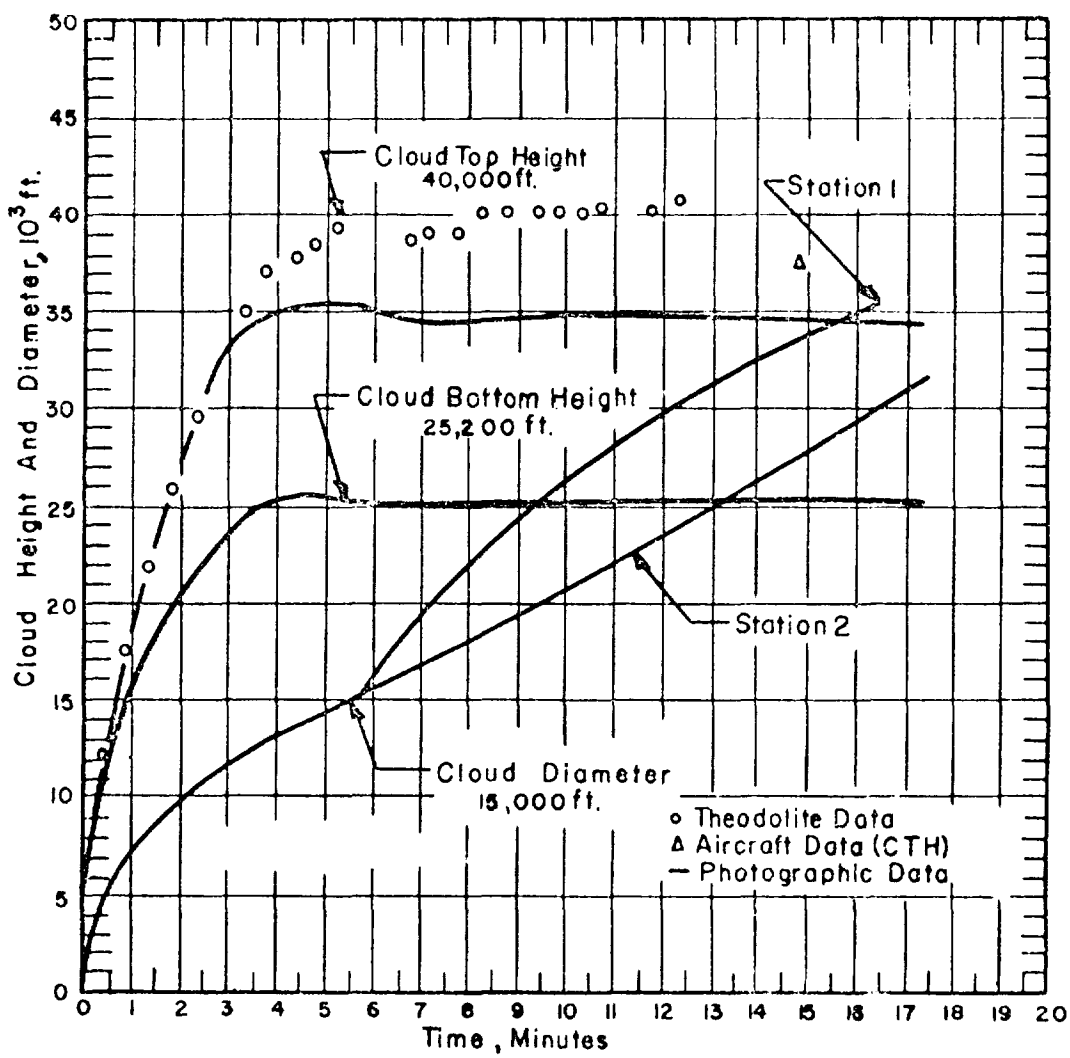


Figure 161. Cloud Dimensions: Operation TEAPOT - Zucchini.

TABLE 46 NEVADA WIND DATA FOR OPERATION TEAPOT- ZUCCHINI

Altitude (MSL)	H-hour Dir	H-hour Speed
feet	degrees	mph
Surface	320	07
5,000	330	14
6,000	340	13
7,000	340	08
8,000	340	07
9,000	330	09
10,000	310	13
11,000	300	17
12,000	310	25
13,000	310	29
14,000	310	35
15,000	310	40
16,000	310	45
17,000	300	48
18,000	300	49
19,000	290	46
20,000	290	46
21,000	290	49
22,000	280	59
23,000	270	59
24,000	270	63
25,000	260	69
26,000	260	74
27,000	260	77
28,000	260	82
29,000	270	83
30,000	270	83
31,000	270	82
32,000	260	80
33,000	260	77
34,000	260	75
35,000	250	74
36,000	250	74
37,000	250	76
38,000	250	79
39,000	260	80
40,000	260	78
41,000	260	72
42,000	260	63
43,000	260	67
44,000	260	41
45,000	250	39
46,000	240	41
47,000	230	46
48,000	240	45
49,000	250	40
50,000	250	31

NOTES:

1. Tropopause height was 44,000 ft MSL.
2. At shot height the temperature was 2.1°C and the pressure 851 mb.

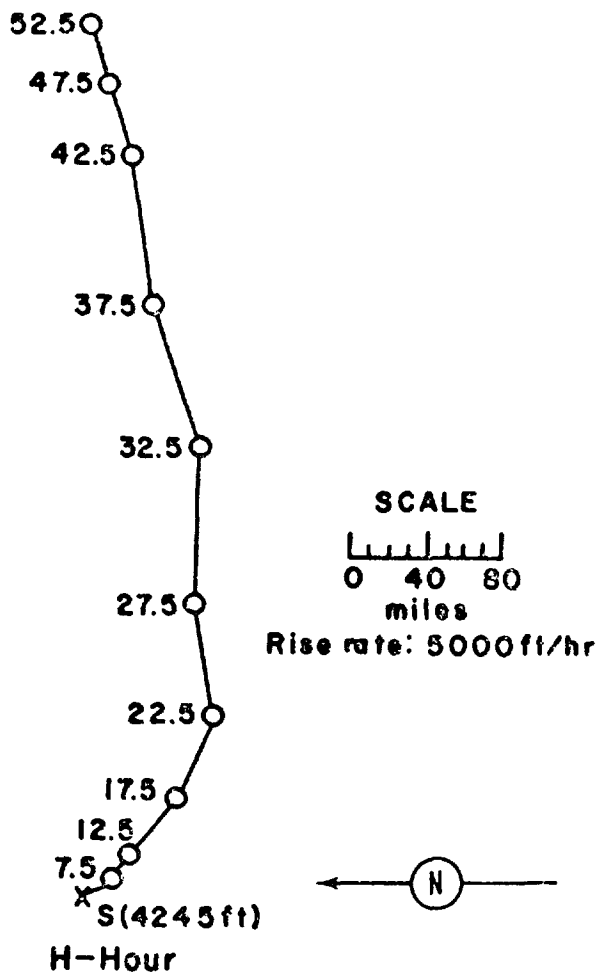


Figure 162. Hodograph for Operation TEAPOT - Zucchini.

56 PROJECT - Safety Experiment No. 1

	PST	GMT
DATE:	1 Nov 1955	1 Nov 1955
TIME:	1410	2210

Sponsor: LASL

SITE: NTS - Area 11a
Site elevation: 4,200 ft

HEIGHT OF BURST: Surface

TYPE OF BURST AND PLACEMENT:
Surface burst on Nevada soil

CLOUD TOP HEIGHT: NM
CLOUD BOTTOM HEIGHT: NM

REMARKS:

No fission product fallout resulted from this test. Alpha surface contamination extended about 70 feet from ground zero, apparently in all directions. At one point, approximately 400 yards from ground zero, alpha readings of 200 to 3500 counts/min were observed on the recovery cable and samples. The alpha readings were taken with the "Pee-Wee" alpha survey meter. This survey meter is a battery operated proportional counter with a separate alpha-sensitive probe which has a steel grid over 0.25-mil mylar with an effective area of 55 cm^2.

56 PROJECT - Safety Experiment No. 2

	PST	GMT
DATE:	3 Nov 1955	3 Nov 1955
TIME:	1315	2115

Sponsor: LASL

SITE: NTS - Area 11B
Site elevation: 4,200 ft

HEIGHT OF BURST: Surface

TYPE OF BURST AND PLACEMENT:
Surface burst on Nevada soil

CLOUD TOP HEIGHT: NM
CLOUD BOTTOM HEIGHT: NM

REMARKS:

No fission product fallout resulted from this test. "Alpha surface contamination levels around the zero pad were in excess of $2x10^6$ counts/min. In general, the plywood from the zero shack was a factor of 10 higher in alpha activity than the metal liner, with the plywood reading about $2x10^6$ counts/min. At 400 yards from zero the cable showed 10,000 to 20,000 counts/min alpha and the sample holders above 20,000 counts/min."

56 PROJECT - Safety Experiment No. 3

	PST	GMT
DATE:	5 Nov 1955	5 Nov 1955
TIME:	1155	1955

Sponsor: LASL

SITE: NTS - Area 11C
Site elevation: 4,200 ft

HEIGHT OF BURST: 3 ft

TYPE OF BURST AND PLACEMENT:
Surface burst on Nevada soil

CLOUD TOP HEIGHT: NM
CLOUD BOTTOM HEIGHT: NM

REMARKS:

No significant fission product fallout resulted from this test. "A maximum of 120 mr/hr gamma at H+1 hour was found at the center of the zero pad. The level decreased rapidly to less than 1 mr/hr at approximately 100 feet from the center."

"Alpha surface contamination levels around the zero pad were lower than on Shot 2 by about a factor of 10, with the plywood exhibiting higher readings than the metal, as before."

56 PROJECT - Safety Experiment No. 4

	PST time	GMT
DATE:	18 Jan 1956	18 Jan 1956
TIME:	1330	2130

Sponsor: LASL

SITE: NTS - Area 11D
Site elevation: 4,200 ft

HEIGHT OF BURST: 3 ft

TYPE OF BURST AND PLACEMENT:
Surface burst on Nevada soil

CLOUD TOP HEIGHT: 3,000 ft above GZ
CLOUD BOTTOM HEIGHT: 2,000 ft above GZ

REMARKS:

The on-site fallout pattern was obtained by ground surveys made by scientific projects along a thoroughly marked sampling array. The $t^{-1.2}$ decay approximation was used to extrapolate the dose rates to H+1 hour. Extensive alpha contamination was encountered. An alpha concentration of 1,000 dis/min/in^2 correlated with the 1.0 r/hr at H+1 hour gamma contour dose in, and also with the 10 mr/hr at H+1 hour gamma contour further out.

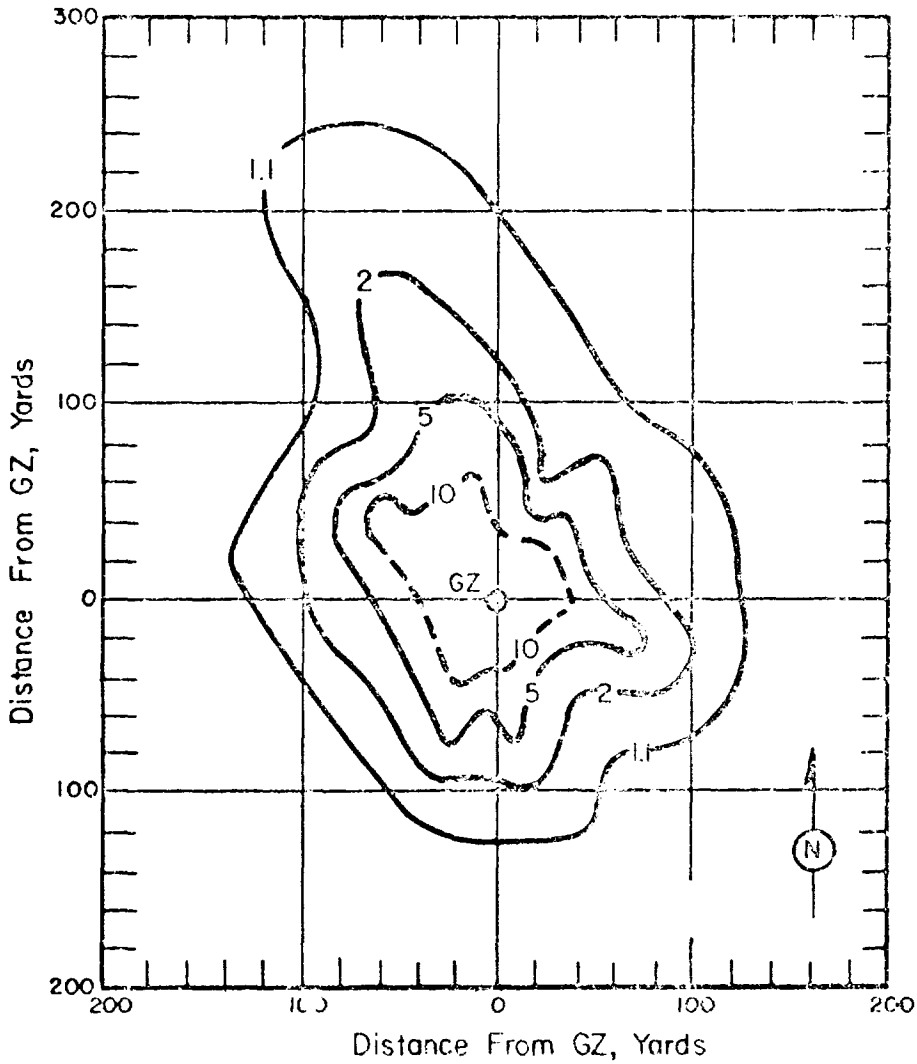
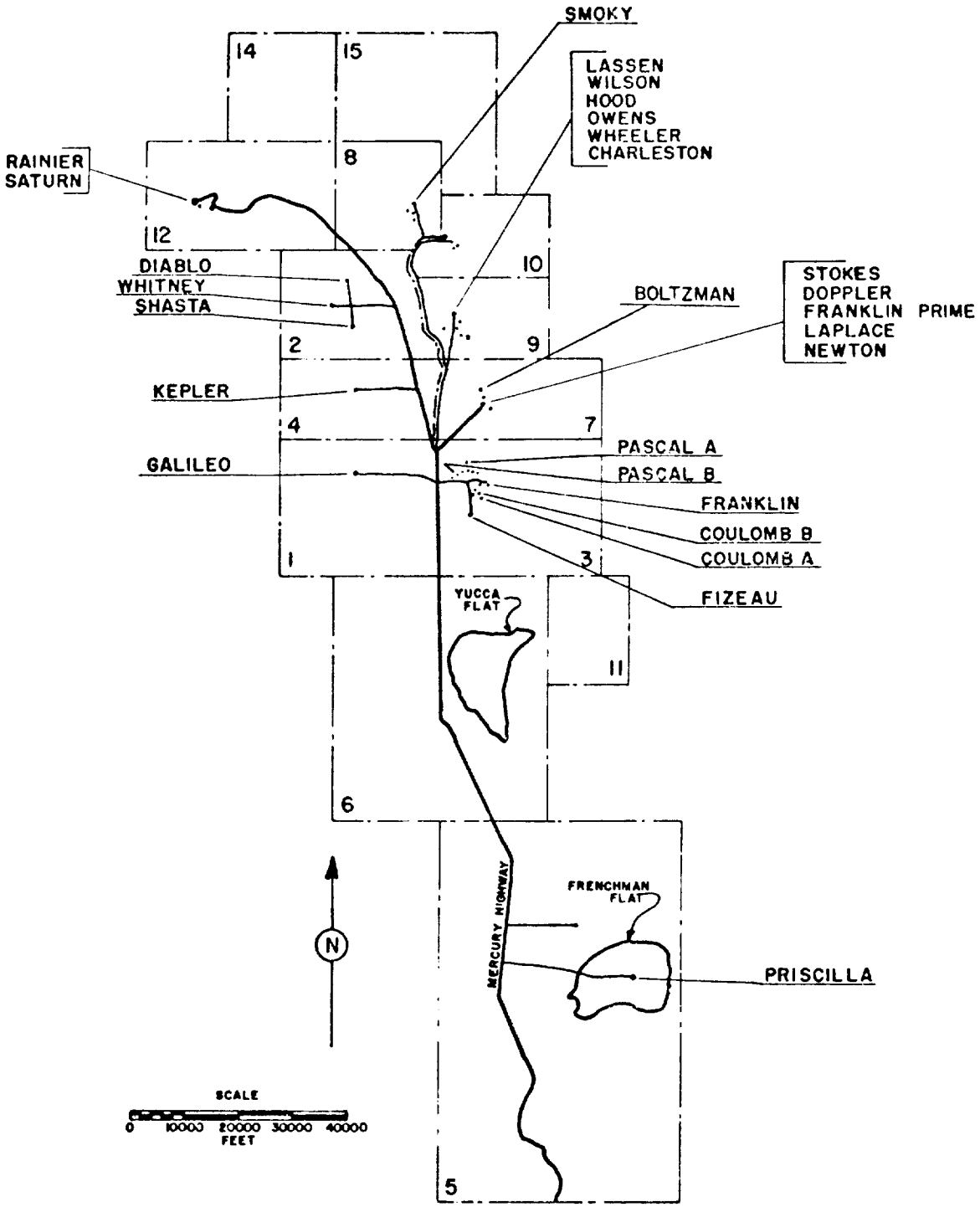


Figure 163. 56 PROJECT - Safety Experiment No. 4 On-site dose rate contours in r/hr at H+1 hour.



NEVADA TEST SITE

Figure 164 . Operation PLUMBBOB, Shot Locations.

OPERATION PLUMBBOB - Safety Experiment No. 5 - 57 Test Group

	PST	GMT
DATE:	24 Apr 1957	24 Apr 1957
TIME:	0627	1427

Sponsor: LASL - DOD

SITE: NTS - Area 13
Site elevation: 4,585 ft

HEIGHT OF BURST: Surface

TYPE OF BURST AND PLACEMENT:
Surface burst on Nevada soil

CLOUD TOP HEIGHT: 750 ft
CLOUD BOTTOM HEIGHT: 400 ft

REMARKS:

Only alpha contamination was observed. The survey was made with gas proportional alpha counters (Model PAC-1G) over concrete pads. The concrete pads were placed next to fallout collectors. The alpha-survey contours were adjusted by using results of radiochemical analyses of the fallout collector contents.

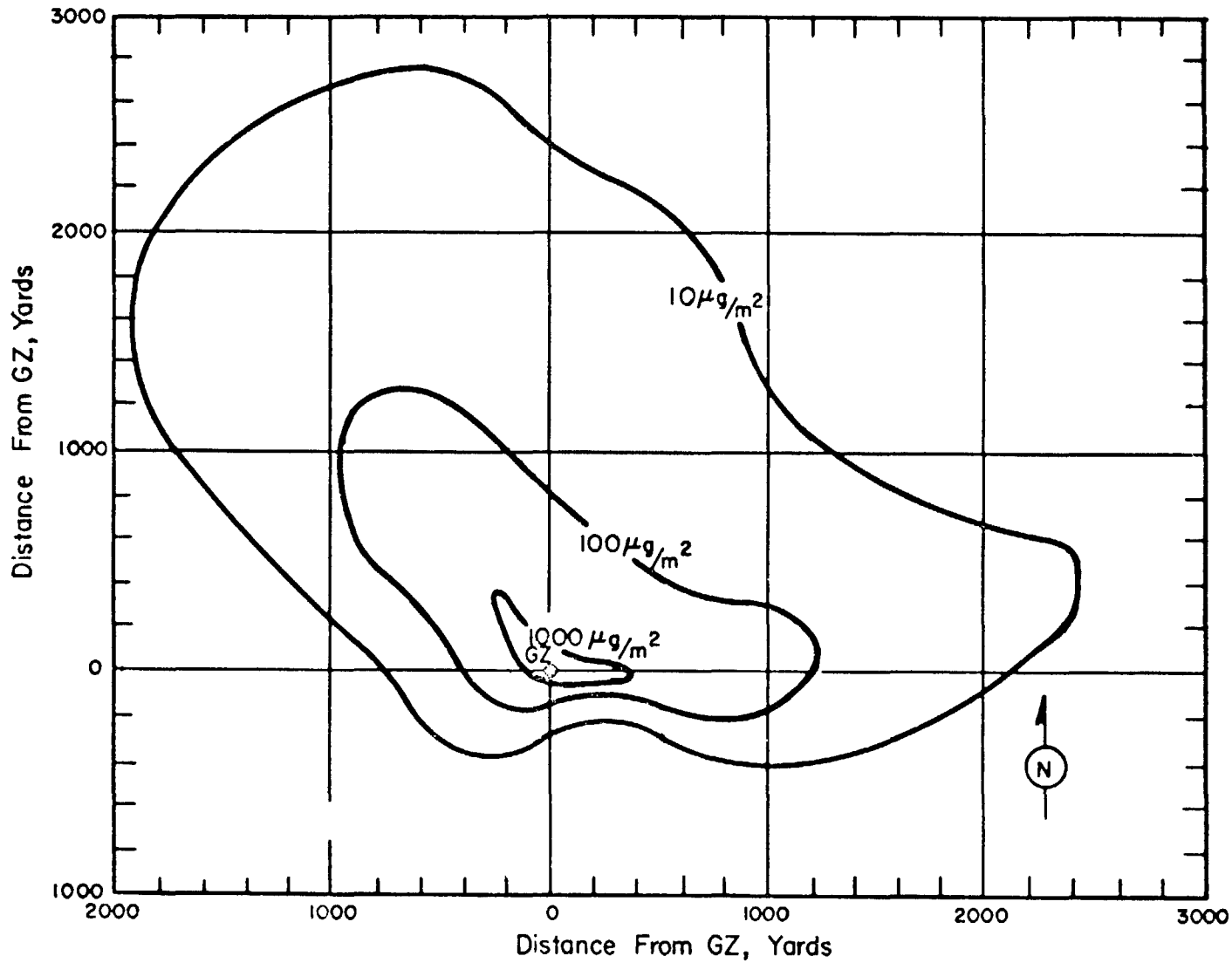


Figure 165. Operation PLUMBBOB - Safety Experiment No. 5 - 57 Test Group. On-site alpha contamination in micrograms per square meter.

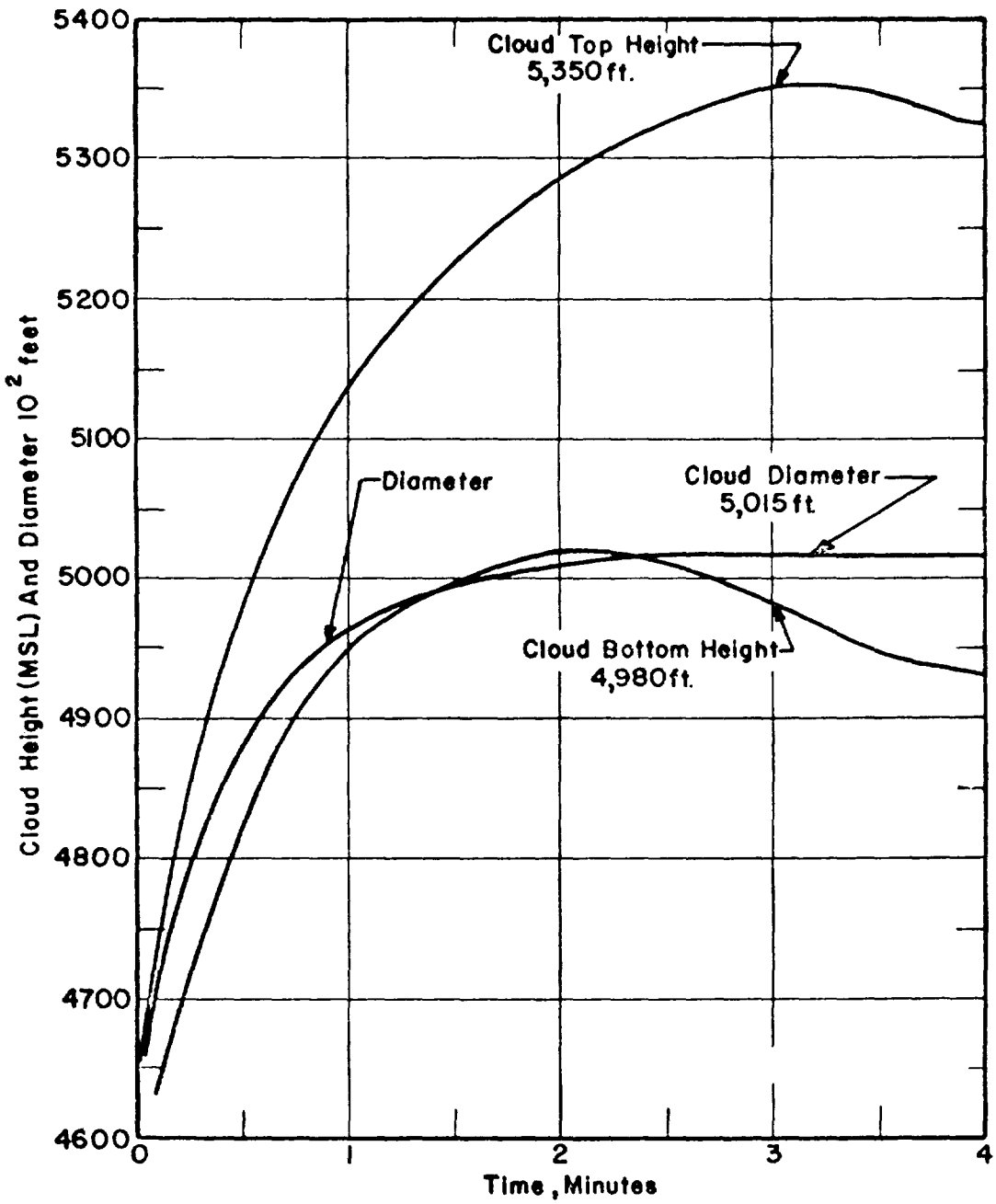


Figure 166. Cloud Dimensions: Operation PLUMBBOB
Safety Experiment No. 5 - 57 Test Group

NEVADA WIND DATA FOR OPERATION PLUMBBOB SAFETY EXPERIMENT NO. 5 - 57 TEST GROUP

Wind velocities were measured using theodolites at two stations during the period H-2 hours to H+1½ hours. Light winds (2 to 6 miles per hour) and high shear existed during the period of observation for the height range, surface to 1000 feet. The resulting hodographs from the two stations differ markedly from each other and are not consistent with the observed alpha contamination pattern. Probably the best description of the mean wind structure is provided by a reconstruction based upon ground and aerial photography of the cloud. The hodograph shown in figure 279 is based upon such photographic observations

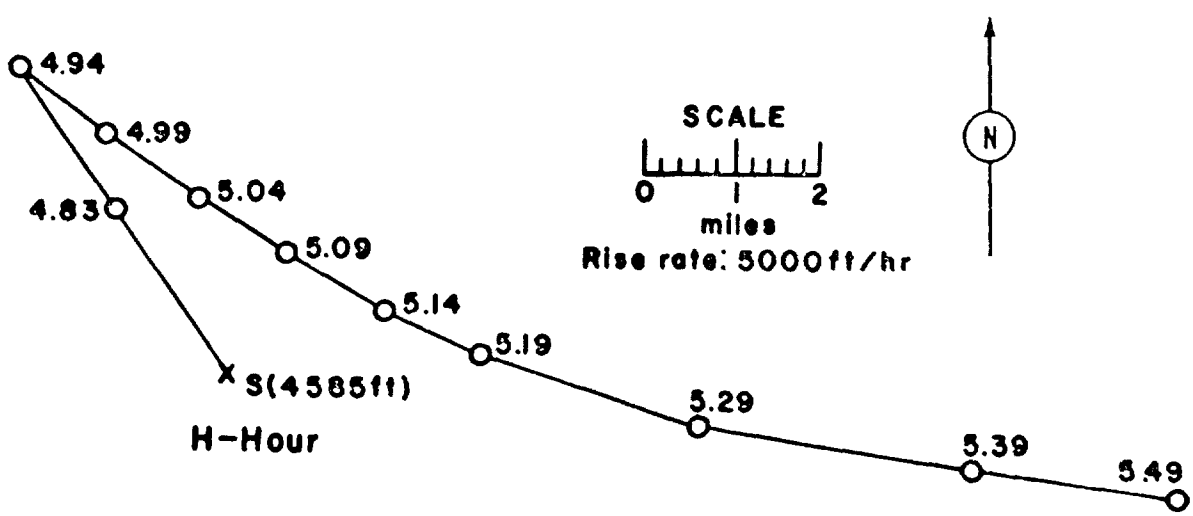


Figure 167. Hodograph for Operation PLUMBBOB Safety Experiment No. 5 - 57 Test Group.

OPERATION PLUMBBOB - Boltzmann

	PDT	GMT
DATE:	28 May 1957	28 May 1957
TIME:	0455	1155

TOTAL YIELD: 12 kt

Sponsor: LASL

SITE: NTS - Area 7C
37° 09' 41" N
116° 01' 25" W
Site elevation: 4,235 ft

HEIGHT OF BURST: 500 ft

TYPE OF BURST AND PLACEMENT:
Tower burst over Nevada soil

CLOUD TOP HEIGHT: 33,000 ft MSL
CLOUD BOTTOM HEIGHT: 23,000 ft MS

CRATER DATA: No crater

FIREBALL DATA:
Time to 1st minimum: NM
Time to 2nd maximum: 174 to 180 msec
Radius at 2nd maximum: NM

REMARKS:

The on-site fallout pattern was drawn from ground survey readings made by the Radiological Safety organization using AN/PDR 43 and AN/PDR 39 survey instruments. The readings were taken at H+7 hrs, D+1 day, D+3 days, D+4 days, and D+7 days along eight radial roads in order to determine radiation exclusion areas. The $t^{-1.2}$ decay approximation was used to extrapolate the dose-rate readings to H+1 hour. The reliability of the extrapolated dose-rate readings is questionable because of the uncertainty in decay rates.

The off-site fallout pattern was analyzed by Program 37 of UCLA. Actual decay data were used to plot the H+12 hour dose-rate contours. The $t^{-1.2}$ decay approximation was used by NDL to extrapolate the dose-rate readings to H+1 hour. The dashed lines show the estimated shape of the iso-intensity contours from GZ to the location of the closest measurement. The 2 r/hr "hot spot", some 70 miles downwind of GZ, was located immediately downwind of a mountain range and rain was reported in the general vicinity at the time the fallout occurred.

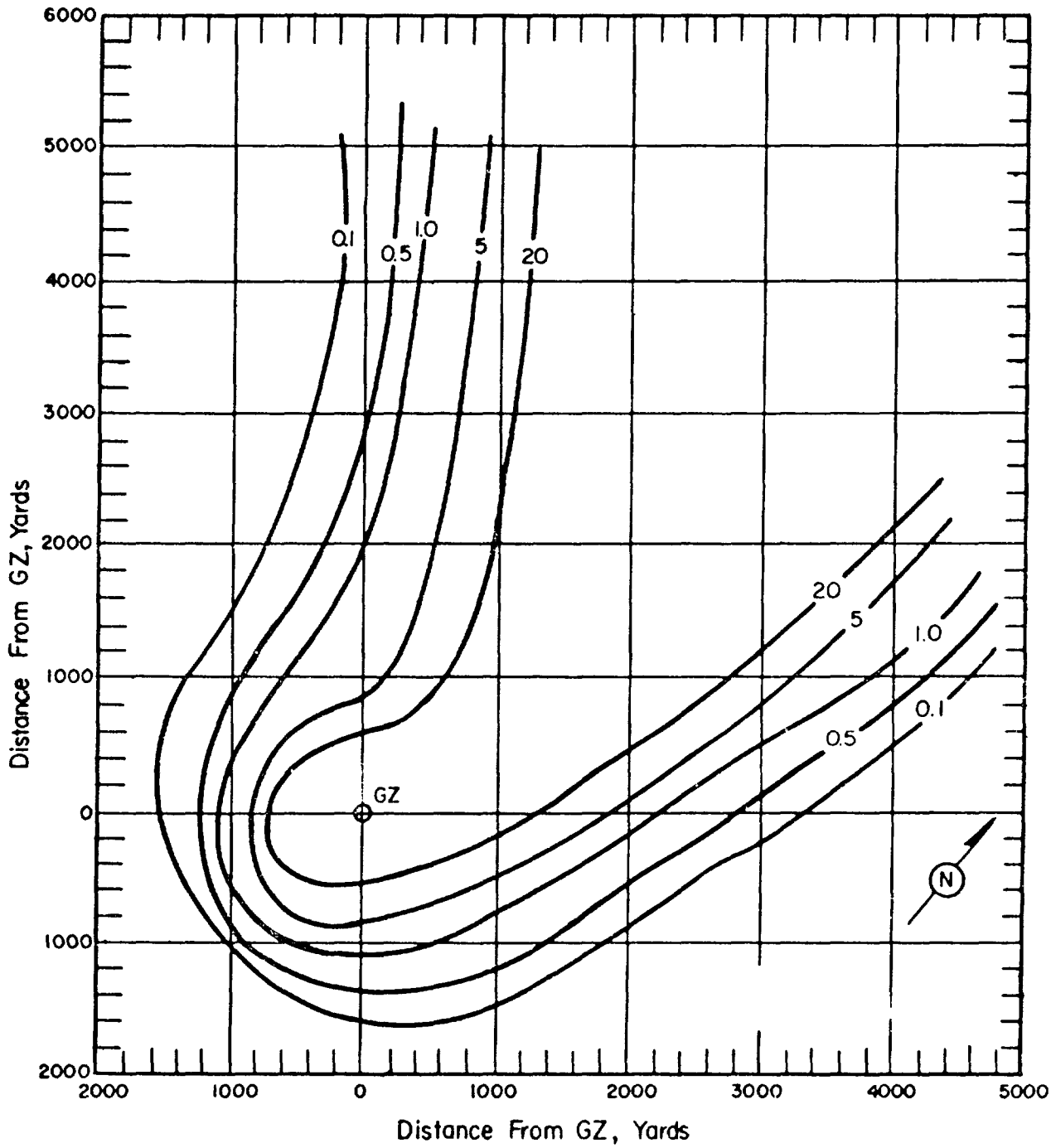


Figure 168. Operation PLUMBBOB - Boltzmann.
On-site dose rate contours in r/hr at H+1 hour.

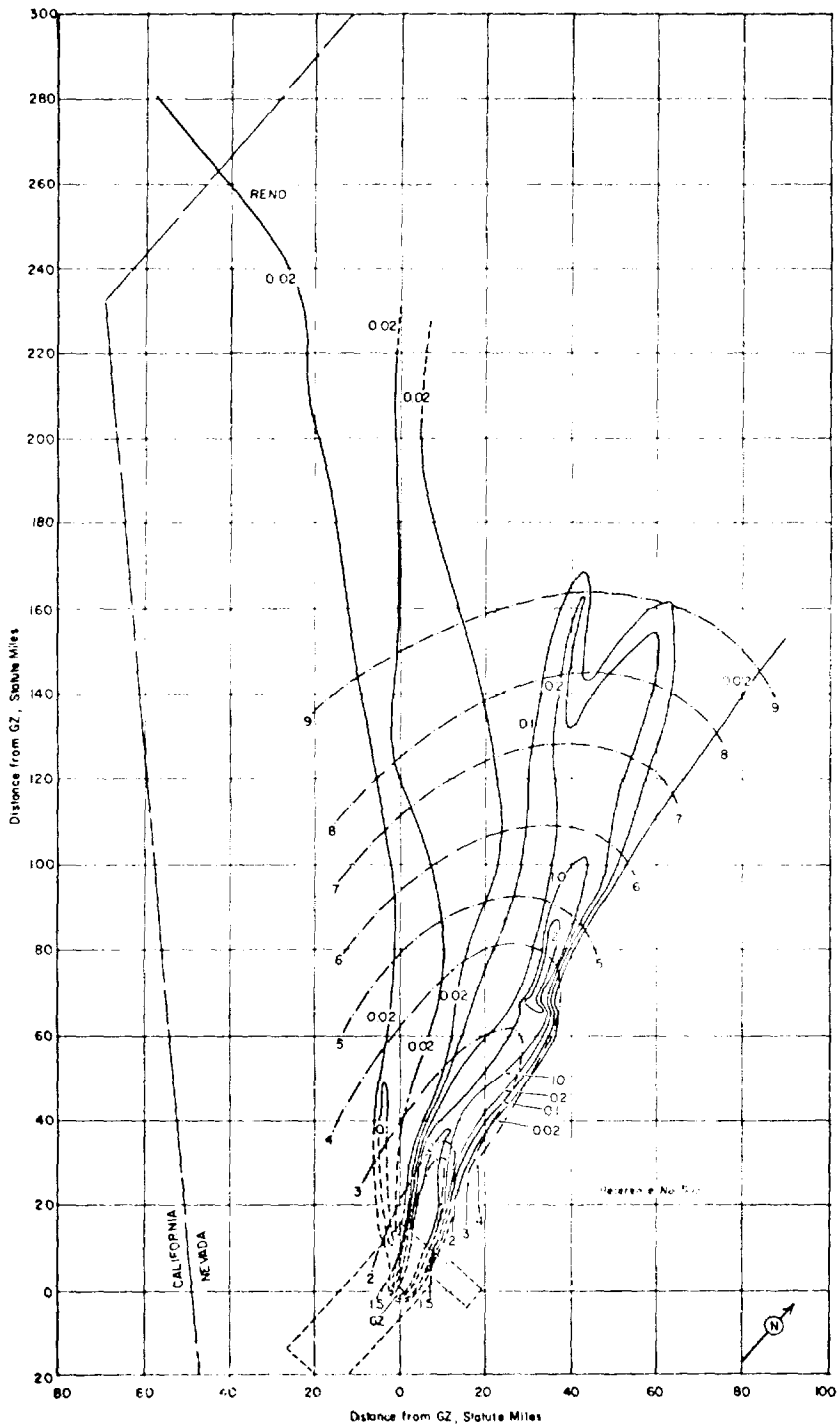


Figure 169. Operation PLUMBBOB - Boltzmann. Off-site dose rate contours in r/hr at H+1 hour.

TABLE 47 NEVADA WIND DATA FOR OPERATION PLUMBBOB - BOLTZMANN

Altitude (MSL)	H-hour		H+3 hours		Altitude (MSL)	H-hour		H+3 hours	
	Dir	Speed	Dir	Speed		Dir	Speed	Dir	Speed
feet	degrees	mph	degrees	mph	feet	degrees	mph	degrees	mph
Surface	Calm	Calm	120	02	28,000	160	23	---	--
5,000	Calm	Calm	130	05	29,000	170	23	---	--
6,000	Calm	Calm	140	07	30,000	170	24	160	25
7,000	Calm	Calm	140	05	31,000	180	25	---	--
8,000	200	12	150	08	32,000	180	26	---	--
9,000	190	13	150	14	33,000	180	26	---	--
10,000	150	15	140	15	34,000	180	26	---	--
11,000	140	17	---	--	35,000	190	26	190	38
12,000	140	18	150	16	36,000	190	46	---	--
13,000	140	20	---	--	37,000	200	51	---	--
14,000	130	21	130	23	38,000	220	47	---	--
15,000	130	24	(130)	(29)	39,000	220	53	---	--
16,000	140	31	140	36	40,000	220	54	210	61
17,000	140	29	---	--	41,000	220	55	---	--
18,000	140	31	160	35	42,000	210	61	---	--
19,000	140	30	---	--	43,000	210	52	---	--
20,000	150	28	130	29	44,000	210	45	---	--
21,000	160	25	---	--	45,000	230	52	220	45
22,000	160	23	---	--	46,000	240	46	---	--
23,000	170	23	150	26	47,000	240	39	---	--
24,000	170	21	---	--	48,000	230	36	---	--
25,000	170	21	160	26	49,000	230	32	---	--
26,000	170	21	---	--	50,000	230	33	220	32
27,000	170	23	---	--	51,000	230	38	---	--

NOTES:

1. Numbers in parentheses are estimated values.
2. Wind data was obtained from the Yucca weather station.
3. Tropopause height was 41,000 ft MSL.
4. At H-hour the surface air pressure was 868 mb, the temperature 18.1°C, the dew point 4.5°C and the relative humidity 41%.

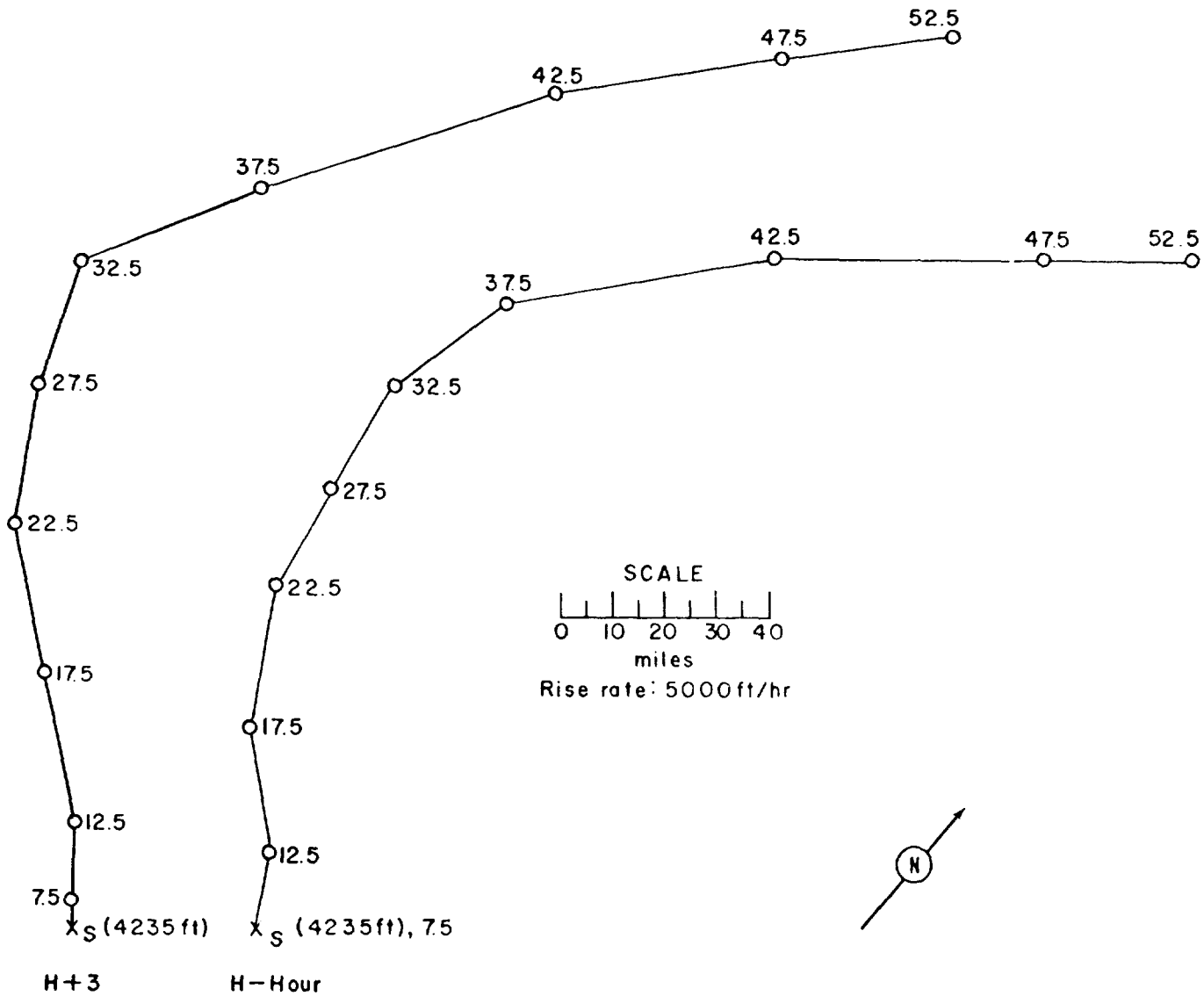


Figure 170. Hodographs for Operation PLUMBBOB - Boltzmann.

OPERATION PLUMBBOB - Franklin

	PDT	GMT
DATE:	2 Jun 1957	2 Jun 1957
TIME:	0455	1155

TOTAL YIELD: 140 tons

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

Sponsor: LASL

SITE: NTS - Area 3
37° 02' 52" N
116° 01' 16" W
Site elevation: 4,026 ft

HEIGHT OF BURST: 300 ft

TYPE OF BURST AND PLACEMENT:
Tower burst over Nevada soil

CLOUD TOP HEIGHT: 16,700 ft
CLOUD BOTTOM HEIGHT: 14,000 ft

CRATER DATA: No crater

REMARKS:

The pattern was obtained from ground-survey readings of the Radiological Safety Division of Reynolds Electrical and Engineering Co., Inc., using AN/PDR 43 and AN/PDR 39 survey instruments. The readings were taken at H+1 hour and D+1 day along eight radial lines in order to determine radiation exclusion areas. The dose-rate readings were extrapolated to H+1 hour using actual dose-rate decay data

No off-site fallout was observed.

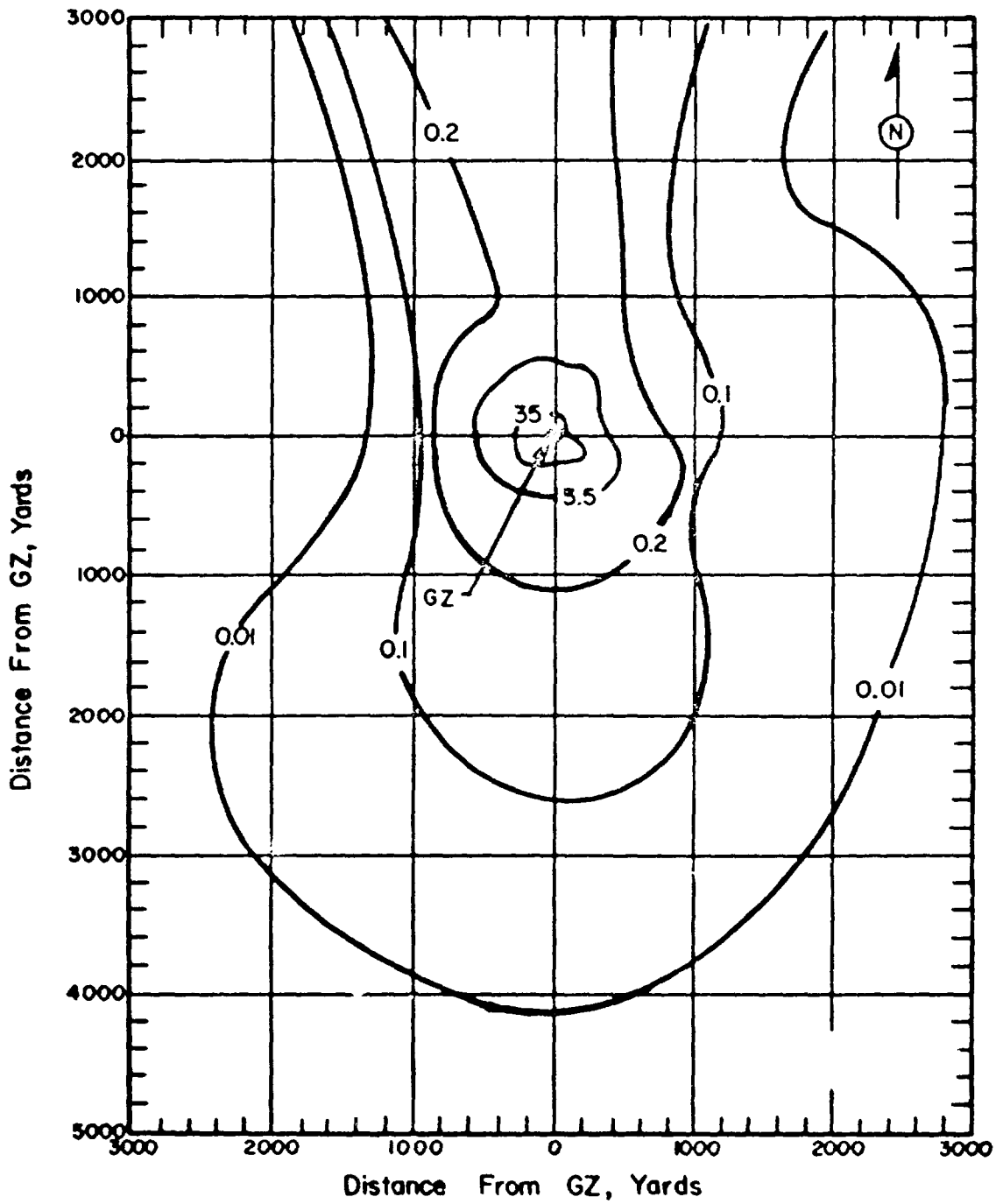


Figure 171. Operation PLUMBBOB - Franklin
On-site dose rate contours in r/hr at H+1 hour.

TABLE 48 NEVADA WIND DATA FOR OPERATION PLUMBBOB - FRANKLIN

Altitude (MSL)	H+1 hour		H+3 hours	
	Dir	Speed	Dir	Speed
feet	degrees	mph	degrees	mph
Surface	Calm	Calm	Calm	Calm
5,000	Calm	Calm	Calm	Calm
6,000	Calm	Calm	Calm	Calm
7,000	Calm	Calm	Calm	Calm
8,000	Calm	Calm	150	02
9,000	Calm	Calm	150	06
10,000	Calm	Calm	150	07
11,000	Calm	Calm	---	--
12,000	130	08	160	07
13,000	130	09	---	--
14,000	120	07	160	07
15,000	120	07	(220)	(06)
16,000	180	07	280	05
17,000	040	03	---	--
18,000	310	09	Calm	Calm
19,000	310	09	---	--
20,000	310	07	Calm	Calm
21,000	310	09	---	--
22,000	270	07	---	--
23,000	230	09	Calm	Calm
24,000	230	13	---	--
25,000	230	16	Calm	Calm
30,000	290	07	280	12
35,000	300	09	300	16
40,000	300	23	320	21
45,000	320	31	310	26
50,000	280	24	290	31

NOTES:

1. Numbers in parentheses are estimated values.
2. Wind data was obtained from the Yucca weather station.
3. At the surface the air pressure was 878 mb, the temperature 14.0°C, the dew point 3.0°C, and the relative humidity 47%.

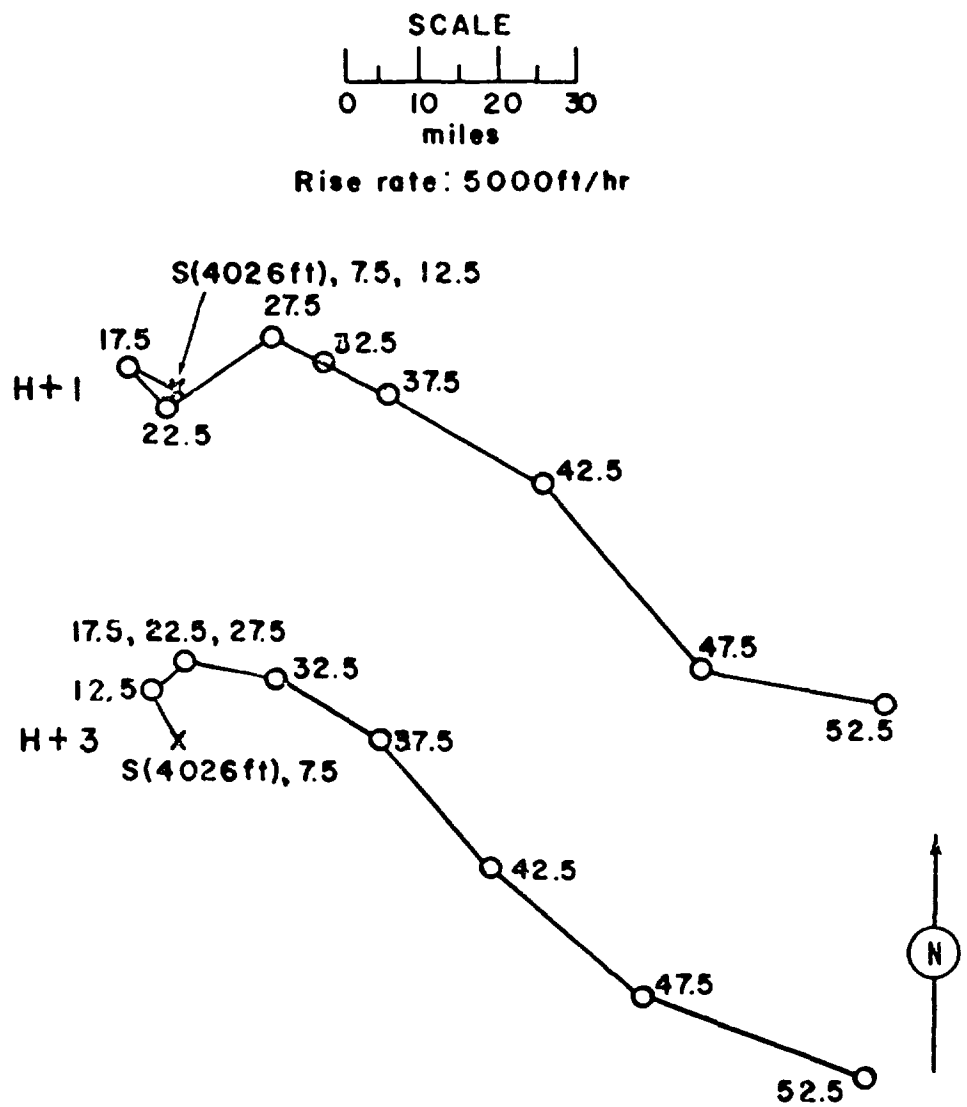


Figure 172. Hodographs for Operation PLUMBBOB- Franklin.

OPERATION PLUMBBOB - Lassen

	PDT	GMT
DATE:	5 Jun 1957	5 Jun 1957
TIME:	0445	1145

TOTAL YIELD: 0.5 tons

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

CRATER DATA: No crater

Sponsor: UCRL

SITE: NTS - Area 9a
37° 08' 05" N
116° 02' 27" W
Site elevation: 4,230 ft

HEIGHT OF BURST: 500 ft

TYPE OF BURST AND PLACEMENT:
Air burst from balloon over Nevada soil

CLOUD TOP HEIGHT: 6,600 ft
CLOUD BOTTOM HEIGHT: NM

REMARKS:

The activity is primarily induced activity. The on-site pattern was obtained from H+1 hour ground survey readings of the Radiological Safety Division of Reynolds Electrical and Engineering Co., Inc., using AN/PDR-43 and AN/PDR-39 survey instruments. No decay corrections were necessary. The pattern is fairly reliable.

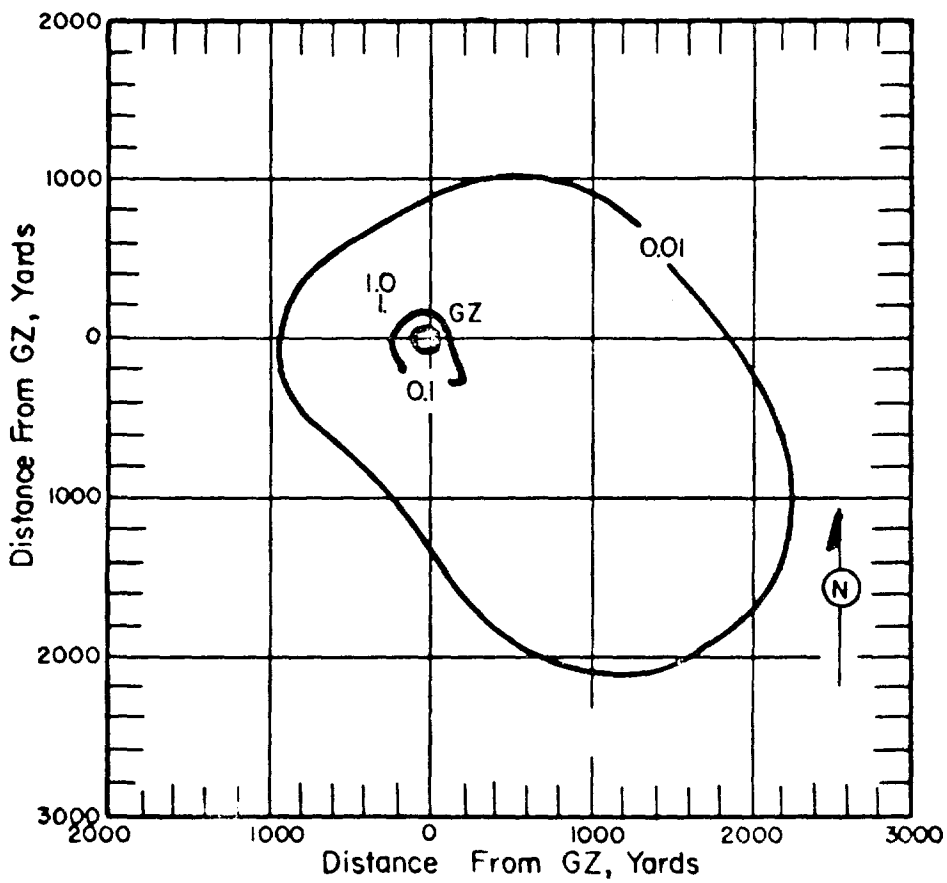


Figure 173. Operation PLUMBBOB - Lassen. On-site dose rate contours in r/hr at H+1 hour.

TABLE 49 NEVADA WIND DATA FOR OPERATION PLUMBBOB- LASSEN

Altitude (MSL)	H-hour		H+2½ hours	
	Dir	Speed	Dir	Speed
feet	degrees	mph	degrees	mph
Surface	Calm	Calm	Calm	Calm
4,700	230	06	---	--
5,000	230	09	330	08
6,000	250	09	300	12
7,000	270	09	250	16
8,000	270	09	250	18
9,000	270	09	290	21
10,000	270	09	290	23
11,000	250	10	(295)	(37)
12,000	220	05	300	31
13,000	230	09	---	--
14,000	240	08	280	21
15,000	230	07	---	--
16,000	200	07	260	20
17,000	180	07	---	--
18,000	200	07	230	23
19,000	200	10	---	--
20,000	210	17	220	21
21,000	220	17	---	--
22,000	220	17	---	--
23,000	220	15	210	23
24,000	220	16	---	--
25,000	210	18	200	23
30,000	240	14	---	--
35,000	260	18	---	--
40,000	250	26	---	--
45,000	300	29	---	--
50,000	300	24	---	--

NOTES:

1. Numbers in parentheses are estimated values.
2. Tropopause height was 42,618 ft MSL at H-hour.
3. Wind Data was obtained from the Yucca weather station.
4. At H+1 hour the surface air pressure was 873 mb, the temperature 23.3°C, the dew point 9.5°C and the relative humidity 40%.

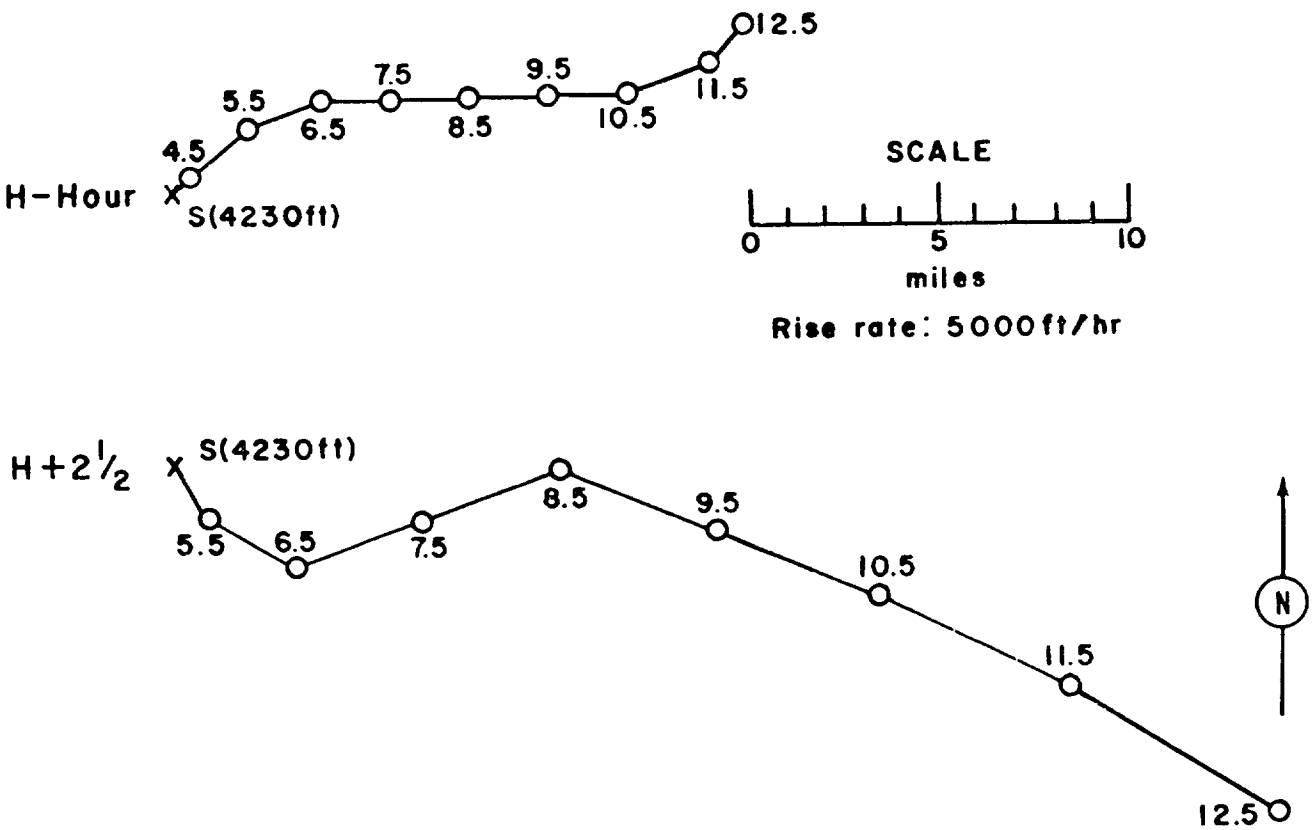


Figure 174. Hodographs for Operation PLUMBBOB - Lassen.

OPERATION PLUMBBOB - Wilson

	PDT	GMT
DATE:	18 Jun 1957	18 Jun 1957
TIME:	0445	1145

TOTAL YIELD: 10 kt

Sponsor: UCRL

SITE: NTS - Area 9a
37° 08' 05" N
116° 02' 27" W
Site elevation: 4,230 ft

HEIGHT OF BURST: 500 ft

FIREBALL DATA:
Time to 1st min.: NM
Time to 2nd max.: 133 msec
Radius at 2nd max: NM

CRATER DATA: No crater

TYPE OF BURST AND PLACEMENT:
Air burst from balloon over Nevada soil

CLOUD TOP HEIGHT: 35,000 ft MSL
CLOUD BOTTOM HEIGHT: 25,000 ft MSL

REMARKS:

On-site contamination was primarily due to induced activity. The on-site pattern was obtained from ground survey readings of the Radiological Safety Division of Reynolds Electrical and Engineering Co., Inc., using AN/PDR 43 and AN/PDR 39 survey instruments. The readings were taken at H+2 hours, D+1 day, D+2 days and D+3 days along eight radial roads to determine radiation exclusion areas. The dose-rate readings are not reliable because the induced-activity-decay curve is not strictly applicable to a mixture of fission products and induced activities. Decay measurements indicated a decay rate similar to Na^{24} for distances out to 1,200 yards from GZ. The off-site fallout was analyzed by Program 37 of UCLA and the USWB Special Projects Section. They used actual decay data to plot the H+12 hour dose-rate contours. The $t^{-1.2}$ decay approximation was used by NDL to extrapolate the H+12 hour dose-rate contours to H+1 hour. The times of arrival were estimated from the wind data.

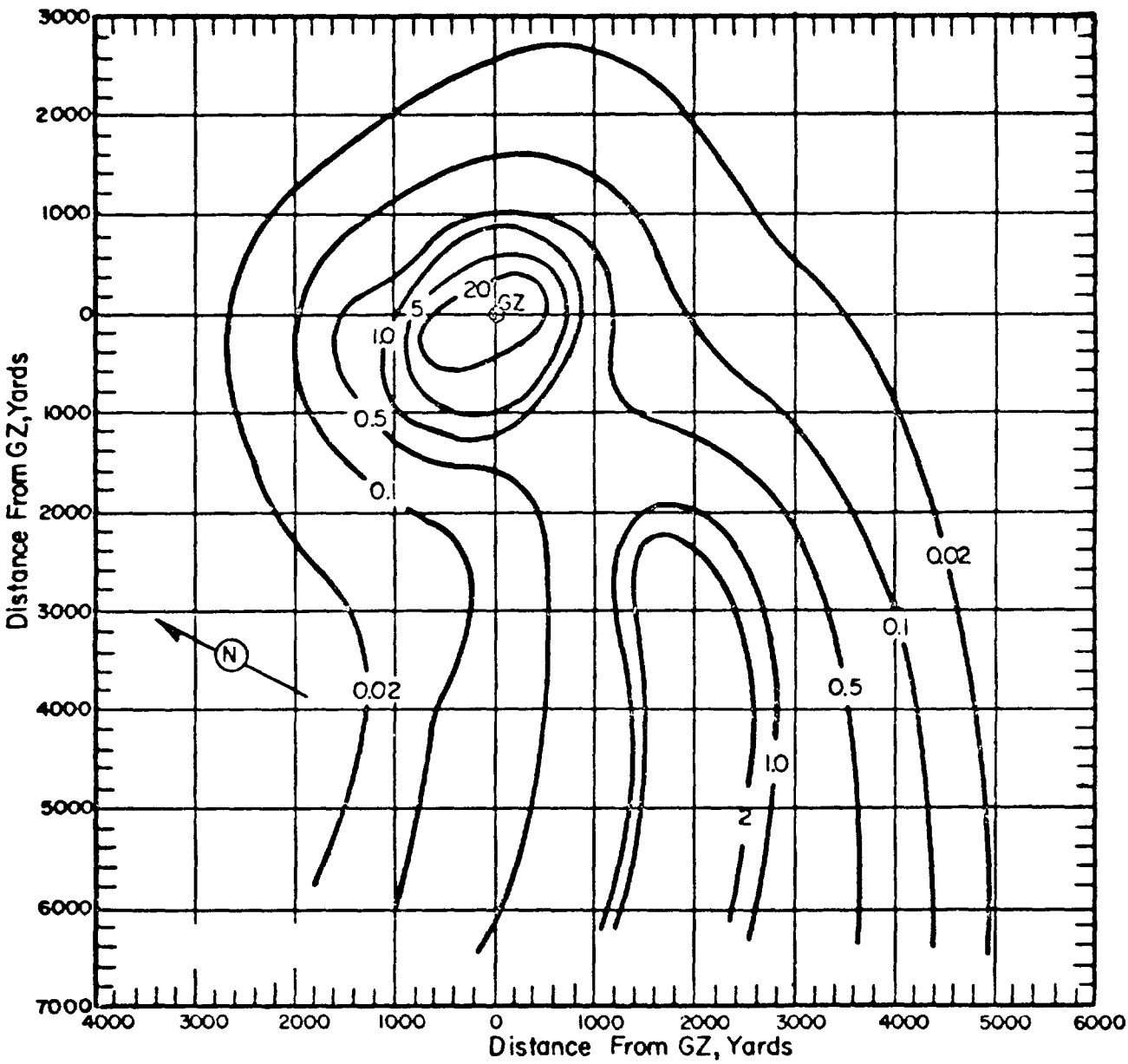


Figure 175. Operation PLUMBBOB - Wilson. On-site dose rate contours in r/hr at H+1 hour.

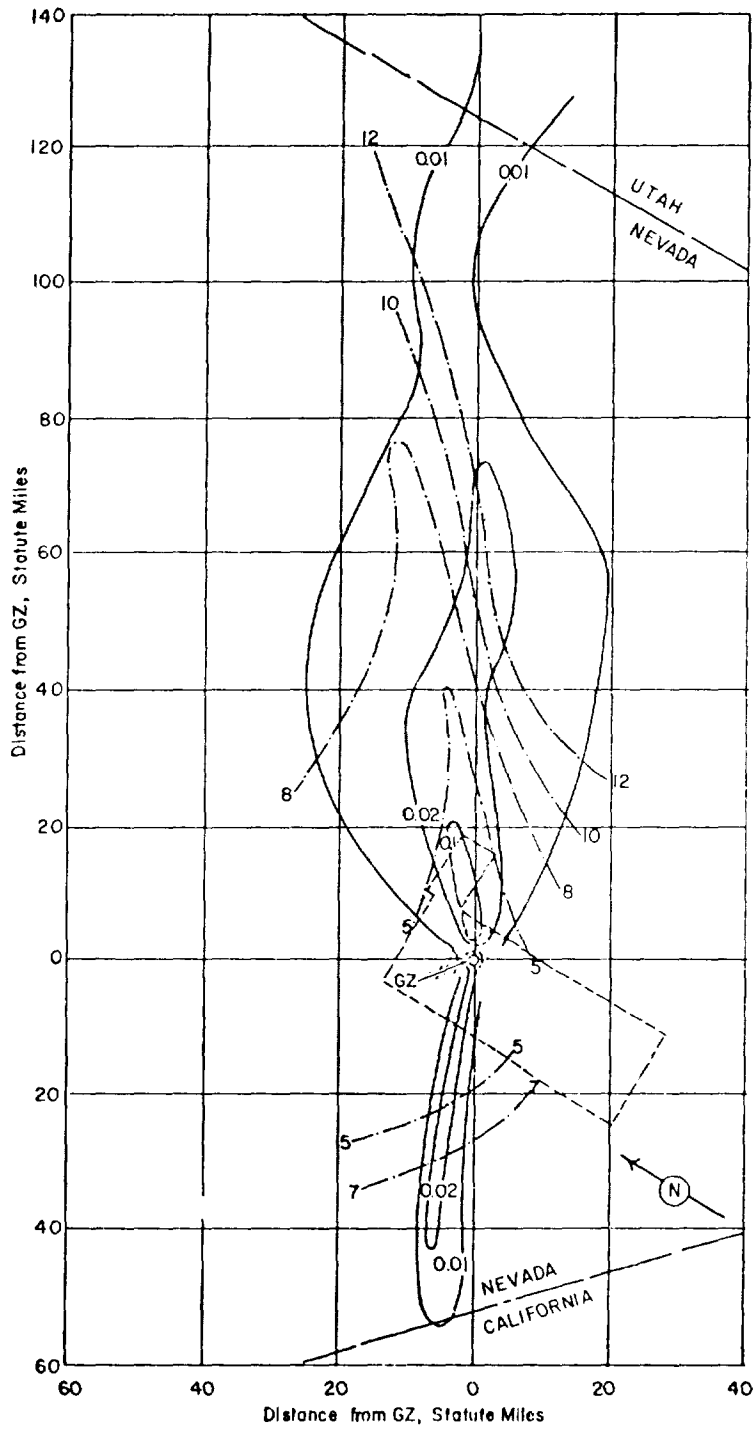


Figure 176. Operation PLUMBBOB - Wilson. Off-site dose rate contours in r/hr at H+1 hour.

TABLE 50 NEVADA WIND DATA FOR OPERATION PLUMBBOB- WILSON

Altitude (MSL)	H-hour		H+3 hours		Altitude (MSL)	H-hour		H+3 hours	
	Dir	Speed	Dir	Speed		Dir	Speed	Dir	Speed
feet	degrees	mph	degrees	mph	feet	degrees	mph	degrees	mph
Surface	340	05	340	02	28,000	220	15	---	--
5,000	030	10	010	06	29,000	230	20	---	--
6,000	060	12	040	09	30,000	240	18	220	20
7,000	080	12	060	12	31,000	240	17	---	--
8,000	070	12	070	12	32,000	230	23	---	--
9,000	060	12	060	12	33,000	230	26	---	--
10,000	060	09	060	12	34,000	240	24	---	--
11,000	050	12	---	--	35,000	240	22	230	21
12,000	080	09	080	06	36,000	240	22	---	--
13,000	150	05	---	--	37,000	240	22	---	--
14,000	310	02	340	08	38,000	240	22	---	--
15,000	300	05	(340)	(08)	39,000	240	22	---	--
16,000	290	02	330	07	40,000	240	24	230	25
17,000	310	09	---	--	41,000	230	26	---	--
18,000	290	09	320	10	42,000	240	24	---	--
19,000	260	09	---	--	43,000	250	20	---	--
20,000	250	09	280	14	44,000	260	17	---	--
21,000	230	09	---	--	45,000	260	17	240	28
22,000	220	09	---	--	46,000	260	20	---	--
23,000	220	10	220	16	47,000	250	24	---	--
24,000	220	13	---	--	48,000	250	25	---	--
25,000	220	14	220	17	49,000	260	24	---	--
26,000	210	13	---	--	50,000	260	21	260	21
27,000	210	12	---	--	51,000	260	16	---	--
					52,000	260	13	---	--
					53,000	260	10	---	--
					54,000	260	10	---	--

NOTES:

1. Numbers in parentheses are estimated values.
2. Tropopause height was 40,000 ft MSL at H-hour.
3. Wind data was obtained from the Yucca weather station.
4. At H-hour the surface air pressure was 882 mb, the temperature 17.0°C, the dew point 2.8°C and the relative humidity 38%.

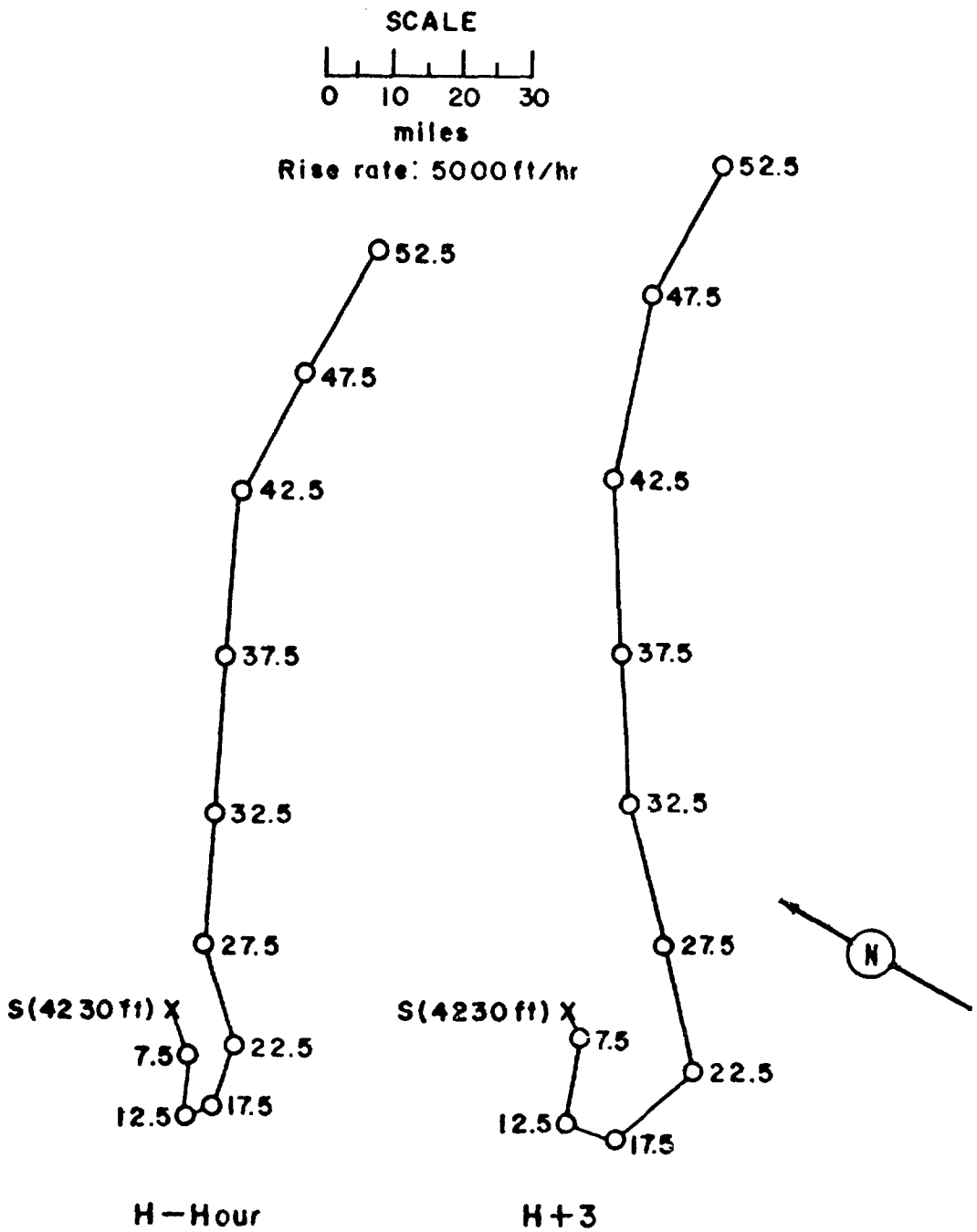


Figure 177. Hodographs for Operation PLUMBBOB - Wilson.

OPERATION PLUMBBOB - Priscilla

	PDT	GMT
DATE:	24 Jun 1957	24 Jun 1957
TIME:	0630	1330

TOTAL YIELD: 37 kt

Sponsor: LASL - DOD

SITE: NTS - Area Frenchman's Flat
37° 47' 53" N
116° 55' 44" W
Site elevation: 3,076 ft

HEIGHT OF BURST: 700 ft

FIREBALL DATA:
Time to 1st minimum: NM
Time to 2nd maximum: 202 to 225 msec
Radius at 2nd maximum: NM

CRATER DATA: No crater

TYPE OF BURST AND PLACEMENT:
Air burst from balloon over Nevada soil

CLOUD TOP HEIGHT: 43,000 ft MSL
CLOUD BOTTOM HEIGHT: 24,000 ft MSL

REMARKS:

On-site contamination was due primarily to induced activities. The on-site dose-rate contours were obtained from ground survey readings of the Radiological Safety Division of Reynolds Electrical and Engineering Co., Inc., and from aerial surveys of a scientific project using AN/PDR 39 and AN/PDR 43 survey instruments. The readings were taken at H+2 hours, H+6 hours, D+1 day, D+2 days and D+3 days along eight radial roads to determine radiation exclusion areas. The induced activity decay curve for Nevada soil was used to extrapolate the dose rate readings to H+1 hour. The dose-rate readings are not reliable because the induced activity decay curve is not strictly applicable to a mixture of fission products and induced activities. Decay measurements indicated a decay rate similar to Na^{24} for distances out to 1,200 yards from ground zero.

The off-site fallout was analyzed by Program 37 of UCLA and the USWB Special Projects Section. They used actual decay data to plot the H+12 hour dose-rate contours. The $t^{-1.2}$ decay approximation was used by NDL to extrapolate the H+12 hour dose-rate contours to H+1 hour. The intensity contours are based on ground and aerial survey data, but the shapes of the close-in contours were estimated due to lack of data. The estimation of time of arrival was done by using measured arrival times at known points

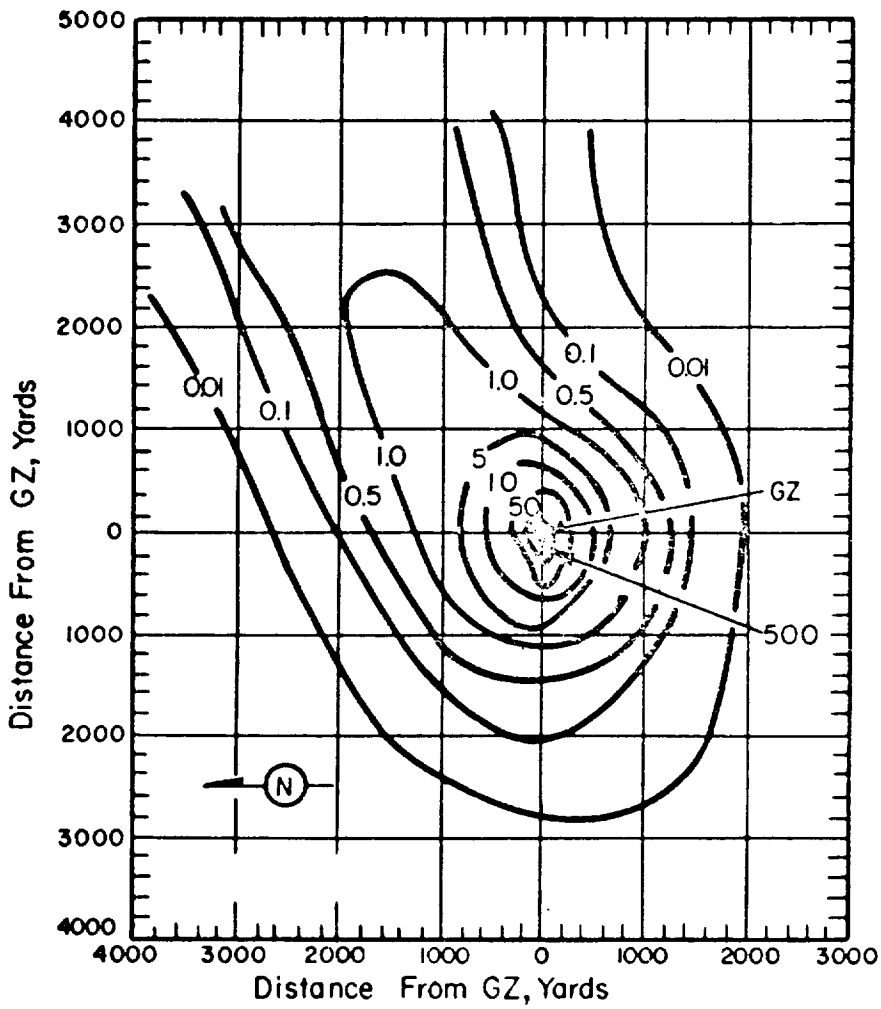


Figure 178. Operation PLUMBBOB - Priscilla. On-site dose rate contours in r/hr at H+1 hour.

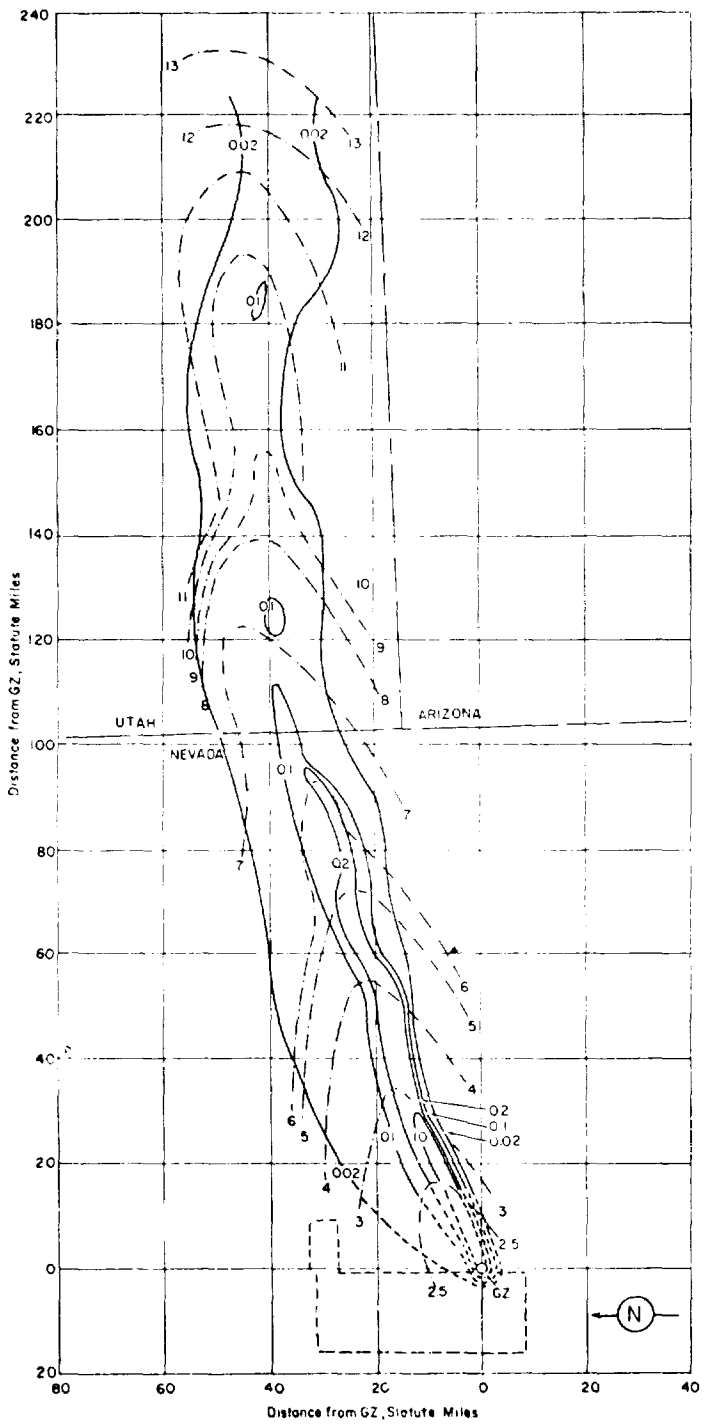


Figure 179. Operation PLUMBBOB - Priscilla. Off-site dose rate contours in r/hr at H+1 hour.

TABLE 51 NEVADA WIND DATA FOR OPERATION PLUMBBOB- PRISCILLA

Altitude (MSL)	H+1 hour		H+4 hours		Altitude (MSL)	H+1 hour		H+4 hours	
	Dir	Speed	Dir	Speed		Dir	Speed	Dir	Speed
feet	degrees	mph	degrees	mph	feet	degrees	mph	degrees	mph
Surface	Calm	Calm	180	05	29,000	250	20	---	--
4,000	Calm	Calm	180	09	30,000	250	20	250	15
5,000	220	03	190	09	31,000	250	18	---	--
6,000	220	07	210	09	32,000	260	16	---	--
7,000	220	07	229	07	33,000	280	12	---	--
8,000	230	09	220	07	34,000	260	15	---	--
9,000	240	09	210	07	35,000	240	15	250	14
10,000	230	09	210	08	36,000	240	20	---	--
11,000	230	07	---	--	37,000	240	23	---	--
12,000	230	08	240	07	38,000	240	26	---	--
13,000	210	09	---	--	39,000	240	32	---	--
14,000	210	08	240	05	40,000	250	41	260	52
15,000	220	07	(250)	(06)	41,000	260	46	---	--
16,000	240	08	260	07	42,000	260	49	---	--
17,000	260	12	---	--	43,000	260	51	---	--
18,000	250	13	240	16	44,000	250	51	---	--
20,000	260	09	240	14	45,000	250	52	250	60
21,000	250	06	---	--	46,000	260	51	---	--
22,000	230	05	---	--	47,000	260	48	---	--
23,000	240	05	230	14	48,000	260	46	---	--
24,000	250	08	---	--	49,000	260	45	---	--
25,000	250	09	240	16	50,000	270	40	270	40
26,000	250	10	---	--	51,000	270	29	---	--
27,000	250	16	---	--	52,000	270	29	---	--
28,000	250	17	---	--	53,000	270	29	---	--
					54,655	270	29	---	--

NOTES:

1. Numbers in parentheses are estimated values.
2. Tropopause height was 49,212 ft MSL at H-hour.
3. Wind data was obtained from rawinsonde observations at the Yucca Weather Station and this data was supplemented by observations below 5,100 ft MSL over ground zero.
4. At H-hour the surface air pressure was 909.5 mb, the temperature 17.5 ± 1°C, the dew point -0.6°C and the relative humidity 29%.

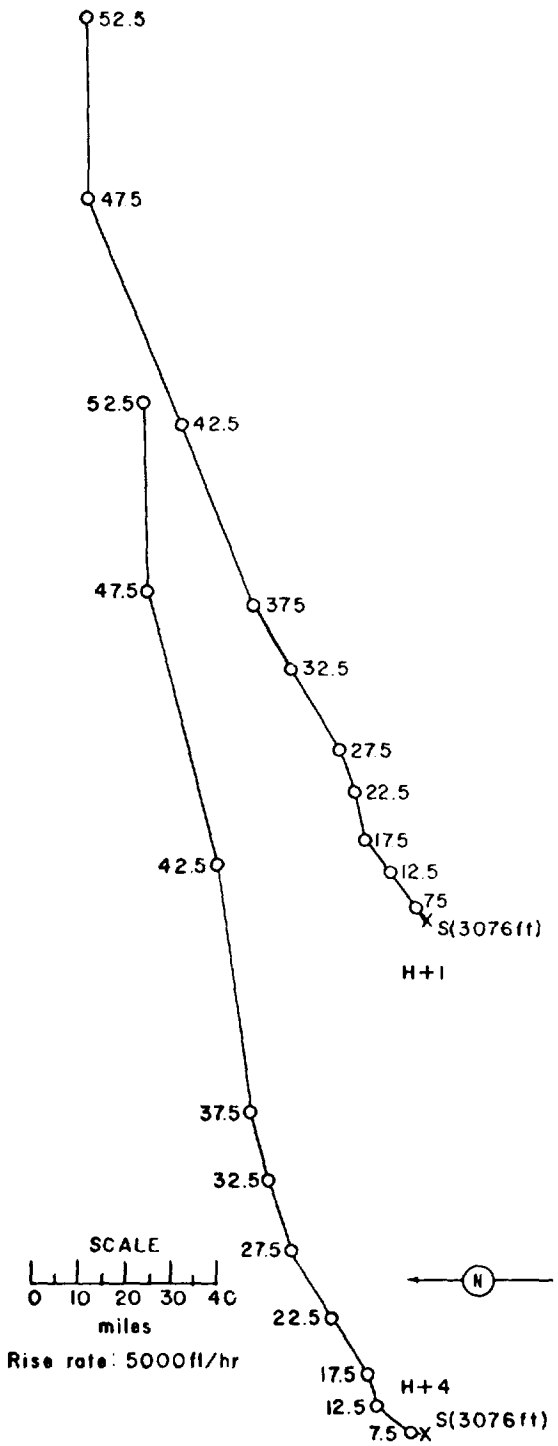


Figure 180. Hodographs for Operation PLUMBBOB - Priscilla.

OPERATION PLUMBBOB - Coulomb A Safety Experiment

Sponsor: LASL

DATE: 1 Jul 1957 1 Jul 1957
TIME: 1030 1730

SITE: NTS - Area 3 H
37° 02' 30" N
116° 01' 33" W
Site elevation: ~ 4,000 ft

HEIGHT OF BURST: Surface

TYPE OF BURST AND PLACEMENT:
Surface burst on Nevada soil

CLOUD TOP HEIGHT: 1,000 ft
CLOUD BOTTOM HEIGHT: NM

REMARKS:

An extensive alpha survey was carried out in the area within a 50-yard radius of ground zero. A general level of 15,000 c/m/55 cm^2 was detected in this area

OPERATION PLUMBBOB - Hood

	PDT	GMT
DATE:	5 Jul 1957	5 Jul 1957
TIME:	0440	1140

TOTAL YIELD: 74 kt

FIREBALL DATA:
Time to 1st minimum: NM
Time to 2nd maximum: 276 to 280 msec
Radius at 2nd maximum: NM

CRATER DATA: No Crater

Sponsor: UCRL

SITE: NTS - Area 9a
37° 08' 05" N
116° 02' 27" W
Site elevation: 4,230 ft

HEIGHT OF BURST: 1,500 ft

TYPE OF BURST AND PLACEMENT:
Air burst from balloon over Nevada soil

CLOUD TOP HEIGHT: 48,000 ft MSL
CLOUD BOTTOM HEIGHT: 35,000 ft MSL

REMARKS:
On-site contamination was due primarily to induced activities. The on-site dose rate contours were obtained from ground survey readings of the Radiological Safety Division of Reynolds Electrical and Engineering Company, Inc., using AN/PDR 39 and AN/PDR 43 survey instruments. The readings were taken at H+1 hour, H+6 hours, D+1 day, D+2 days and D+3 days. The neutron induced-activity-decay curve for Nevada soil was used to extrapolate the dose-rate readings to H+1 hour. Few readings were taken to the north and east of ground zero because of rough terrain and numerous brush fires ignited by the detonation. The off-site fallout was analyzed by Program 37 of UCLA and the USWB Special Projects Section. They used actual decay data to plot the H+12 hour dose-rate contours. The $t^{-1.2}$ decay approximation was used by NDL to extrapolate the H+12 hour dose-rate contours to H+1 hour. The fallout pattern is based on ground and aerial survey data.

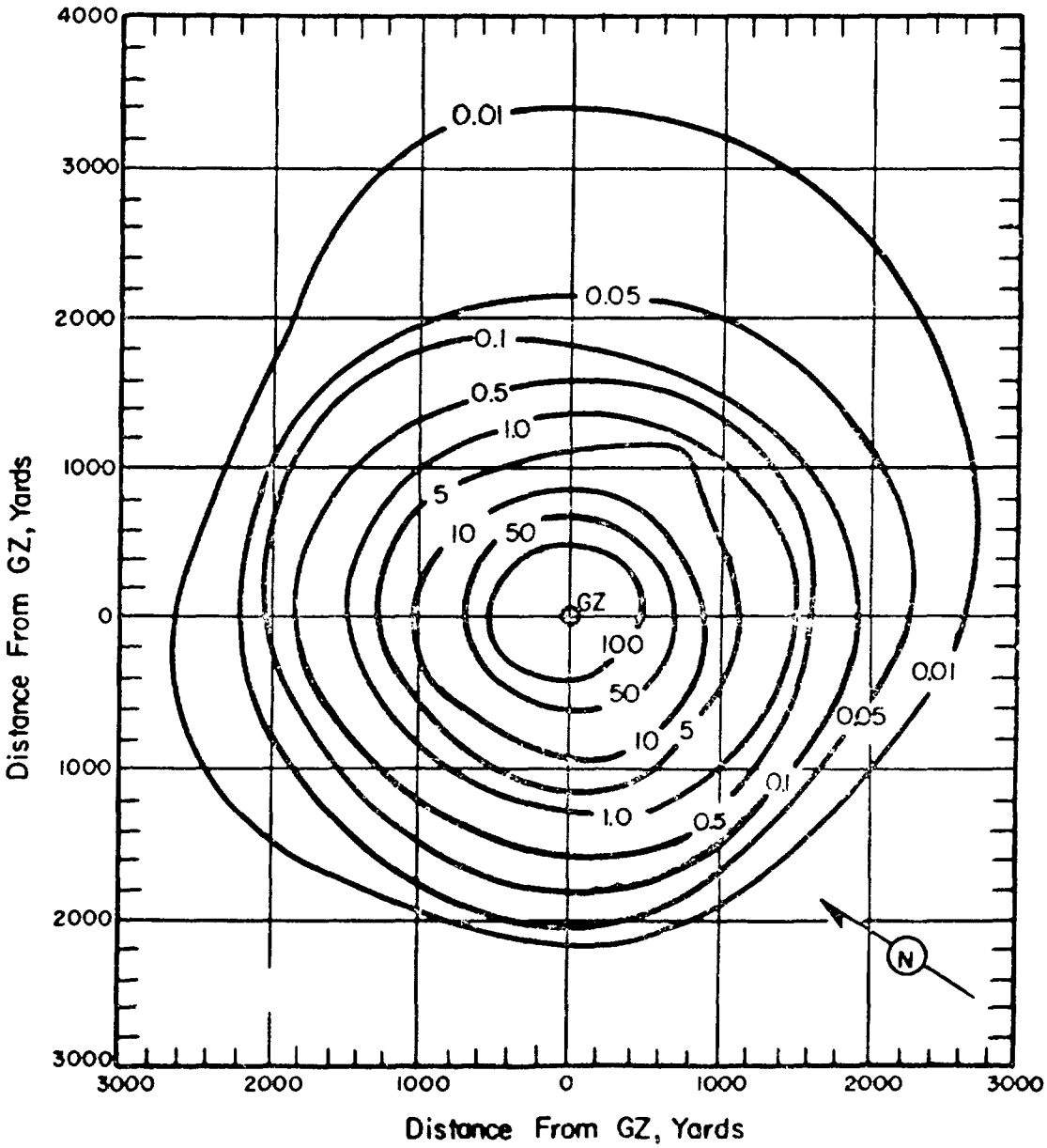


Figure 181. Operation PLUMBBOB - Hood. On-site dose rate contours in r/hr at H+1 hour.

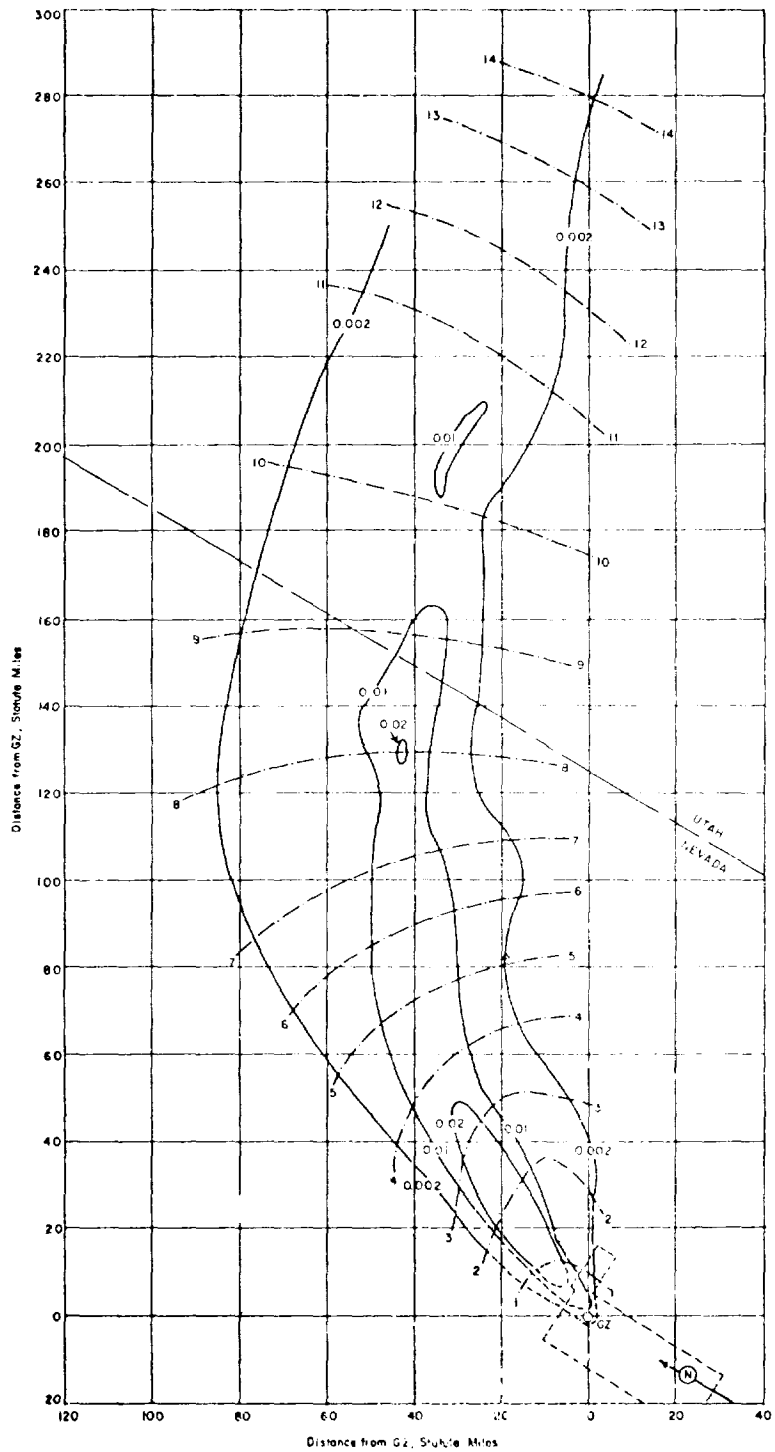


Figure 182. Operation PLUMBBOB - Hood. Off-site dose rate contours in r/hr at H+1 hour.

TABLE 52 NEVADA WIND DATA FOR OPERATION PLUMBBOB- HOOD

Altitude (MSL)	H-hour Dir	H-hour Speed	Altitude (MSL)	H-hour Dir	H-hour Speed
feet	degrees	mph	feet	degrees	mph
Surface	Calm	Calm	29,000	200	18
5,000	320	02	30,000	200	20
6,000	200	05	31,000	200	24
7,000	200	08	32,000	210	26
8,000	180	09	33,000	210	31
9,000	170	12	34,000	220	21
10,000	160	12	35,000	230	22
12,000	150	14	36,000	220	25
13,000	160	17	37,000	210	24
14,000	170	23	38,000	210	23
15,000	180	30	39,000	210	25
16,000	180	33	40,000	210	26
17,000	180	33	41,000	210	26
18,000	180	24	42,000	210	28
19,000	180	17	43,000	220	32
20,000	180	12	44,000	220	36
21,000	210	09	45,000	220	39
22,000	220	09	46,000	220	39
23,000	220	12	47,000	220	38
24,000	230	13	48,000	230	36
25,000	230	10	49,000	230	32
26,000	220	10	50,000	230	28
27,000	190	12	51,000	230	23
28,000	190	14	52,000	230	22
			53,000	220	22
			54,000	230	22

NOTES:

1. Tropopause height was 53,149 ft MSL at H-hour.
2. Wind data was obtained from the Yucca weather station.
3. At H-hour, the surface air pressure was 876 mb, the temperature 21.0°C, the dew point -3.3°C and the relative humidity 19%.

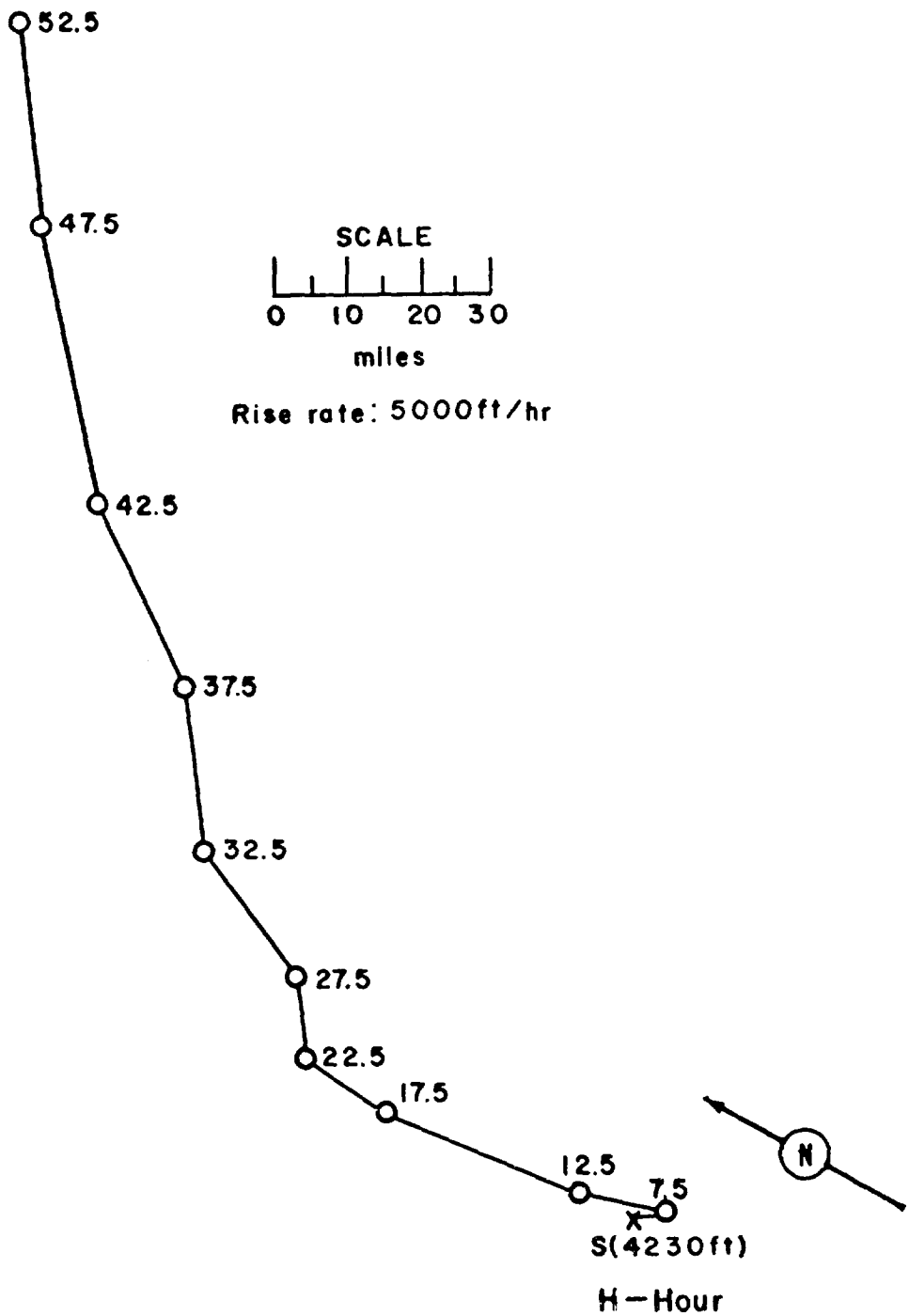


Figure 183. Hodograph for Operation PLUMBBOB - Hood.

OPERATION PLUMBBOB - Diablo

	PDT	GMT
DATE:	15 Jul 1957	15 Jul 1957
TIME:	0430	1130

TOTAL YIELD: 17 kt

FIREBALL DATA:
Time to 1st minimum: NM
Time to 2nd maximum: 250 to 265 msec
Radius of 2nd maximum: NM

CRATER DATA: No crater

Sponsor: UCRL

SITE: NTS - Area 2b
37° 09' 01" N
116° 06' 31" W
Site elevation: 4,469 ft

HEIGHT OF BURST: 500 ft

TYPE OF BURST AND PLACEMENT:
Tower burst over Nevada soil

CLOUD TOP HEIGHT: 32,000 ft MSL
CLOUD BOTTOM HEIGHT: 20,000 ft MSL

REMARKS:

No on-site fallout pattern was obtained from ground survey readings obtained by the Radiological Safety Organization using AN/PDR 39 and AN/PDR 43 survey instruments. The readings were taken along 4 radial roads at H+1 hour and along 6 radial roads at H+7 hours, D+1 day, D+2 days, D+3 days, and D+4 days. The $t^{-1.2}$ decay approximation was used by NDL to extrapolate the dose-rate readings to H+1 hour.

The off-site fallout was analyzed by program 37 of UCLA. Actual decay data were used to plot the H+12-hour dose-rate contours. The $t^{-1.2}$ decay approximation was used by NDL to extrapolate the H+12-hour dose-rate readings to H+1 hour. "The shape of the fallout pattern on the western edge was estimated and may be too far to the west. The lack of roads and bad ground features precluded the collection of data in this area. Arrival times after six hours were estimated on the basis of the measured arrival times and the use of calculated trajectories"

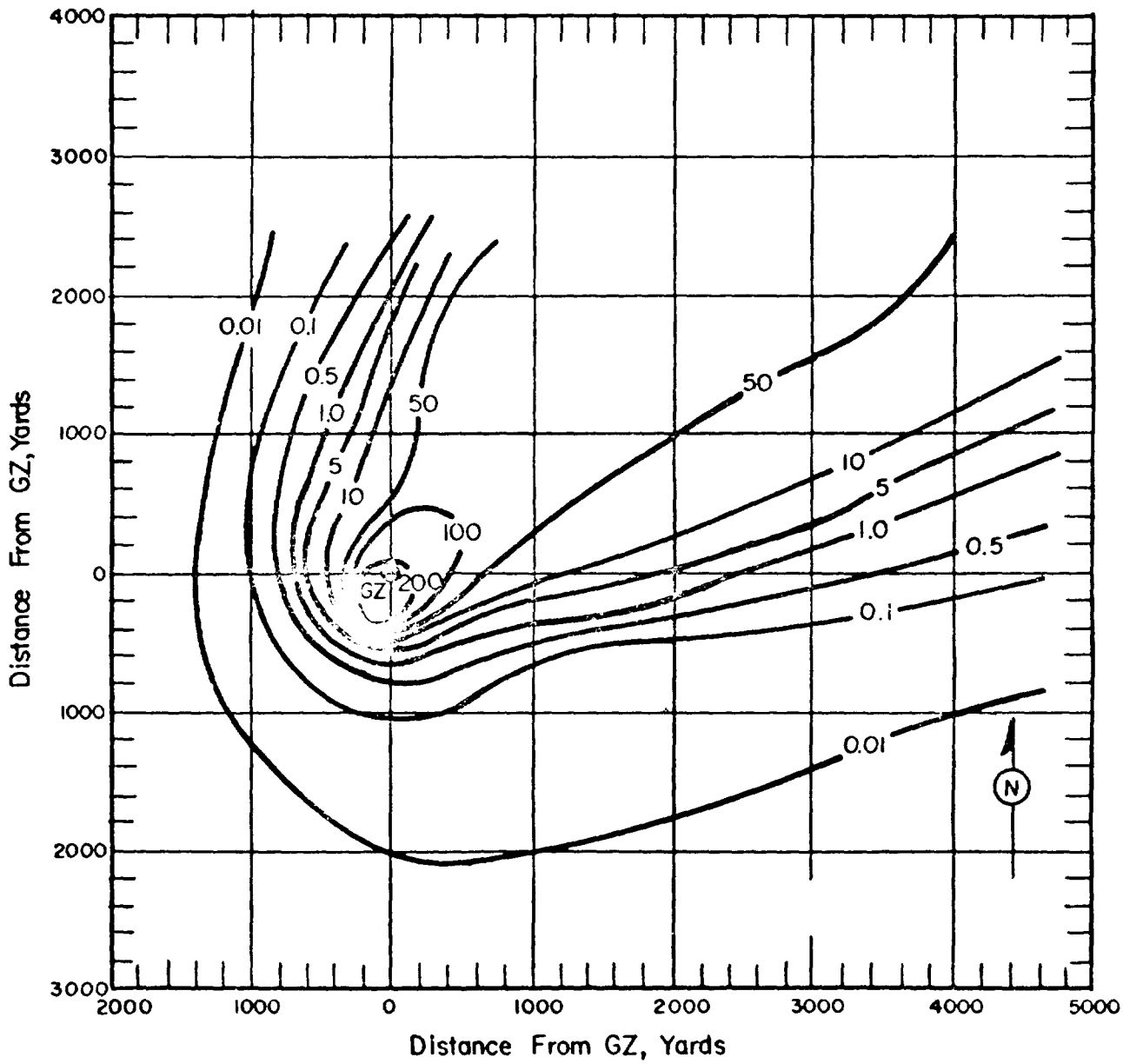


Figure 184. Operation PLUMBBOB - Diablo.
On-site dose rate contours in r/hr at H+1 hour.

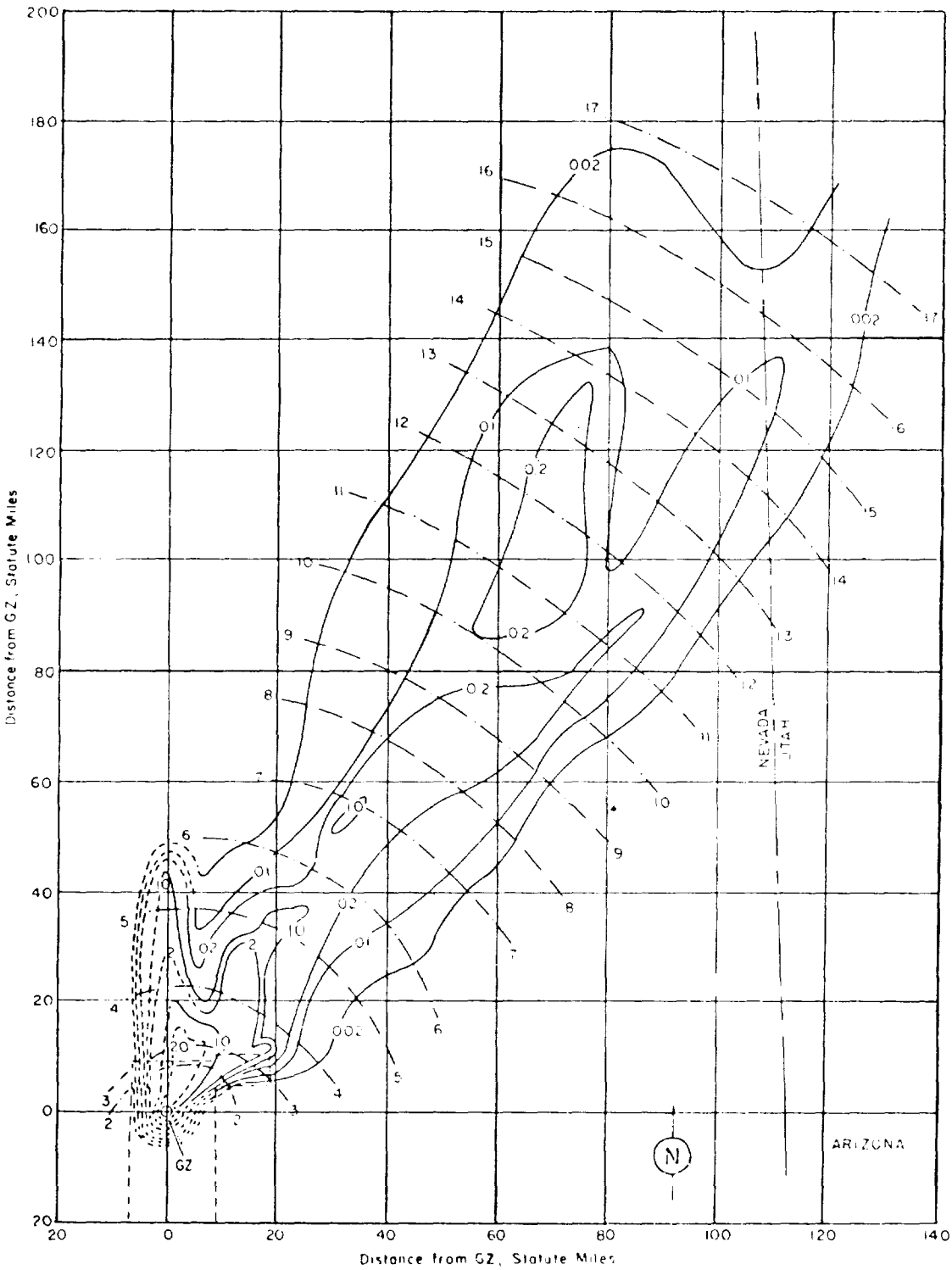


Figure 185. Operation PLUMBBOB - Diablo.
Off-site dose rate contours in r/hr at H+1 hour.

TABLE 53 NEVADA WIND DATA FOR OPERATION PLUMBBOB- DIABLO

Altitude (MSL)	H-hour Dir	H-hour Speed	H+3 hours Dir	H+3 hours Speed	Altitude (MSL)	H-hour Dir	H-hour Speed	H+3 hours Dir	H+3 hours Speed
feet	degrees	mph	degrees	mph	feet	degrees	mph	degrees	mph
Surface	Calm	Calm	Calm	Calm	30,000	280	10	250	06
5,000	220	05	210	02	31,000	290	13	---	--
6,000	220	07	200	06	32,000	290	14	---	--
7,000	220	08	190	07	33,000	290	14	---	--
8,000	220	10	180	06	34,000	290	14	---	--
9,000	220	08	160	10	35,000	280	14	270	20
10,000	200	07	160	10	36,000	270	16	---	--
11,000	170	07	---	--	37,000	270	17	---	--
12,000	190	07	180	09	38,000	260	17	---	--
13,000	200	07	---	--	39,000	260	17	---	--
14,000	210	09	210	13	40,000	260	17	240	16
15,000	220	09	(220)	(10)	41,000	260	16	---	--
16,000	210	07	230	08	42,000	260	14	---	--
17,000	210	07	---	--	43,000	240	14	---	--
18,000	210	07	210	10	44,000	220	14	---	--
19,000	230	07	---	--	45,000	230	16	250	16
20,000	250	09	230	09	46,000	240	18	---	--
21,000	270	09	---	--	47,000	260	22	---	--
22,000	280	08	---	--	48,000	250	21	---	--
23,000	290	07	280	07	49,000	260	18	---	--
24,000	300	07	---	--	50,000	260	15	240	08
25,000	300	12	290	05	51,000	260	12	---	--
26,000	300	14	---	--	52,000	210	07	---	--
27,000	300	13	---	--	53,000	190	07	---	--
28,000	300	12	---	--					
29,000	290	12	---	--					

NOTES:

1. Numbers in parentheses are estimated values.
2. Tropopause height was 43,000 ft MSL at H-hour.
3. Wind data was obtained from the Yucca weather station.
4. At H-hour the surface air pressure was 864 mb, the temperature 23.1°C, the dew point -0.8°C and the relative humidity 20%.

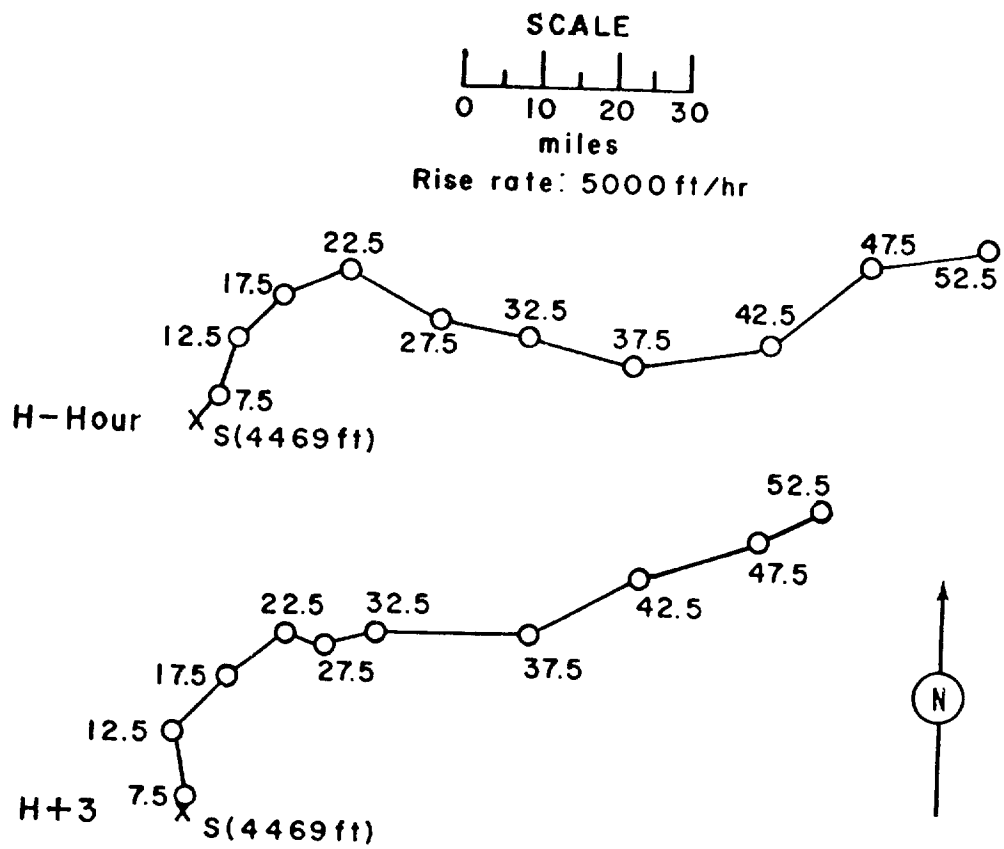


Figure 186. Hodographs for Operation PLUMBBOB - Diablo.

OPERATION PLUMBBOB - John

	PDT	GMT
DATE:	19 July 1957	19 July 1957
TIME:	0700	1400

TOTAL YIELD: ~2 kt

FIREBALL DATA:
Time to 1st minimum: NM
Time to 2nd maximum: 46 to 55 msec
Radius at 2nd maximum: NM

CRATER DATA: No crater

Sponsor: DOD

SITE: NTS - Area 10
37° 09' 38" N
116° 03' 11" W
Site elevation: 4,290 ft

HEIGHT OF BURST: 20,000 ft

TYPE OF BURST AND PLACEMENT:
Air burst from rocket over Nevada soil

CLOUD TOP HEIGHT: 44,000 ft MSL
CLOUD BOTTOM HEIGHT: NM

REMARKS: No local fallout.

TABLE 54 NEVADA WIND DATA FOR OPERATION PLUMBBOB– JOHN

Altitude (MSL)	H-hour		H+4 hours		Altitude (MSL)	H-hour		H+4 hours	
	Dir	Speed	Dir	Speed		Dir	Speed	Dir	Speed
feet	degrees	mph	degrees	mph	feet	degrees	mph	degrees	mph
Surface	Calm	Calm	180	14	29,000	200	24	---	--
5,000	180	09	190	16	30,000	190	24	190	33
6,000	180	12	200	20	31,000	180	26	---	--
7,000	190	21	200	20	32,000	190	29	---	--
8,000	180	24	190	20	33,000	200	32	---	--
9,000	180	24	190	20	34,000	190	26	---	--
10,000	180	24	180	20	35,000	190	44	210	44
11,000	180	28	---	--	36,000	190	48	---	--
12,000	170	16	180	25	37,000	190	49	---	--
13,000	180	15	---	--	38,000	200	49	---	--
14,000	180	15	200	29	39,000	200	52	---	--
15,000	190	15	(200)	(29)	40,000	200	55	200	50
16,000	190	17	200	29	41,000	200	54	---	--
17,000	200	17	---	--	42,000	200	54	---	--
18,000	200	18	210	25	43,000	190	56	---	--
19,000	210	16	---	--	44,000	200	54	---	--
20,000	210	17	220	22	45,000	220	48	210	32
21,000	210	17	---	--	46,000	220	42	---	--
22,000	210	20	---	--	47,000	220	36	---	--
23,000	210	22	220	22	48,000	220	35	---	--
24,000	200	22	--	--	49,000	210	33	---	--
25,000	200	21	200	21	50,000	210	35	210	33
26,000	200	21	---	--	51,000	210	36	---	--
27,000	190	22	---	--	52,000	210	29	---	--
28,000	190	23	---	--	53,000	200	25	---	--

NOTES:

1. Numbers in parentheses are estimated values.
2. Tropopause height was 47,500 ft MSL at H-hour.
3. Wind data was obtained from the Yucca weather station.
4. At H-hour, the surface air pressure was 868 mb, the temperature 22.1°C, the dew point 1.3°C and the relative humidity 25%.

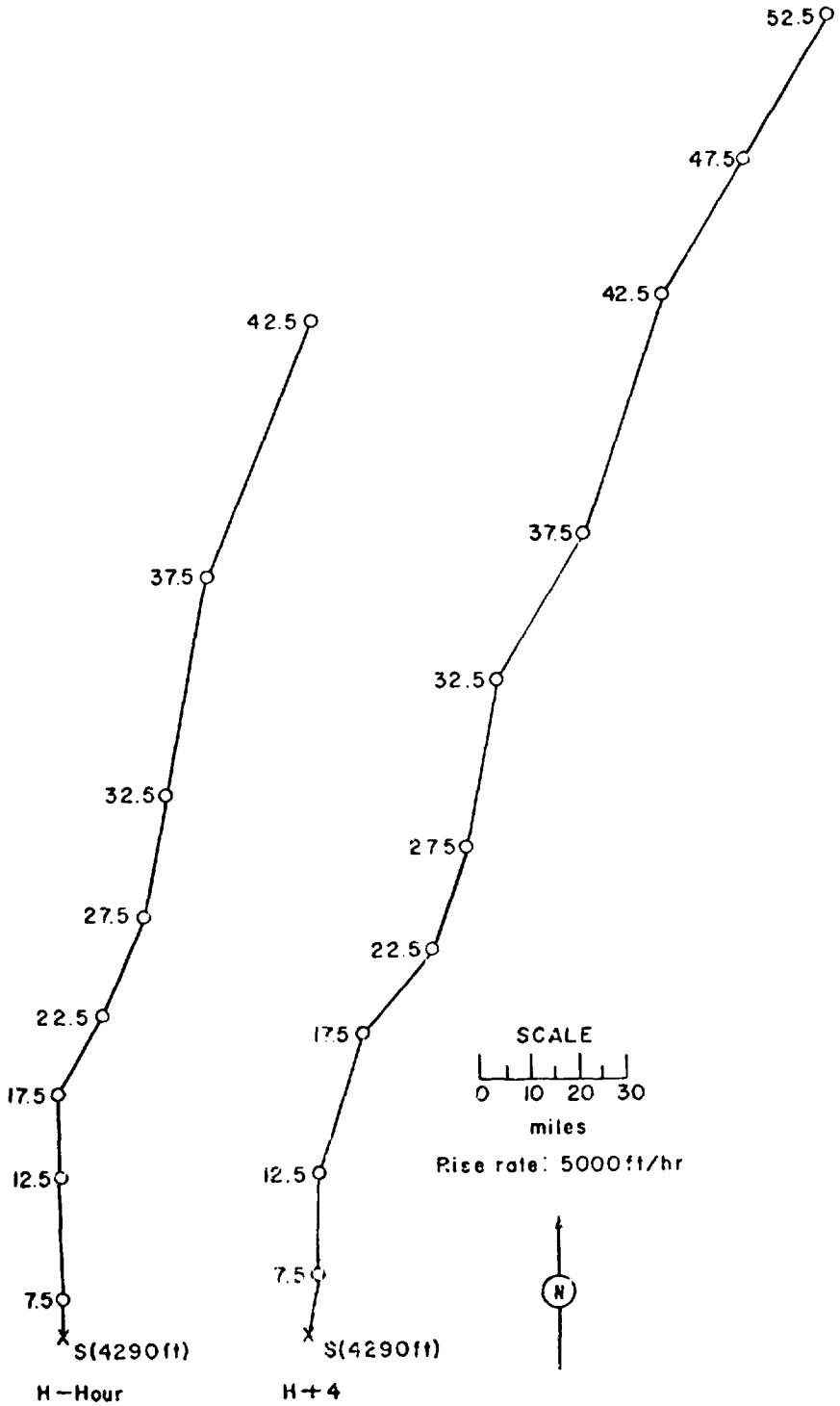


Figure 187. Hodographs for Operation PLUMBBOB - John.

OPERATION PLUMBBOB - Kepler

	PDT	GMT
DATE:	24 July 1957	24 July 1957
TIME:	0450	1150

TOTAL YIELD: 10 kt

FIREBALL DATA:
Time to 1st minimum: NM
Time to 2nd maximum: 62 msec
Radius at 2nd maximum: NM

CRATER DATA: No crater

Sponsor: LASL

SITE: NTS - Area 4
37° 05' N
116° 06' W
Site elevation: 4,309 ft

HEIGHT OF BURST: 500 ft

TYPE OF BURST AND PLACEMENT:
Tower burst over Nevada soil

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

REMARKS:

The on-site fallout pattern was obtained from ground survey readings of the Radiological Safety Division of Reynolds Electrical and Engineering Co., Inc., using AN/PDR 39 and AN/PDR 43 survey instruments. The readings were taken at H+6 hours, D+1 day, D+2 days, D+3 days, and D+5 days along eight radial roads to determine radiation exclusion areas. The reliability of the extrapolated dose-rate readings is questionable because of the uncertainty in decay rates. The $t^{-1.2}$ decay approximation was used to extrapolate the dose-rate readings to H+1 hour.

The off-site fallout was analyzed by the USWB Special Projects Section. The $t^{-1.2}$ decay approximation was used to extrapolate the dose-rate readings to H+1 hour. The fallout pattern is not reliable. There were discrepancies in the several monitor runs.

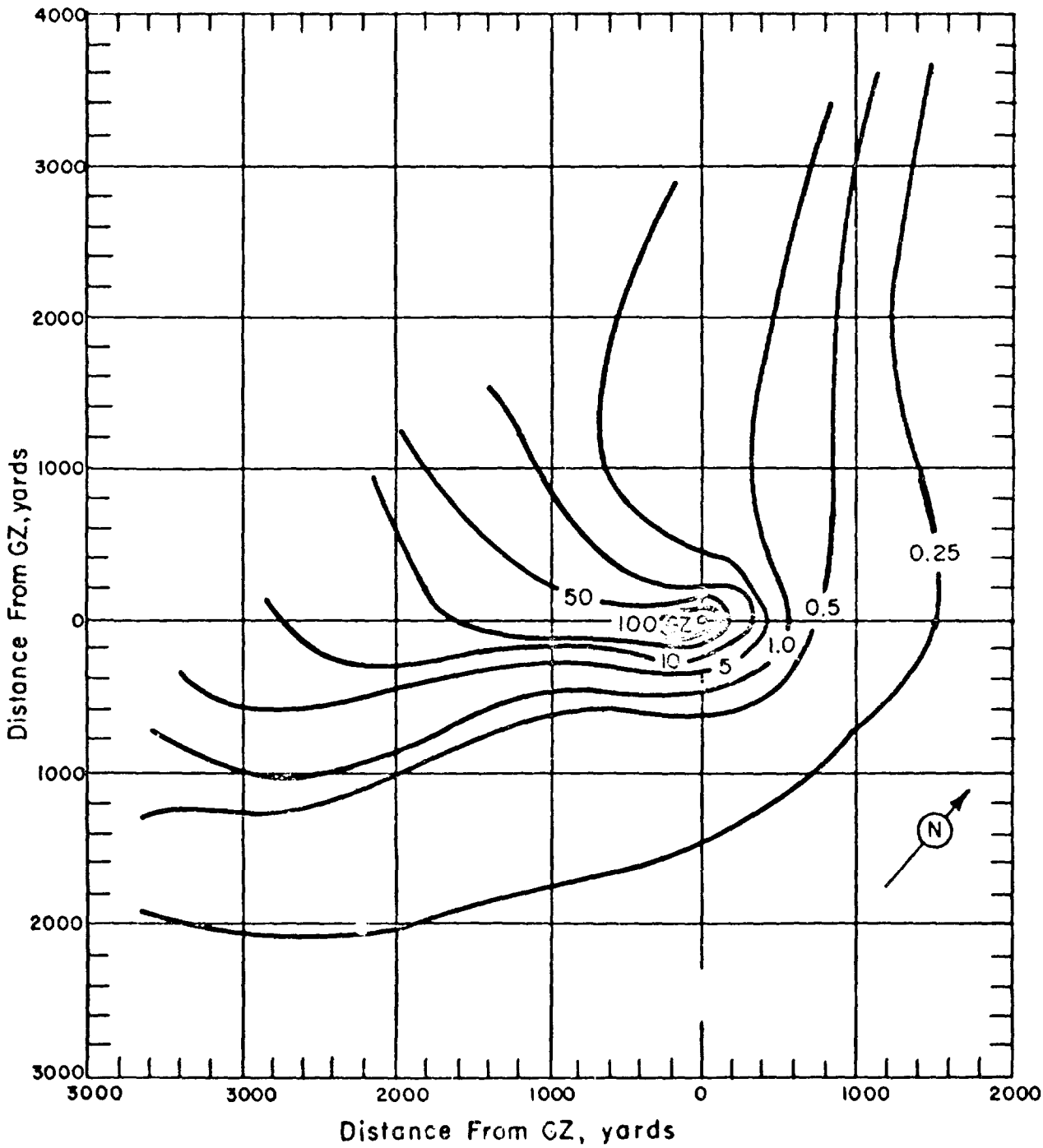


Figure 188. Operation PLUMBBOB - Kepler.
On-site dose rate contours in r/hr at H+1 hour.

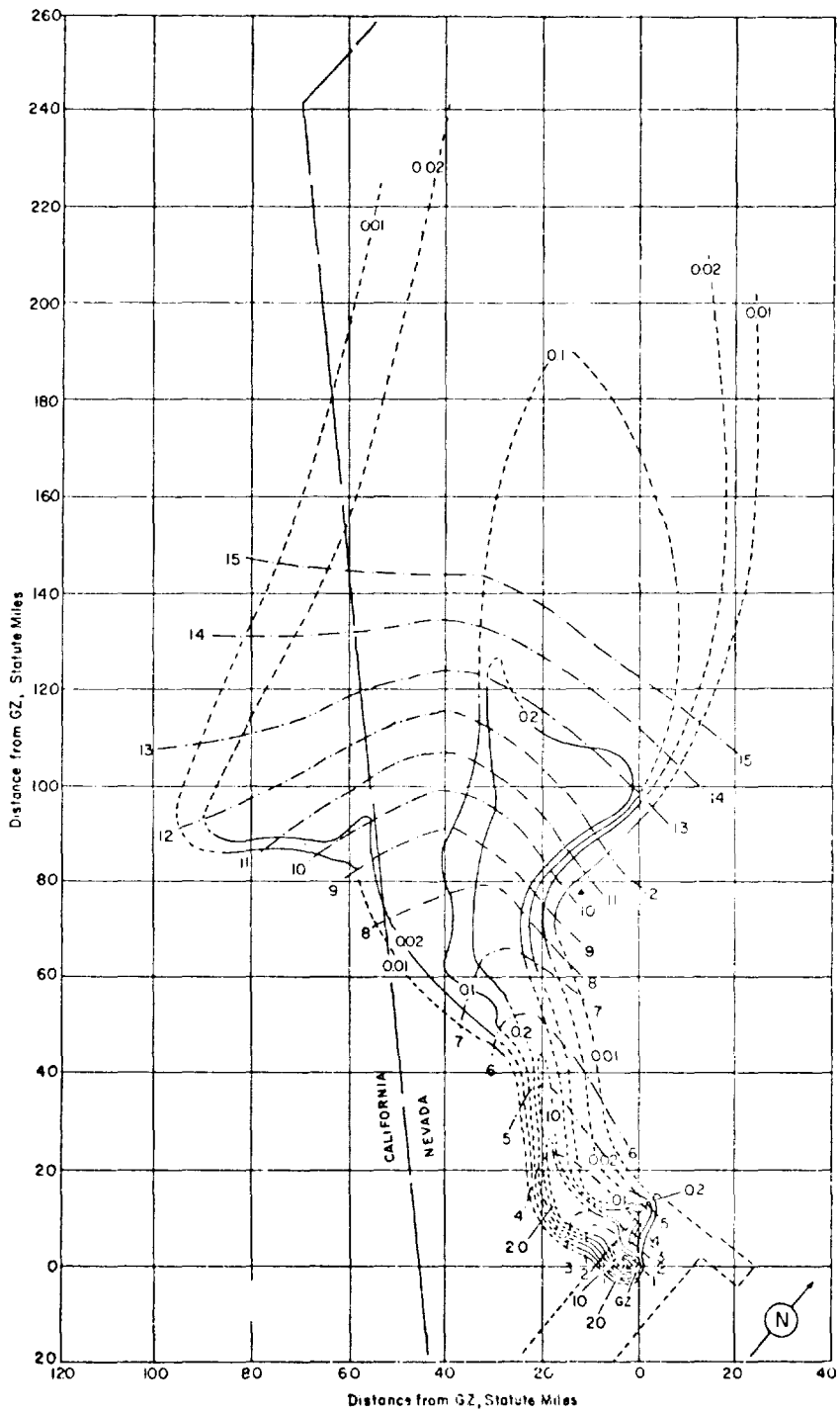


Figure 189. Operation PLUMBBOB - Kepler.
Off-site dose rate contours in r/hr at H+1 hour.

TABLE 55 NEVADA WIND DATA FOR OPERATION PLUMBBOB- KEPLER

Altitude (MSL)	H-hour		H+6 hours		Altitude (MSL)	H-hour		H+6 hours	
	Dir	Speed	Dir	Speed		Dir	Speed	Dir	Speed
feet	degrees	mph	degrees	mph	feet	degrees	mph	degrees	mph
Surface	Calm	Calm	110	13	31,000	230	22	---	--
5,000	020	02	120	20	32,000	230	24	---	--
6,000	060	07	130	20	33,000	230	24	---	--
7,000	270	03	120	14	34,000	220	25	---	--
8,000	150	05	140	07	35,000	220	29	210	33
9,000	170	06	150	10	36,000	220	37	---	--
10,000	210	06	140	12	37,000	230	39	---	--
11,000	140	07	---	--	38,000	230	41	---	--
12,000	070	12	100	08	39,000	220	43	---	--
13,000	100	07	---	--	40,000	220	41	210	68
14,000	130	12	110	14	41,000	220	40	---	--
15,000	090	15	(140)	(12)	42,000	210	41	---	--
16,000	090	16	180	09	43,000	210	43	---	--
17,000	080	16	---	--	44,000	220	40	---	--
18,000	100	07	200	14	45,000	230	38	230	40
19,000	150	05	---	--	46,000	230	32	---	--
20,000	230	07	180	09	47,000	230	31	---	--
21,000	230	07	---	--	48,000	230	31	---	--
22,000	250	10	---	--	49,000	230	31	---	--
23,000	270	14	180	16	50,000	240	28	240	25
24,000	250	09	---	--	51,000	250	24	---	--
25,000	260	10	200	16	52,000	250	20	---	--
26,000	250	12	---	--	53,000	260	16	---	--
27,000	230	13	---	--	55,000	280	08	200	15
28,000	230	15	---	--					
29,000	230	18	---	--					
30,000	230	20	200	20					

NOTES:

1. Numbers in parentheses are estimated.
2. Tropopause height was 33,300 ft MSL at H-hour.
3. Wind data was obtained from the Yucca weather station.
4. At H-hour the surface air pressure was 865 mb, the temperature 21.0°C, the dew point -5.0°C and the relative humidity 22%.

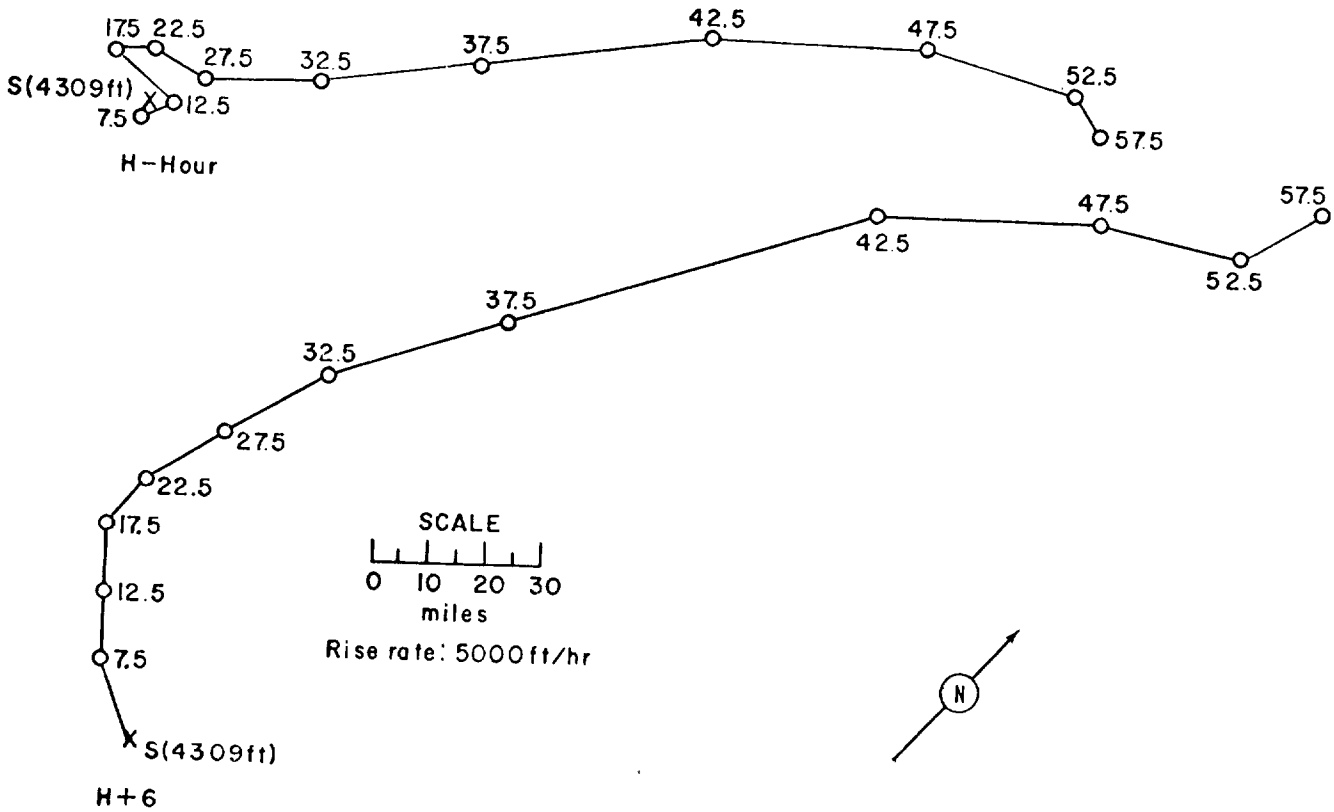


Figure 190. Hodographs for Operation PLUMBBOB - Kepler.

OPERATION PLUMBBOB - Owens

	PDT	GMT
DATE:	25 July 1957	25 July 1957
TIME:	0630	1330

TOTAL YIELD: 9.7 kt

Sponsor: UCRL

SITE: NTS - Area 9b
37° 08' 05" N
116° 02' 27" W
Site elevation: 4,215 ft

HEIGHT OF BURST: 500 ft

FIREBALL DATA:
Time to 1st minimum: NM
Time to 2nd maximum: 94 msec
Radius at 2nd maximum: NM

CRATER DATA: No crater

TYPE OF BURST AND PLACEMENT:
Air burst from balloon over Nevada soil

CLOUD TOP HEIGHT: 35,000 ft MSL
CLOUD BOTTOM HEIGHT: 20,000 ft MSL

REMARKS:

On-site contamination was due primarily to induced activity. The pattern was obtained from ground survey readings of the Radiological Safety Division of Reynolds Electrical and Engineering Co., Inc., using AN/PDR 39 and AN/PDR 43 survey instruments. The readings were taken at H+1 hour, H+6 hours, D+1 day, D+2 days, D+3 days and D+5 days along eight radial roads to determine radiation exclusion areas. The dose-rate readings were extrapolated to H+1 hour by the generalized decay curve for neutron-induced activity in Nevada soil. The extrapolated dose rates are not very accurate because of uncertainty in decay rates.

The off-site fallout was analyzed by the USWB Special Projects Section. The $t^{-1.2}$ decay approximation was used to extrapolate the dose-rate readings to H+1 hour. Most of the pattern attributed to Owens was in an area relatively free from residual contamination. Boltzman debris was to the west and Diablo debris to the east, but only on the fringes of the Owens fallout is there much uncertainty in the analysis. Widely scattered showers occurred throughout most of Nevada on D-day and D+1 day.

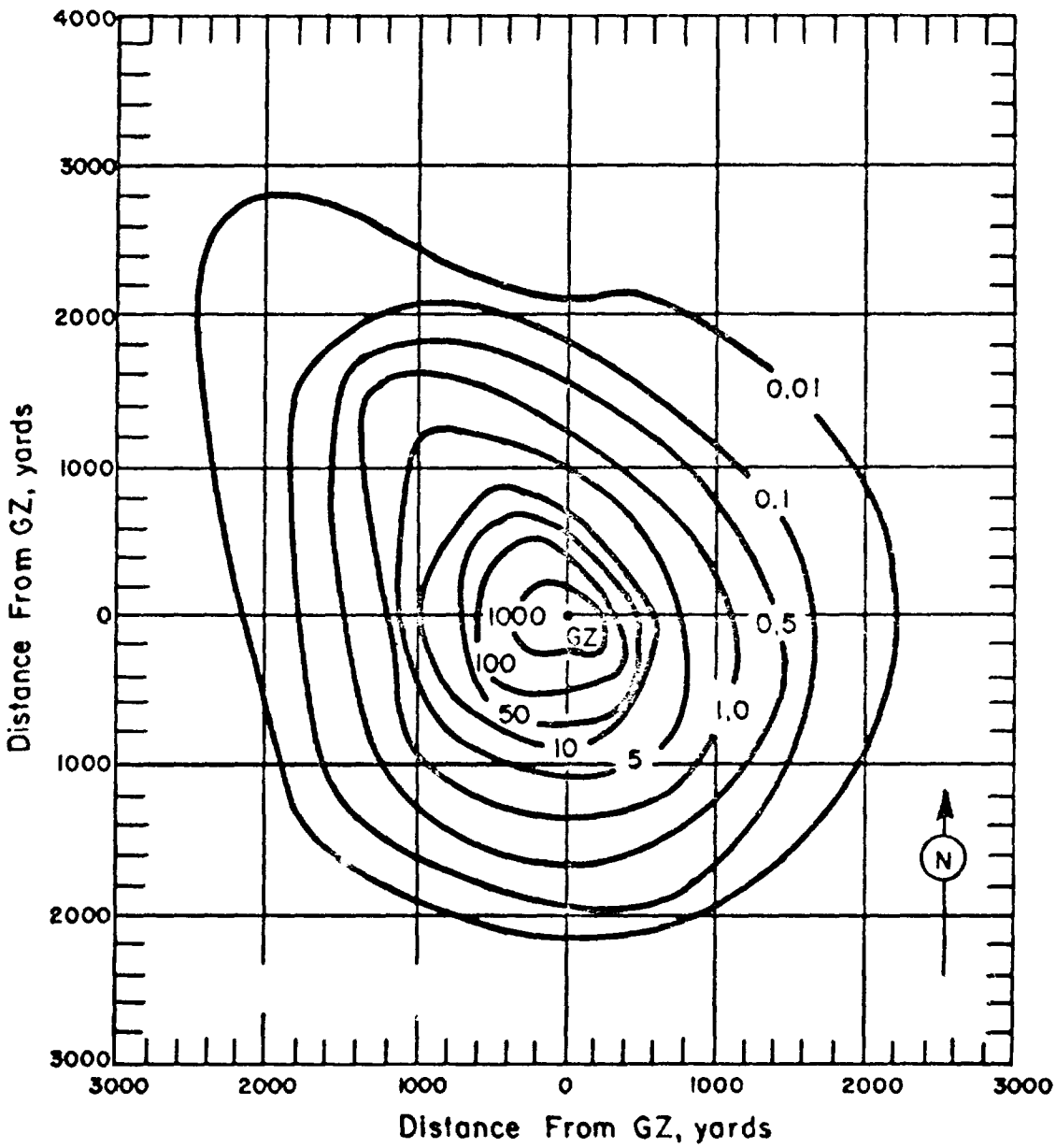


Figure 191. Operation PLUMBBOB - Owens.
On-site dose rate contours in r/hr at H+1 hour.

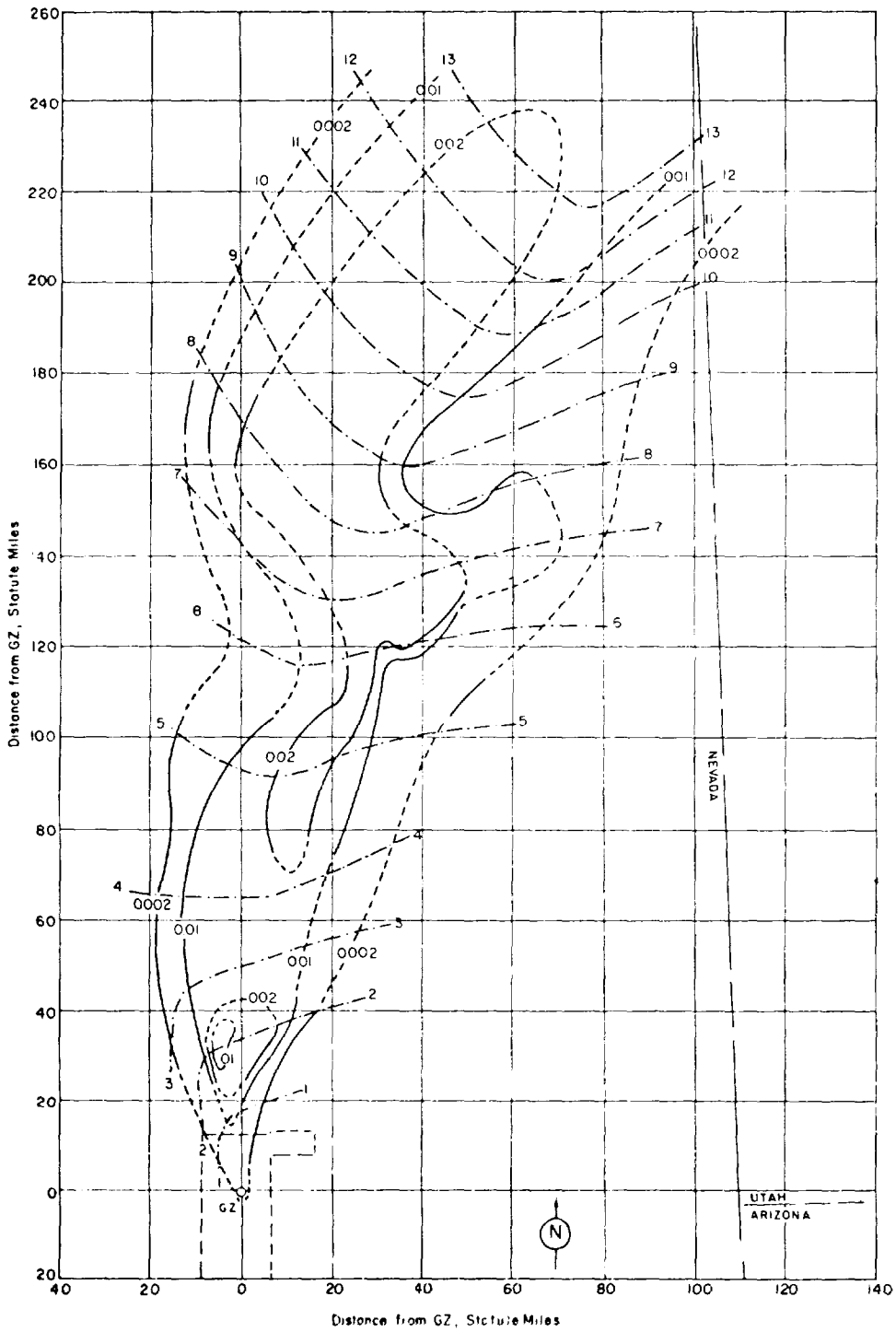


Figure 192. Operation PLUMBBOB - Owens.
Off-site dose rate contours in r/hr at H+1 hour.

TABLE 56 NEVADA WIND DATA FOR OPERATION PLUMBBOB- OWENS

Altitude (MSL)	H-hour		H+4½ hours		Altitude (MSL)	H-hour		H+4½ hours	
	Dir	Speed	Dir	Speed		Dir	Speed	Dir	Speed
feet	degrees	mph	degrees	mph	feet	degrees	mph	degrees	mph
Surface	Calm	Calm	120	05	30,000	220	35	200	38
5,000	320	03	140	05	31,000	220	26	---	--
6,000	040	04	170	05	32,000	210	32	---	--
7,000	140	06	210	07	33,000	210	35	---	--
8,000	160	08	210	07	34,000	210	38	---	--
9,000	170	14	210	12	35,000	210	49	210	54
10,000	170	16	210	17	36,000	210	53	---	--
11,000	170	20	---	--	37,000	210	47	---	--
12,000	070	12	200	29	38,000	220	45	---	--
13,000	170	22	---	--	39,000	240	51	---	--
14,000	160	22	180	26	40,000	230	43	230	41
15,000	160	23	(180)	(25)	41,000	230	36	---	--
16,000	160	24	170	24	42,000	230	36	---	--
17,000	160	24	---	--	43,000	230	37	---	--
18,000	170	22	160	24	44,000	230	39	---	--
19,000	170	23	---	--	45,000	230	40	220	31
20,000	180	20	180	23	46,000	230	41	---	--
21,000	210	14	---	--	47,000	240	41	---	--
22,000	210	15	---	--	48,000	240	33	---	--
23,000	200	16	180	17	49,000	240	28	---	--
24,000	210	17	---	--	50,000	240	21	200	24
25,000	210	18	200	17	51,000	210	15	---	--
26,000	220	18	---	--	52,000	180	09	---	--
27,000	220	20	---	--	53,000	170	15	---	--
28,000	220	20	---	--	55,000	---	--	220	15
29,000	220	20	---	--					

NOTES:

1. Numbers in parentheses are estimated values.
2. Tropopause height was 49,300 ft MSL at H-hour.
3. Wind data was obtained from the Yucca weather station.
4. At H-hour the surface air pressure was 871 mb, the temperature 20.0°C, the dew point -3.6°C and the relative humidity 20%.

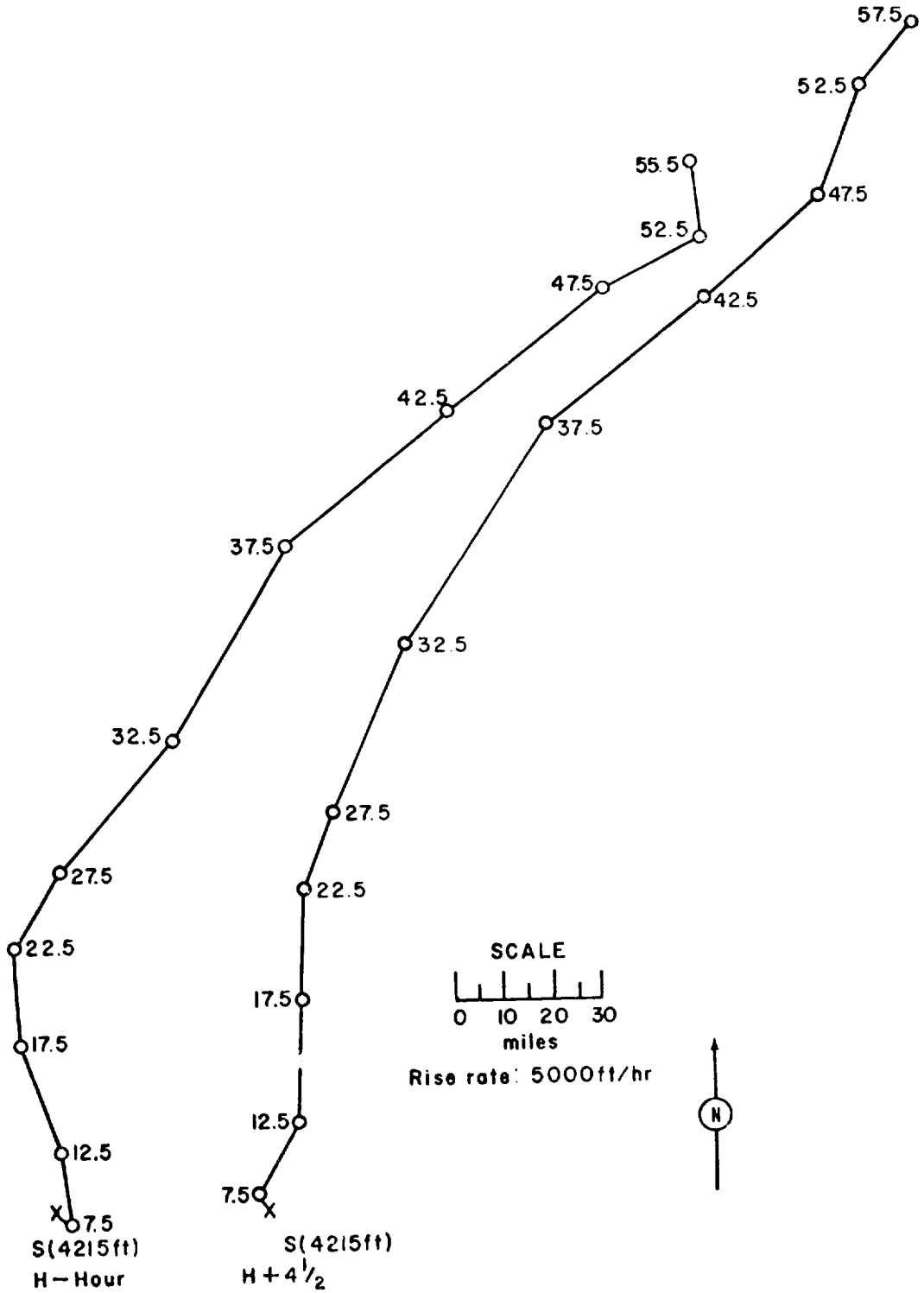


Figure 193. Hodographs for Operation PLUMBBOB - Owens.

OPERATION PLUMBBOB - Pascal A Safety Experiment

	PDT	GMT
DATE:	26 July 1957	26 July 1957
TIME:	0100	0800

Sponsor: LASL

SITE: NTS - Area 3J
37° 03' 03" N
116° 01' 56" W
Site elevation: ~4,050 ft

HEIGHT OF BURST: -500 ft
Underground

TYPE OF BURST AND PLACEMENT:
Subsurface burst. Partially stemmed well. Device located at the bottom of a cased 200 ft hole with a 50 ft block of concrete above it and an open space up to a heavy concrete cap at the top.

CLOUD TOP HEIGHT: 5,500 ft MSL
CLOUD BOTTOM HEIGHT: NM

REMARKS:

The on-site fallout pattern was obtained from ground survey readings of the Radiological Safety Division of Reynolds Electrical and Engineering Co., Inc., using AN/PDR 39 and AN/PDR 43 survey instruments. The readings were taken at H+8 hours, D+1 day, and D+2 days along four radial lines to determine radiation exclusion areas. The $t^{-1.2}$ decay approximation was used to extrapolate the dose-rate readings to H+1 hour. The fallout pattern is not reliable because only a few readings were taken. Heavy alpha contamination was detected in a strip about 200 yards wide and 2000 yards long within the 12 r/hr contour.

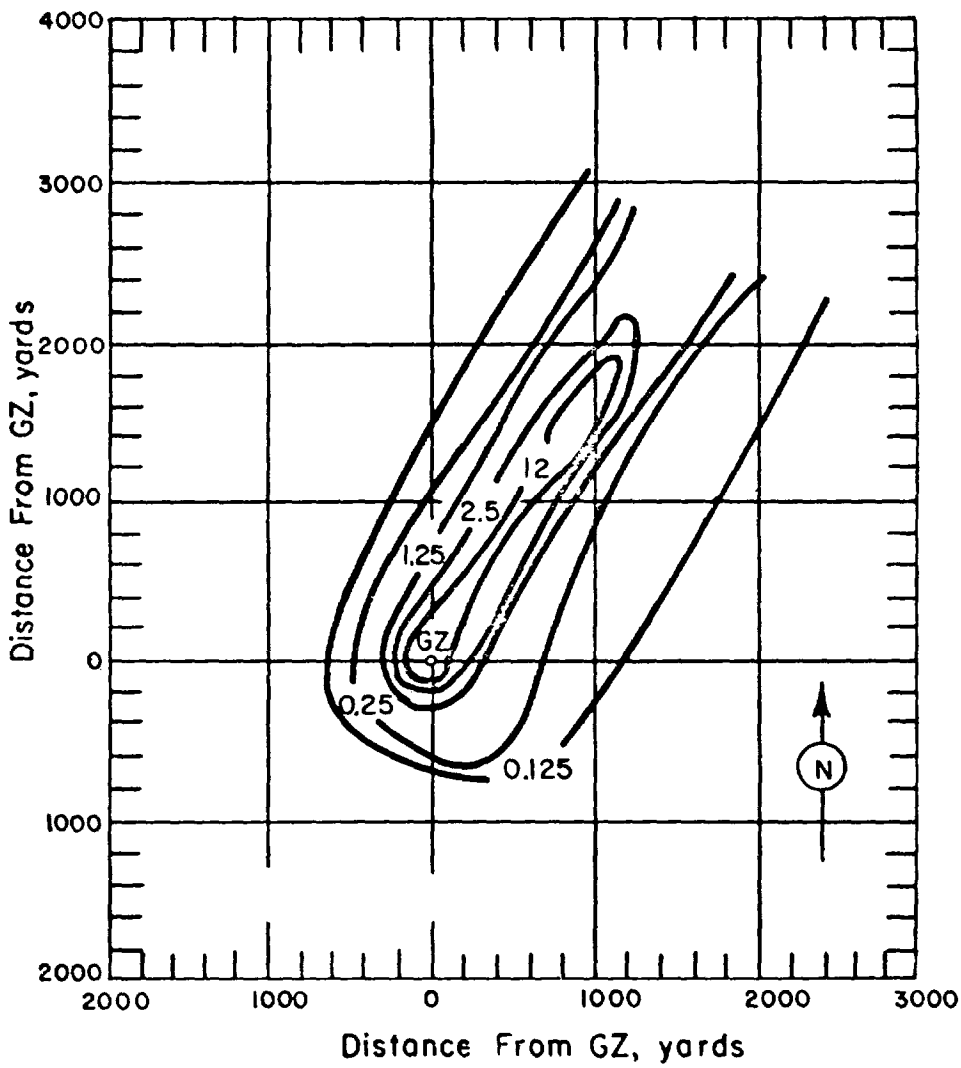


Figure 194. Operation PLUMBBOB - Pascal A.
On-site dose rate contours in r/hr at H+1 hour.

OPERATION PLUMBBOB - Stokes

	PDT	GMT
DATE:	7 Aug 1957	7 Aug 1957
TIME:	0525	1225

TOTAL YIELD: 19 kt

FIREBALL DATA:
Time to 1st minimum: NM
Time to 2nd maximum: 160 msec
Radius at 2nd maximum: NM

CRATER DATA: No crater

Sponsor: LASL

SITE: NTS - Area 7b
37° 05' 12" N
116° 01' 25" W
Site elevation: 4,186 ft

HEIGHT OF BURST: 1,500 ft

TYPE OF BURST AND PLACEMENT:
Air burst from balloon over Nevada soil

CLOUD TOP HEIGHT: 37,000 ft MSL
CLOUD BOTTOM HEIGHT: 27,000 ft MSL

REMARKS:
On-site contamination was due primarily to induced activity. The pattern was obtained from ground survey readings of the Radiological Safety Division of Reynolds Electrical and Engineering Co., Inc., using AN/PDR 39 and AN/PDR 43 survey instruments. The readings were taken at H+½ hour, H+6 hours, D+1 day, D+2 days, D+3 days and D+5 days along radial lines to determine radiation exclusion areas. The dose-rate readings were extrapolated to H+1 hour by the general induced activity decay curve for Nevada soil

The off-site fallout was analyzed by the USWB Special Projects Section. The $t^{-1.2}$ decay approximation was used to extrapolate the dose-rate readings to H+1 hour. "The fallout pattern attributed to Shot Stokes is on the fringes of fallout from two previous tower bursts (Boltzman and Diablo) and is rather uncertain."

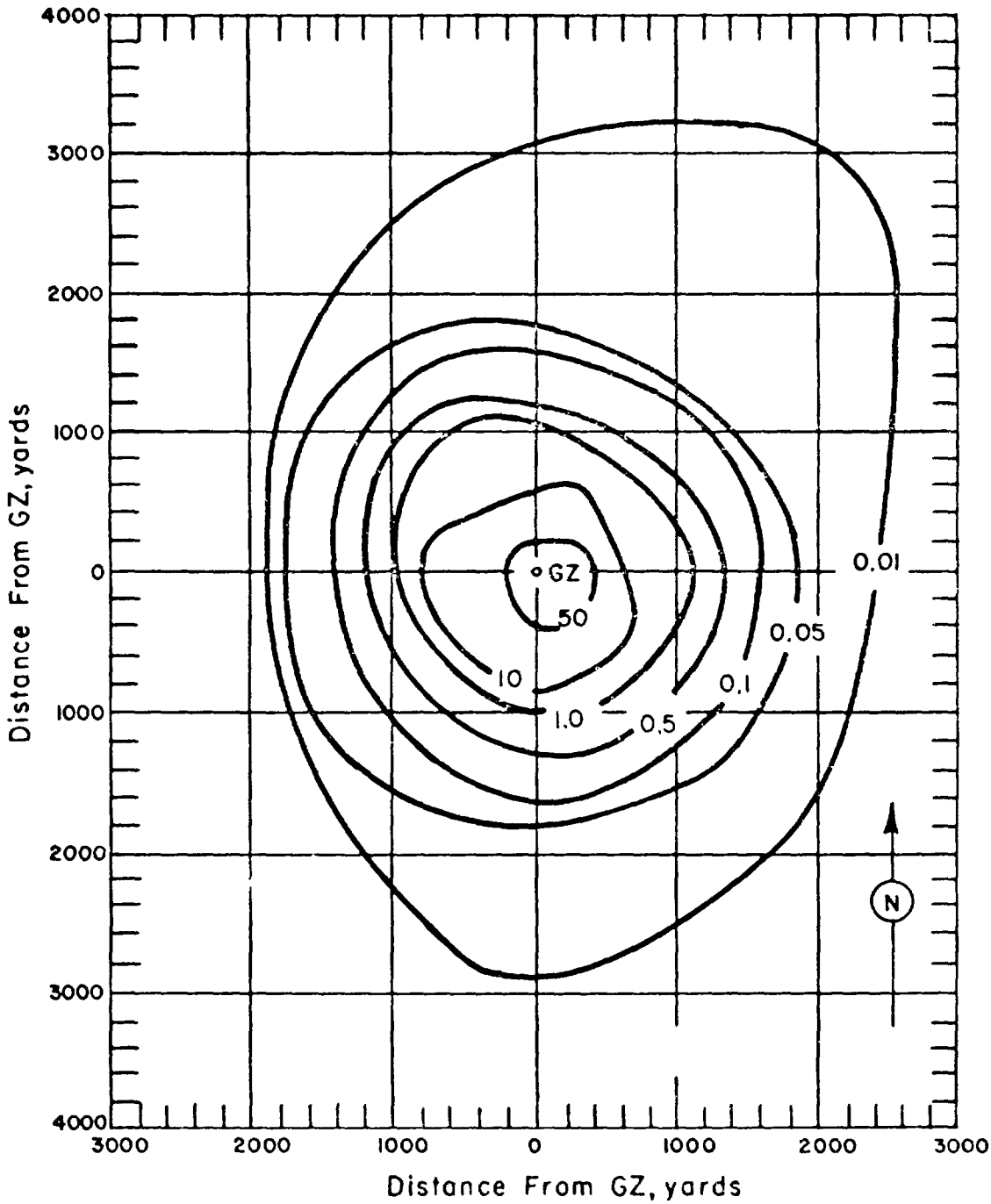


Figure 195. Operation PLUMBBOB - Stokes.
On-site dose rate contours in r/hr at H+1 hour.

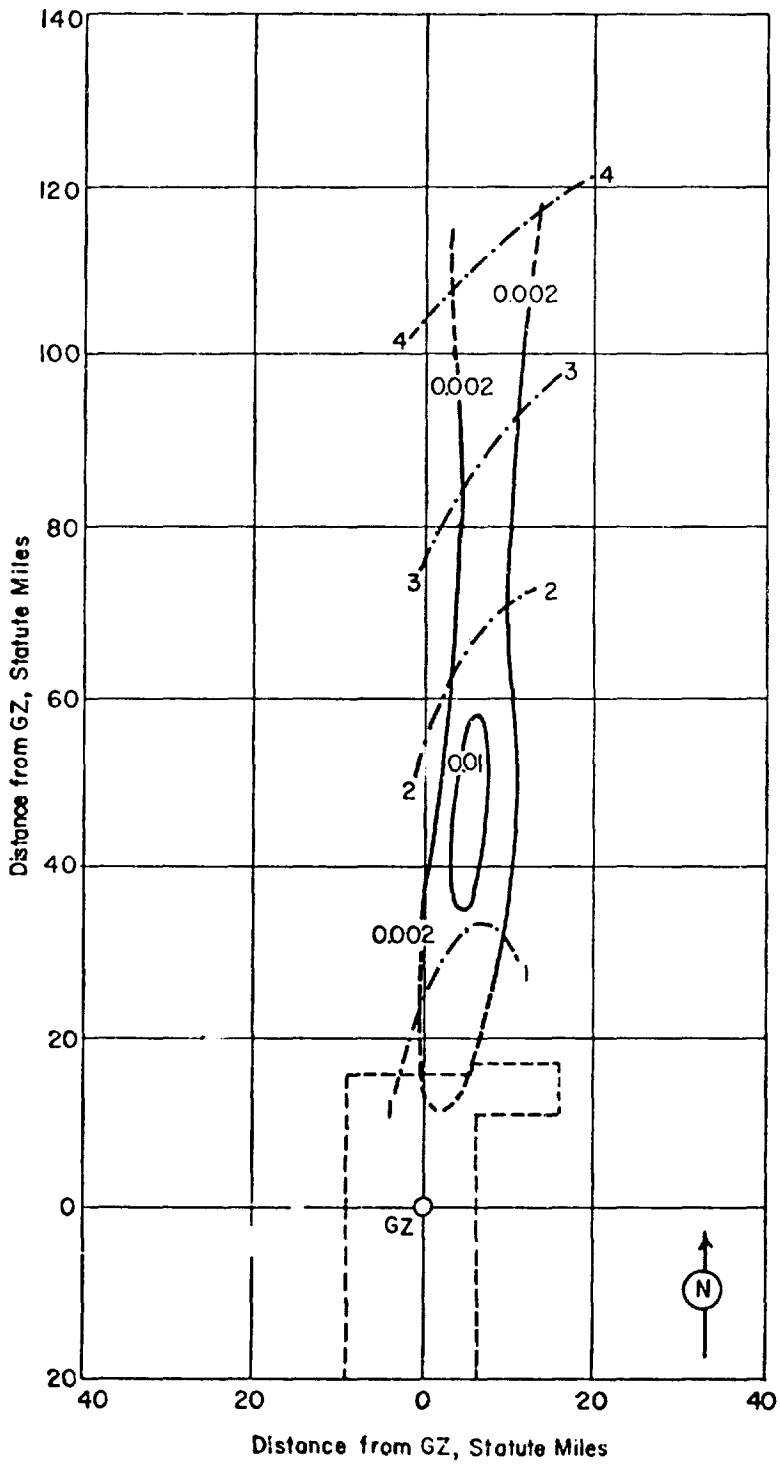


Figure 196. Operation PLUMBBOB - Stokes
Off-site dose rate contours in r/hr at H+1 hour.

TABLE 57 NEVADA WIND DATA FOR OPERATION PLUMBBOB- STOKES

Altitude (MSL)	H+1 hour Dir	H+1 hour Speed
feet	degrees	mph
Surface	Calm	Calm
5,000	200	02
6,000	200	06
7,000	140	07
8,000	100	09
9,000	150	07
10,000	160	09
11,000	170	12
12,000	180	17
13,000	190	28
14,000	190	29
15,000	180	31
16,000	170	38
17,000	180	39
18,000	180	44
19,000	180	46
20,000	180	47
21,000	180	47
22,000	180	53
23,000	180	50
24,000	180	51
25,000	190	55
26,000	190	61
27,000	200	69
28,000	200	73

Altitude (MSL)	H+1 hour Dir	H+1 hour Speed
feet	degrees	mph
29,000	220	72
30,000	200	76
31,000	200	76
32,000	200	76
33,000	200	76
34,000	230	72
35,000	200	80
36,000	200	79
37,000	200	84
38,000	200	98
39,000	200	101
40,000	200	105
41,000	200	87
42,000	210	69
43,000	200	77
44,000	200	84
45,000	210	75
46,000	210	60
47,000	210	59
48,000	210	56
49,000	210	50
50,000	200	43
54,472	200	28

NOTES:

1. Tropopause height was 46,800 ft MSL at H-hour.
2. Wind data was obtained from the Yucca weather station.
3. At H+1 hour the surface air pressure was 870 mb, the temperature 16.8°C, the dew point -4.9°C and the relative humidity 22%.

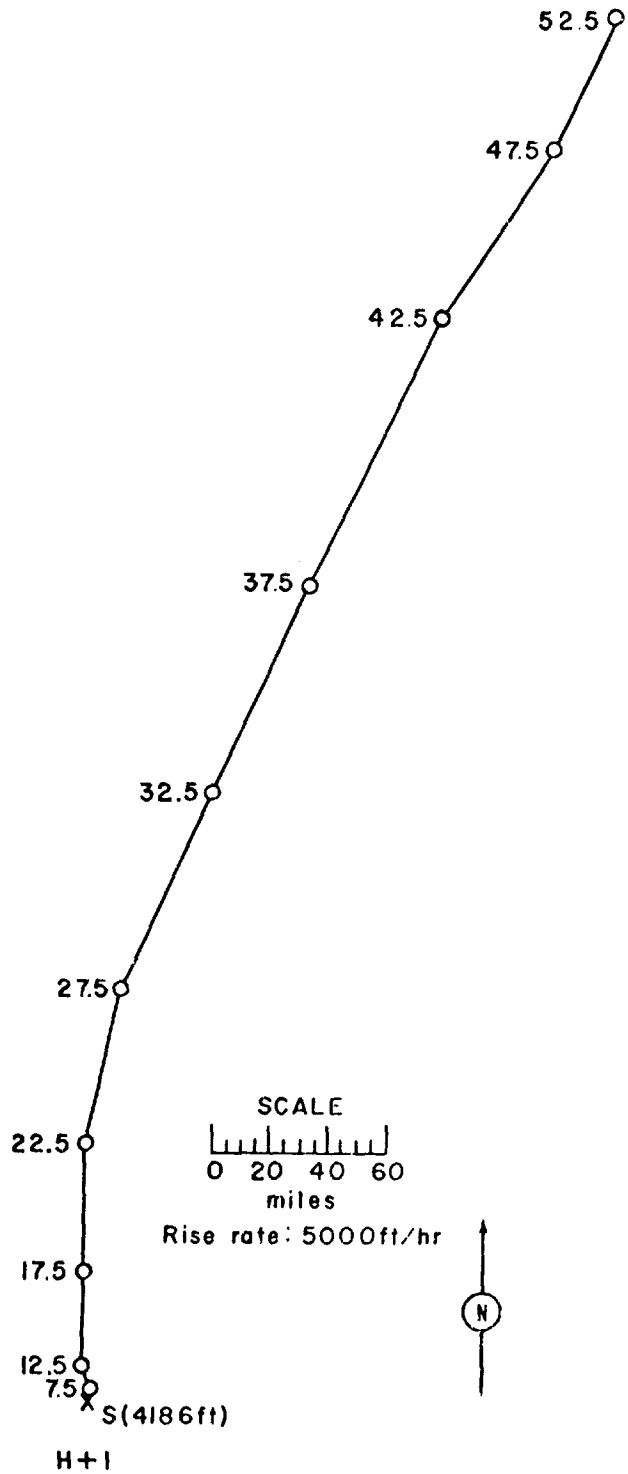


Figure 197. Hodographs for Operation PLUMBBOB - Stokes.

OPERATION PLUMBBOB - Saturn Safety Experiment

	PDT	GMT
DATE:	9 Aug 1957	10 Aug 1957
TIME:	1800	0100

Sponsor: UCRL

SITE: NTS - Area 12-c
37° 11' 38" N
116° 02' 00" W

HEIGHT OF BURST: -128 ft

TYPE OF BURST AND PLACEMENT:
Subsurface burst - Tunnel in Nevada soil

CLOUD TOP HEIGHT: NM
CLOUD BOTTOM HEIGHT: NM

REMARKS:

No fallout.

OPERATION PLUMBBOB - Shasta

	PDT	GMT
DATE:	18 Aug 1957	18 Aug 1957
TIME:	0500	1200

TOTAL YIELD: 17 kt

FIREBALL DATA:
Time to 1st minimum: NM
Time to 2nd maximum: 220 ± 255 msec
Radius at 2nd maximum: NM

CRATER DATA: No crater

Sponsor: UCRL

SITE: NTS - Area 2a
37° 07' 41" N
116° 06' 23" W
Site elevation: 4,387 ft

HEIGHT OF BURST: 500 ft

TYPE OF BURST AND PLACEMENT:
Tower burst over Nevada soil

CLOUD TOP HEIGHT: 32,000 ft MSL
CLOUD BOTTOM HEIGHT: 16,000 ft MSL

REMARKS:
The on-site fallout pattern was obtained from ground survey readings of the Radiological Safety Division of Reynolds Electrical and Engineering Co., Inc., using AN/PDR 39 and AN/PDR 43 survey instruments. The readings were taken at H+3 hours, H+6 hours, D+1 day, D+2 days and D+3 days along 6 radial lines to determine radiation exclusion areas. The $t^{-1.2}$ decay approximation was used to extrapolate the dose rate readings to H+1 hour.

The off-site fallout was analyzed by Program 37 of UCLA and the USWB Special Projects Section. They used actual decay data to plot the H+12 hour dose-rate contours. The $t^{-1.2}$ decay approximation was used by NDL to extrapolate the H+12 hour dose-rate contours to H+1 hour. Raincut occurred in the Alamo-Hiko, Nevada area as well as in the Lincoln Mine Area. The fallout pattern is the result of the subtraction of Diablo residual activities from measured data. Arrival times after six hours were estimated from the wind data.

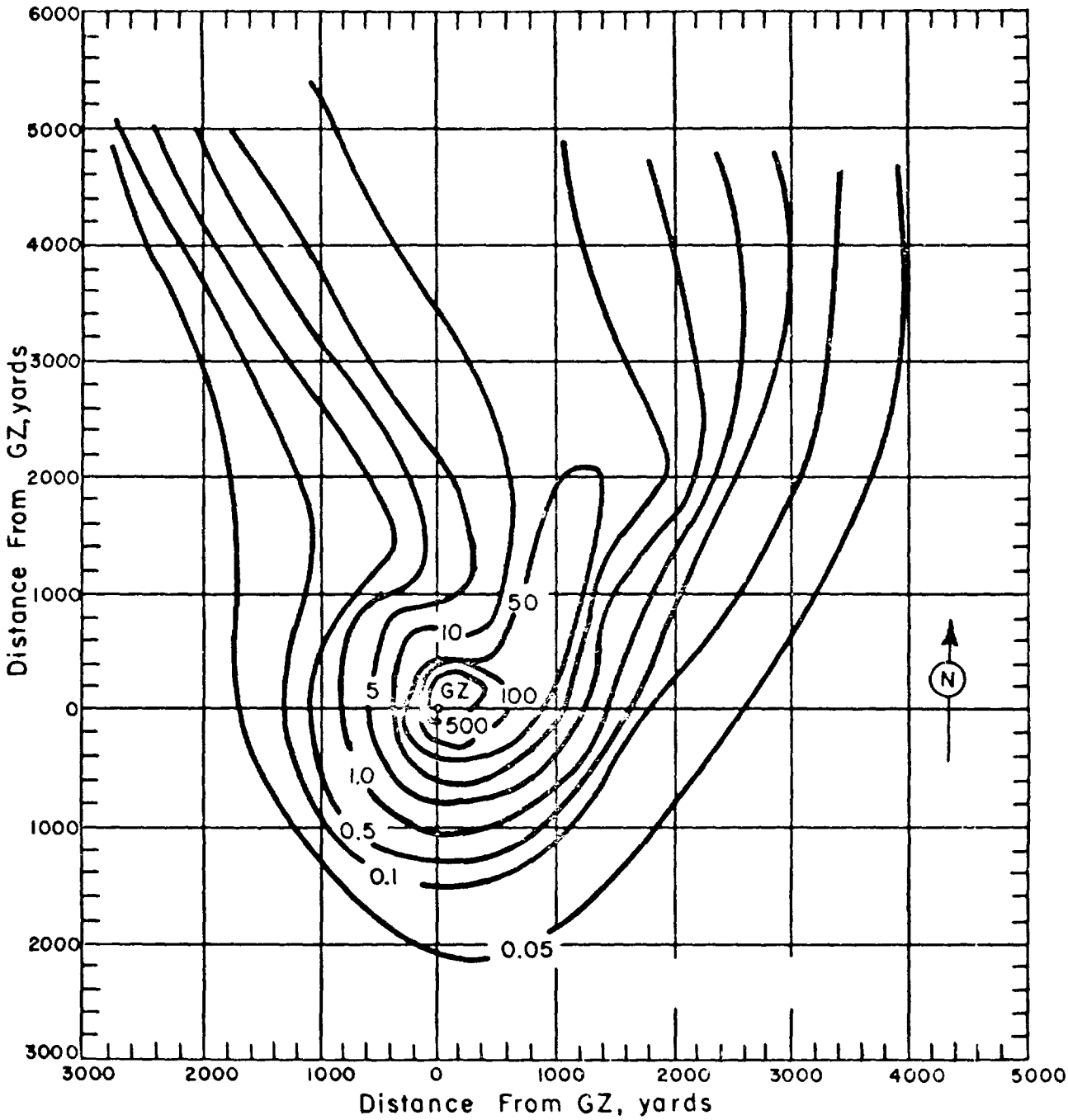


Figure 198. Operation PLUMBBOB - Shasta.
On-site dose rate contours in r/hr at H+1 hour.

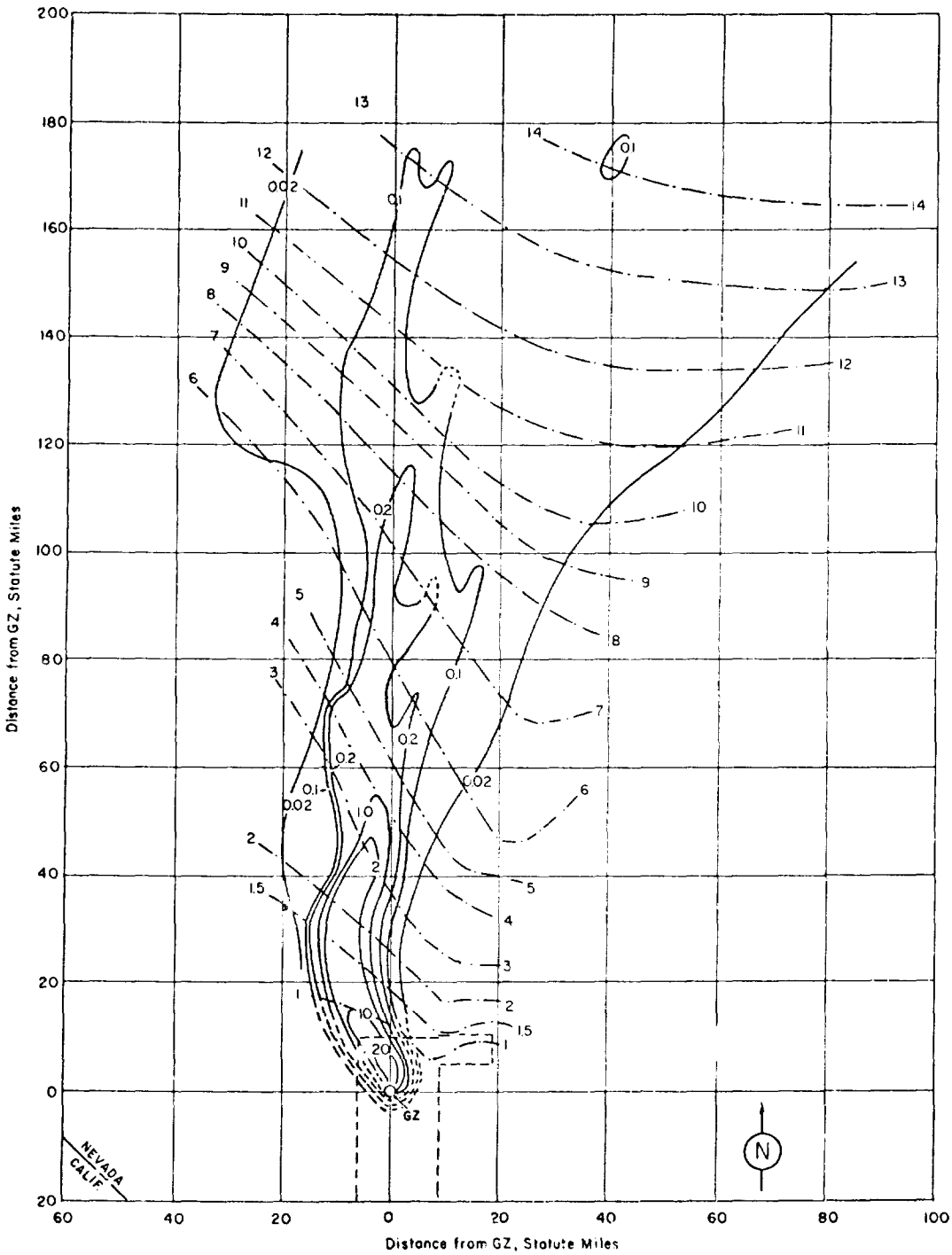


Figure 199. Operation PLUMBBOB - Shasta.
Off-site dose rate contours in r/hr at H+1 hour.

TABLE 58 NEVADA WIND DATA FOR OPERATION PLUMBBOB- SHASTA

Altitude (MSL)	H-hour		H+5½ hours	
	Dir	Speed	Dir	Speed
feet	degrees	mph	degrees	mph
Surface	Calm	Calm	180	08
5,000	200	05	180	09
6,000	220	10	200	12
7,000	220	14	200	12
8,000	230	15	210	12
9,000	220	15	210	09
10,000	220	13	190	09
11,000	190	07	---	--
12,000	150	09	170	16
13,000	140	10	---	--
14,000	140	12	180	16
15,000	150	10	(170)	(21)
16,000	150	14	170	26
17,000	150	18	---	--
18,000	150	17	180	28
19,000	140	12	---	--
20,000	130	12	180	21
21,000	150	05	---	--
22,000	240	05	---	--
23,000	280	07	180	08
24,000	300	07	---	--
25,000	300	08	210	05
26,000	300	08	---	--
27,000	300	07	---	--
28,000	290	07	---	--
29,000	270	07	---	--
30,000	260	10	210	10
31,000	250	14	---	--
32,000	240	17	---	--
33,000	240	21	---	--
34,000	240	23	---	--
35,000	240	26	230	21
36,000	240	30	---	--
37,000	240	32	---	--
38,000	240	38	---	--
39,000	240	41	---	--
40,000	240	45	240	53
41,000	240	50	---	--
42,000	240	53	---	--
43,000	240	54	---	--
44,000	240	54	---	--
45,000	240	52	250	52
46,000	250	51	---	--
47,000	250	45	---	--
48,000	250	41	---	--
49,000	260	36	---	--
50,000	260	29	260	13
51,000	270	24	---	--
52,000	280	18	---	--
53,000	300	13	---	--

NOTES:

1. Numbers in parentheses are estimated values.
2. Tropopause height was 49,800 ft MSL at H-hour.
3. Wind data was obtained from the Yucca weather station.
4. At H-hour the surface air pressure was 866 mb, the temperature 26.4°C, the dew point 8.9°C and the relative humidity 33%.

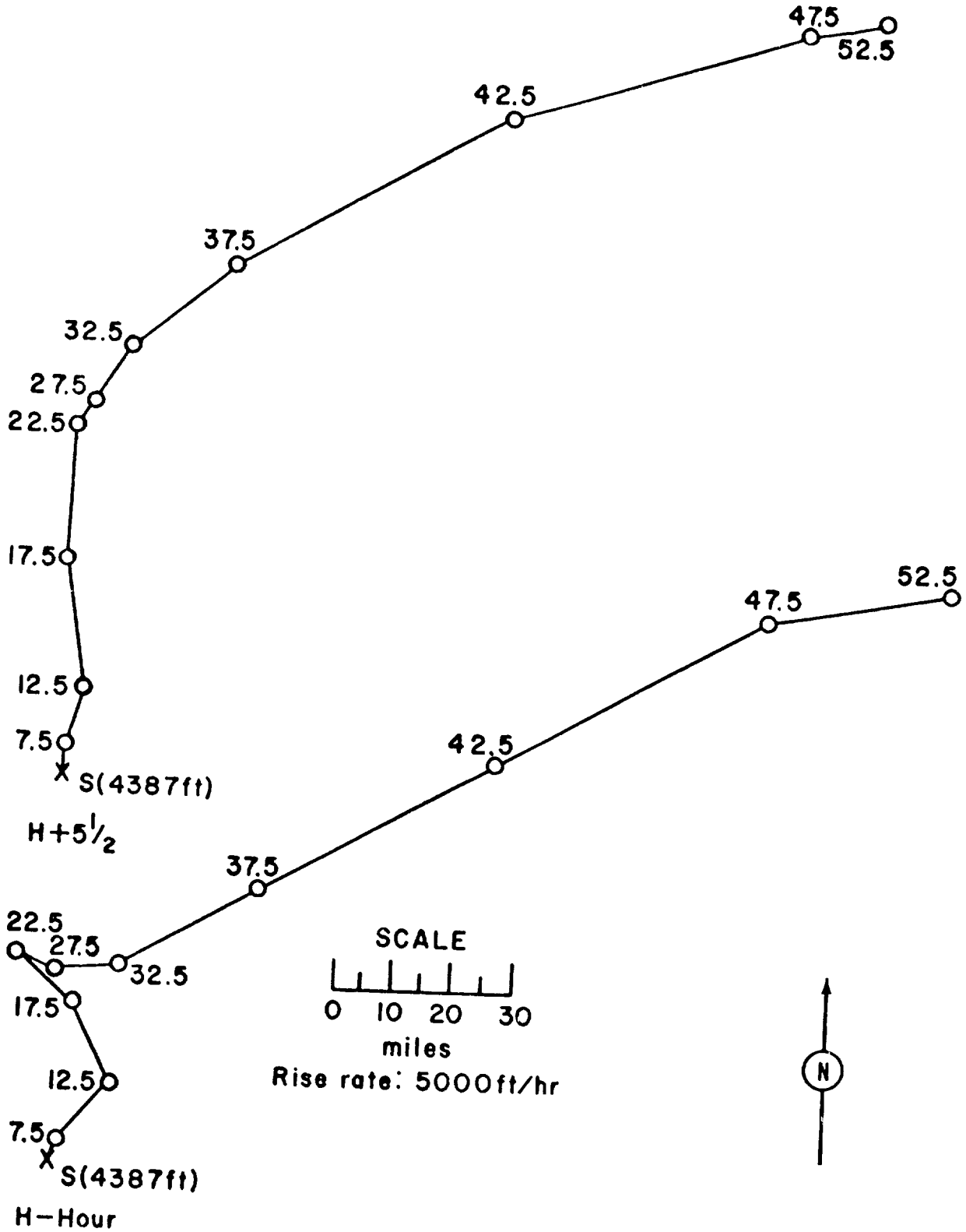


Figure 200. Hodographs for Operation PLUMBBOB - Shasta.

OPERATION PLUMBBOB - Doppler

	PDT	GMT
DATE:	23 Aug 1957	23 Aug 1957
TIME:	0530	

TOTAL YIELD: 11 kt

Sponsor: LASL

SITE: NTS - Area 7a
37° 05' 12" N
116° 01' 25" W
Site elevation: 4,230 ft

HEIGHT OF BURST: 1,500 ft

FIREBALL DATA:
Time to 1st minimum: NM
Time to 2nd maximum: 122 to 125 msec
Radius at 2nd maximum: NM

CRATER DATA: No crater

TYPE OF BURST AND PLACEMENT:
Air burst from balloon over Nevada soil

CLOUD TOP HEIGHT: 38,000 ft MSL
CLOUD BOTTOM HEIGHT: 23,000 ft MSL

REMARKS:
The contamination was due primarily to induced activity. The on-site pattern was obtained from ground survey readings of the Radiological Safety Division of Reynolds Electrical and Engineering Co., Inc., using AN/PDR 39 and AN/PDR 43 survey instruments. The readings were taken at H+$\frac{3}{4}$ hour, H+6 hours, D+1 day and D+3 days along eight radial roads to determine radiation exclusion areas. The dose-rate readings were extrapolated to H+1 hour by the general induced activity-decay curve for Nevada soil

The off-site fallout was analyzed by the USWB Special Projects Section. The $t^{-1.2}$ decay approximation was used to extrapolate the dose-rate readings to H+1 hour. "Some of the radioactivity is believed to be from Shot Shasta. The pattern interpolated between the burst site and the Nevada Route 38 (approximately 80 miles downwind) can only be a rough approximation in the absence of measurements, but its orientation, at least, is consistent with the wind analysis"

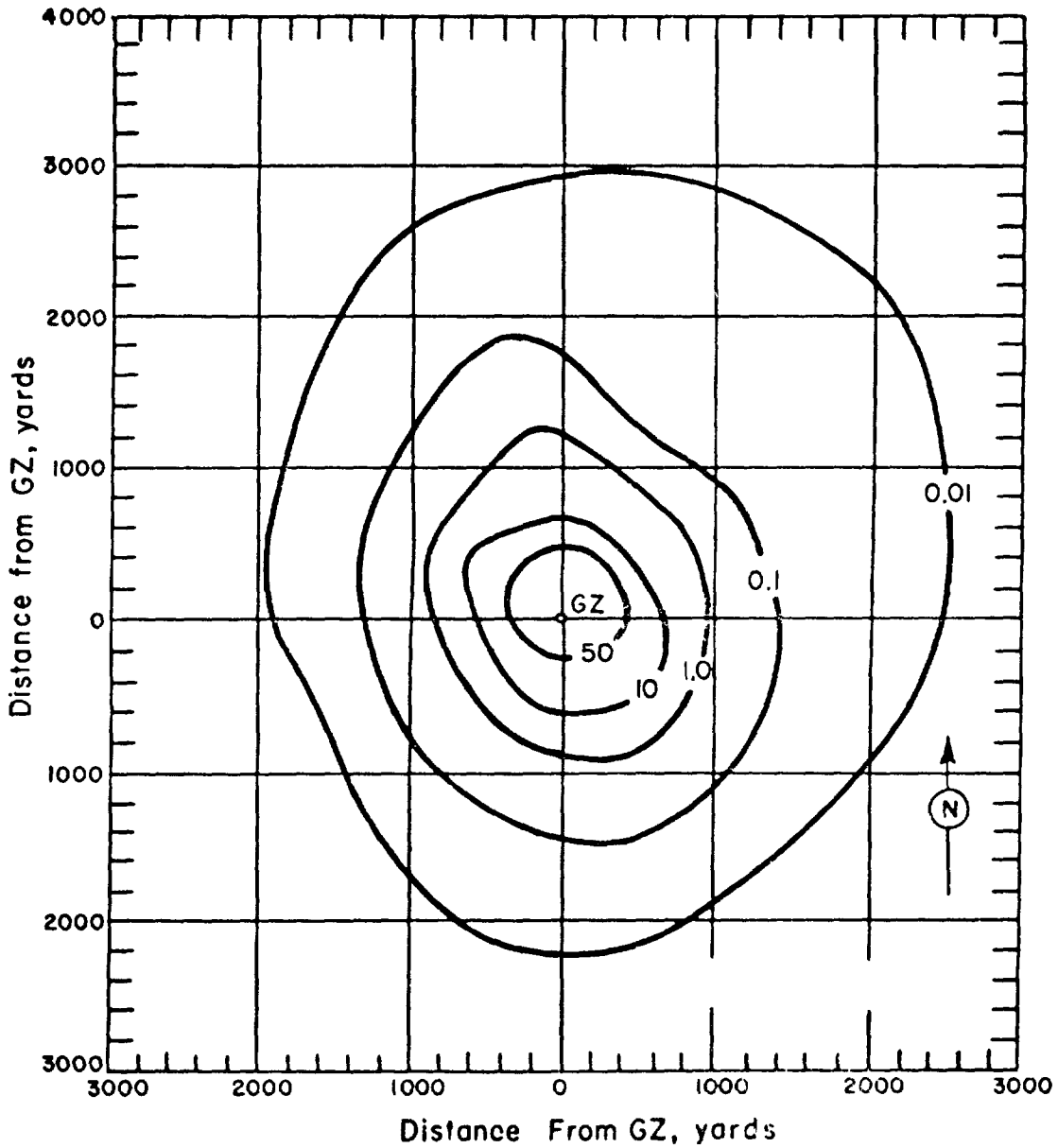


Figure 201. Operation PLUMBBOB - Doppler.
On-site dose rate contours in r/hr at H+1 hour.

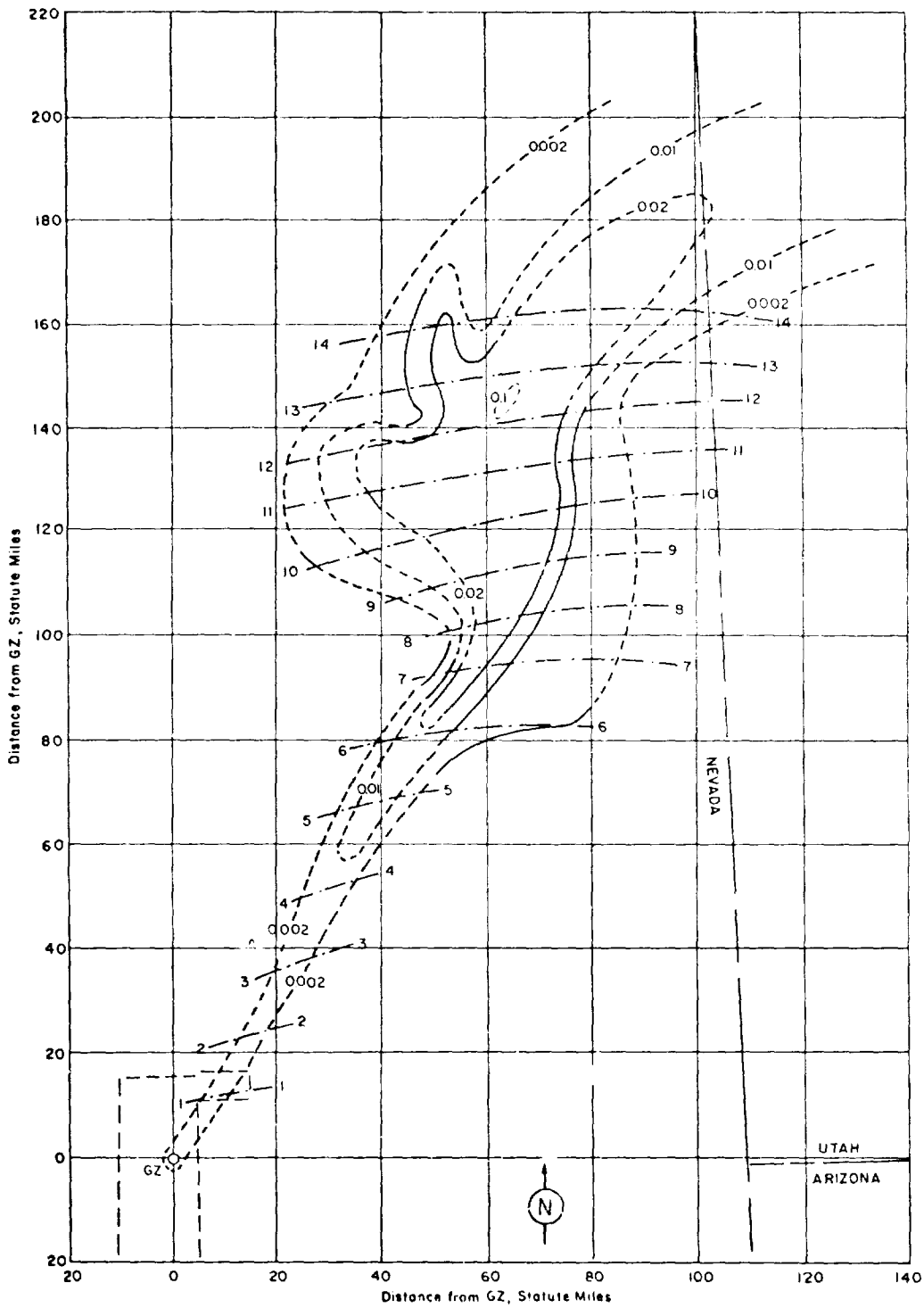


Figure 202. Operation PLUMBBOB - Doppler.
Off-site dose rate contours in r/hr at H+1 hour.

TABLE 59 NEVADA WIND DATA FOR OPERATION PLUMBBOB - DOPPLER

Altitude (MSL)	H-hour		H+3 hours		Altitude (MSL)	H-hour		H+3 hours	
	Dir	Speed	Dir	Speed		Dir	Speed	Dir	Speed
feet	degrees	mph	degrees	mph	feet	degrees	mph	degrees	mph
Surface	Calm	Calm	Calm	Calm	29,000	230	50	---	--
5,000	Calm	Calm	Calm	Calm	30,000	230	50	230	43
5,685(BH)	Calm	Calm	---	--	31,000	230	50	---	--
6,000	Calm	Calm	Calm	Calm	32,000	210	50	---	--
7,000	220	03	Calm	Calm	33,000	210	51	---	--
8,000	220	08	Calm	Calm	34,000	220	58	---	--
9,000	180	12	080	05	35,000	220	58	220	48
10,000	160	16	130	08	36,000	220	58	---	--
11,000	100	20	---	--	37,000	220	58	---	--
12,000	110	14	150	12	38,000	210	61	---	--
13,000	110	14	---	--	39,000	210	63	---	--
14,000	140	12	130	12	40,000	220	65	220	64
15,000	170	09	(160)	(13)	41,000	220	67	---	--
16,000	150	07	160	14	42,000	220	69	---	--
17,000	150	09	---	--	43,000	220	68	---	--
18,000	170	07	170	14	44,000	220	66	---	--
19,000	190	07	---	--	45,000	220	62	220	56
20,000	200	07	180	15	46,000	230	45	---	--
21,000	190	07	---	--	47,000	230	45	---	--
22,000	210	07	---	--	48,000	230	45	---	--
23,000	200	08	200	15	49,000	230	33	---	--
24,000	200	15	---	--	50,000	230	17	---	--
25,000	210	21	220	23	51,500	210	10	---	--
26,000	210	23	---	--	52,000	200	09	---	--
27,000	210	28	---	--	53,000	210	13	---	--
28,000	210	35	---	--					

NOTES:

1. Numbers in parentheses are estimated values.
2. Tropopause height was 42,800 ft MSL at H-hour.
3. Wind data was obtained from the Yucca weather station.
4. At H-hour the surface air pressure was 877 mb, the temperature 21.4°C, the dew point 13.9°C and the relative humidity 57%.

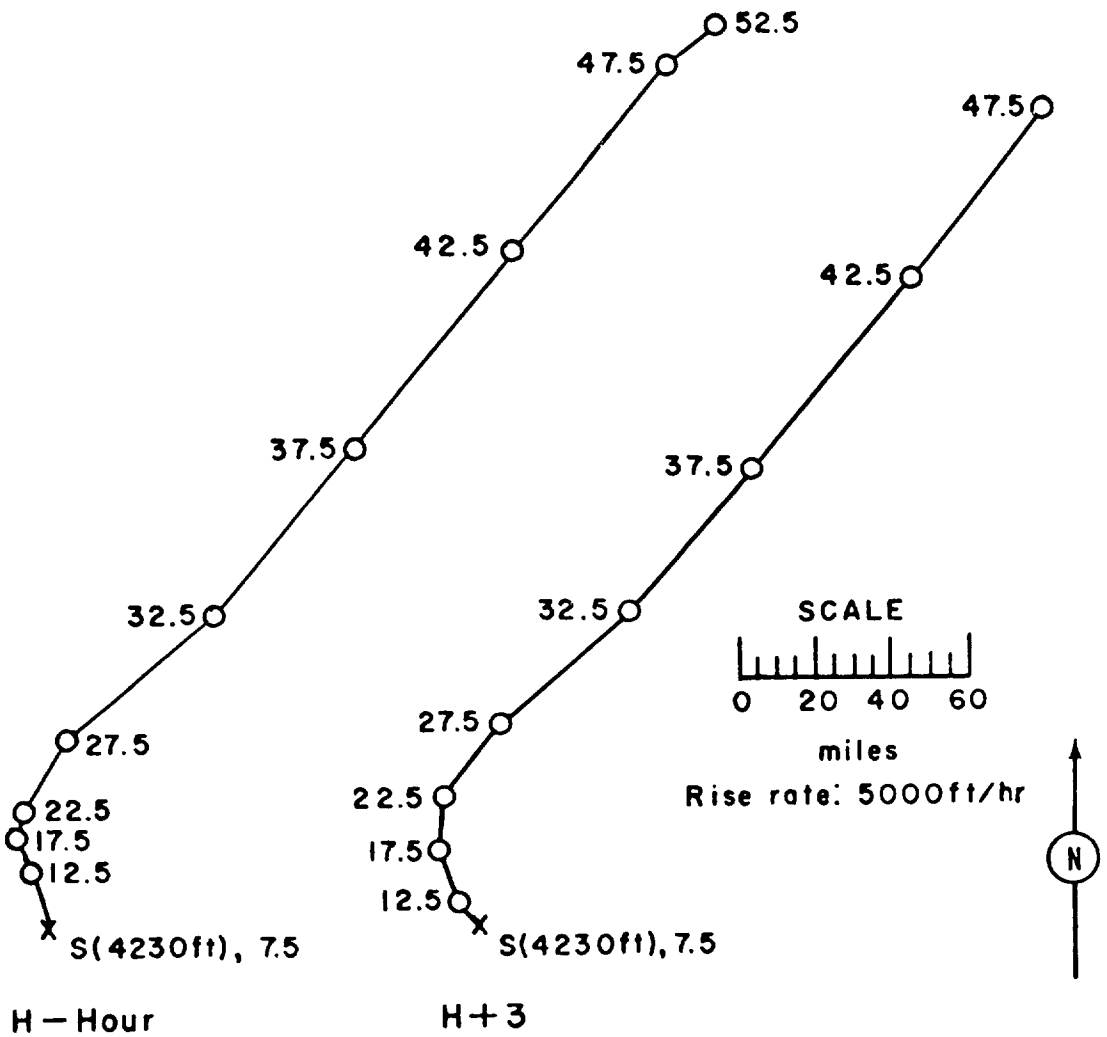


Figure 203. Hodographs for Operation PLUMBBOB - Doppler.

OPERATION PLUMBBOB - Pascal B Safety Experiment

	PDT	GMT
DATE:	27 Aug 1957	27 Aug 1957
TIME:	1535	2235

Sponsor: LASL

SITE: NTS - Area 3-d
37° 02' 56" N
116° 02' W
Site elevation: 4,050 ft

HEIGHT OF BURST: -500 ft
Underground

TYPE OF BURST AND PLACEMENT:
Subsurface burst. Partially stemmed well. Device located at the bottom of a cased 200 ft hole with a 50 ft block of concrete above it, and an open space up to a heavy concrete cap at the top.

REMARKS:

No fallout was observed. Results of the survey indicated background levels of beta-gamma radiation and a maximum of 300 c/m/55 cm^2 of alpha activity at one location.

OPERATION PLUMBBOB - Franklin Prime

	PDT	GMT
DATE:	30 Aug 1957	30 Aug 1957
TIME:	0540	1240

TOTAL YIELD: 4.7 kt

FIREBALL DATA:
Time to 1st minimum: NM
Time to 2nd maximum: 91 to 92 msec
Radius at 2nd maximum: NM

CRATER DATA: No crater

Sponsor: LASL

SITE: NTS - Area 7b
37° 09' 12" N
116° 01' 25" W
Site elevation: 4,186 ft

HEIGHT OF BURST: 750 ft

TYPE OF BURST AND PLACEMENT:
Air burst from balloon over Nevada soil

CLOUD TOP HEIGHT: 32,000 ft MSL
CLOUD BOTTOM HEIGHT: 21,000 ft MSL

REMARKS:

The contamination was due primarily to induced activity. The on-site pattern was obtained from ground survey readings of the Radiological Safety Division of Reynolds Electrical and Engineering Co., Inc., using AN/PDR 39 and AN/PDR 43 survey instruments. The readings were taken at H+$\frac{3}{4}$ hour, H+6 hours, D+2 days and D+3 days along eight radial roads to determine radiation exclusion areas. The dose-rate readings were extrapolated to H+1 hour by the aerial induced activity decay curve for Nevada soil The extrapolated dose rates are not very accurate because the induced activity decay factor is not strictly applicable.

The off-site fallout was analyzed by the USWB Special Projects Section. The $t^{-1.2}$ decay approximation was used to extrapolate the dose-rate readings to H+1 hour. "A considerable amount of the radioactivity observed following Franklin Prime can be attributed to residual debris from previous tower bursts, primarily Shasta and Diablo. This residual activity had to be subtracted from the activity recorded. The resulting pattern should be considered merely as an approximation.

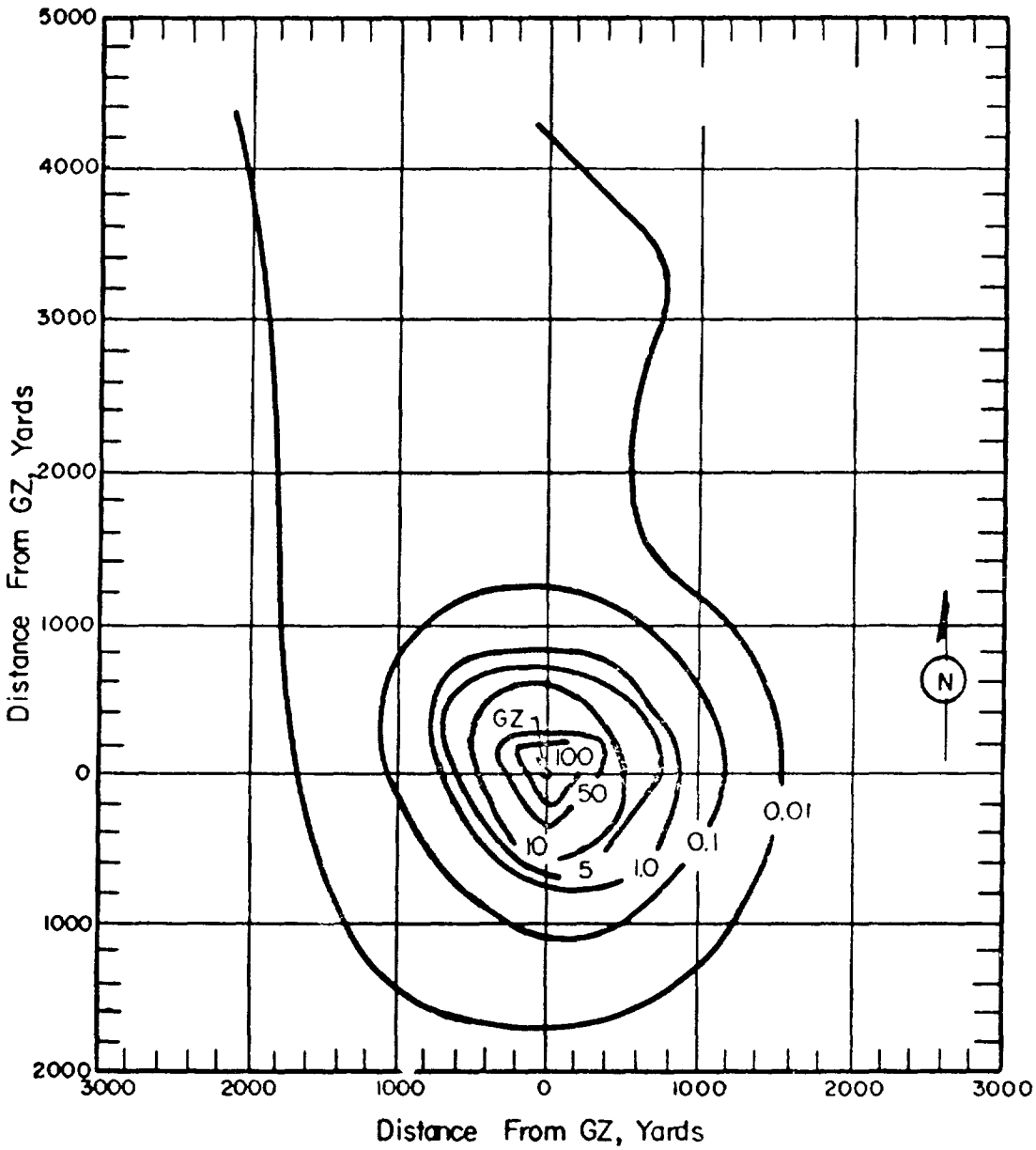


Figure 204. Operation PLUMBBOB - Franklin Prime.
On-site dose rate contours in r/hr at H+1 hour.

TABLE 60 NEVADA WIND DATA FOR OPERATION PLUMBBOB- FRANKLIN PRIME

Altitude (MSL)	H-hour		H+2 hours		Altitude (MSL)	H-hour		H+2 hours	
	Dir	Speed	Dir	Speed		Dir	Speed	Dir	Speed
feet	degrees	mph	degrees	mph	feet	degrees	mph	degrees	mph
Surface	Calm	Calm	Calm	Calm	29,000	230	46	---	--
4,936(BH)	340	02	---	--	30,000	220	46	220	45
5,000	330	02	180	02	31,000	220	44	---	--
6,000	210	06	230	05	32,000	220	51	---	--
7,000	160	12	130	09	33,000	220	54	---	--
8,000	130	14	160	14	34,000	220	54	---	--
9,000	140	15	160	16	35,000	220	55	210	47
10,000	160	16	170	18	36,000	220	55	---	--
11,000	170	17	---	--	37,000	220	54	---	--
12,000	170	20	170	24	38,000	220	49	---	--
13,000	180	22	---	--	39,000	220	51	---	--
14,000	180	22	180	40	40,000	220	56	220	49
15,000	180	25	(180)	(36)	41,000	220	60	---	--
16,000	190	32	190	31	42,000	220	49	---	--
17,000	190	33	---	--	43,000	220	47	---	--
18,000	190	31	220	28	44,000	220	48	---	--
19,000	200	36	---	--	45,000	220	49	240	55
20,000	210	36	210	36	46,000	230	52	---	--
21,000	210	33	---	--	47,000	230	47	---	--
22,000	220	33	---	--	48,000	230	40	---	--
23,000	200	35	210	33	49,000	220	30	---	--
24,000	220	35	---	--	50,000	220	28	210	38
25,000	220	39	230	36	51,000	220	26	---	--
26,000	220	39	---	--	52,000	220	28	---	--
27,000	220	40	---	--	53,000	220	29	---	--
28,000	230	44	---	--					

NOTES:

1. Numbers in parentheses are estimated values.
2. Tropopause height was 32,500 ft MSL at H-hour.
3. Wind data was obtained from the Yucca weather station.
4. At H+$\frac{3}{4}$ hours the surface air pressure was 868 mb, the temperature 11.0°C, the dew point -3.7°C and the relative humidity 35%.

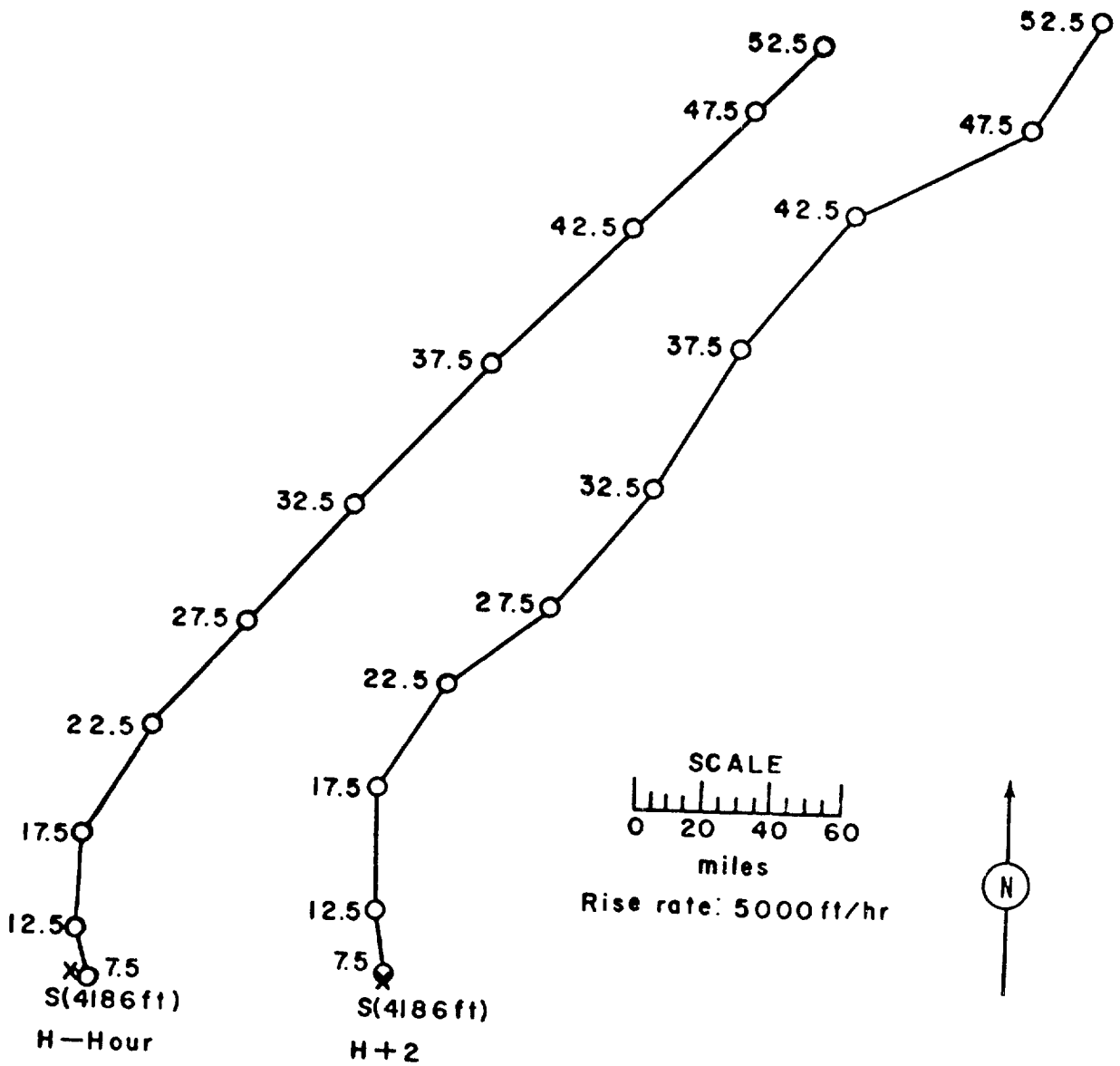


Figure 205. Hodographs for Operation PLUMBBOB - Franklin Prime.

OPERATION PLUMBBOB - Smoky

	PDT	GMT
DATE:	31 Aug 1957	31 Aug 1957
TIME:	0530	1230

TOTAL YIELD: 44 kt

FIREBALL DATA:
Time to 1st minimum: NM
Time to 2nd maximum: 245 to 275 msec
Radius at 2nd maximum: NM

CLOUD TOP HEIGHT: 38,000 ft MSL
CLOUD BOTTOM HEIGHT: NM

Sponsor: UCRL

SITE: NTS - Area - 2c
37° 11' 14" N
116° 04' 04" W
Site elevation: 4,479 ft

HEIGHT OF BURST: 700 ft

TYPE OF BURST AND PLACEMENT:
Tower burst over Nevada soil

CRATER DATA: No crater

REMARKS:

The on-site fallout pattern was obtained from ground survey readings of the Radiological-Safety Division of Reynolds Electrical and Engineering Co., Inc., using AN/PDR 39 and AN/PDR 43 survey instruments. The readings were taken at H+8 hours, D+1 day, D+3 days and D+5 days along eight radial roads to determine radiation exclusion areas. The $t^{-1.2}$ decay approximation was used to extrapolate the dose-rate readings to H+1 hour. The higher dose rates are not very reliable because several days elapsed before such readings were taken.

The off-site fallout pattern was obtained by "The Test Manager's Committee for the Evaluation of Radiation Doses." This committee analyzed all available data and used the actual decay data obtained by the UCLA School of Medicine Atomic Energy Project to report H+12-hour dose-rate contours. The $t^{-1.2}$ decay approximation was used to extrapolate the H+12-hour dose-rate contours to H+1 hour. The pattern is based on ground and aerial survey data. The time of arrival was estimated by using measured times at known points.

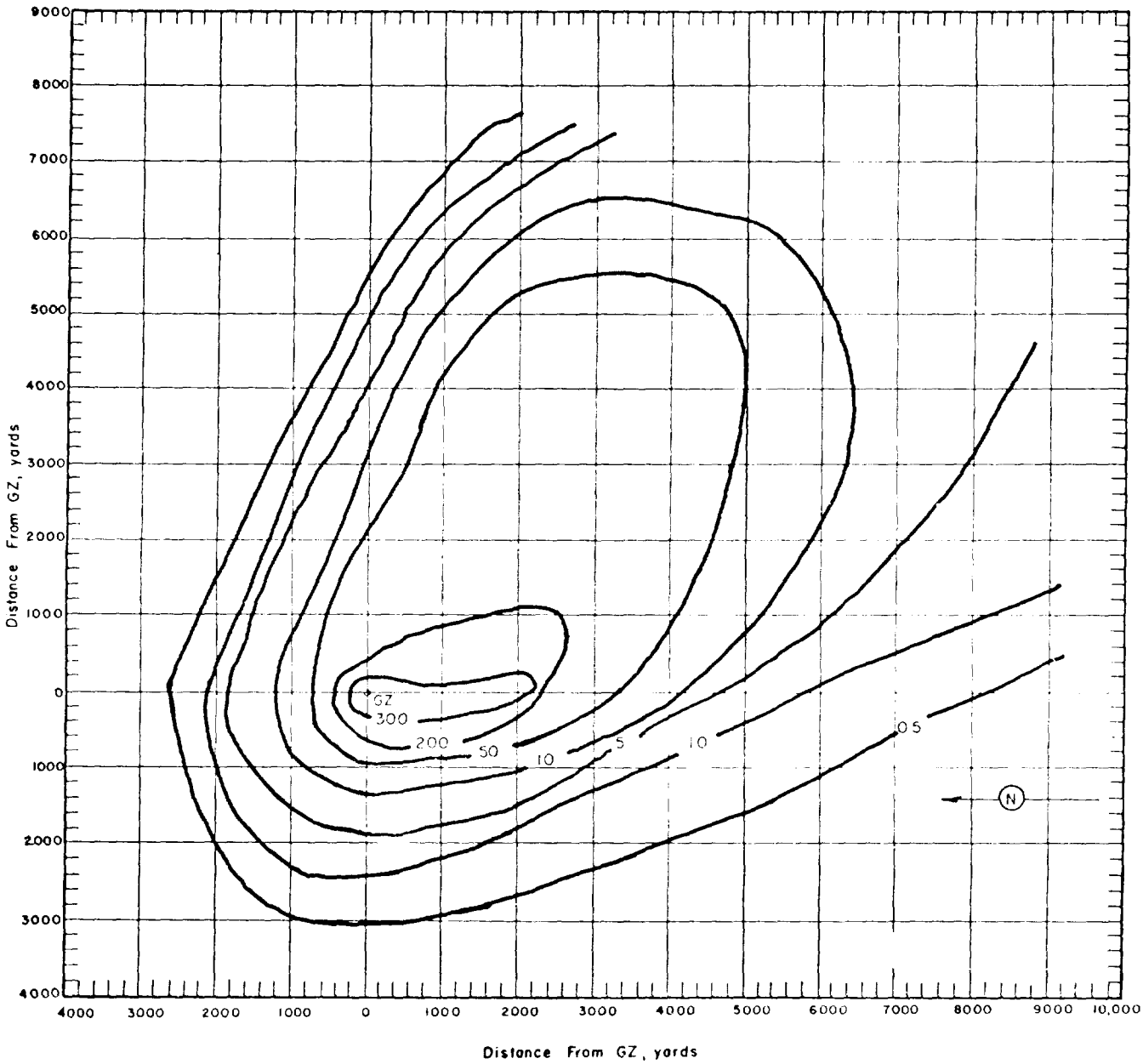


Figure 206. Operation PLUMBBOB - Smoky.
On-site dose rate contours in r/hr at H+1 hour.

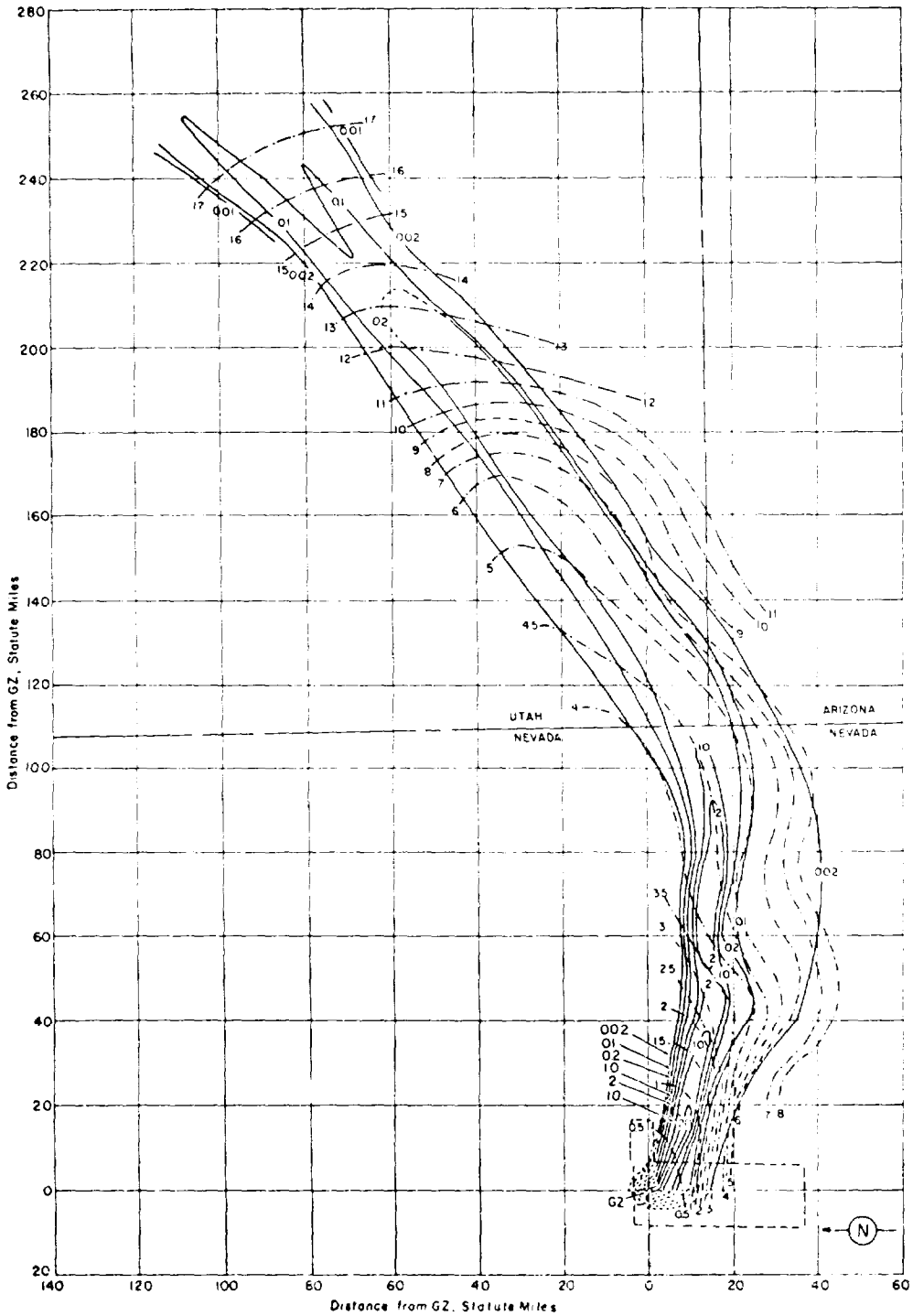


Figure 207. Operation PLUMBBOB - Smoky
Off-site dose rate contours in r/hr at H+1 hour.

TABLE 61 NEVADA WIND DATA FOR OPERATION PLUMBBOB - SMOKY

Altitude (MSL)	H-hour		H+3 hours	
	Dir	Speed	Dir	Speed
feet	degrees	mph	degrees	mph
Surface	Calm	Calm	Calm	Calm
5,000	Calm	Calm	330	05
5,179	(BH)Calm	Calm	---	--
6,000	340	06	350	05
7,000	010	07	060	07
8,000	010	07	080	09
9,000	010	10	040	06
10,000	360	12	360	06
11,000	360	09	---	--
12,000	360	07	360	05
13,000	360	07	---	--
14,000	020	07	280	06
15,000	340	09	(280)	(09)
16,000	290	13	280	13
17,000	280	18	---	--
18,000	290	22	290	20
19,000	290	21	---	--
20,000	280	24	300	23
21,000	280	29	---	--
22,000	280	29	---	--
23,000	280	30	280	31
24,000	270	35	---	--
25,000	270	36	280	38
26,000	280	36	---	--
27,000	270	33	---	--
28,000	270	31	---	--
29,000	280	36	---	--
30,000	280	37	300	33
31,000	280	33	---	--
32,000	280	36	---	--
33,000	270	38	---	--
34,000	270	37	---	--
35,000	270	37	300	35
36,000	270	40	---	--
37,000	270	44	---	--
38,000	270	43	---	--
39,000	270	39	---	--
40,000	270	35	250	33
41,000	270	32	---	--
42,000	270	36	---	--
43,000	260	38	---	--
44,000	260	35	---	--
45,000	250	38	250	39
46,000	230	45	---	--
47,000	250	40	---	--
48,000	260	36	---	--
49,000	250	35	---	--
50,000	240	31	240	25

NOTES:

1. Numbers in parentheses are estimated values.
2. Tropopause height was 35,000 ft MSL at H-hour.
3. Wind data was obtained from the Yucca weather station.
4. At H-hour the air pressure was 856 mb, the temperature 14°C, the dew point -3.6°C and the relative humidity 31%.

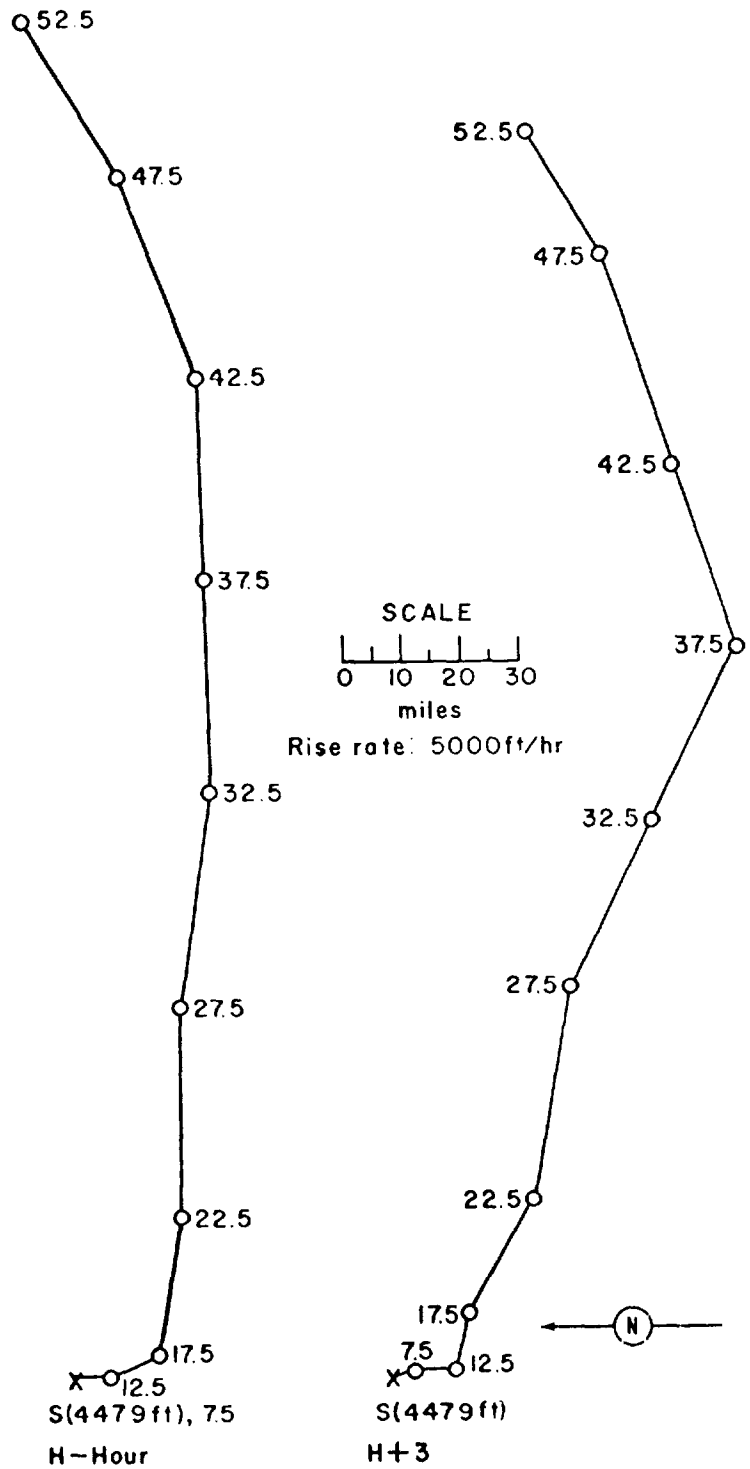


Figure 208. Hodographs for Operation PLUMBBOB - Smoky.

OPERATION PLUMBBOB - Galileo

	PDT	GMT
DATE:	2 Sep 1957	2 Sep 1957
TIME:	0540	1240

TOTAL YIELD: 11 kt

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

CRATER DATA: No crater

Sponsor: LASL

SITE: NTS - Area 1
37° 03' 11" N
116° 06' 09" W
Site elevation: 4,250 ft

HEIGHT OF BURST: 500 ft

TYPE OF BURST AND PLACEMENT:
Tower burst over Nevada soil

CLOUD TOP HEIGHT: 37,000 ft MSL
CLOUD BOTTOM HEIGHT: 17,000 ft MSL

REMARKS:

The on-site pattern was obtained from ground survey readings of the Radiological Safety Division of Reynolds Electrical and Engineering Co., Inc., using AN/PDR 39 and AN/PDR 43 survey instruments. The readings were taken at H+2 hours, H+6 hours, D+1 day, D+2 days and D+3 days along eight radial roads to determine radiation exclusion areas. The dose-rate readings were extrapolated to H+1 hour by the $t^{-1.2}$ decay approximation.

The off-site fallout was analyzed by Program 37 of UCLA. Actual decay data was used to plot the H+12-hour dose-rate contours. The $t^{-1.2}$ decay approximation was used by NDL to extrapolate the H+12-hour dose-rate readings to H+1 hour. The pattern is based on ground and aerial survey data. "The west edge and the close-in portion of this pattern was estimated due to the lack of data"

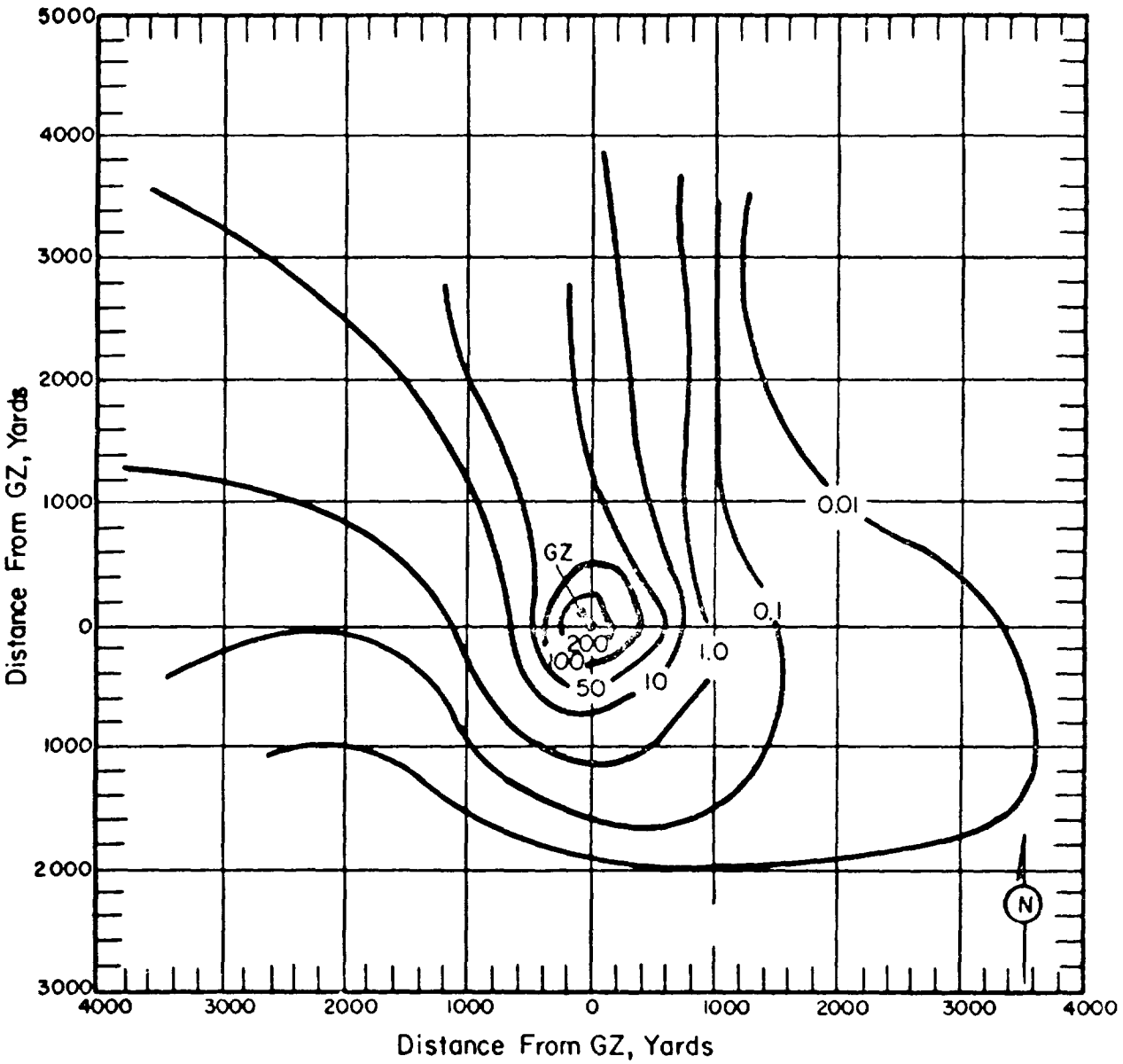


Figure 209. Operation PLUMBBOB - Galileo.
On-site dose rate contours in r/hr at H+1 hour.

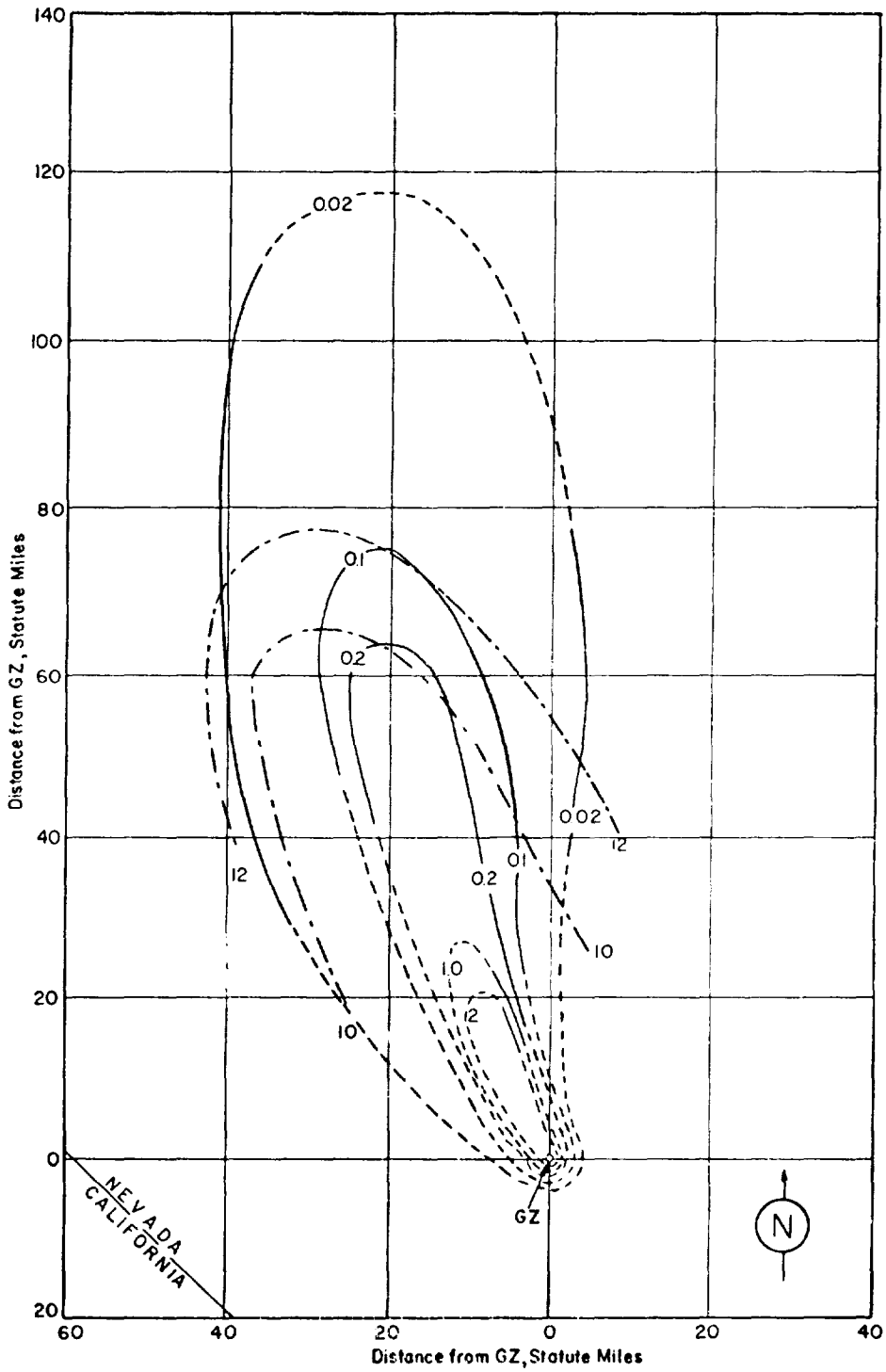


Figure 210. Operation PLUMBBOB - Galileo.
Off-site dose rate contours in r/hr at H+1 hour.

TABLE 62 NEVADA WIND DATA FOR OPERATION PLUMBBOB— GALILEO

Altitude (MSL)	H-hour		H+2 hours		H+5 hours	
	Dir	Speed	Dir	Speed	Dir	Speed
feet	degrees	mph	degrees	mph	degrees	mph
Surface	Calm	Calm	Calm	Calm	Calm	Calm
4,740(BH)	Calm	Calm	---	---	---	--
5,000	Calm	Calm	Calm	Calm	130	05
6,000	230	01	Calm	Calm	150	09
7,000	200	02	Calm	Calm	150	12
8,000	170	05	120	09	150	10
9,000	150	05	140	15	160	08
10,000	140	05	140	15	160	07
11,000	150	07	---	--	---	--
12,000	140	02	150	13	160	09
13,000	160	09	---	--	---	--
14,000	160	07	140	07	150	09
15,000	160	08	(150)	(06)	(160)	(06)
16,000	150	09	150	05	170	03
17,000	130	09	---	--	---	--
18,000	130	10	150	05	140	03
19,000	130	06	---	--	---	--
20,000	080	02	110	02	130	05
21,000	010	06	---	--	---	--
22,000	010	07	---	--	---	--
23,000	010	07	040	02	030	07
24,000	030	07	---	--	---	--
25,000	070	08	180	02	110	05
26,000	090	09	---	--	---	--
27,000	070	12	---	--	---	--
28,000	070	10	---	--	---	--
29,000	070	08	---	--	---	--
30,000	070	07	040	05	010	05
31,000	060	07	---	--	---	--
32,000	040	08	---	--	---	--
33,000	010	12	---	--	---	--
34,000	010	12	---	--	---	--
35,000	040	12	020	02	020	07
36,000	030	13	---	--	---	--
37,000	010	14	---	--	---	--
38,000	360	14	---	--	---	--
39,000	340	12	---	--	---	--
40,000	330	07	290	09	270	08
45,000	240	38	240	25	240	21
50,000	260	36	190	29	250	32

NOTES:

1. Numbers in parentheses are estimated values.
2. Tropopause height was 39,300 ft MSL at H-hour.
3. Wind data was obtained from the Yucca weather station.
4. At H-hour the surface air pressure was 878 mb, the temperature 15.8°C, the dew point -1.5°C and the relative humidity 30%.

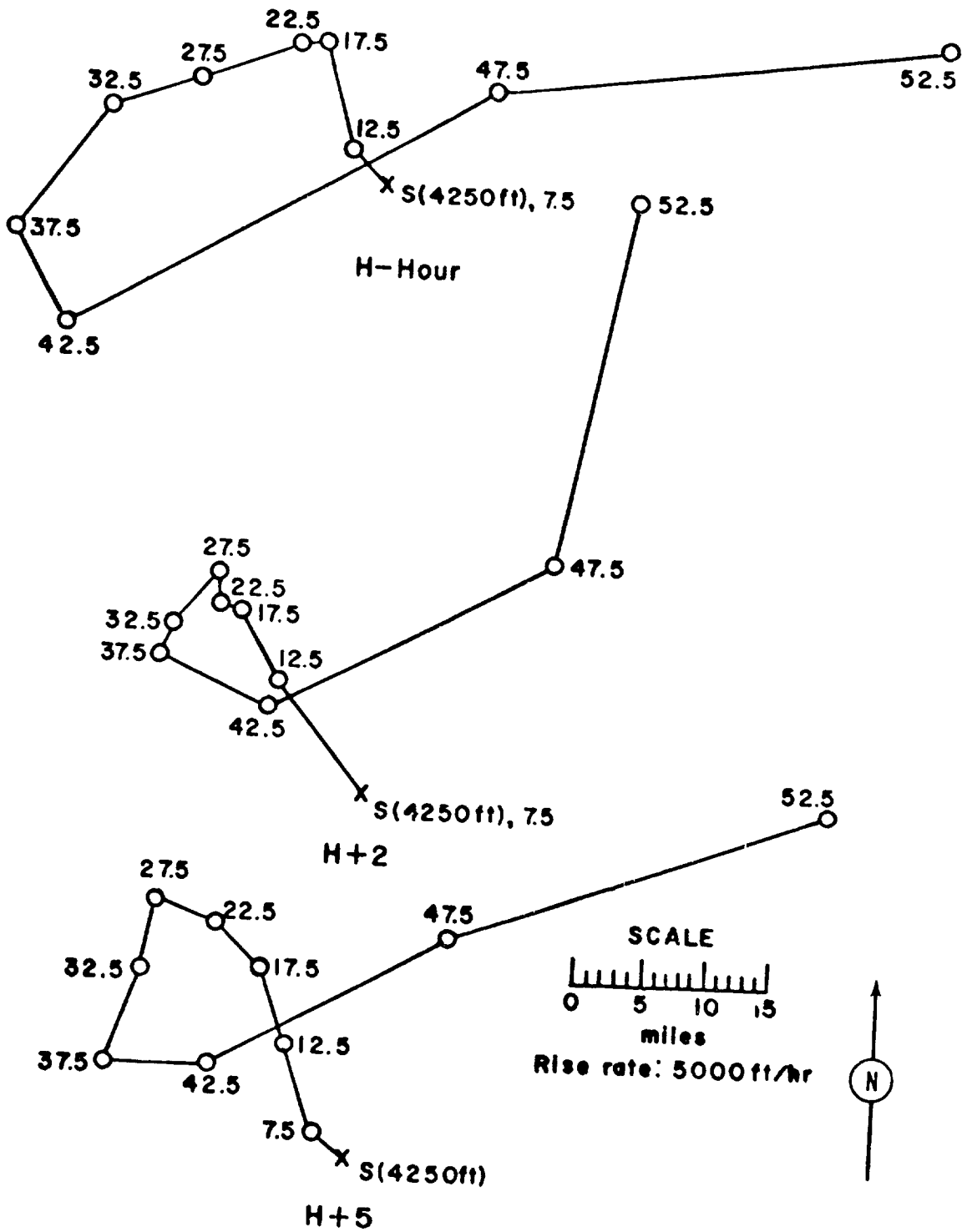


Figure 211. Hodographs for Operation PLUMBBOB - Galileo.

OPERATION PLUMBBOB - Wheeler

	PDT	GMT
DATE:	6 Sep 1957	6 Sep 1957
TIME:	0545	1245

TOTAL YIELD: 197 tons

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

CRATER DATA: No crater

Sponsor: UCRL

SITE: NTS - Area 9-a
37° 08' 05" N
116° 02' 27" W
Site elevation: 4,230 ft

HEIGHT OF BURST: 500 ft

TYPE OF BURST AND PLACEMENT:
Air burst from balloon over Nevada soil

CLOUD TOP HEIGHT: 17,000 ft MSL
CLOUD BOTTOM HEIGHT: 14,000 ft MSL

REMARKS:

The contamination was due primarily to induced activity. The on-site pattern was obtained from ground survey readings of the Radiological Safety Division of Reynolds Electrical and Engineering Co., Inc. using AN/PDR 39 and AN/PDR 43 survey instruments. The readings were taken at H+1 hour, H+8 hours, D+1 day, D+2 days and D+3 days along eight radial roads to determine radiation exclusion areas. The dose rate readings were extrapolated to H+1 hour by the general induced-activity-decay curve for Nevada soil. The pattern is not reliable. The measurements include some residual radiation from previous shots.

The fallout detected by the off-site survey could not be definitely attributed to Wheeler, but may well have been from previous shots.

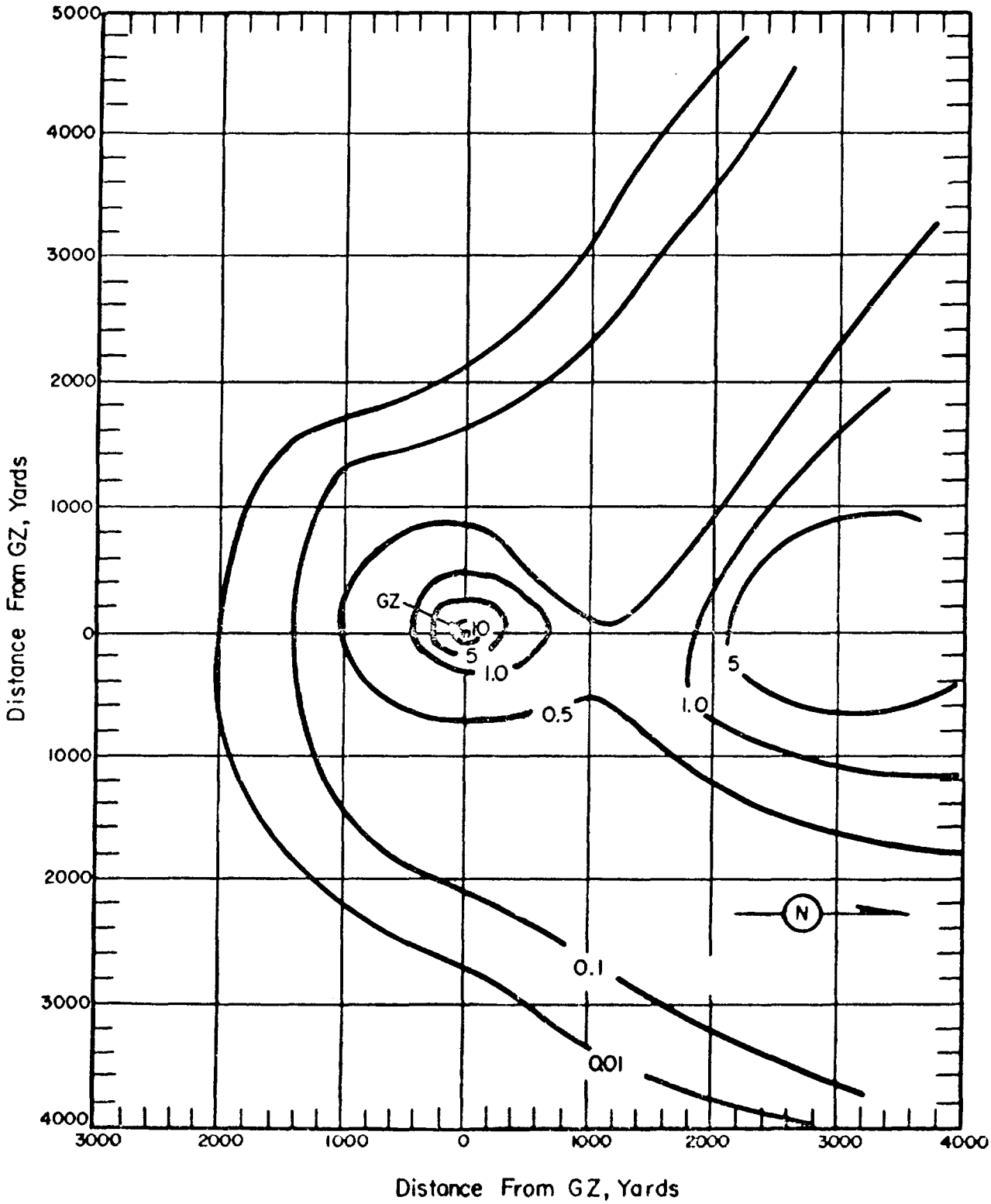


Figure 212. Operation PLUMBBOB - Wheeler.
On-site dose rate contours in r/hr at H+1 hour.

TABLE 63 NEVADA WIND DATA FOR OPERATION PLUMBBOB- WHEELER

Altitude (MSL)	H-hour		H+2 hours		Altitude (MSL)	H-hour		H+2 hours	
	Dir	Speed	Dir	Speed		Dir	Speed	Dir	Speed
feet	degrees	mph	degrees	mph	feet	degrees	mph	degrees	mph
Surface	Calm	Calm	330	03	29,000	090	37	---	--
4,715(BH)	350	03	---	--	30,000	090	37	090	52
5,000	020	06	330	07	31,000	090	45	---	--
6,000	080	07	040	07	32,000	090	55	---	--
7,000	100	07	060	09	33,000	090	66	---	--
8,000	110	09	080	09	34,000	090	70	---	--
9,000	120	12	090	13	35,000	090	71	080	87
10,000	120	13	100	16	36,000	090	73	---	--
11,000	130	15	---	--	37,000	080	74	---	--
12,000	130	17	120	18	38,000	080	70	---	--
13,000	120	17	---	--	39,000	080	67	---	--
14,000	120	20	120	20	40,000	080	67	080	78
15,000	110	20	(120)	(20)	41,000	080	67	---	--
16,000	110	24	120	21	42,000	080	61	---	--
17,000	120	29	---	--	43,000	080	55	---	--
18,000	120	24	140	17	44,000	080	51	---	--
19,000	140	17	---	--	45,000	080	47	080	62
20,000	130	16	120	12	46,000	070	45	---	--
21,000	130	16	---	--	47,000	070	40	---	--
22,000	120	17	---	--	48,000	060	33	---	--
23,000	110	18	120	20	49,000	060	33	---	--
24,000	120	17	---	--	50,000	060	33	070	28
25,000	110	20	110	26	51,000	060	32	---	--
26,000	100	23	---	--	52,000	060	29	---	--
27,000	100	36	---	--	53,000	060	26	---	--
28,000	100	44	---	--					

NOTES:

1. Numbers in parentheses are estimated values.
2. Tropopause height was 50,200 ft MSL at H-hour.
3. Wind data was obtained from the Yucca weather station.
4. At H-hour the surface air pressure was 876 mb, the temperature 15.0°C, the dew point -3.6°C and the relative humidity 25%.

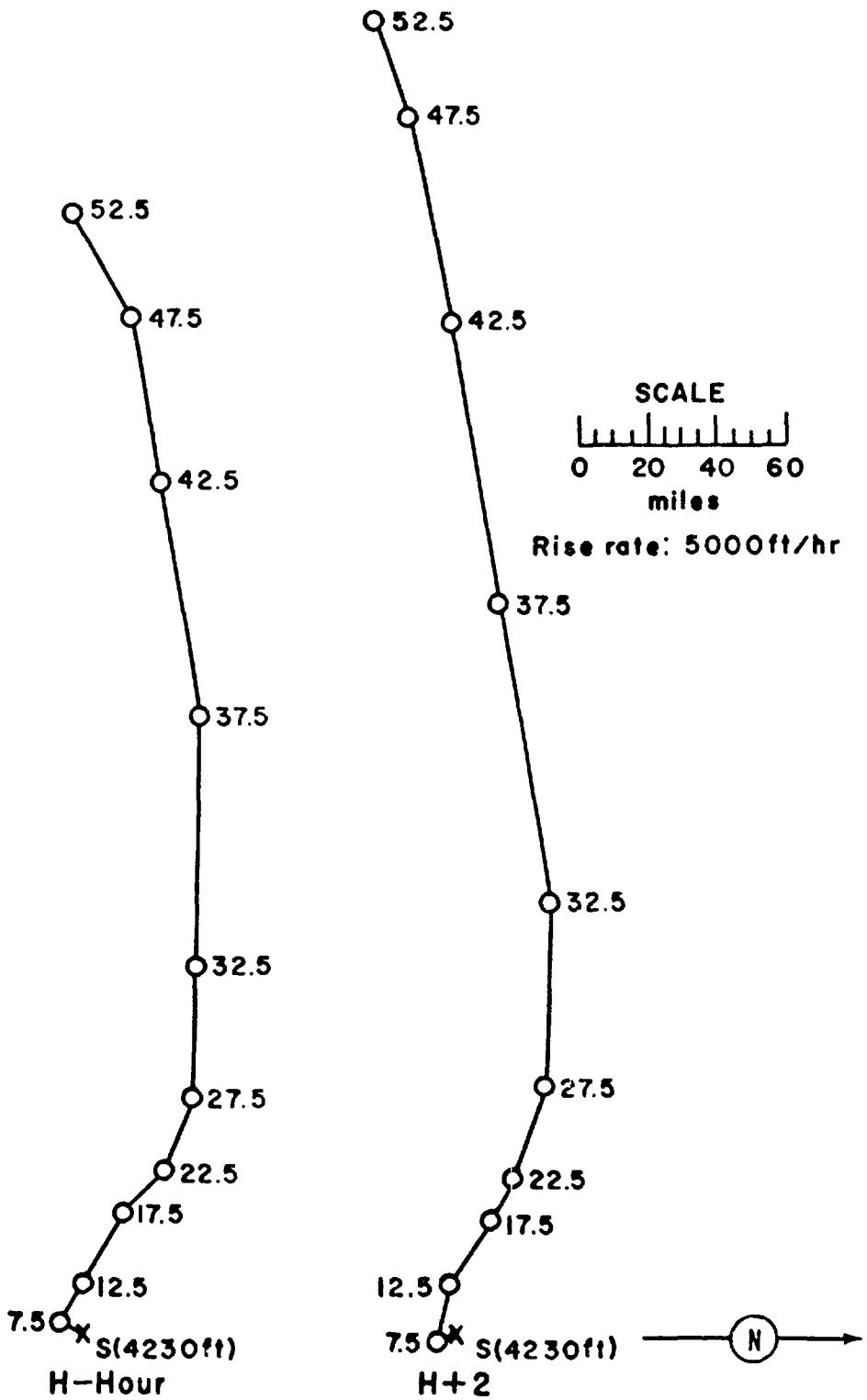


Figure 213. Hodographs for Operation PLUMBBOB - Wheeler.

OPERATION PLUMBBOB - Coulomb B Safety Experiment

	PDT	GMT
DATE:	6 Sep 1957	6 Sep 1957
TIME:	1305	2005

TOTAL YIELD: 0.3 kt

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

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

Sponsor: LASL

SITE: NTS - Area 3g
37° 02' 34" N
116° 01' 37" W
Site elevation: 4,035 ft

HEIGHT OF BURST: 3 ft

TYPE OF BURST AND PLACEMENT:
Surface burst on Nevada soil

REMARKS:
The on-site fallout pattern was obtained from ground survey readings of the Radiological Safety Division of Reynolds Electrical and Engineering Co., Inc., using AN/PDR 39 and AN/PDR 43 survey instruments. The readings were taken at H+½ hour, H+5 hours, D+1 day, D+2 days, and D+3 days along eight radial roads to determine radiation exclusion areas. The $t^{-1.2}$ decay approximation was used to extrapolate the dose-rate readings to H+1 hour. Significant alpha contamination was detected inside the 1 r/hr isointensity line.

The off-site fallout was analyzed by the USWB Special Projects Section The $t^{-1.2}$ decay approximation was used to extrapolate the dose-rate readings to H+1 hour. Due to light winds, a large part of the fallout was probably deposited between GZ and the nearest off-site points for which monitoring data were available.

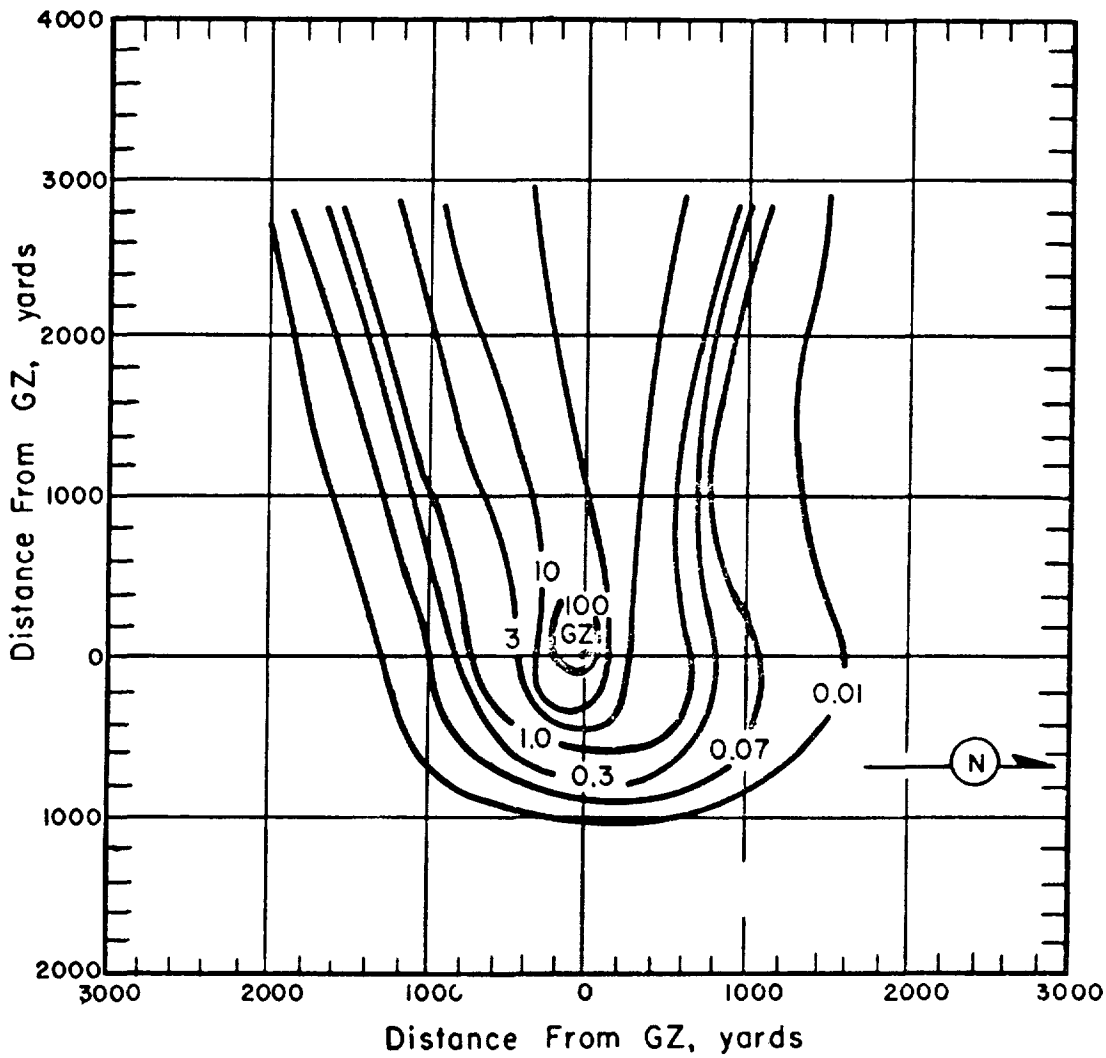


Figure 214. Operation PLUMBBOB - Coulomb B.
On-site dose rate contours in r/hr at H+1 hour.

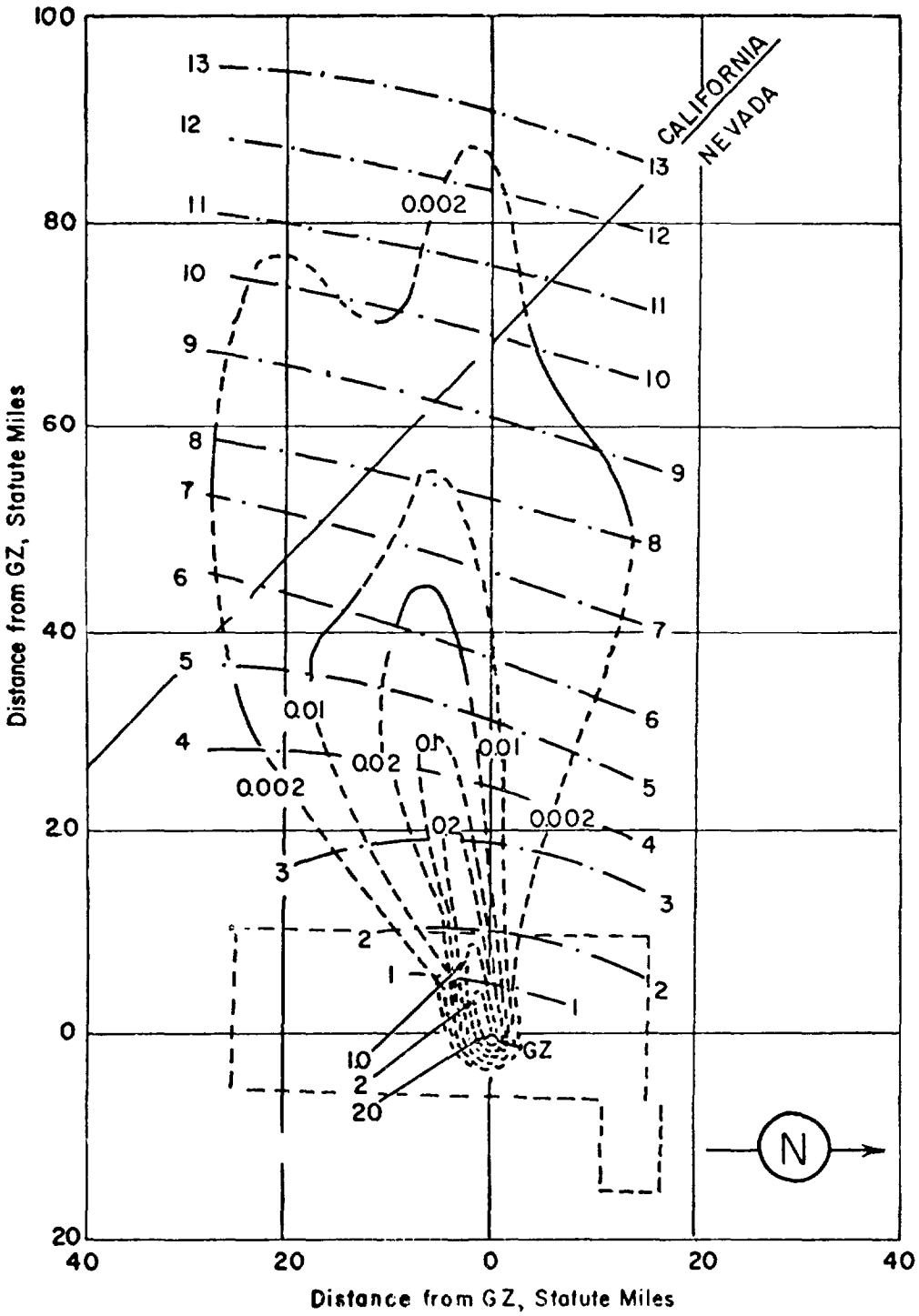


Figure 215. Operation PLUMBBOB - Coulomb B.
Off-site dose rate contours in r/hr at H+1 hour.

TABLE 64 NEVADA WIND DATA FOR OPERATION PLUMBBOB- COULOMB-B

Altitude (MSL)	H-hour		H+1½ hours	
	Dir	Speed	Dir	Speed
feet	degrees	mph	degrees	mph
Surface	050	06	120	05
4,000	050	06	120	05
5,000	040	09	130	05
6,000	020	09	150	05
7,000	030	09	150	03
8,000	040	10	070	02
9,000	040	13	040	05
10,000	030	13	050	05
12,000	020	06	070	05
14,000	140	05	070	09
15,000	(120)	(08)	(090)	(08)
16,000	100	12	100	08
18,000	110	18	120	02
20,000	110	14	090	12
23,000	270	05	090	30
25,000	010	02	100	57
30,000	---	--	100	57
35,000	---	--	100	79
40,000	---	--	090	74
45,000	---	--	080	68
50,000	---	--	080	24

NOTES:

1. Numbers in parentheses are estimated values.
2. Wind data was obtained from the Yucca weather station.
3. Tropopause height was 50,000 ft MSL.

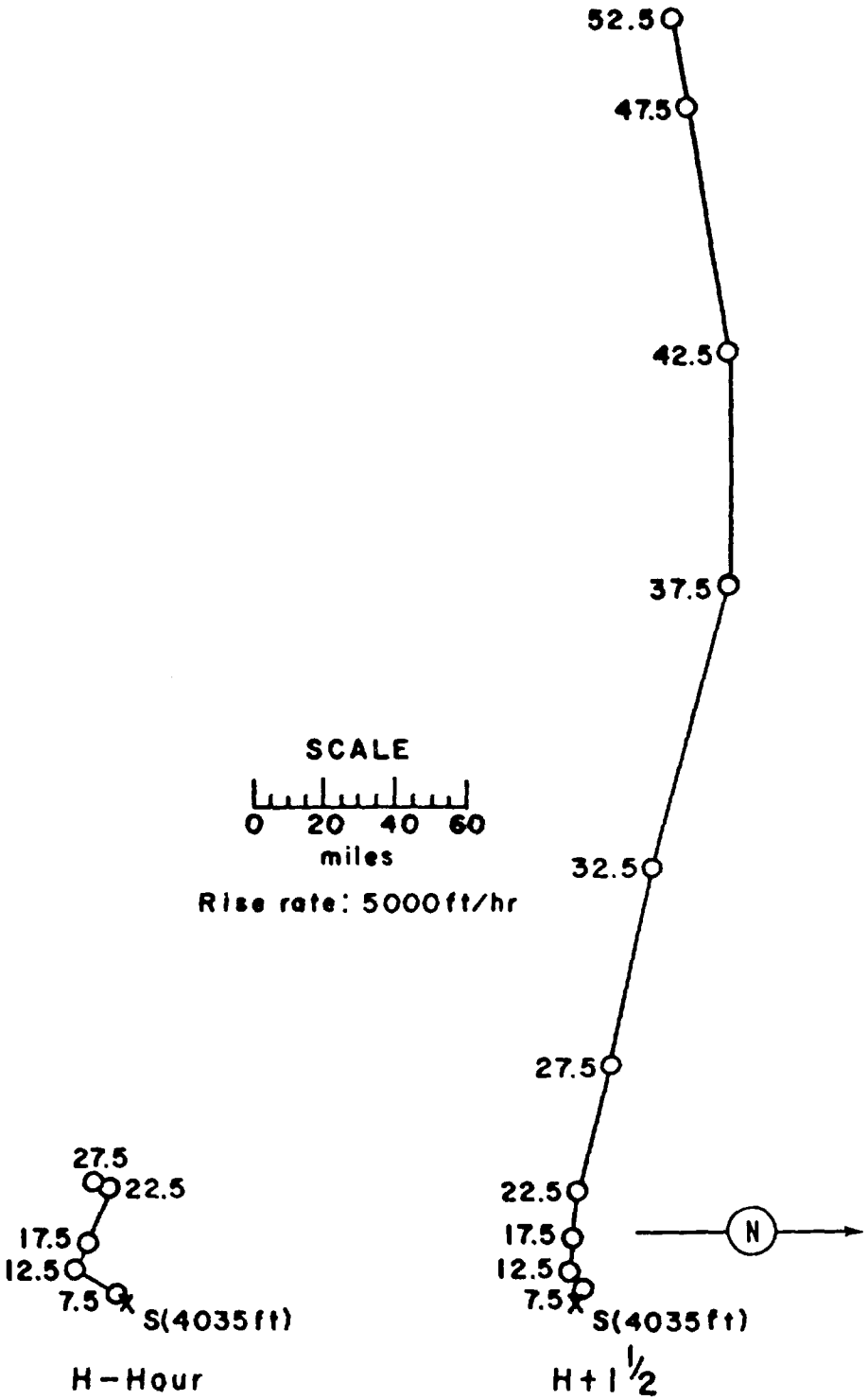


Figure 216. Hodographs for Operation PLUMBBOB - Coulomb-B.

OPERATION PLUMBBOB - LaPlace

	PDT	GMT
DATE:	8 Sep 1957	8 Sep 1957
TIME:	0600	1300

TOTAL YIELD: 1 kt

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

CRATER DATA: No crater

Sponsor: LASL

SITE: NTS - Area 7b
37° 05' 12" N
116° 01' 25" W
Site elevation: 4,186 ft

HEIGHT OF BURST: 750 ft

TYPE OF BURST AND PLACEMENT:
Air burst from balloon over Nevada soil

CLOUD TOP HEIGHT: 20,000 ft MSL
CLOUD BOTTOM HEIGHT: 14,000 ft MSL

REMARKS:
The contamination was due primarily to induced activity. The on-site pattern was obtained from ground survey readings of the Radiological Safety Division of Reynolds Electrical and Engineering Company, Inc., using AN/PDR 39 and AN/PDR 43 survey instruments. The readings were taken at H+1 hour, H+6 hours, D+1 day, D+2 days and D+3 days along eight radial roads to determine radiation exclusion areas. The dose rate readings were extrapolated to H+1 hour by the general induced-activity-decay curve for Nevada soil.

No off-site fallout was observed. The off-site monitors obtained only a few readings slightly above background.

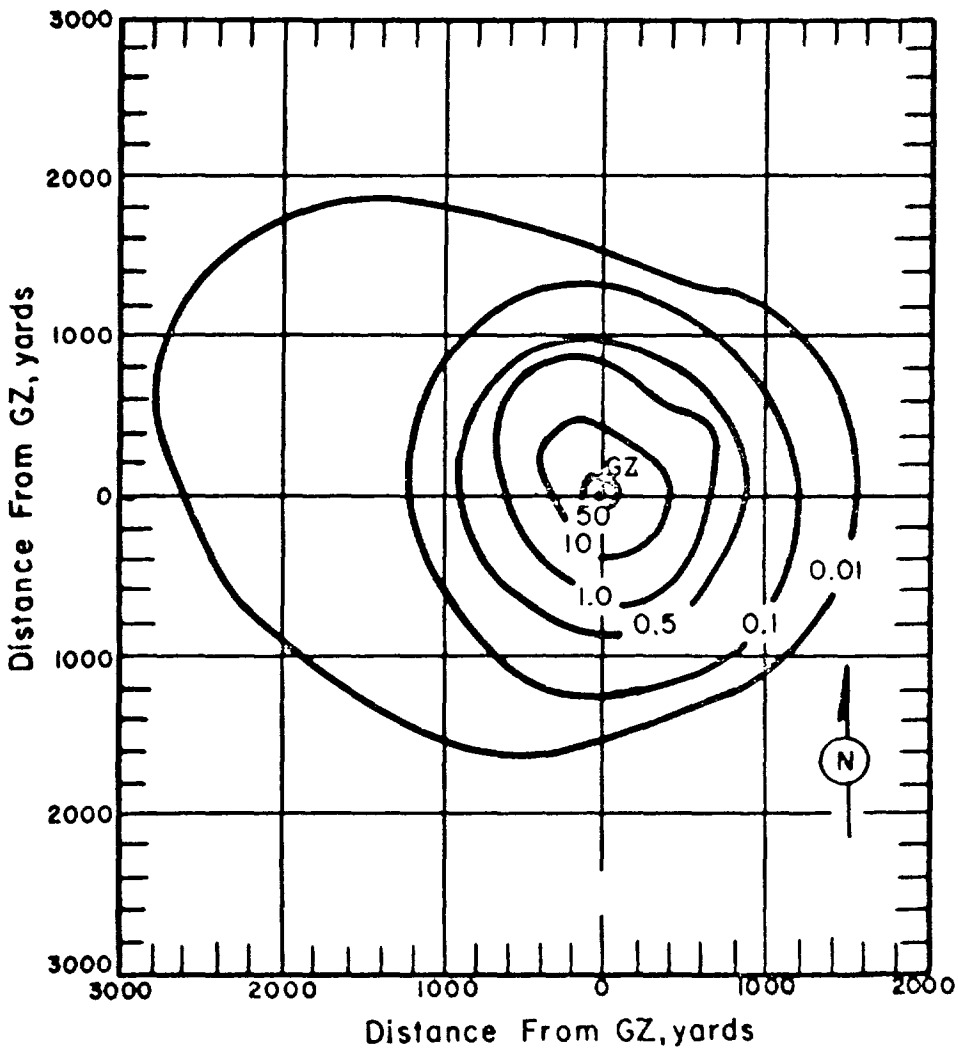


Figure 217. Operation PLUMBBOB - LaPlace.
On-site dose rate contours in r/hr at H+1 hour.

TABLE 65 NEVADA WIND DATA FOR OPERATION PLUMBBOB - LAPLACE

Altitude (MSL)	H-hour		H+2 hours	
	Dir	Speed	Dir	Speed
feet	degrees	mph	degrees	mph
Surface	Calm	Calm	Calm	Calm
4,936(BH)	260	02	---	--
5,000	260	05	270	05
6,000	260	10	280	07
7,000	270	15	270	10
8,000	270	15	260	16
9,000	290	13	280	15
10,000	290	12	300	13
11,000	290	12	---	--
12,000	290	09	280	07
13,000	290	12	---	--
14,000	280	09	230	05
15,000	160	07	(210)	(07)
16,000	150	07	200	09
17,000	150	06	---	--
18,000	160	07	170	05
19,000	140	07	---	--
20,000	120	05	100	09
21,000	110	02	---	--
22,000	010	02	---	--
23,000	060	08	080	16
24,000	100	12	---	--
25,000	100	13	100	17
26,000	110	14	---	--
27,000	130	14	---	--
28,000	150	18	---	--
29,000	170	24	---	--
30,000	160	32	150	24
31,000	160	36	---	--
32,000	150	36	---	--
33,000	150	36	---	--
34,000	150	33	---	--
35,000	150	31	160	28
36,000	150	31	---	--
37,000	150	29	---	--
38,000	160	24	---	--
39,000	160	24	---	--
40,000	160	24	180	18
41,000	170	20	---	--
42,000	180	18	---	--
43,000	160	24	---	--
44,000	160	24	---	--
45,000	160	24	180	20
46,000	160	16	---	--
47,000	190	12	---	--
48,000	270	12	---	--
49,000	350	10	---	--
50,000	060	07	020	09

NOTES:

1. Numbers in parentheses are estimated values.
2. Tropopause height was 44,300 ft MSL at H-hour.
3. Wind data was obtained from the Yucca weather station.
4. At H-hour the surface air pressure was 874 mb, the temperature 19.0°C, the dew point 1.2°C and the relative humidity 30%.

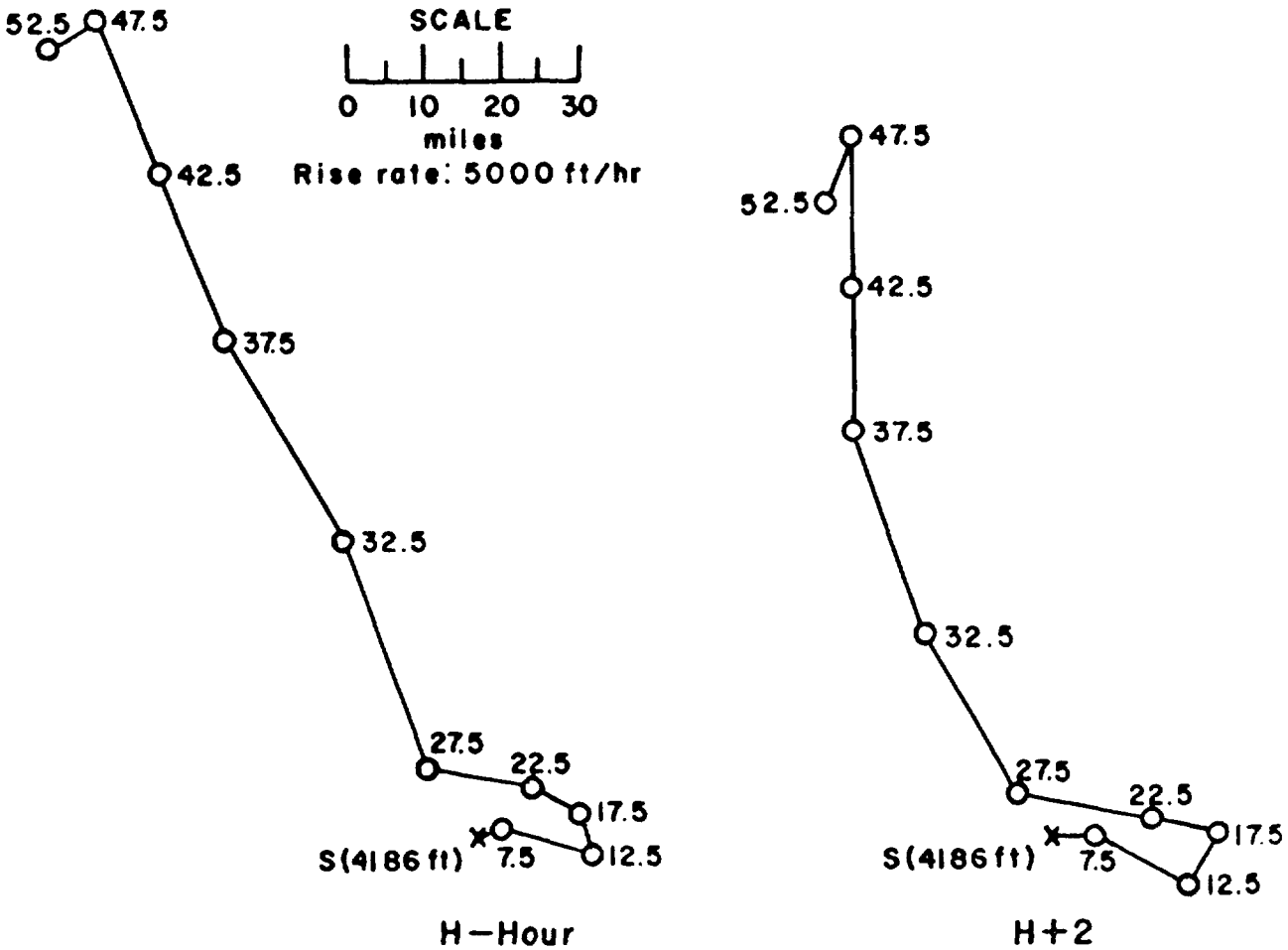


Figure 218. Hodographs for Operation PLUMBBOB - LaPlace.

OPERATION PLUMBBOB - Fizeau

	PDT	GMT
DATE:	14 Sept 1957	14 Sept 1957
TIME:	0945	1645

TOTAL YIELD: 11 kt

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

CRATER DATA: No crater

Sponsor: LASL

SITE: NTS - Area 3b
37° 02' 01" N
116° 01' 53" W
Site elevation: 4,030 ft

HEIGHT OF BURST: 500 ft

TYPE OF BURST AND PLACEMENT:
Tower burst over Nevada soil

CLOUD TOP HEIGHT: 40,000 ft MSL
CLOUD BOTTOM HEIGHT: 27,000 ft MSL

REMARKS:

The on-site pattern was obtained from ground survey readings of the Radiological Safety Division of Reynolds Electrical and Engineering Co., Inc., using AN/PDR 39 and AN/PDR 43 survey instruments. The readings were taken at H+1 hour, H+6 hours, D+1 day and D+2 days along eight radial roads to determine radiation exclusion areas. The dose-rate readings were extrapolated to H+1 hour by the $t^{-1.2}$ decay approximations.

The off-site fallout was analyzed by Program 37 of UCLA. Actual decay data were used to plot the H+12-hour dose-rate contours. The $t^{-1.2}$ decay approximation was used by NDL to extrapolate the H+12-hour dose-rate readings to H+1 hour. "On-Site Rad-Safety supplied data relative to the intensities in Yucca Flat from this shot. Further away, the west edge is estimated since no information was available in this region"

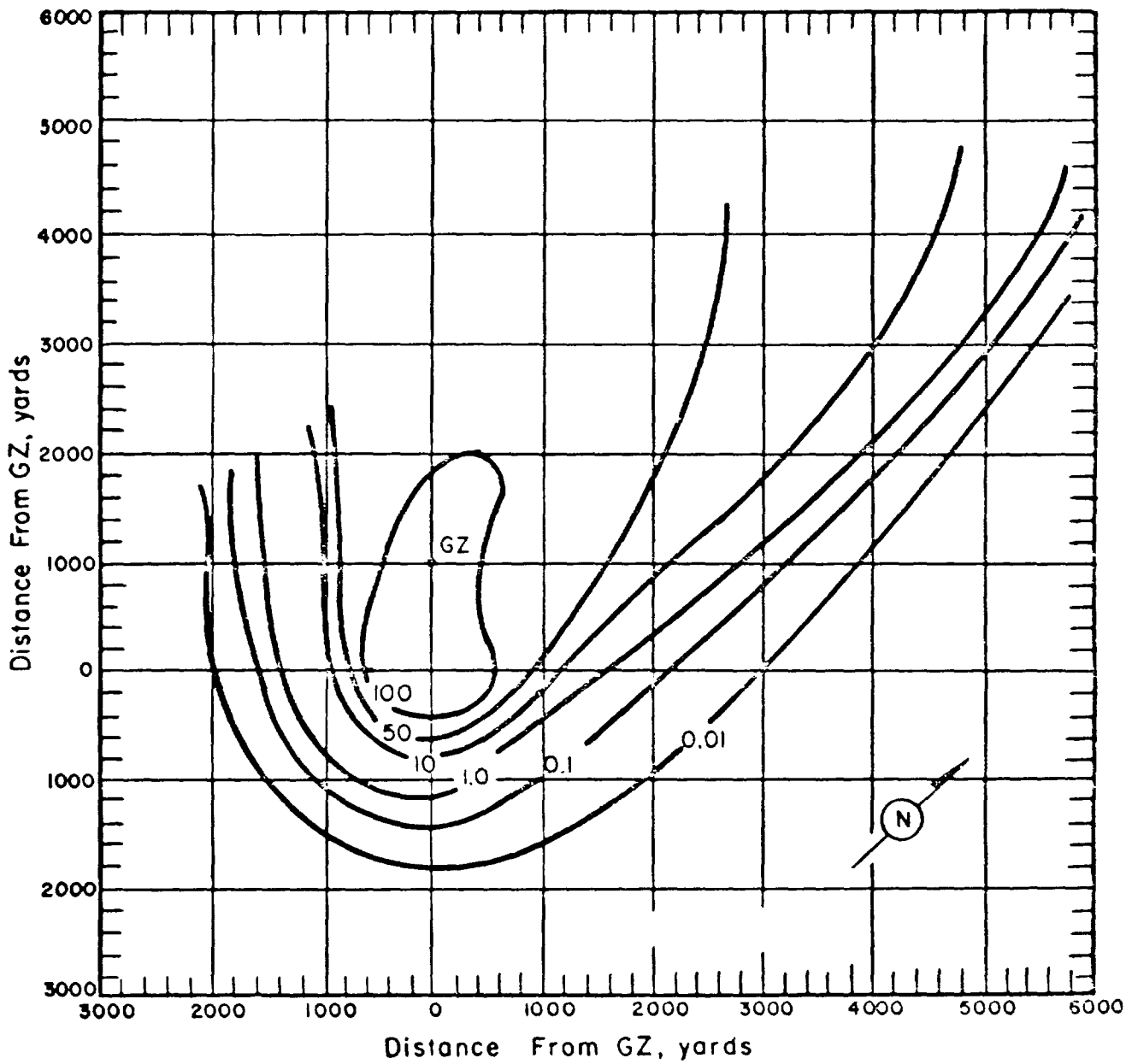


Figure 219. Operation PLUMBBOB - Fizeau.
On-site dose rate contours in r/hr at H+1 hour.

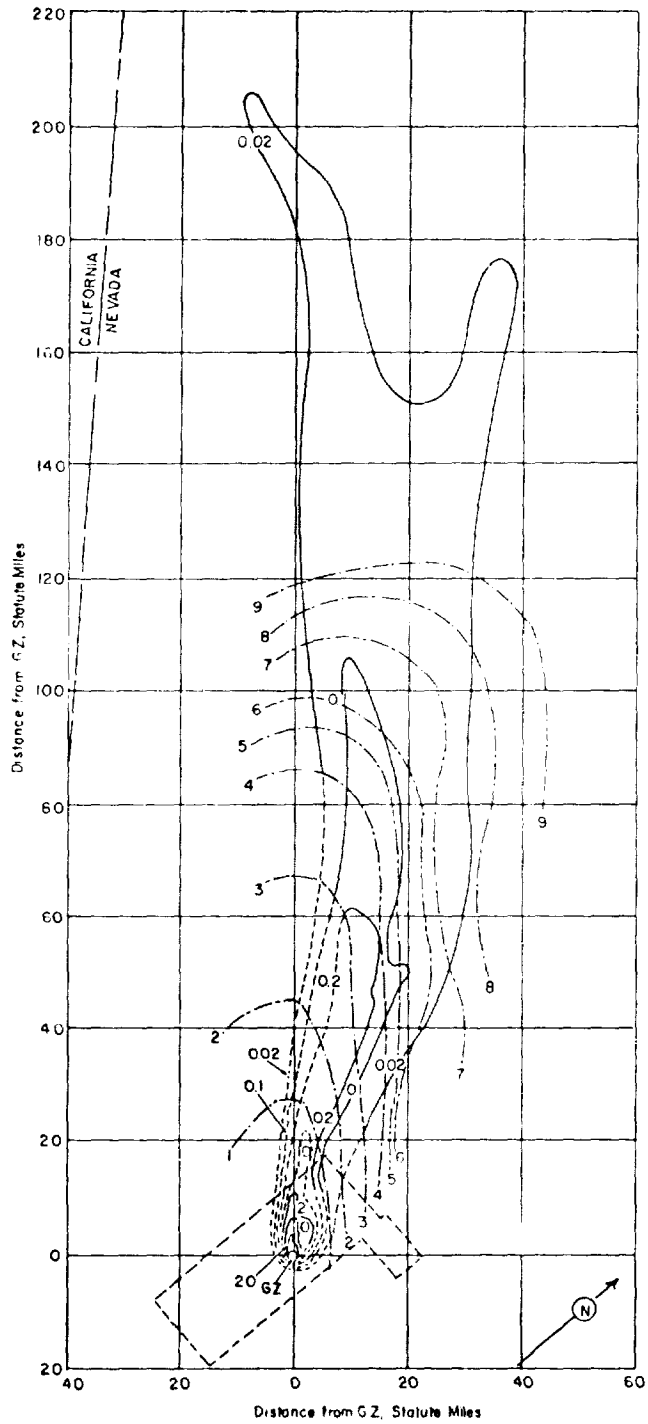


Figure 220. Operation PLUMBBOB - Fizeau.
Off-site dose rate contours in r/hr at H+1 hour.

TABLE 66 NEVADA WIND DATA FOR OPERATION PLUMBBOB- FIZEAU

Altitude (MSL)	H-hour		H+1 hour		H+7½ hours	
	Dir	Speed	Dir	Speed	Dir	Speed
feet	degrees	mph	degrees	mph	degrees	mph
Surface	Calm	Calm	Calm	Calm	180	05
4,497(BH)	Calm	Calm	---	--	---	--
5,000	050	05	050	05	180	05
6,000	070	05	070	05	190	05
7,000	070	03	070	03	210	05
8,000	080	02	080	02	240	06
9,000	090	02	090	02	240	10
10,000	110	05	110	05	250	14
11,000	140	07	---	--	---	--
12,000	180	08	180	07	190	09
13,000	210	07	---	--	---	--
14,000	190	12	190	13	150	06
15,000	180	13	(180)	(13)	(150)	(07)
16,000	180	13	180	13	140	09
17,000	170	10	---	--	---	--
18,000	150	09	150	09	160	15
19,000	120	14	---	--	---	--
20,000	120	17	120	17	170	16
21,000	100	18	---	--	---	--
22,000	110	16	---	--	---	--
23,000	120	12	120	12	150	15
24,000	140	09	---	--	---	--
25,000	180	07	180	12	160	12
26,000	160	07	---	--	---	--
27,000	110	20	---	--	---	--
28,000	110	22	---	--	---	--
29,000	120	26	---	--	---	--
30,000	120	39	120	39	120	32
31,000	110	29	---	--	---	--
32,000	110	26	---	--	---	--
33,000	120	24	---	--	---	--
34,000	120	22	---	--	---	--
35,000	120	17	120	17	140	21
36,000	120	15	---	--	---	--
37,000	140	14	---	--	---	--
38,000	160	14	---	--	---	--
39,000	190	14	---	--	---	--
40,000	210	14	210	14	180	17
45,000	220	10	220	10	240	23
50,000	240	12	240	12	270	15

NOTES:

1. Numbers in parentheses are estimated values.
2. Tropopause height was 43,000 ft MSL at H-hour.
3. Wind data was obtained from the Yucca weather station.
4. At H-hour the surface air pressure was 880 mb, the temperature 25.1°C, the dew point -1.5°C, and the relative humidity 17%.

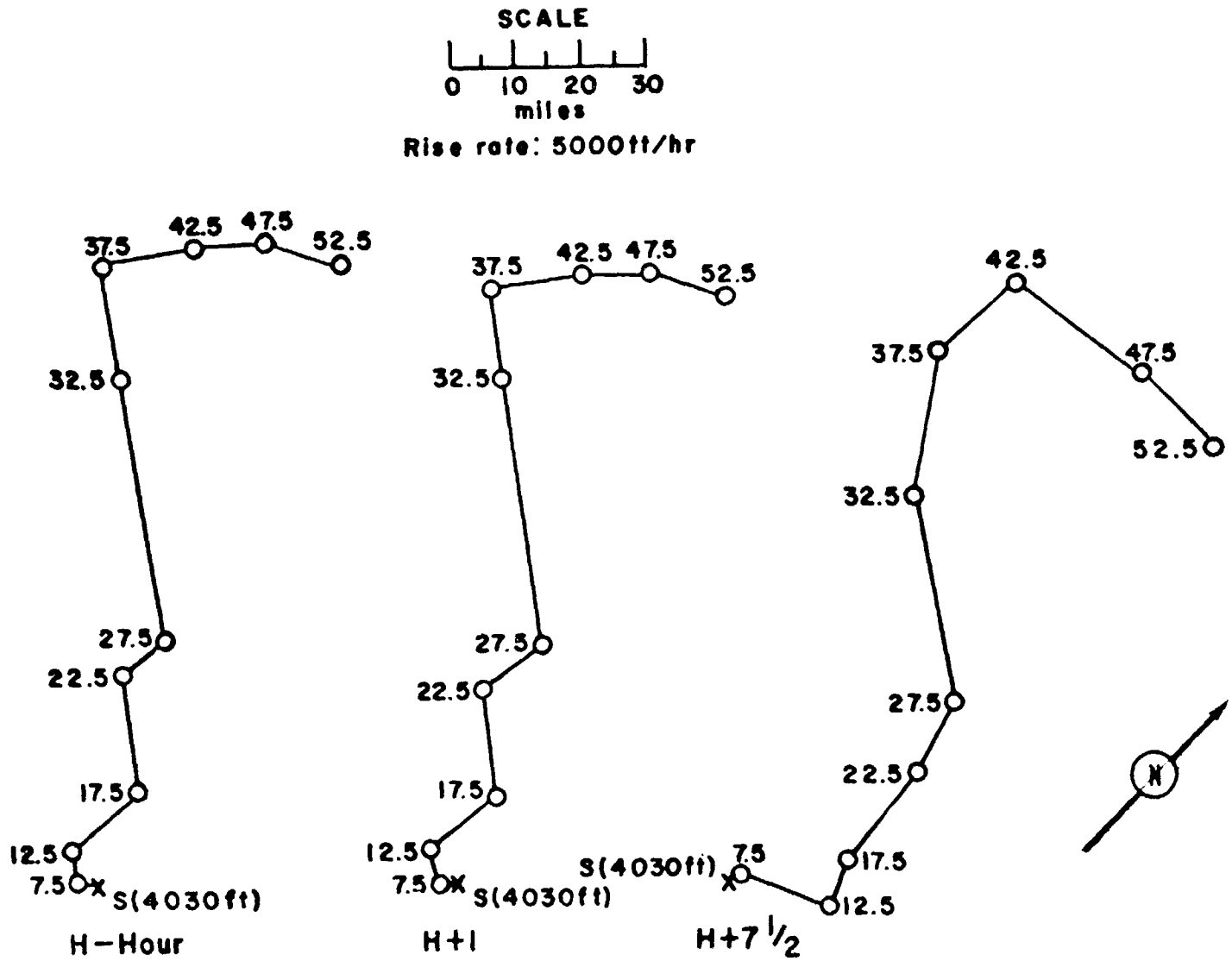


Figure 221. Hodographs for Operation PLUMBBOB - Fizeau.

OPERATION PLUMBBOB - Newton

	PDT	GMT
DATE:	16 Sep 1957	16 Sep 1957
TIME:	0550	1250

TOTAL YIELD: 12 kt

Sponsor: LASL

SITE: NTS - Area 7b
37° 05' 12" N
116° 01' 25" W
Site elevation: 4,186 ft

HEIGHT OF BURST: 1,500 ft

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

CLOUD TOP HEIGHT: 32,000 ft MSL
CLOUD BOTTOM HEIGHT: 19,000 ft MSL

TYPE OF BURST AND PLACEMENT:
Air burst from balloon over Nevada soil

CRATER DATA: No crater

REMARKS:

The contamination was due primarily to induced activity. The on-site pattern was obtained from ground survey readings of the Radiological Safety Division of Reynolds Electrical and Engineering Co., Inc., using AN/PDR 39 and AN/PDR 43 survey instruments. The readings were taken at H+3 hours, H+6 hours, D+1 day, D+2 days and D+3 days along eight radial roads to determine radiation exclusion areas. The dose-rate readings were extrapolated to H+1 hour by the induced activity decay curve for Nevada soil The extrapolated dose rates are not accurate because the decay factor used is not strictly applicable.

The off-site fallout was analyzed by Program 37 of UCLA. Actual decay data were used to plot the H+12-hour dose-rate contours. The $t^{-1.2}$ decay approximation was used by NDL to extrapolate the H+12-hour dose-rate readings to H+1 hour. Since very little reliable data were available, this pattern is basically an estimate

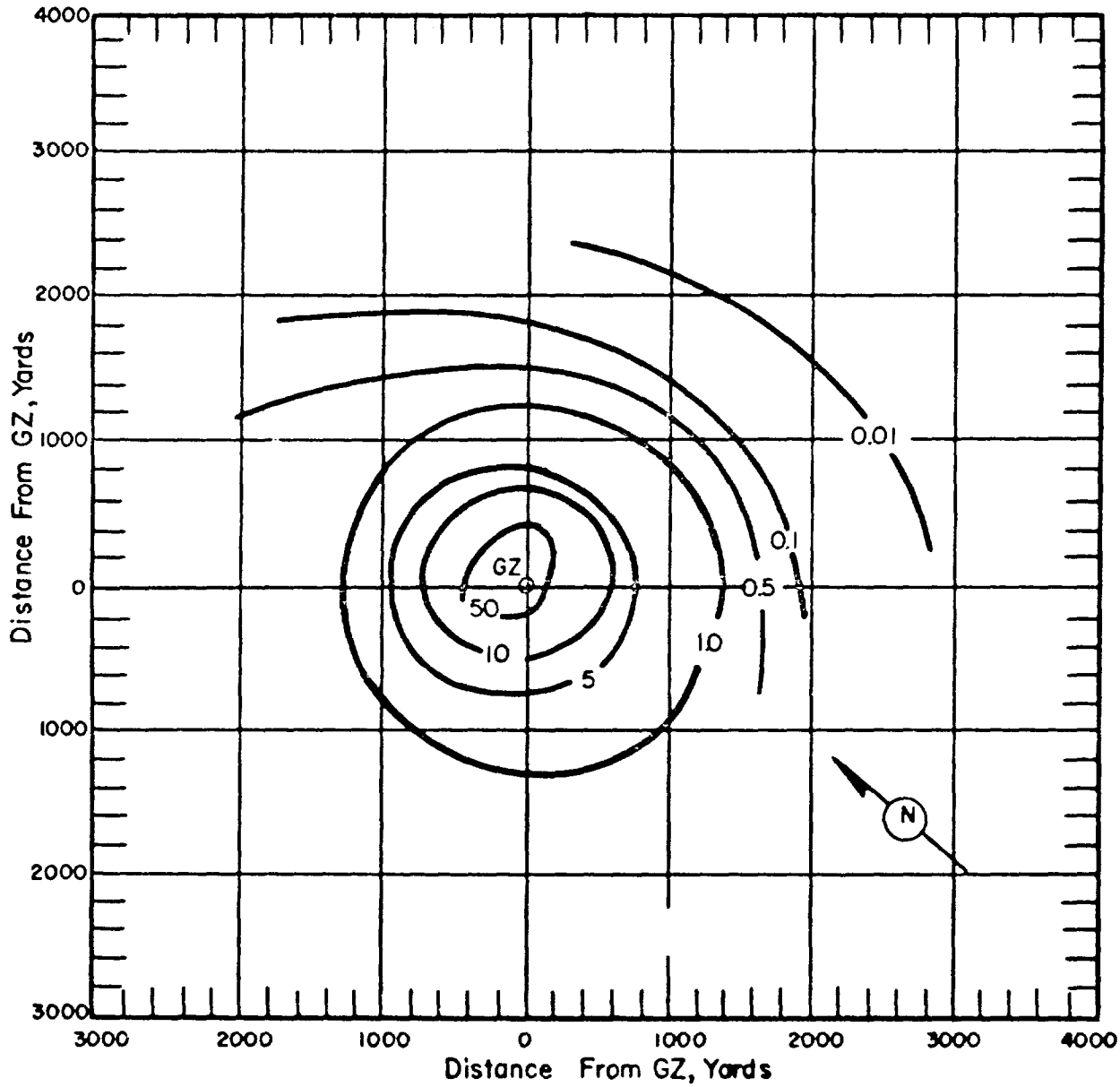


Figure 222. Operation PLUMBBOB - Newton.
On-site dose rate contours in r/hr at H+1 hour.

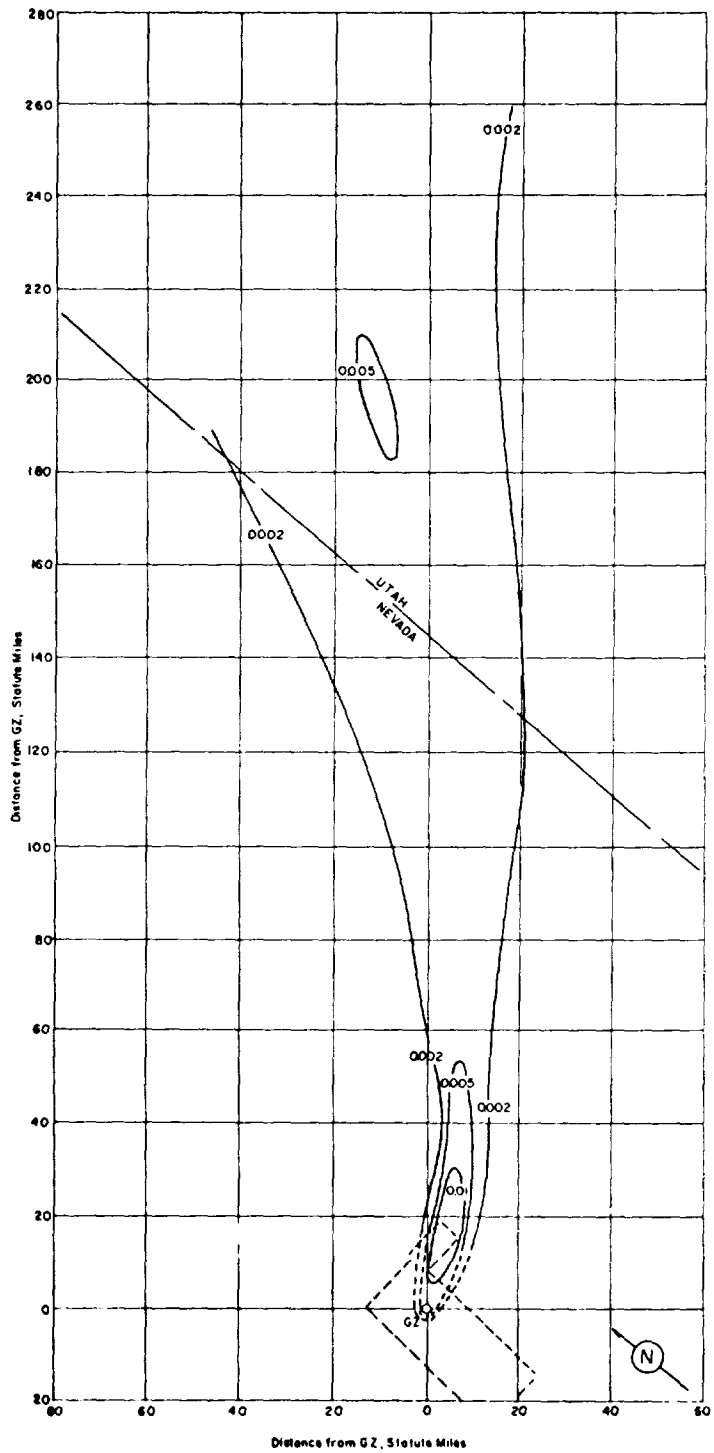


Figure 223. Operation PLUMBBOB - Newton.
Off-site dose rate contours in r/hr at H+1 hour.

TABLE 67 NEVADA WIND DATA FOR OPERATION PLUMBBOB— NEWTON

Altitude (MSL)	H-hour		H+1 hour		H+2½ hours	
	Dir	Speed	Dir	Speed	Dir	Speed
feet	degrees	mph	degrees	mph	degrees	mph
Surface	Calm	Calm	Calm	Calm	Calm	Calm
5,000	200	05	200	05	180	05
5,686(BH)	200	06	---	--	---	--
6,000	190	09	190	10	180	09
7,000	190	17	190	17	180	18
8,000	190	20	190	20	180	22
9,000	200	18	200	17	190	22
10,000	200	20	200	20	190	22
11,000	200	18	---	--	---	--
12,000	200	18	210	22	210	22
13,000	210	21	---	--	---	--
14,000	220	22	220	22	240	22
15,000	240	22	(230)	(22)	(240)	(23)
16,000	240	22	240	22	250	25
17,000	250	25	---	--	---	--
18,000	250	25	250	26	260	28
19,000	250	28	---	--	---	--
20,000	250	32	250	32	240	29
21,000	250	33	---	--	---	--
22,000	250	32	---	--	---	--
23,000	250	45	250	45	240	37
24,000	250	47	---	--	---	--
25,000	250	48	250	48	250	51
26,000	250	51	---	--	---	--
27,000	260	56	---	--	---	--
28,000	260	66	---	--	---	--
29,000	260	74	---	--	---	--
30,000	260	82	260	82	260	95
31,000	260	79	---	--	---	--
32,000	250	76	---	--	---	--
33,000	250	76	---	--	---	--
34,000	250	77	---	--	---	--
35,000	250	75	250	75	260	83
36,000	250	68	---	--	---	--
37,000	250	62	---	--	---	--
38,000	250	64	---	--	---	--
39,000	250	67	---	--	---	--
40,000	250	58	250	58	250	71
45,000	250	69	250	69	250	64
50,000	250	38	250	38	250	38

NOTES:

1. Numbers in parentheses are estimated values.
2. Tropopause height was 52,500 ft MSL at H-hour.
3. Wind data was obtained from the Yucca weather station.
4. At H-hour, the surface air pressure was 862 mb, the temperature 13.2°C, the dew point -5.6°C, and the relative humidity 27%.

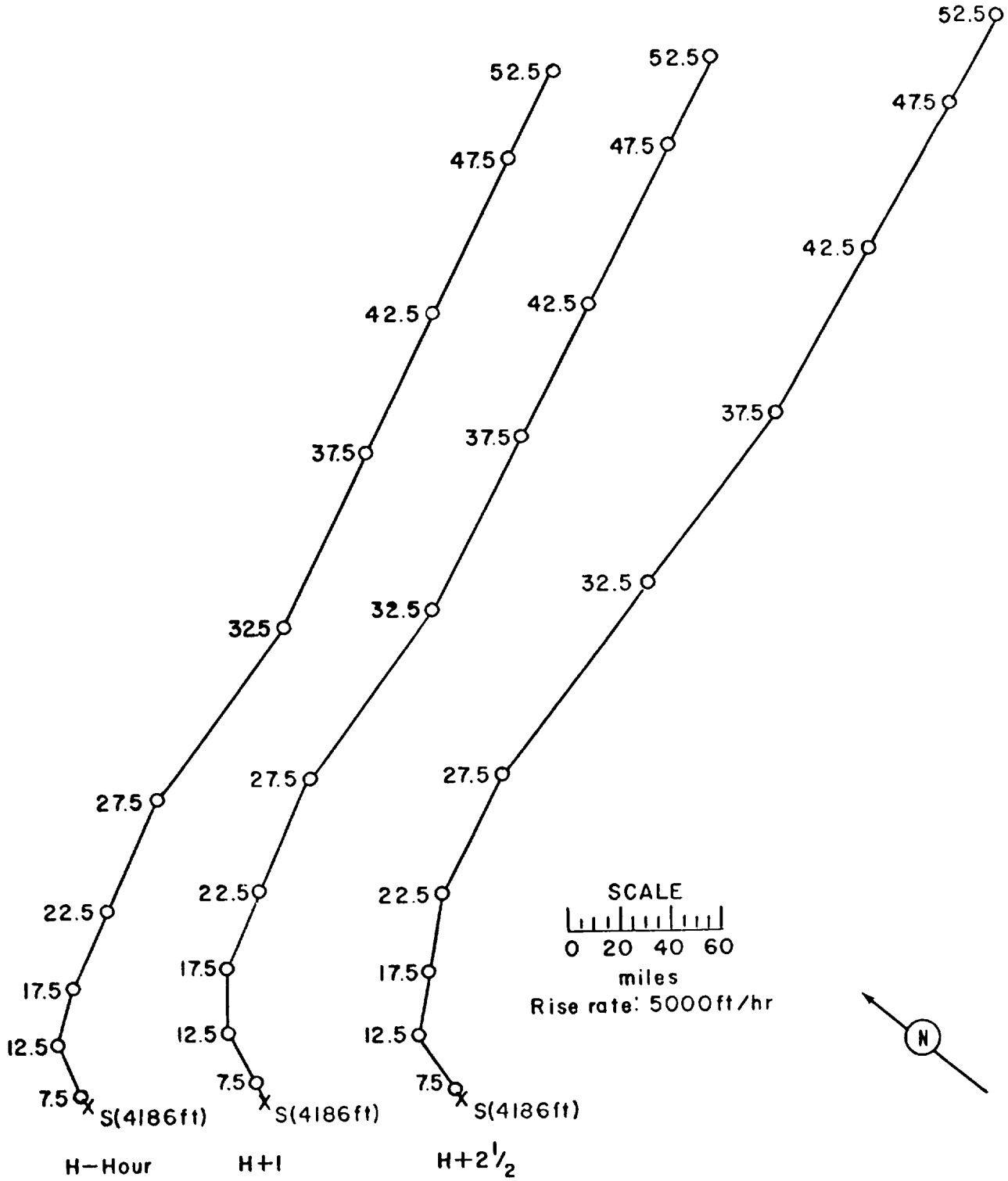


Figure 224. Hodographs for Operation PLUMBBOB - Newton.

OPERATION PLUMBBOB - Rainier

	PDT	GMT
DATE:	19 Sep 1957	19 Sep 1957
TIME:	1000	1700

TOTAL YIELD: 1.7 kt

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

CRATER DATA:
The diameter of the contained bubble was 110 ft.

Sponsor: UCRL

SITE: NTS - Area 12b
37° 11' 45" N
116° 12' 11" W
Site elevation: 6,611 ft

HEIGHT OF BURST: -800 ft Underground
Vertical depth 899 ft
Slant to nearest surface 790 ft

TYPE OF BURST AND PLACEMENT:
Subsurface burst - Nevada soil

REMARKS:

No fallout resulted from this detonation. The blast collapsed the tunnel wall and all the radiation was contained in the tunnel.

OPERATION PLUMBBOB - Whitney

	PDT	GMT
DATE:	23 Sep 1957	23 Sep 1957
TIME:	0530	1230

TOTAL YIELD: 19 kt

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

CRATER DATA: No crater

Sponsor: UCRL

SITE: NTS - Area 2
37° 08' 18" N
116° 07' 03" W
Site elevation: 4,486 ft

HEIGHT OF BURST: 500 ft

TYPE OF BURST AND PLACEMENT:
Tower burst over Nevada soil

CLOUD TOP HEIGHT: 30,000 ft MSL
CLOUD BOTTOM HEIGHT: 18,000 ft MSL

REMARKS:

The on-site fallout pattern was obtained from ground survey readings of the Radiological Safety Division of Reynolds Electrical and Engineering Co., Inc., using AN/PDR 39 and AN/PDR 43 survey instruments. The readings were taken at H+2 hours, H+6 hours, D+1 day, D+2 days and D+3 days along eight radial roads to determine radiation exclusion areas. The $t^{-1.2}$ decay approximation was used to extrapolate the dose-rate readings to H+1 hour.

The off-site fallout was analyzed by Program 37 of UCLA. Actual decay data were used to plot the H+12-hour dose-rate contours. The $t^{-1.2}$ decay approximation was used by NDL to extrapolate the H+12-hour dose-rate readings to H+1 hour. "This pattern was based on ground and aerial data, but the northern-most portion of the pattern was based on aerial data only. There was no information relative to the close-in levels and this portion was estimated"

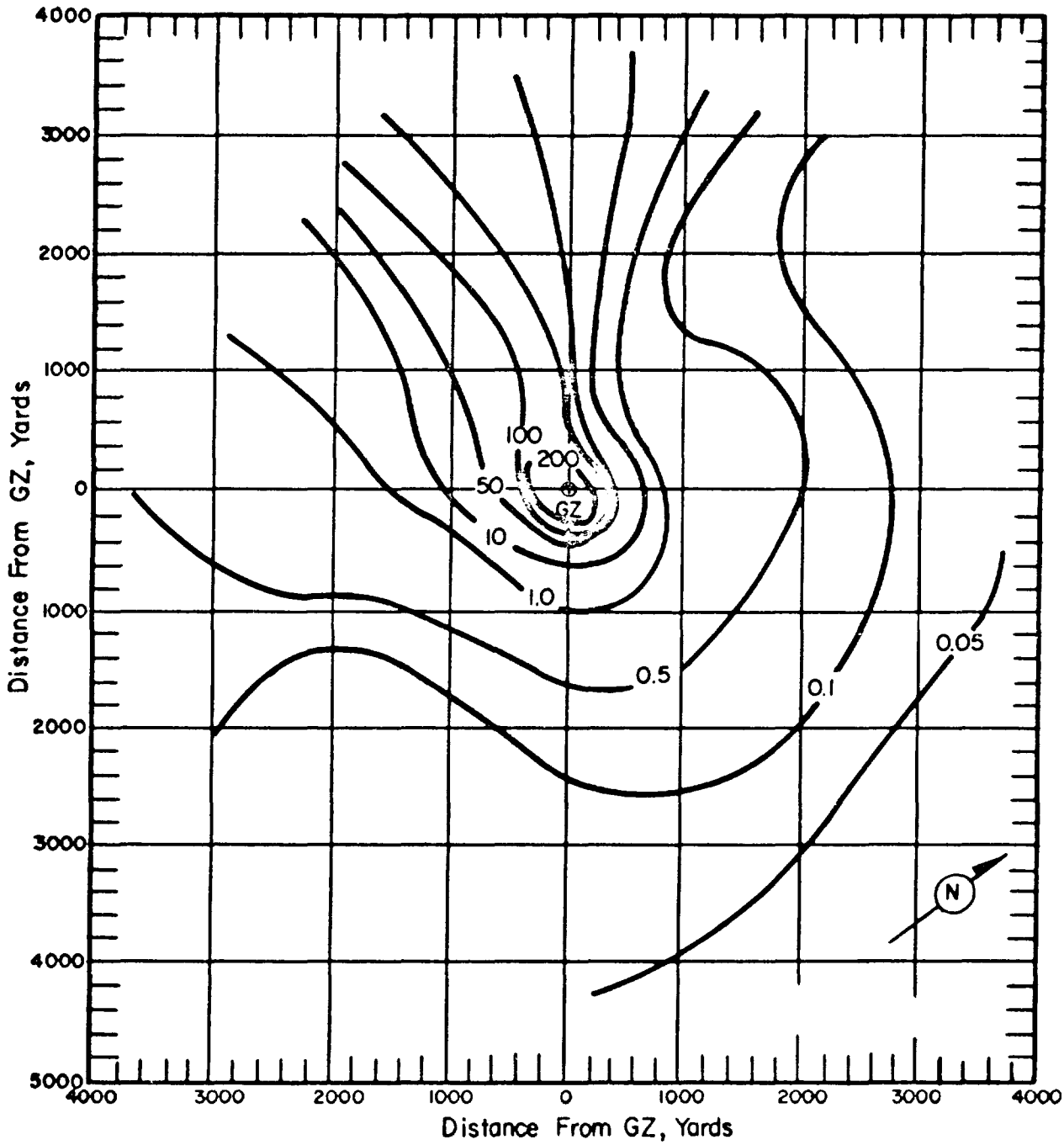


Figure 225. Operation PLUMBBOB - Whitney.
On-site dose rate contours in r/hr at H+1 hour.

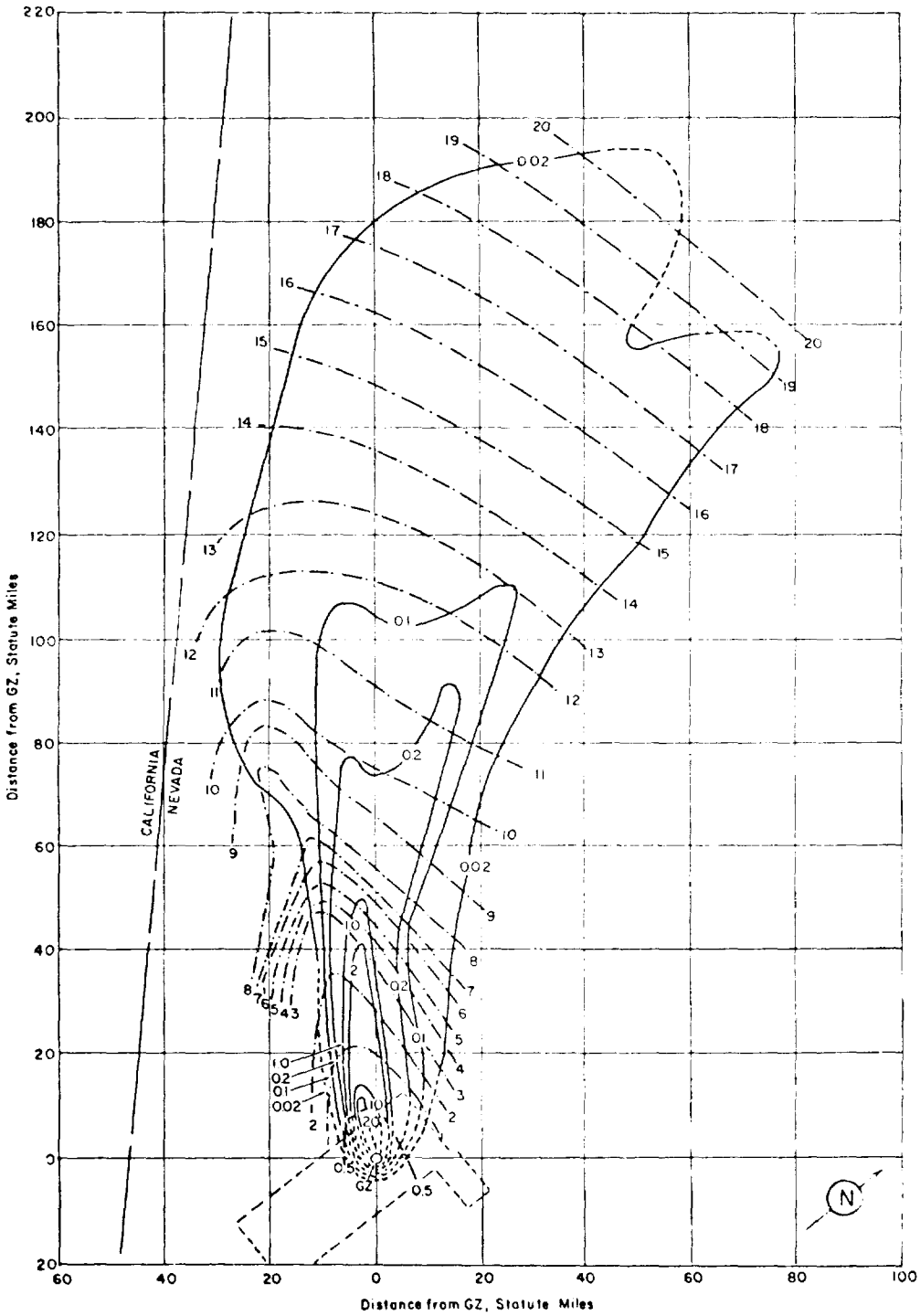


Figure 226. Operation PLUMBBOB - Whitney.
Off-site dose rate contours in r/hr at H+1 hour.

TABLE 68 NEVADA WIND DATA FOR OPERATION PLUMBBOB- WHITNEY

Altitude (MSL)	H-hour		H+2½ hours		Altitude (MSL)	H-hour		H+2½ hours	
	Dir	Speed	Dir	Speed		Dir	Speed	Dir	Speed
feet	degrees	mph	degrees	mph	feet	degrees	mph	degrees	mph
Surface	Calm	Calm	360	05	30,000	100	13	100	09
4,987(BH)	Calm	Calm	---	--	31,000	090	09	---	--
5,000	030	09	030	08	32,000	040	06	---	--
6,000	070	12	060	09	33,000	340	06	---	--
7,000	100	12	090	09	34,000	300	10	---	--
8,000	130	12	140	14	35,000	290	12	280	08
9,000	140	12	150	13	36,000	290	10	---	--
10,000	160	09	170	08	37,000	280	09	---	--
11,000	180	12	---	--	38,000	280	09	---	--
12,000	170	10	160	12	39,000	280	13	---	--
13,000	130	16	---	--	40,000	270	15	270	13
14,000	120	16	120	14	41,000	270	18	---	--
15,000	120	12	(110)	(14)	42,000	280	20	---	--
16,000	110	12	100	13	43,000	280	18	---	--
17,000	100	09	---	--	44,000	280	14	---	--
18,000	090	12	090	09	45,000	290	21	250	21
19,000	090	12	---	--	46,000	280	21	---	--
20,000	090	09	080	09	47,000	270	18	---	--
21,000	090	12	---	--	48,000	260	21	---	--
22,000	080	12	---	--	49,000	260	21	---	--
23,000	070	12	070	12	50,000	260	18	270	20
24,000	060	10	---	--	51,000	260	17	---	--
25,000	040	08	070	09	52,000	270	16	---	--
26,000	050	05	---	--	53,000	270	15	---	--
27,000	070	08	---	--					
28,000	090	12	---	--					
29,000	090	13	---	--					

NOTES:

1. Numbers in parentheses are estimated values.
2. Tropopause height was 53,100 ft MSL at H-hour.
3. Wind data was obtained from the Yucca weather station.
4. At H-hour the surface air pressure was 867 mb, the temperature 16.1°C, the dew point -3.6°C and the relative humidity 25%.

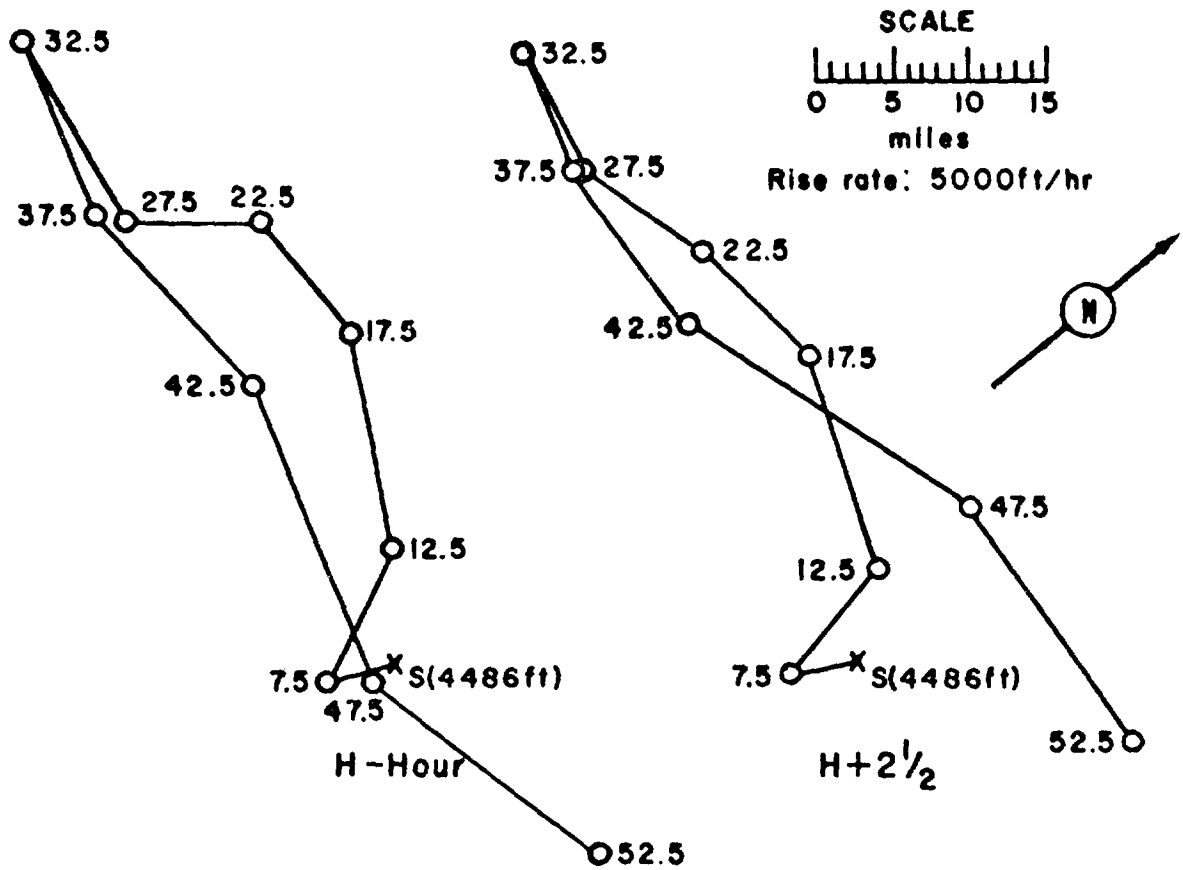


Figure 227. Hodographs for Operation PLUMBBOB - Whitney.

OPERATION PLUMBBOB - Charleston

	PDT	PST
DATE:	28 Sep 1957	28 Sep 1957
TIME:	0600	1300

TOTAL YIELD: 12 kt

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

CLOUD TOP HEIGHT: 32,000 ft MSL
CLOUD BOTTOM HEIGHT: 20,000 ft MSL

Sponsor: UCRL

SITE: NTS - Area 9a
37° 08' 05" N
116° 02' 27" W
Site elevation: 4,215 ft

HEIGHT OF BURST: 1,500 ft

TYPE OF BURST AND PLACEMENT:
Air burst from balloon over Nevada soil

CRATER DATA: No crater

REMARKS:

The contamination was due primarily to induced activity. The on-site pattern was obtained from ground survey readings of the Radiological Safety Division of Reynolds Electrical and Engineering Co., Inc., using AN/PDR 39 and AN/PDR 43 survey instruments. The readings were taken at H+1 hour, H+6 hours, D+1 day, D+2 days and D+3 days along eight radial roads to determine radiation exclusion areas. The dose-rate readings were extrapolated to H+1 hour by the general induced-activity-decay curve for Nevada soil

The monitors did not detect any off-site fallout which can be attributed to this shot.

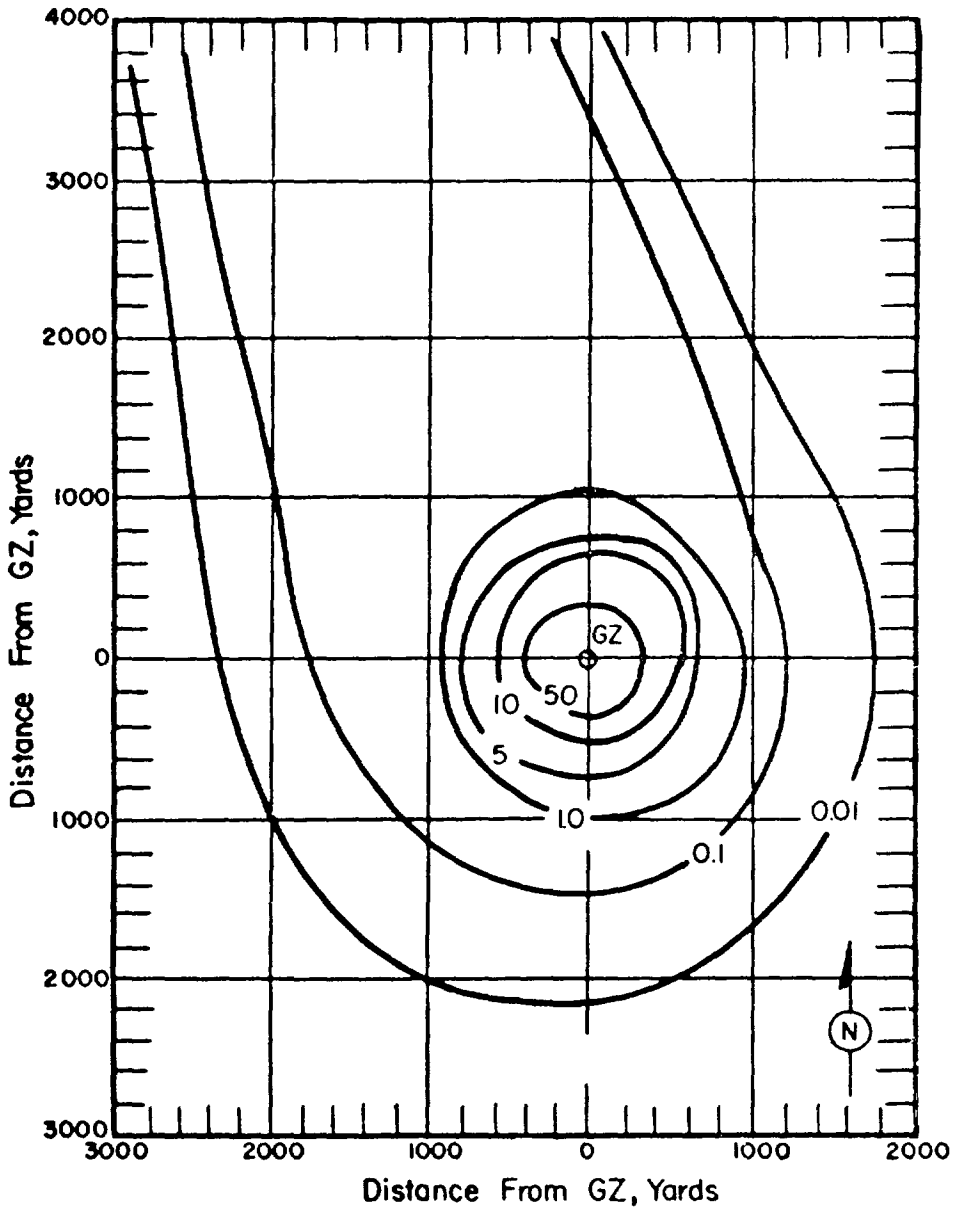


Figure 228. Operation PLUMBBOB - Charleston.
On-site dose rate contours in r/hr at H+1 hour.

TABLE 69 NEVADA WIND DATA FOR OPERATION PLUMBBOB- CHARLESTON

Altitude (MSL)	H+¼ hour		H+2 hours		H+2¾ hours	
	Dir	Speed	Dir	Speed	Dir	Speed
feet	degrees	mph	degrees	mph	degrees	mph
Surface	Calm	Calm	Calm	Calm	Calm	Calm
5,000	180	05	180	05	180	06
5,715(BH)	---	--	---	--	180	07
6,000	180	16	180	10	180	09
7,000	180	20	180	15	180	15
8,000	180	22	190	20	190	20
9,000	180	24	190	25	190	25
10,000	190	23	210	26	210	26
11,000	---	--	---	--	210	26
12,000	190	23	190	38	190	37
13,000	---	--	---	--	190	51
14,000	190	42	190	51	190	53
15,000	(190)	(38)	(190)	(47)	190	46
16,000	190	35	190	43	190	44
17,000	---	--	---	--	190	55
18,000	180	44	180	41	180	43
19,000	---	--	---	--	180	45
20,000	190	39	180	37	180	36
21,000	---	--	---	--	180	35
22,000	---	--	---	--	180	36
23,000	190	41	190	43	190	43
24,000	---	--	---	--	190	46
25,000	190	40	190	48	190	47
26,000	---	--	---	--	190	48
27,000	---	--	---	--	190	51
28,000	---	--	---	--	190	50
29,000	---	--	---	--	190	50
30,000	190	44	190	51	190	51
31,000	---	--	---	--	190	48
32,000	---	--	---	--	190	50
33,000	---	--	---	--	190	46
34,000	---	--	---	--	200	43
35,000	200	47	200	38	210	45
40,000	210	45	210	46	220	48
45,000	220	52	210	52	220	52
50,000	220	40	210	40	210	41
60,000	260	07	020	05	---	--

NOTES:

1. Numbers in parentheses are estimated values.
2. Tropopause height was 44,830 ft MSL at H-hour.
3. Wind data was obtained from the Yucca weather station.

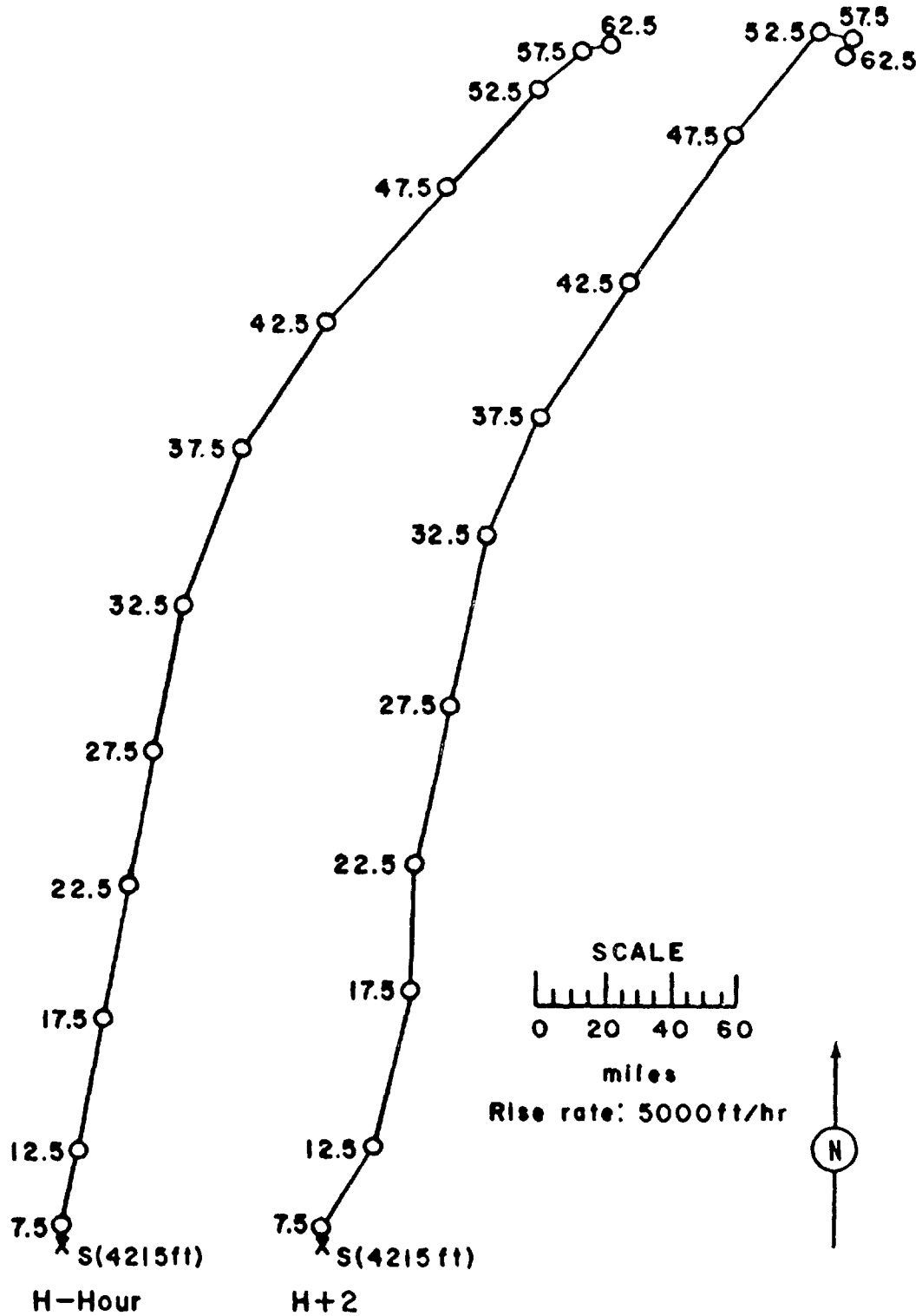


Figure 229. Hodographs for Operation PLUMBBOB - Charleston.

OPERATION PLUMBBOB - Morgan

	PST	GMT
DATE:	7 Oct 1957	7 Oct 1957
TIME:	0500	1300

TOTAL YIELD: 8 kt

Sponsor: UCRL

SITE: NTS - Area 9a
37° 08' 05" N
116° 02' 27" W
Site elevation: 4,214 ft

HEIGHT OF BURST: 500 ft

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

CRATER DATA: No crater

TYPE OF BURST AND PLACEMENT:
Air burst from balloon over Nevada soil

CLOUD TOP HEIGHT: 40,000 ft MSL
CLOUD BOTTOM HEIGHT: 26,000 ft MSL

REMARKS:
The contamination was due primarily to induced activity. The on-site pattern was obtained from ground survey readings of the Radiological Safety Division of Reynolds Electrical and Engineering Company, Inc., using AN/PDR 39 and AN/PDR 43 survey meters. The readings were taken at H+$\frac{3}{4}$ hour, H+6 hours, D+1 day, D+2 days and D+3 days along eight radial roads to determine radiation exclusion areas. The dose-rate readings were extrapolated to H+1 hour by the general induced-activity-decay curve for Nevada soil

The off-site fallout was analyzed by the USWB Special Projects Section. The $t^{-1.2}$ decay approximation was used to extrapolate the dose-rate readings to H+1 hour. "The Morgan debris apparently fell over or near residual debris from Smoky, but the uncertainties in the decay law and in the effects of weathering make it impossible to determine the Morgan pattern with any certainty"

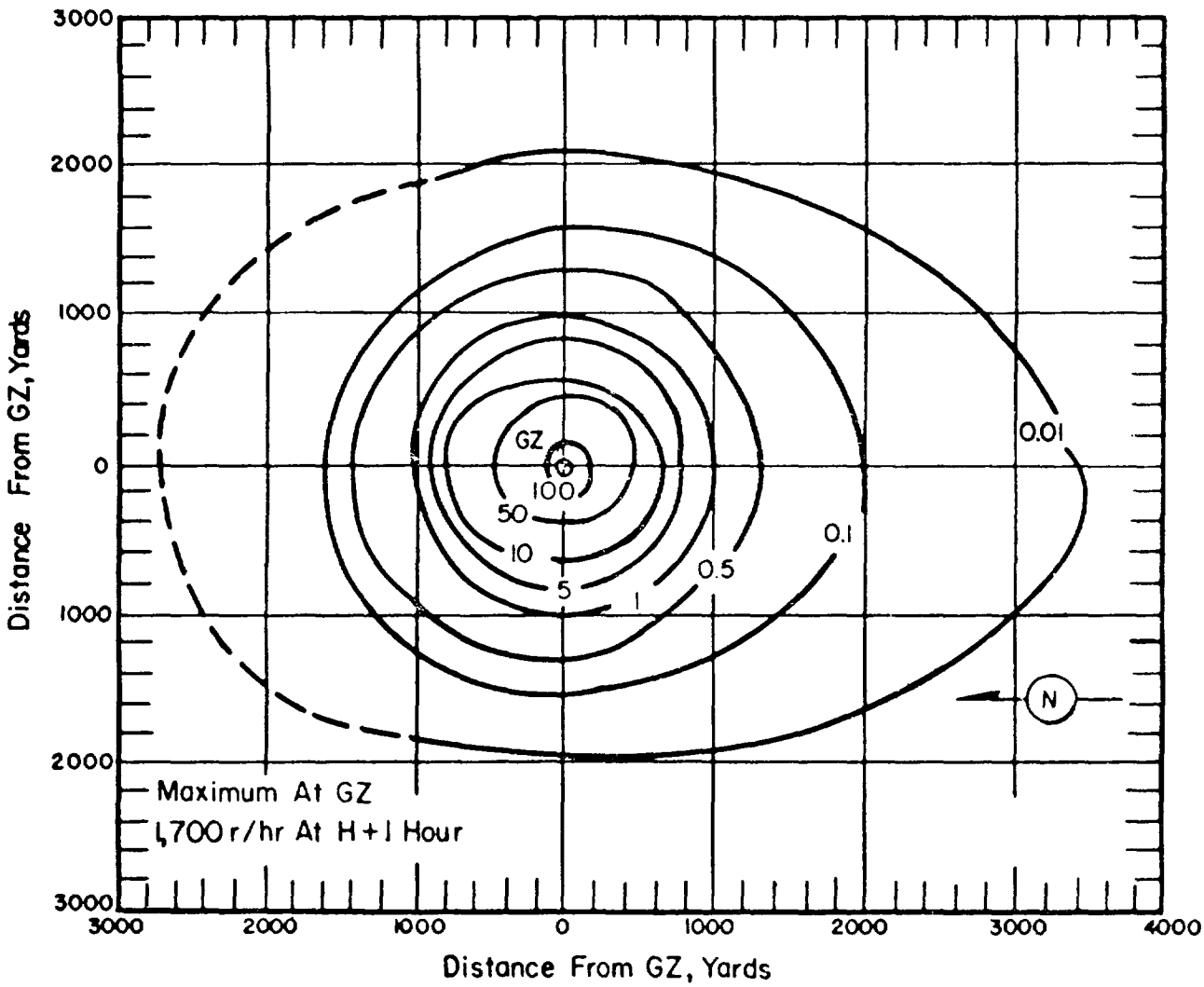


Figure 230 . Operation PLUMBBOB - Morgan.
On-site dose rate contours in r/hr at H+1 hour.

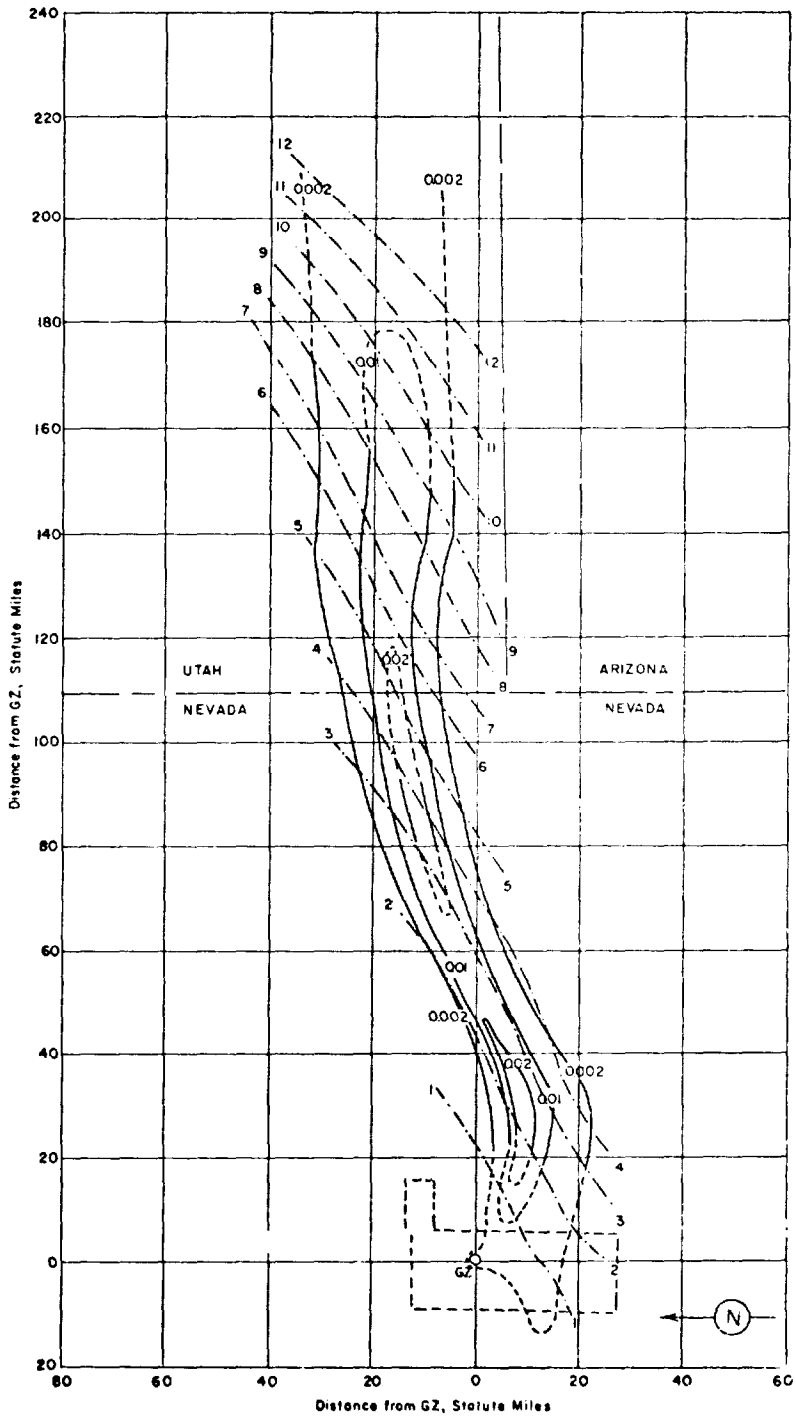


Figure 231. Operation PLUMBBOB - Morgan.
Off-site dose rate contours in r/hr at H+1 hour.

TABLE 70 NEVADA WIND DATA FOR OPERATION PLUMBBOB- MORGAN

Altitude (MSL)	H-Hour		H+2 hours		Altitude (MSL)	H-hour		H+2 hours	
	Dir	Speed	Dir	Speed		Dir	Speed	Dir	Speed
feet	degrees	mph	degrees	mph	feet	degrees	mph	degrees	mph
Surface	Calm	Calm	Calm	Calm	30,000	280	47	280	41
4,715(BH)	350	08	---	--	31,000	280	52	---	--
5,000	350	12	350	12	32,000	280	51	---	--
6,000	010	14	360	20	33,000	280	50	---	--
7,000	020	09	010	17	34,000	280	53	---	--
8,000	010	05	030	08	35,000	270	55	270	39
9,000	320	09	020	06	36,000	270	54	---	--
10,000	300	14	280	07	37,000	260	52	---	--
11,000	300	14	---	--	38,000	260	51	---	--
12,000	290	12	270	12	39,000	250	52	---	--
13,000	280	09	---	--	40,000	250	55	250	59
14,000	280	13	270	14	41,000	250	60	---	--
15,000	280	18	(270)	(16)	42,000	260	59	---	--
16,000	270	21	280	18	43,000	260	58	---	--
17,000	270	24	---	--	44,000	260	58	---	--
18,000	280	31	290	26	45,000	240	58	250	60
19,000	280	36	---	--	46,000	240	56	---	--
20,000	270	35	270	30	47,000	240	53	---	--
21,000	270	38	---	--					
22,000	270	41	---	--					
23,000	260	43	270	41					
24,000	260	45	---	--					
25,000	270	43	270	41					
26,000	270	41	---	--					
27,000	270	40	---	--					
28,000	270	41	---	--					
29,000	280	45	---	--					

NOTES:

1. Numbers in parentheses are estimated values.
2. Tropopause height was 37,400 ft MSL at H-hour.
3. Wind data was obtained from the Yucca weather station.
4. At H-hour the surface air pressure was 869 mb, the temperature 7.3°C, the dew point -5.9°C and the relative humidity 38%.

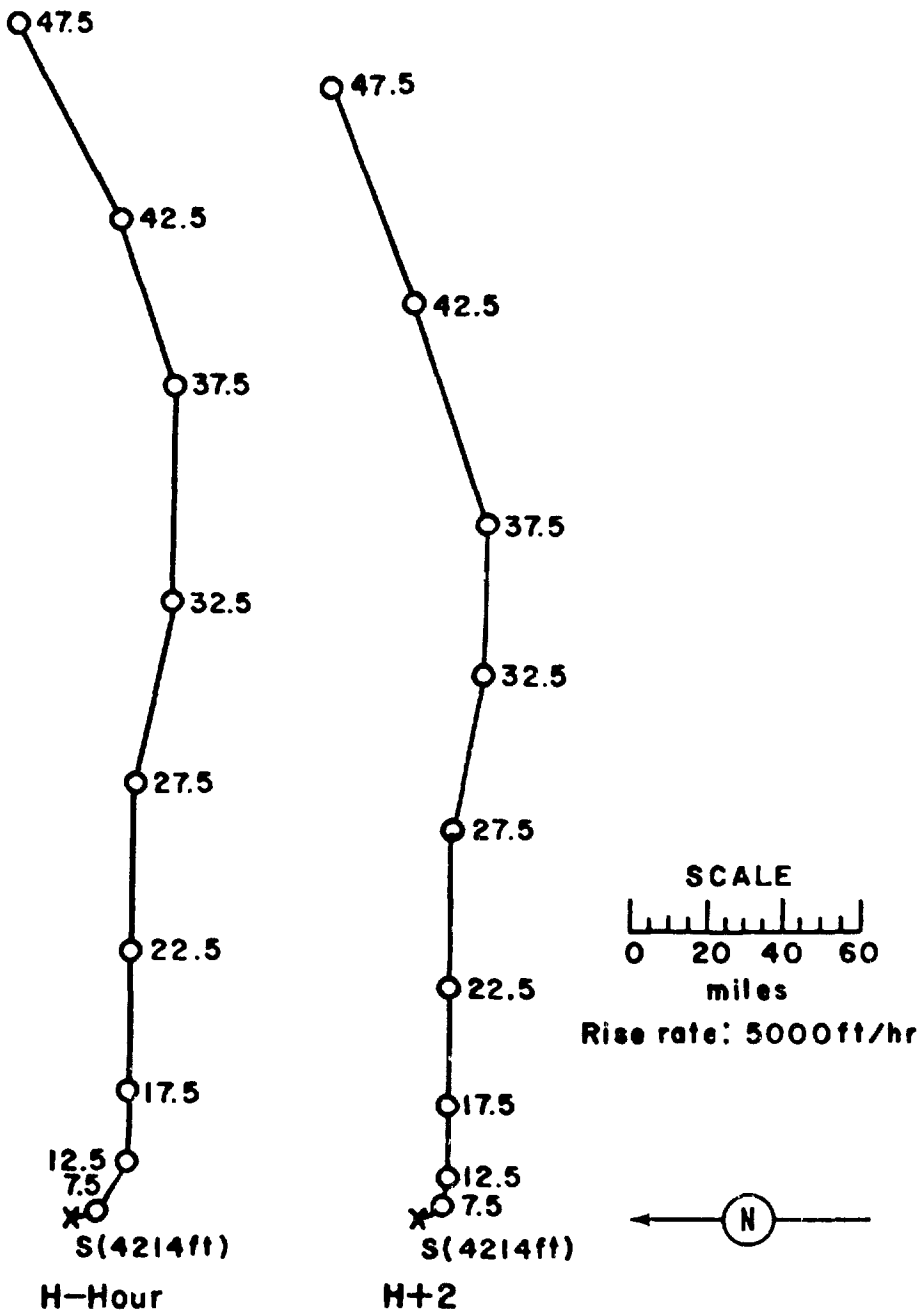
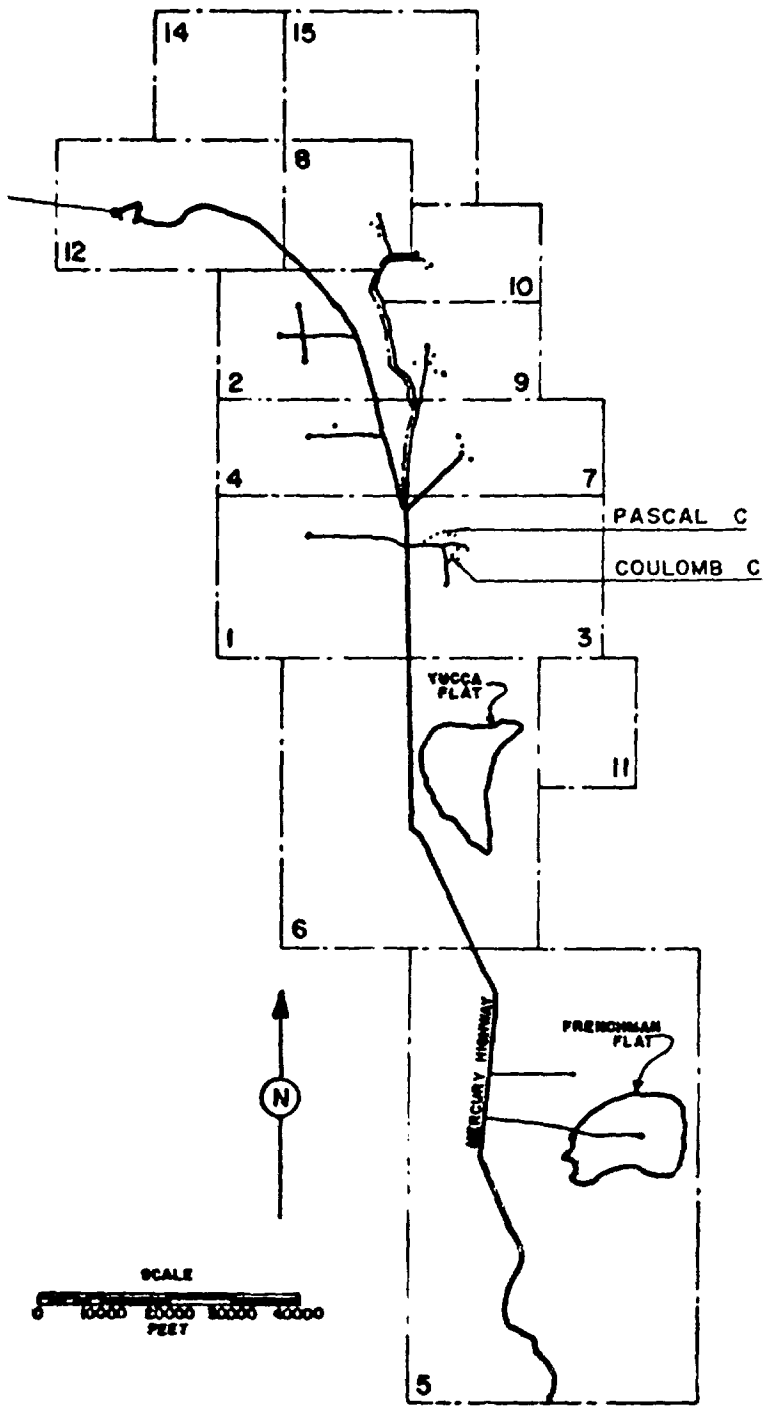


Figure 232. Hodographs for Operation PLUMBBOB - Morgan.



NEVADA TEST SITE

Figure 233. Project 58 Shot Locations.

58 PROJECT - Pascal C Safety Experiment

	PST	GMT
DATE:	6 Dec 1957	6 Dec 1957
TIME:	1215	2015

Sponsor: LASL

SITE: NTS - Area 3e
37° 03' N
116° 01' 50" W
Site elevation: 4,035 ft

HEIGHT OF BURST: -250 ft

TYPE OF BURST AND PLACEMENT:
Subsurface burst in 36-inch diameter partially stemmed well. Device located at the bottom of a cased 200-ft hole with a 50-ft block of concrete above it and an open space up to a heavy concrete cap at the top.

CLOUD TOP HEIGHT: 7,000 ft MSL
CLOUD BOTTOM HEIGHT: NM

REMARKS: Light on-site contamination was produced.

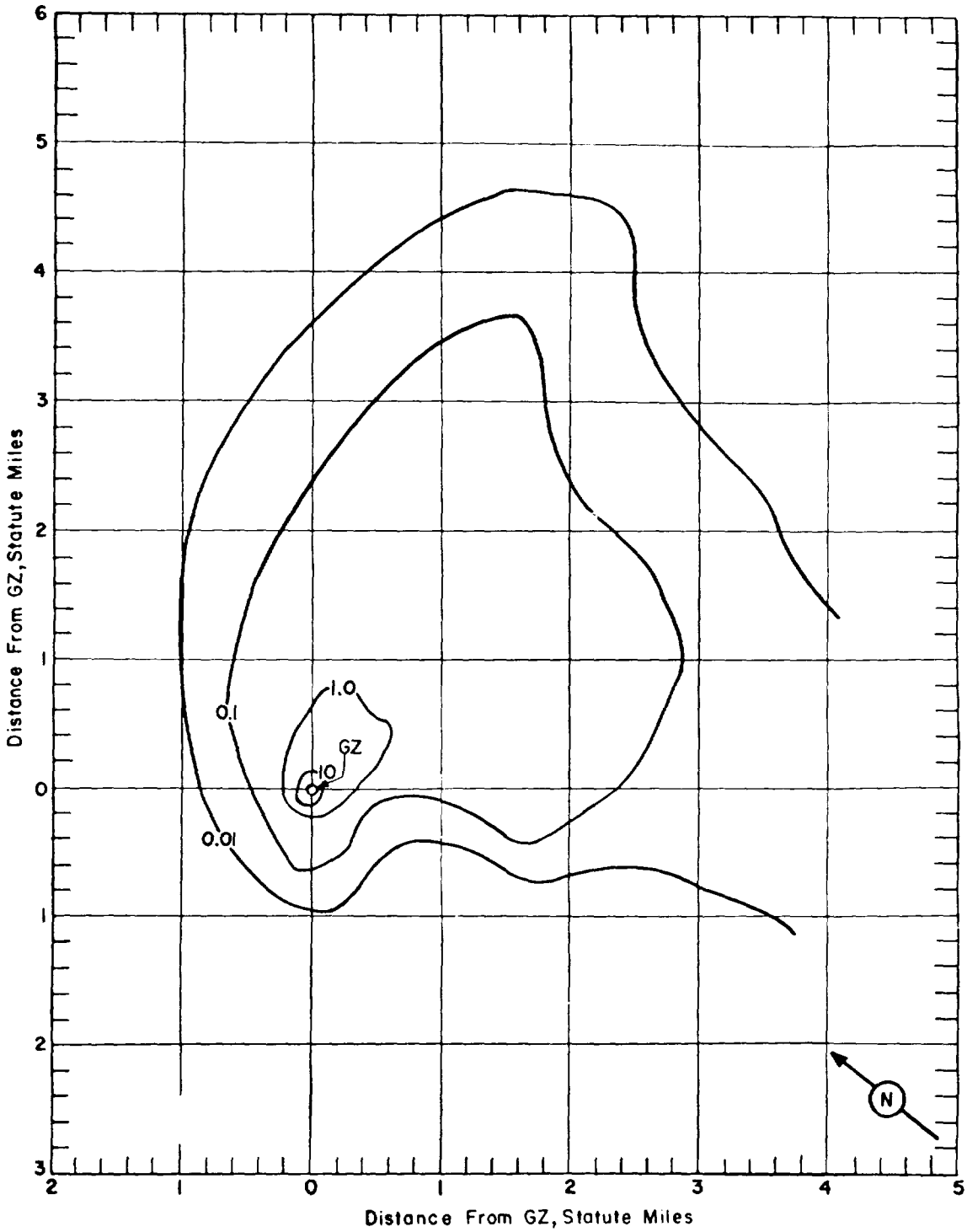


Figure 234. 58 Project - Pascal C.
On-site dose rate contours in r/hr at H+1 hour.

TABLE 71 NEVADA WIND DATA FOR OPERATION 58 PROJECT - PASCAL-C

Altitude (MSL)	H-hour	
	Dir	Speed
feet	degrees	mph
Surface	---	--
4,290	150	03
4,790	180	07
5,290	190	04
5,790	240	02
6,290	340	04
6,790	310	08
7,290	290	11
7,790	300	14
8,290	300	13

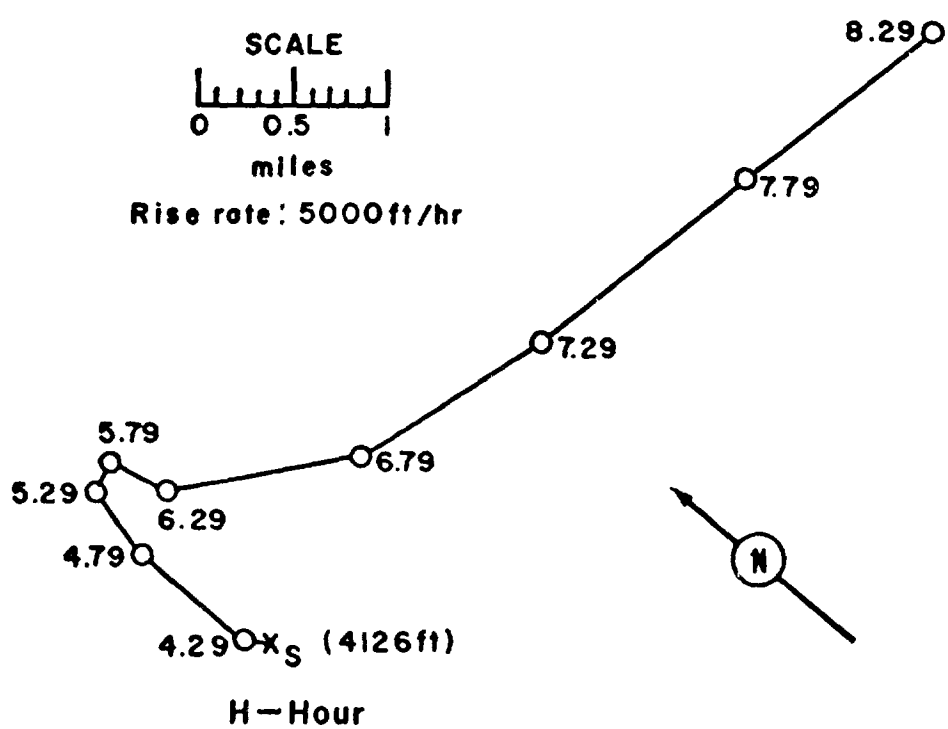


Figure 235. Hodograph for Operation 58 Project - Pascal-C.

58 PROJECT - Coulomb C Safety Experiment

	PST	GMT
DATE:	9 Dec 1957	9 Dec 1957
TIME:	1200	2000

TOTAL YIELD: 0.5 kt

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

CLOUD TOP HEIGHT: 13,000 ft MSL
CLOUD BOTTOM HEIGHT: NM

Sponsor: LASL

SITE: NTS - Area 3i
37° 02' 54" N
116° 01' 27" W
Site elevation: 4,050 ft

HEIGHT OF BURST: Surface

TYPE OF BURST AND PLACEMENT:
Surface burst - Cab on Nevada soil

CRATER DATA: NM

REMARKS:

The fallout pattern was drawn from measurements made by a scientific project and is well defined and reliable.

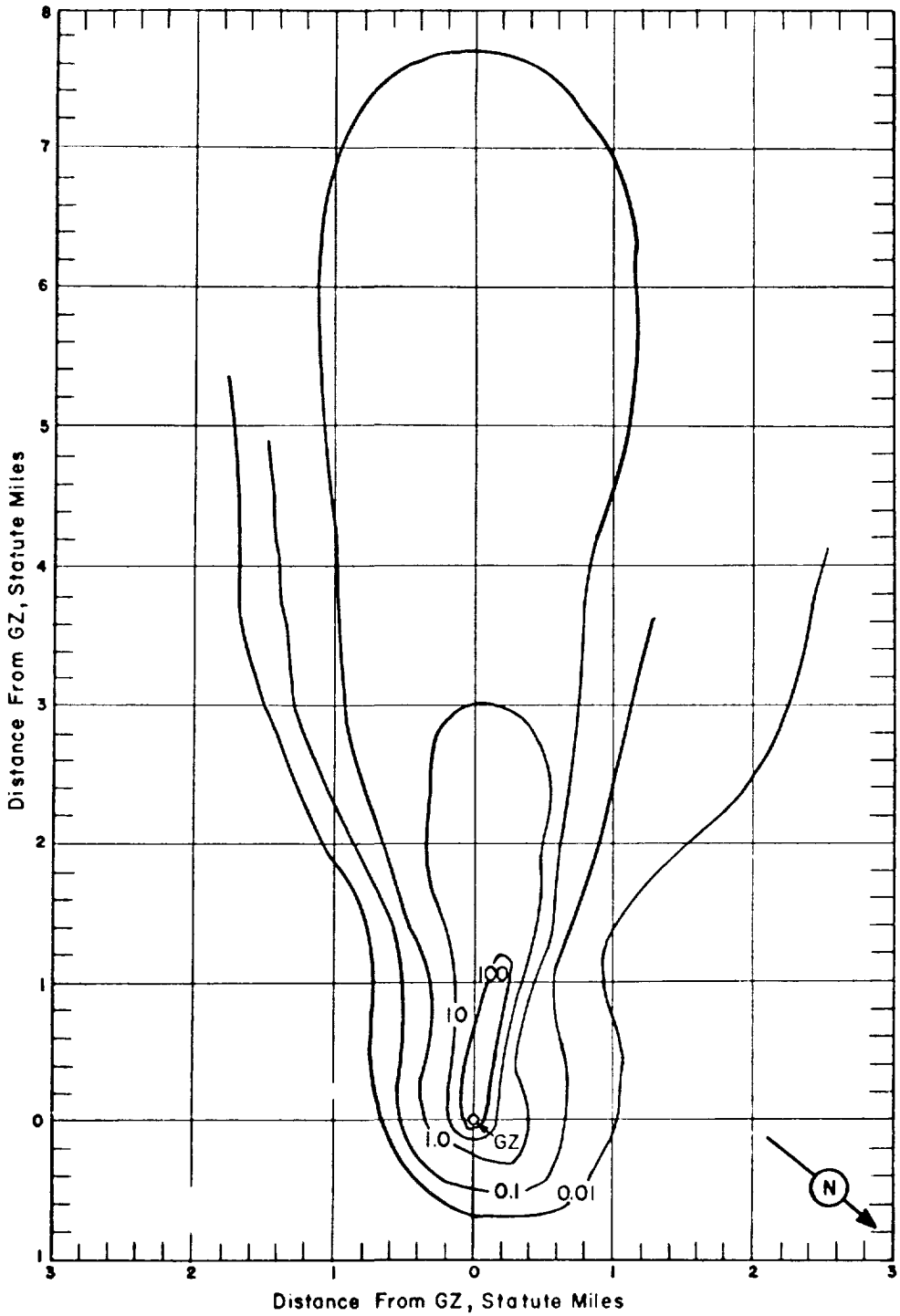


Figure 236. 58 Project - Coulomb-C.
On-site dose rate contours in r/hr at H+1 hour.

TABLE 72 NEVADA WIND DATA FOR OPERATION 58 PROJECT - COULOMB-C

Altitude (MSL)	H-hour	
	Dir	Speed
feet	degrees	mph
Surface	---	--
5,000	030	11
6,000	020	13
7,000	020	07
8,000	090	07
9,000	050	04
10,000	040	06
11,000	120	03
12,000	140	05
13,000	150	13
14,000	140	23
15,000	140	18
16,000	150	16
17,000	170	14
18,000	160	13
19,000	140	09
20,000	180	03

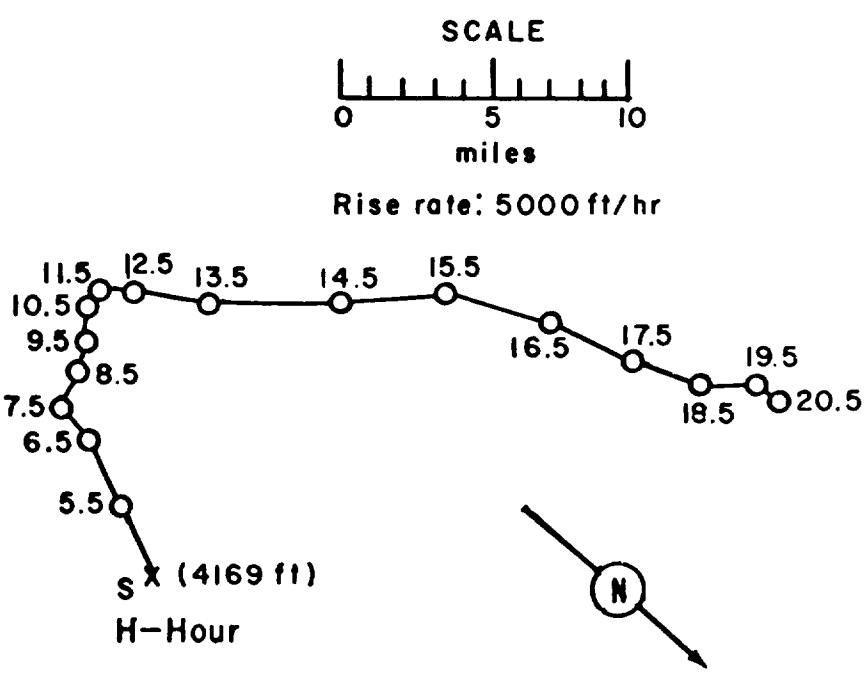


Figure 237. Hodograph for Operation 58 Project - Coulomb-C.

58 PROJECT - Venus Safety Experiment

	PST	GMT
DATE:	22 Feb 1958	23 Feb 1958
TIME:	1700	0100

Sponsor: UCRL

SITE: NTS - Area 12d
37° 11' 32" N
116° 11' 43" W

TYPE OF BURST AND PLACEMENT:
Subsurface burst (Tunnel)

CLOUD TOP HEIGHT: NM
CLOUD BOTTOM HEIGHT: NM

HEIGHT OF BURST: -100 ft

58 PROJECT - Uranus Safety Experiment

	PST	GMT
DATE:	14 Mar 1958	14 Mar 1958
TIME:	1400	2200

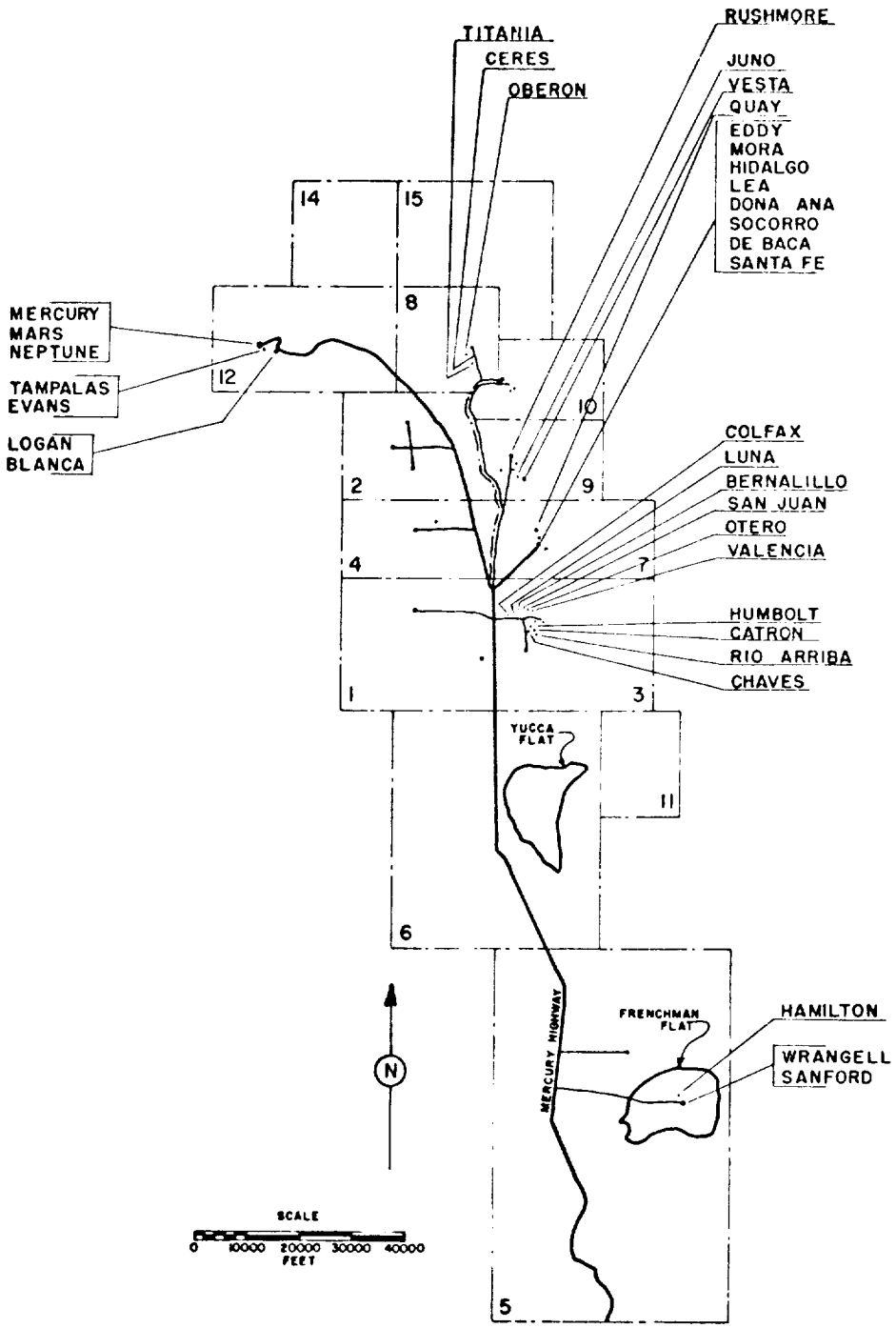
Sponsor: UCRL

SITE: NTS - Area 12d
37° 11' 32" N
116° 11' 43" W

TYPE OF BURST AND PLACEMENT:
Subsurface burst (Tunnel)

CLOUD TOP HEIGHT: NM
CLOUD BOTTOM HEIGHT: NM

HEIGHT OF BURST: -114 ft



NEVADA TEST SITE

Figure 238. Operation HARDTACK II, Shot Locations.

OPERATION HARDTACK II - Otero Safety Experiment

	PDT	GMT
DATE:	12 Sep 1958	12 Sep 1958
TIME:	1300	2000

FISSION YIELD: 38 tons

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

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

Sponsor: LASL

SITE: NTS Area 3q
37° 02' 60" N
116° 01' 55" W
Site elevation: 4,035 ft

HEIGHT OF BURST: -480 ft

TYPE OF BURST AND PLACEMENT:
Subsurface burst - deep well

CRATER DATA: Not available

REMARKS:

The on-site fallout documentation was performed by the Radiological Safety Division of the Reynolds Electrical and Engineering Company for purposes of personnel safety. Readings were taken with AN/PDR 39 or Tracerlab SU-10 instruments at H+1 hour, H+3½ hours, D+1 day, D+2 days and D+3 days. The portion of the pattern indicated by solid lines is fairly reliable. The dotted portion is only an approximation in the absence of measurements. The $t^{-1.2}$ decay approximation was used to extrapolate the dose-rate readings to H+1 hour.

The off-site fallout documentation was performed with Beckman MX-5 and AN/PDR 39 instruments by the U. S. Public Health Service for purposes of public safety. The portion of the pattern indicated by solid lines is fairly reliable. The $t^{-1.2}$ decay approximation was used to extrapolate the dose-rate readings to H+1 hour.

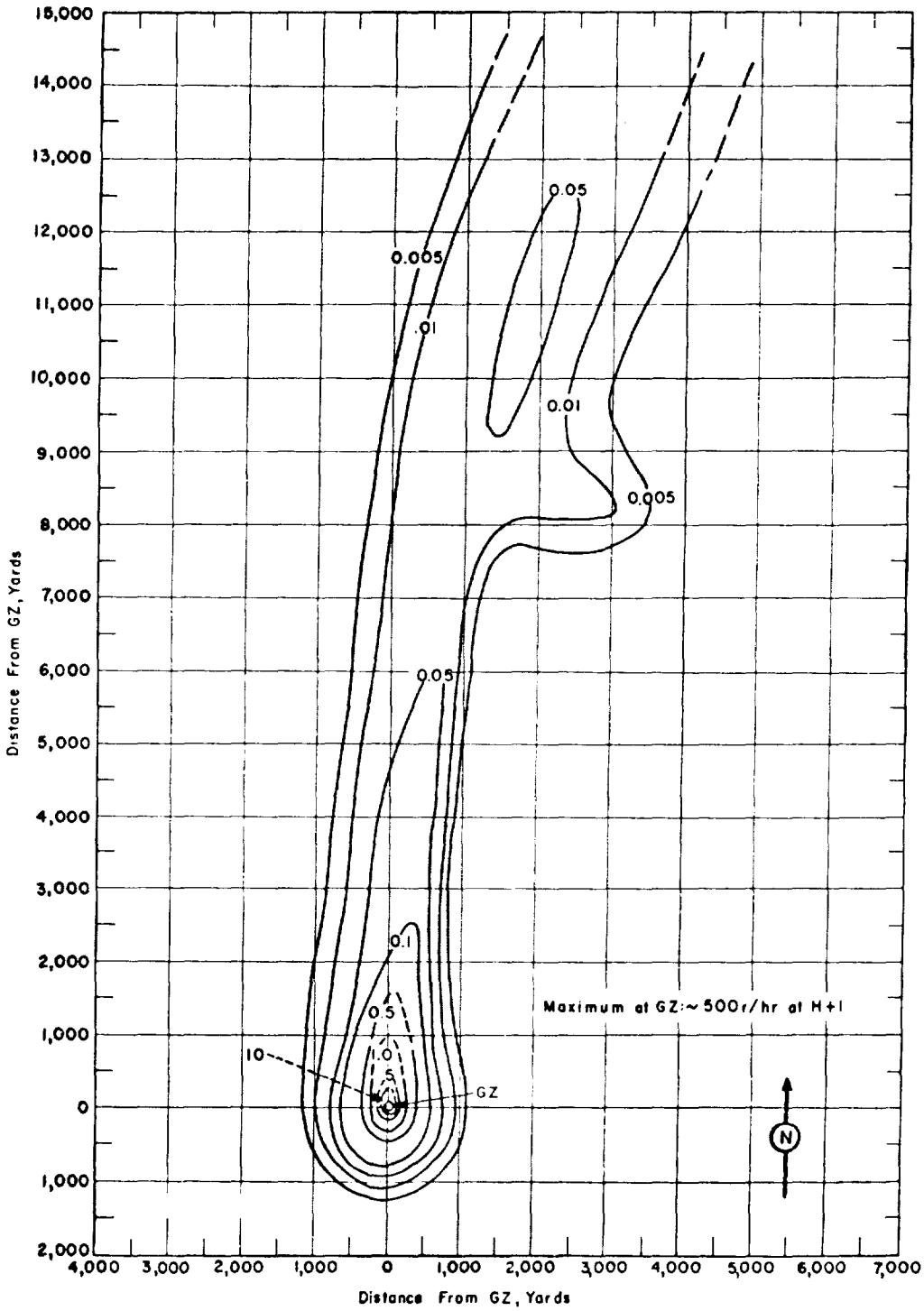


Figure 239. Operation HARDTACK II - Otero.
On-site dose rate contours in r/hr at H+1 hour.

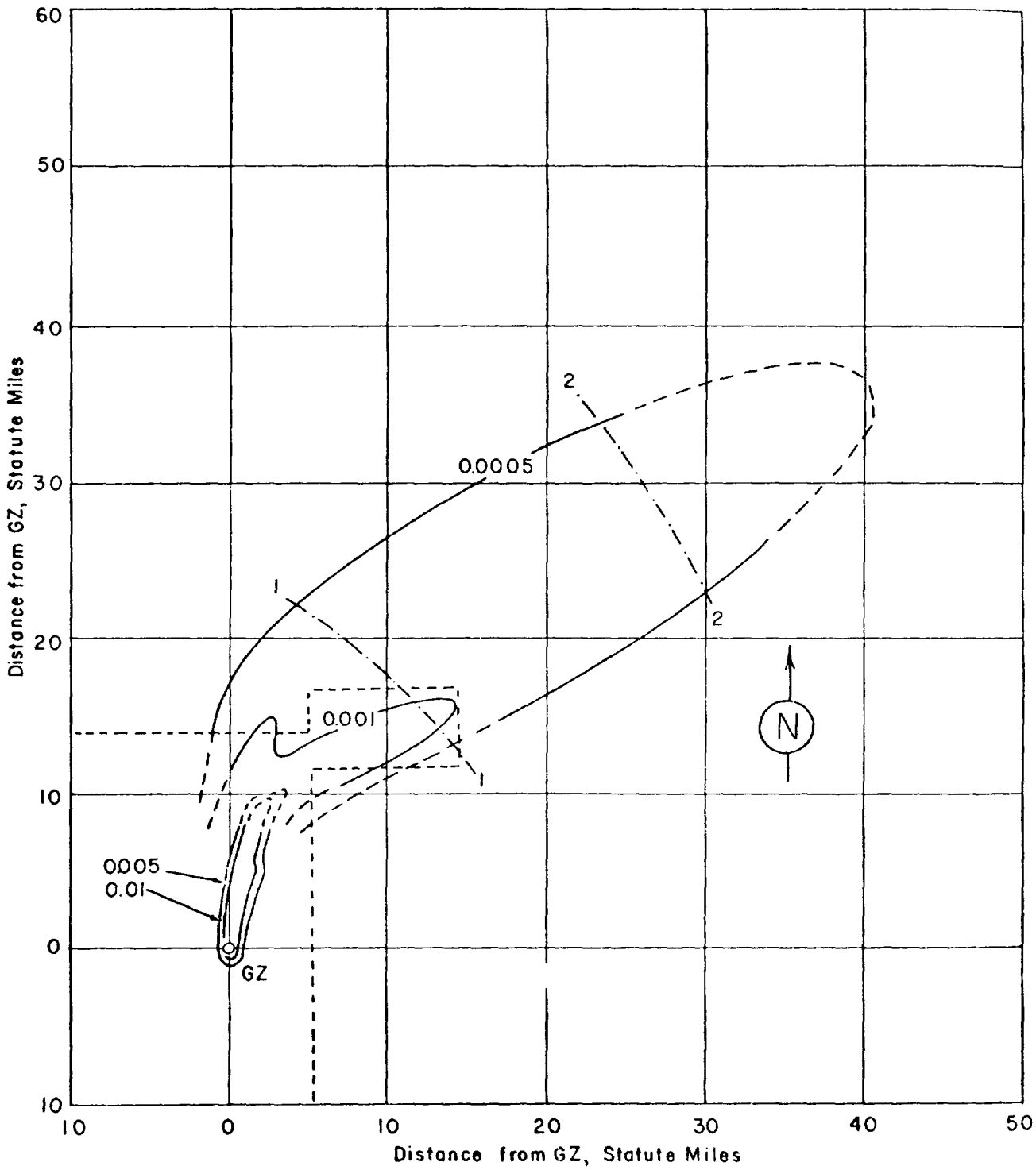


Figure 240. Operation HARDTACK II - Otero.
Off-site dose rate contours in r/hr at H+1 hour.

TABLE 73 NEVADA WIND DATA FOR OPERATION HARDTACK II- OTERO

Altitude (MSL)	H-hour	
	Dir	Speed
feet	degrees	mph
Surface	180	29
5,000	180	31
6,000	180	36
7,000	180	38
8,000	190	30
9,000	200	28
10,000	210	31
11,000	210	47
12,000	220	54

NOTE: Wind data was obtained from the Yucca weather station.

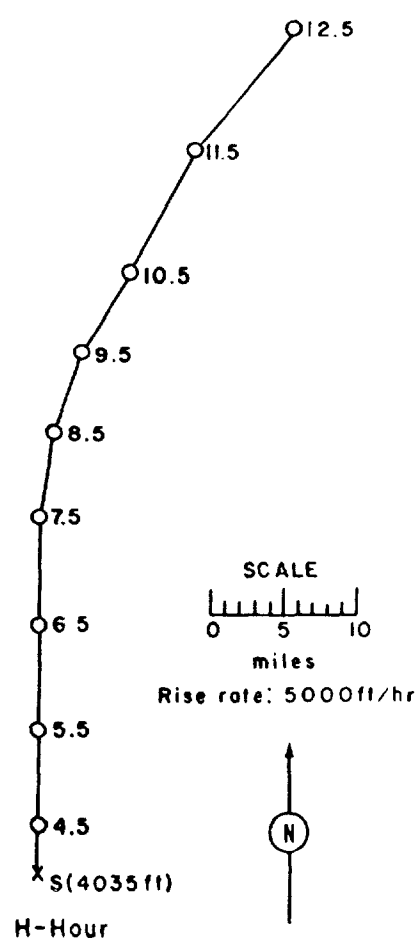


Figure 241. Hodograph for Operation HARDTACK II - Otero.

OPERATION HARDTACK II - Bernalillo Safety Experiment

	PDT	GMT
DATE:	17 Sep 1958	17 Sep 1958
TIME:	1230	1930

TOTAL YIELD: 15 tons

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

CRATER DATA: Not available

Sponsor: LASL

SITE: NTS - Area 3n
37° 02' 58" N
116° 01' 59" W
Site elevation: 4,030 ft

HEIGHT OF BURST: -456 ft

TYPE OF BURST AND PLACEMENT:
Subsurface burst - deep well

CLOUD TOP HEIGHT: 7,500 ft MSL
CLOUD BOTTOM HEIGHT: 5,500 ft MSL

REMARKS:

The on-site fallout documentation was performed by the Radiological Safety Division of the Reynolds Electrical and Engineering Company for purposes of personnel safety. Readings were taken with AN/PDR 39 or Tracerlab SU-10 instruments at H+$\frac{1}{2}$ hour, H+3$\frac{3}{4}$ hours, D+1 day, D+2 days and D+3 days. "The greater portion of this pattern was well documented and should be fairly reliable. The downwind extent of the 0.005 r/hr and 0.05 r/hr isolines was estimated in the absence of measurements." The $t^{-1.2}$ decay approximation was used to extrapolate the dose-rate readings to H+1 hour. No significant fallout was reported by the off-site monitors.

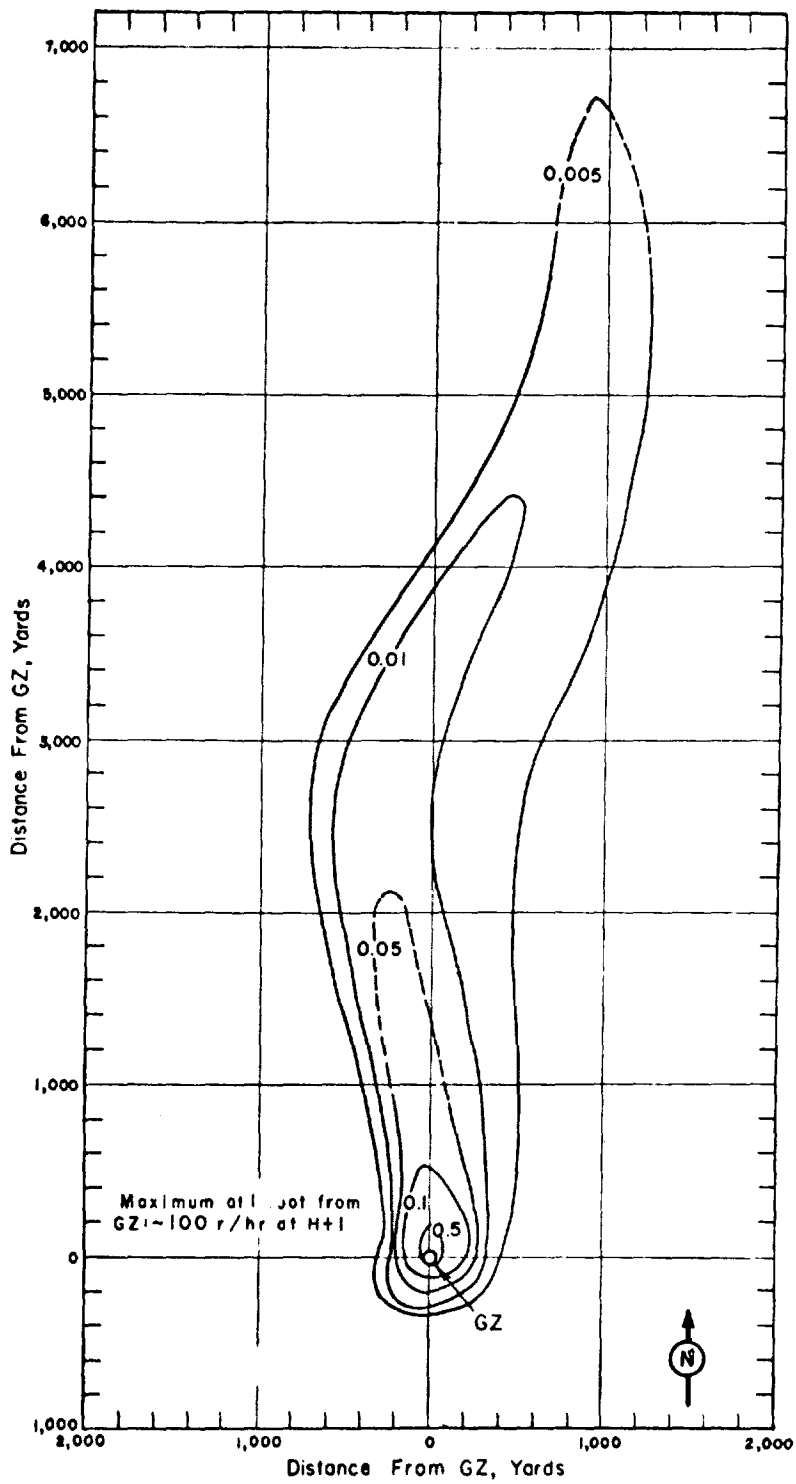


Figure 242. Operation HARDTACK II - Bernalillo.
On-site dose rate contours in r/hr at H+1 hour.

TABLE 74 NEVADA WIND DATA FOR OPERATION HARDTACK II - BERNALILLO

Altitude (MSL)	H-hour	
	Dir	Speed
feet	degrees	mph
Surface	180	15
5,000	180	23
6,000	180	24
7,000	200	20
8,000	210	17
9,000	210	17
10,000	210	18

NOTE: Wind data was obtained from the Yucca weather station.

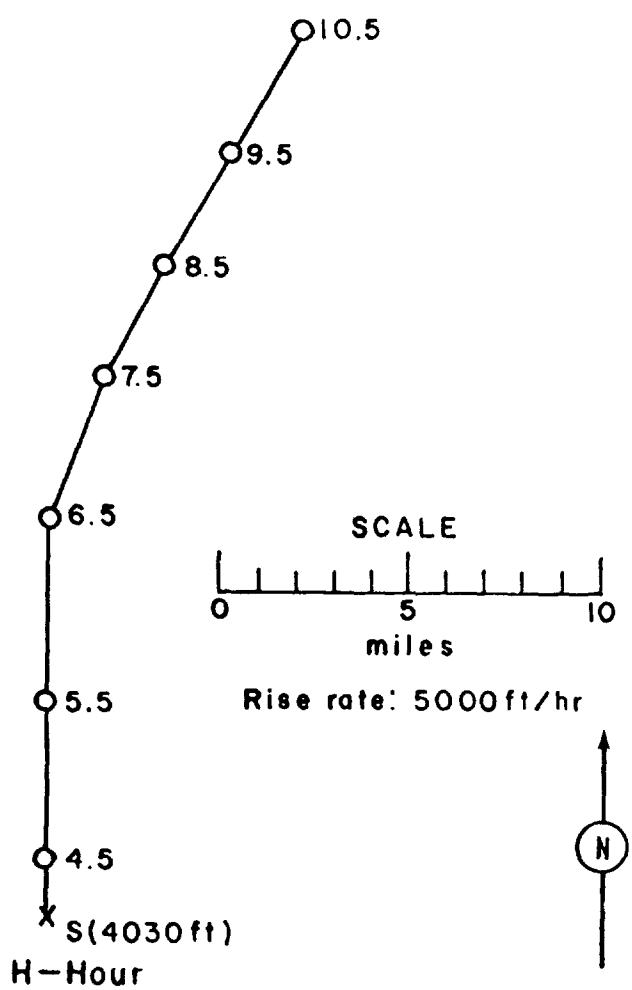


Figure 243. Hodograph for Operation HARDTACK II - Bernalillo.

OPERATION HARDTACK II - Eddy

	PDT	GMT
DATE:	19 Sep 1958	19 Sep 1958
TIME:	0700	1400

TOTAL YIELD: 83 tons

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

CRATER DATA: No crater

Sponsor: LASL

SITE: NTS - Area 7b
37° 05' 12" N
116° 01' 25" W
Site elevation: 4,186 ft

HEIGHT OF BURST: 500 ft

TYPE OF BURST AND PLACEMENT:
Air burst from balloon over Nevada soil

CLOUD TOP HEIGHT: 11,000 ft MSL
CLOUD BOTTOM HEIGHT: 7,500 ft MSL

REMARKS:

The on-site fallout documentation was performed by the Radiological Safety Division of the Reynolds Electrical and Engineering Company for purposes of personnel safety. Readings were taken with AN/PDR-39 or Tracerlab SU-10 instruments at H+½ hour, H+6 hours, D+1 day, D+2 days, and D+3 days along eight radial roads. The sodium-24 decay rate was used to extrapolate the dose-rate readings to H+1 hour. This decay rate is not strictly applicable although it closely approximates the observed decay.

The off-site fallout documentation was performed with Beckman MX-5 and AN/PDR-39 instruments by the U. S. Public Health Service for purposes of public safety. Readings were taken at about 10-mile intervals except in populated places or when the dose rate varied considerably with distance. "The far northerly portion of the pattern may be in error. No airborne activity above background was recorded in this general area. The easterly portion of the pattern was interpolated. The rest of the pattern was well documented and should be fairly reliable." The $t^{-1.2}$ decay approximation was used to extrapolate the dose-rate readings to H+1 hours.

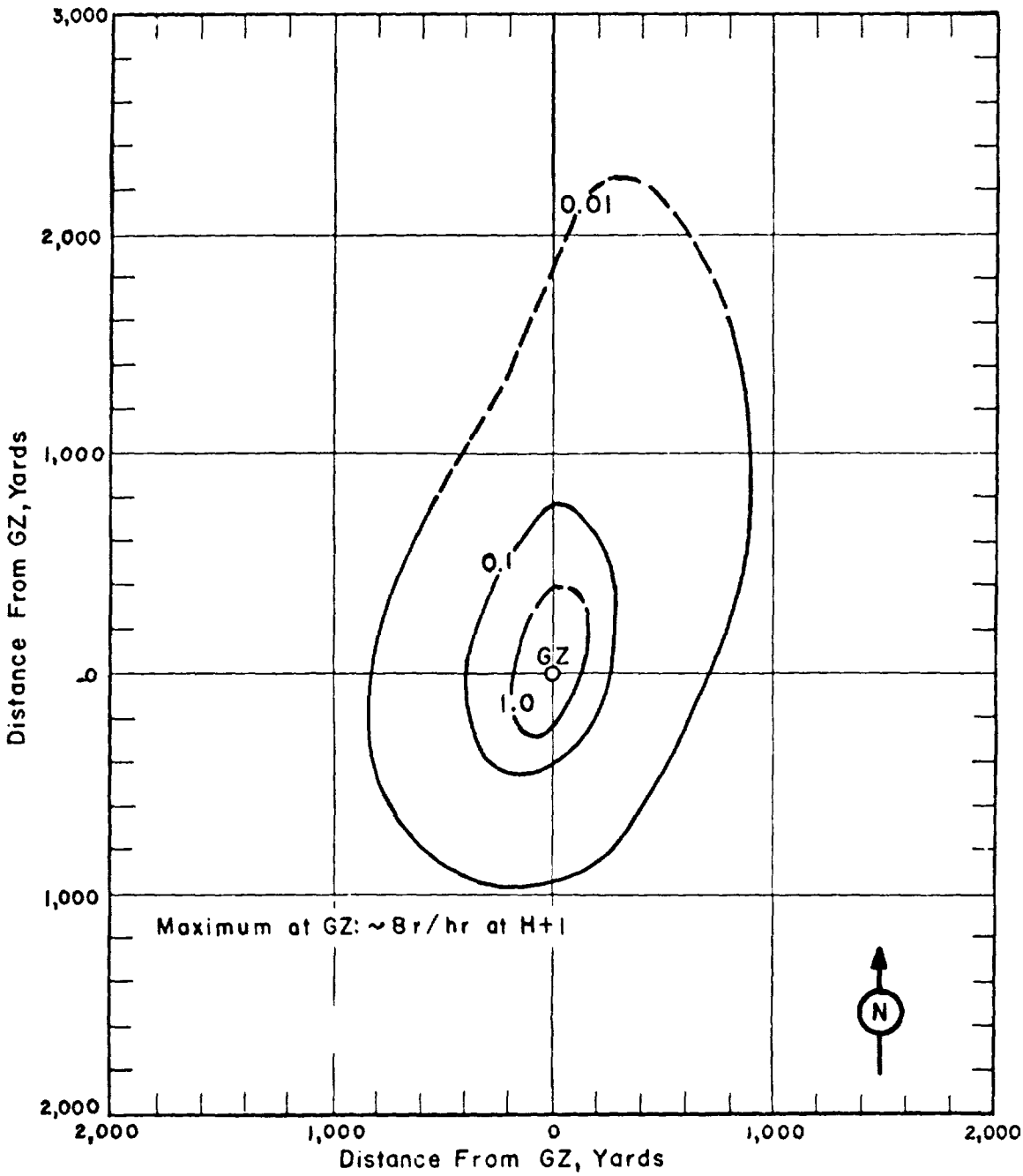


Figure 244 . Operation HARDTACK II - Eddy.
On-site dose rate contours in r/hr at H+1 hour.

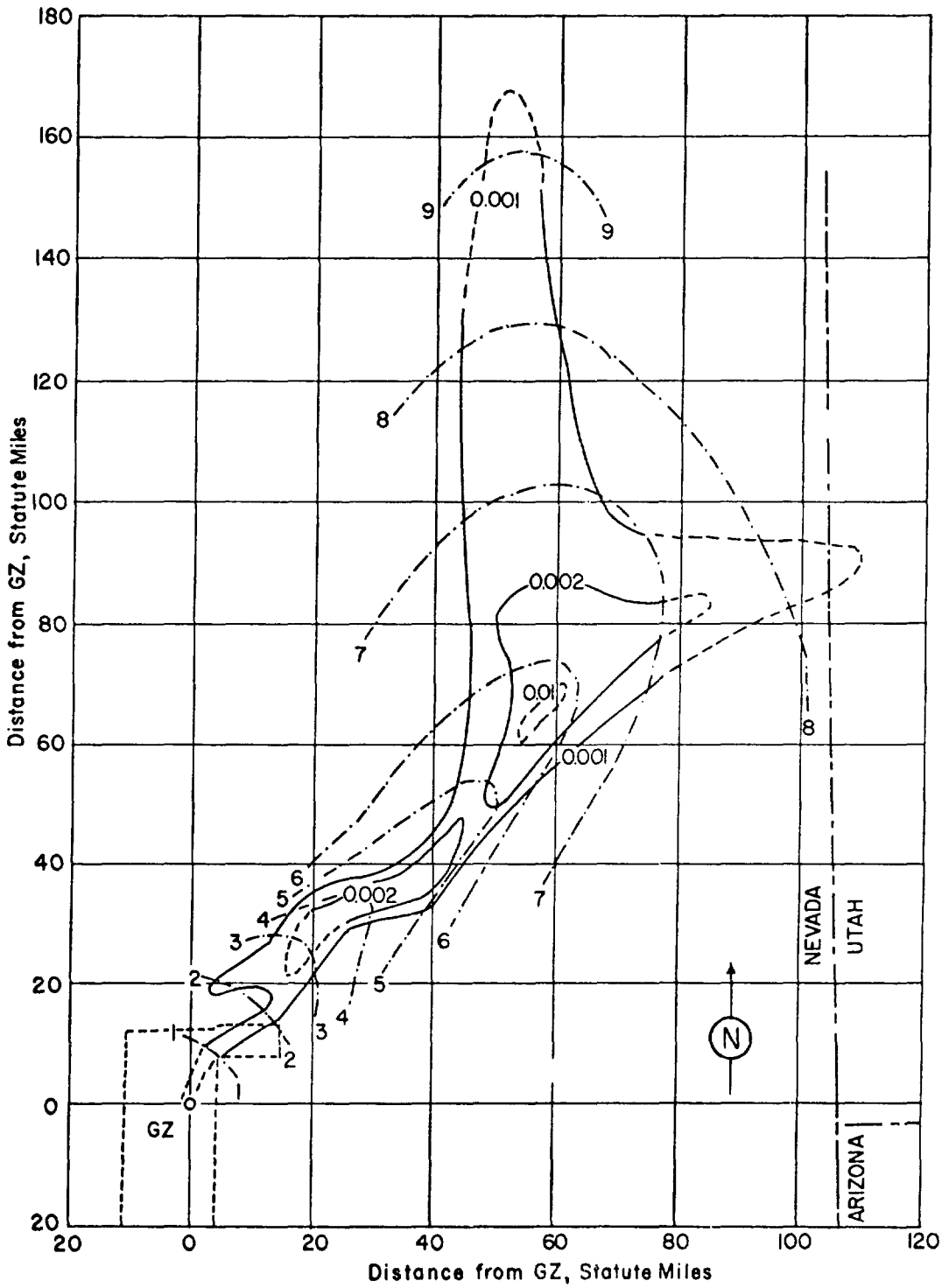


Figure 245. Operation HARDTACK II - Eddy.
Off-site dose rate contours in r/hr at H+1 hour.

TABLE 75 NEVADA WIND DATA FOR OPERATION HARDTACK II- EDDY

Altitude (MSL)	H-hour Dir	H-hour Speed
feet	degrees	mph
Surface	Calm	Calm
5,000	240	08
6,000	210	13
7,000	210	13
8,000	210	14
9,000	210	14
10,000	190	13
11,000	180	10
12,000	170	06

NOTES:

1. Wind data was obtained from the Yucca weather station.
2. Tropopause height was 48,000 ft MSL.
3. The surface air pressure was 12.69 psi, the temperature 14.2°C, the dew point -7.9°C, and the relative humidity 21%.

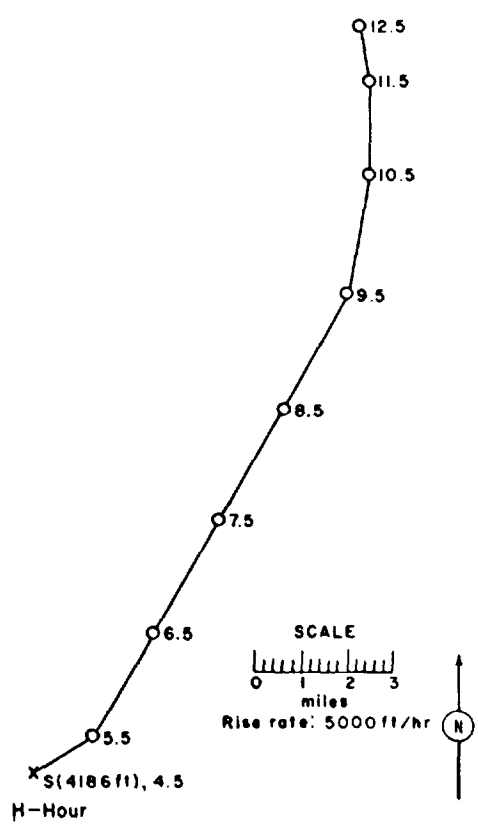


Figure 246. Hodograph for Operation HARDTACK II- Eddy.

OPERATION HARDTACK II - Luna Safety Experiment

	PDT	GMT
DATE:	21 Sep 1958	21 Sep 1958
TIME:	1200	1900

TOTAL YIELD: 1.5 tons

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

CRATER DATA: Not available

Sponsor: LASL

SITE: NTS - Area 3m
37° 02' 57" N
116° 02' 01" W
Site elevation: 4,031 ft

HEIGHT OF BURST AND PLACEMENT:
Subsurface burst - 484 ft below surface in well

CLOUD TOP HEIGHT: NM
CLOUD BOTTOM HEIGHT: NM

REMARKS:

The on-site fallout documentation was performed by the Radiological Safety Division of the Reynolds Electrical and Engineering Company for purposes of personnel safety. Readings were taken with AN/PDR-39 or Tracerlab SU-10 instruments at H+½ hour, H+6 hours, D+1 day, D+2 days and D+3 days along eight radial roads. Since there were few readings in the area where fallout should have occurred based on the wind data it is difficult to draw a pattern with any confidence. The $t^{-1.2}$ decay approximation was used to extrapolate the dose rate readings to H+1 hour.

There were no readings above background reported off-site.

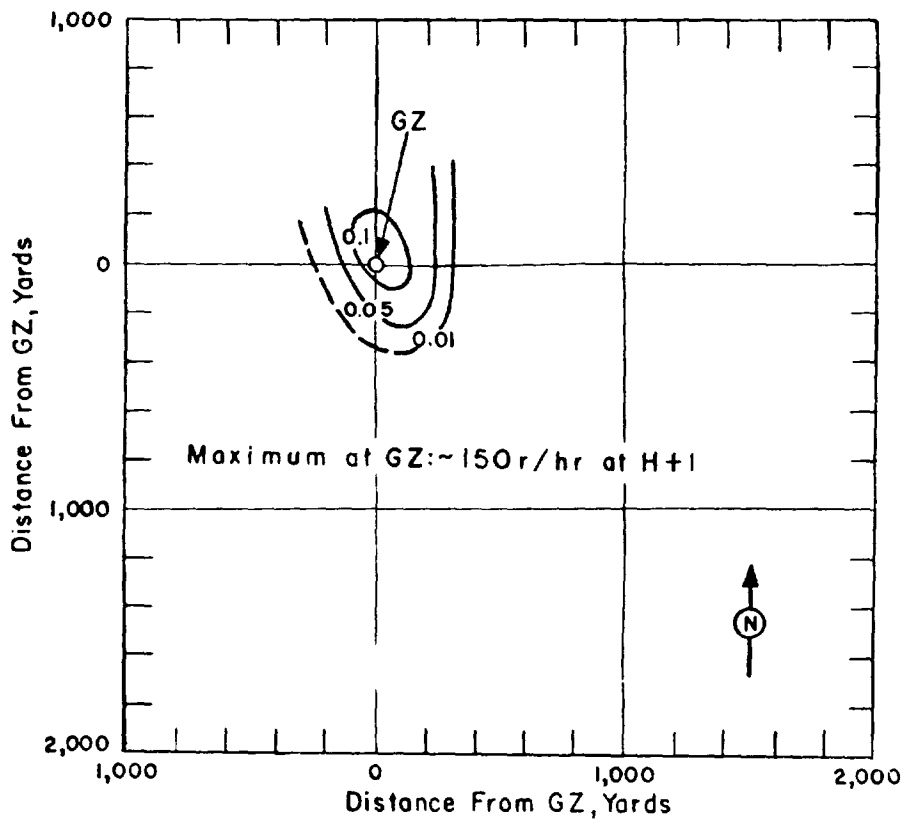


Figure 247. Operation HARDTACK II - Luna.
On-site dose rate contours in r/hr at H+1 hour.

TABLE 76 NEVADA WIND DATA FOR OPERATION HARDTACK II - LUNA

Altitude (MSL)	H-hour	
	Dir	Speed
feet	degrees	mph
Surface	160	05
5,000	170	09
6,000	180	10
7,000	180	13
8,000	190	16
9,000	190	21

NOTE: Wind data was obtained from the Yucca weather station.

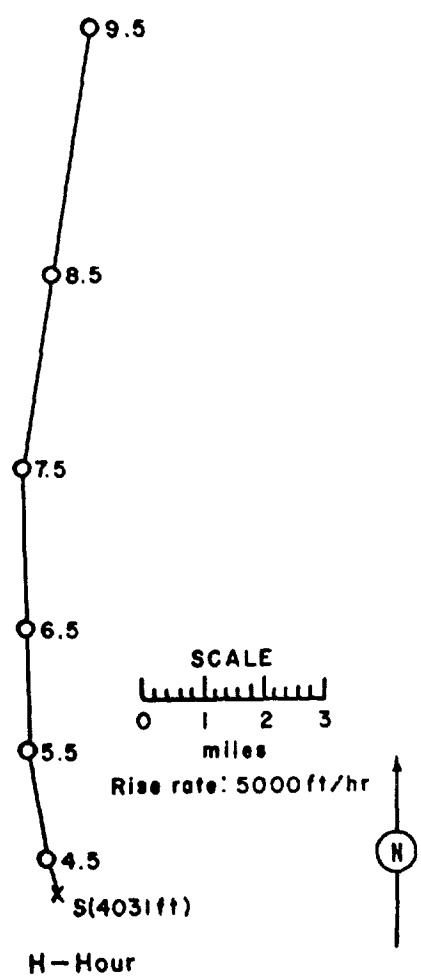


Figure 248. Hodograph for Operation HARDTACK II - Luna.

OPERATION HARDTACK II - Mercury Safety Experiment

	PDT	GMT
DATE:	23 Sep 1958	23 Sep 1958
TIME:	1500	2200

Sponsor: UCRL

SITE: NTS - Area 12f
37° 11' 35" N
116° 12' 02" W
Site elevation: 6,720 ft

DEPTH OF BURST: 183 ft

TYPE OF BURST AND PLACEMENT:
Subsurface burst - Tunnel in Nevada soil

CLOUD TOP HEIGHT: NM
CLOUD BOTTOM HEIGHT: NM

REMARKS:
Since there was essentially no nuclear yield, no venting into the atmosphere was observed. There was, however, some alpha contamination in the main tunnel.

OPERATION HARDTACK II - Valencia Safety Experiment

	PDT	GMT
DATE:	27 Sep 1958	26 Sep 1958
TIME:	1300	2000

TOTAL YIELD: 2 tons

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

CRATER DATA: Not available

Sponsor: LASL

SITE: NTS - Area 3r
37° 02' 59" N
116° 01' 47" W
Site elevation: 4,033 ft

HEIGHT OF BURST: -484 ft

TYPE OF BURST AND PLACEMENT:
Subsurface burst - Well in Nevada soil

REMARKS:

The on-site fallout documentation was performed by the Radiological Safety Division of the Reynolds Electrical and Engineering Company for purposes of personnel safety. Readings were taken with AN/PDR-39 or Tracerlab SU-10 instruments at H+½ hour, H+4 hours, D+1 day and D+2 days along eight radial roads. The documentation was such as to give a reliable pattern. The $t^{-1.2}$ decay approximation was used to extrapolate the dose rate readings to H+1 hour.

No radiation intensities significantly above background were found by the off-site monitors.

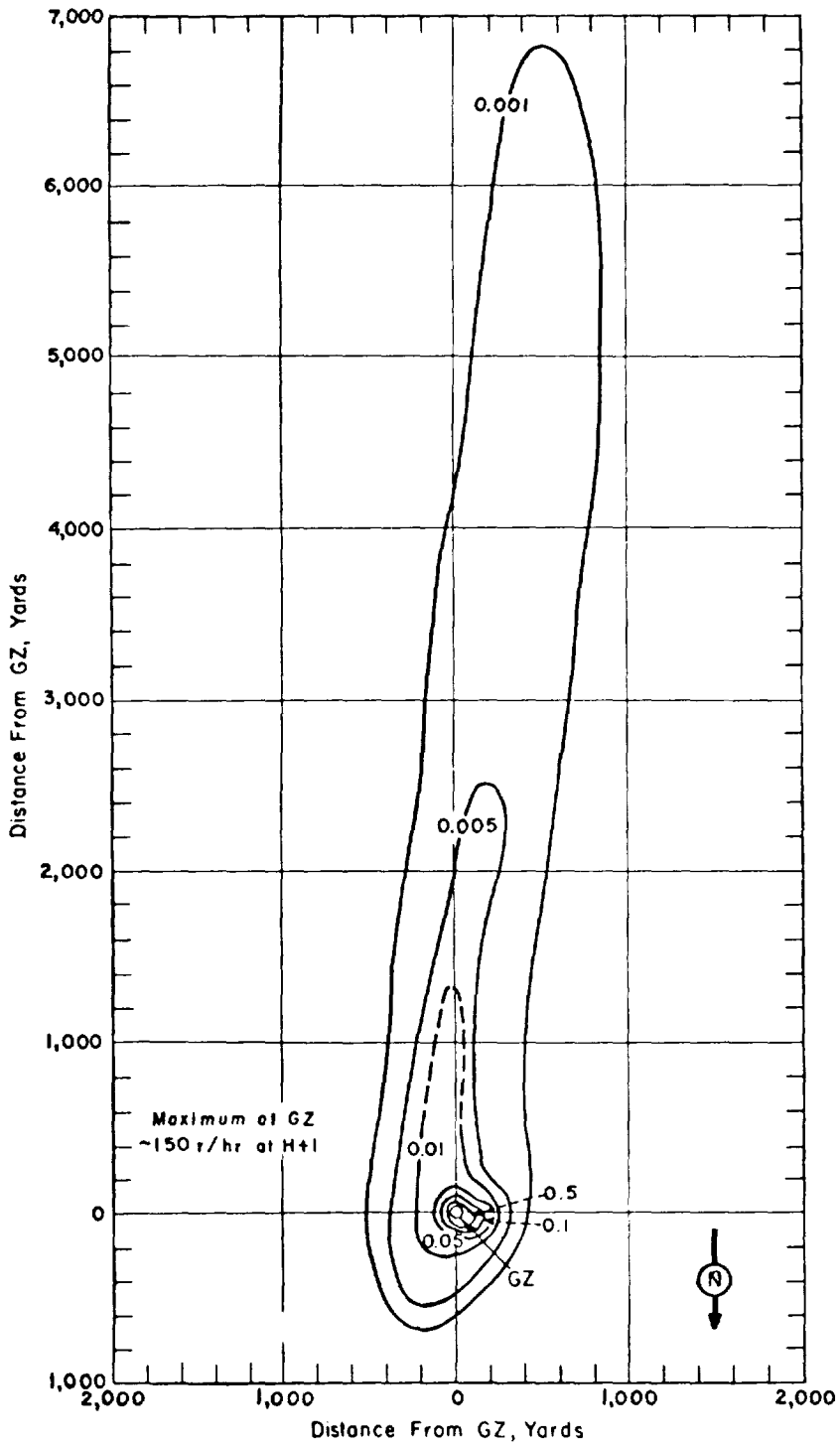


Figure 249. Operation HARDTACK II - Valencia.
On-site dose rates in r/hr at H+1 hour.

TABLE 77 NEVADA WIND DATA FOR OPERATION HARDTACK II- VALENCIA

Altitude (MSL)	H-hour	
	Dir	Speed
feet	degrees	mph
Surface	20	17
5,000	10	20
6,000	20	21
7,000	30	21
8,000	30	20

NOTE : Wind data was obtained from the Yucca weather station.

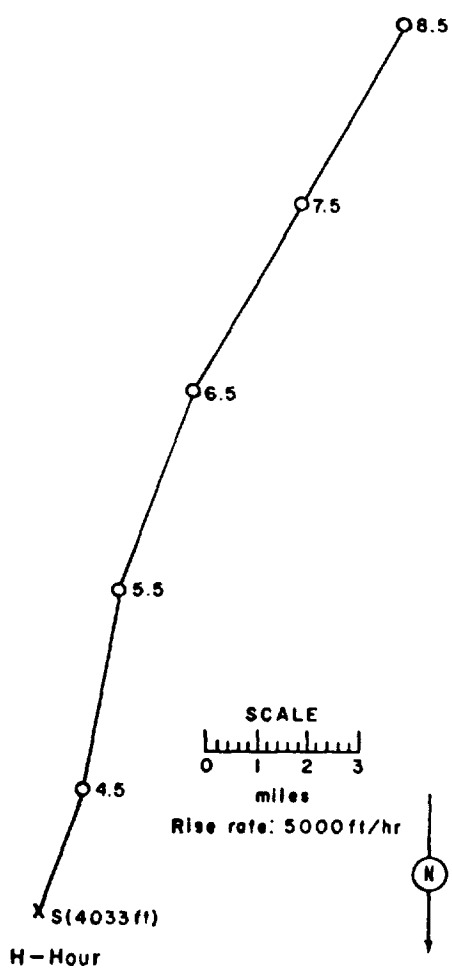


Figure 250. Hodograph for Operation HARDTACK II - Valencia.

OPERATION HARDTACK II - Mars Safety Experiment

	PDT	GMT
DATE:	27 Sep 1958	28 Sep 1958
TIME:	1700	0000

TOTAL YIELD: 13 tons

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

Sponsor: UCRL

SITE: NTS - Area 12f.02
37° 11' 35" N
116° 12' 02" W
Site elevation: 6,720 ft

DEPTH OF BURST: 140 ft

TYPE OF BURST AND PLACEMENT:
Subsurface burst - Tunnel in Nevada soil

REMARKS:
The on-site fallout documentation was performed by the Radiological Safety Division of the Reynolds Electrical and Engineering Company for purposes of personnel safety. Readings were taken with AN/PDR-39 or Tracerlab SU-10 instruments at H+1 hour, D+1 day and D+3 days. ("The only road which could be monitored in the direction of fallout was the Area 12 access road; therefore, there is considerable uncertainty as to the cross-wind extent of this pattern.")

The down-wind and up-wind extent of the contamination should be fairly reliable. The $t^{-1.2}$ decay approximation was used to extrapolate the dose-rate readings to H+1 hour.

No radioactivity above background was detected off-site.

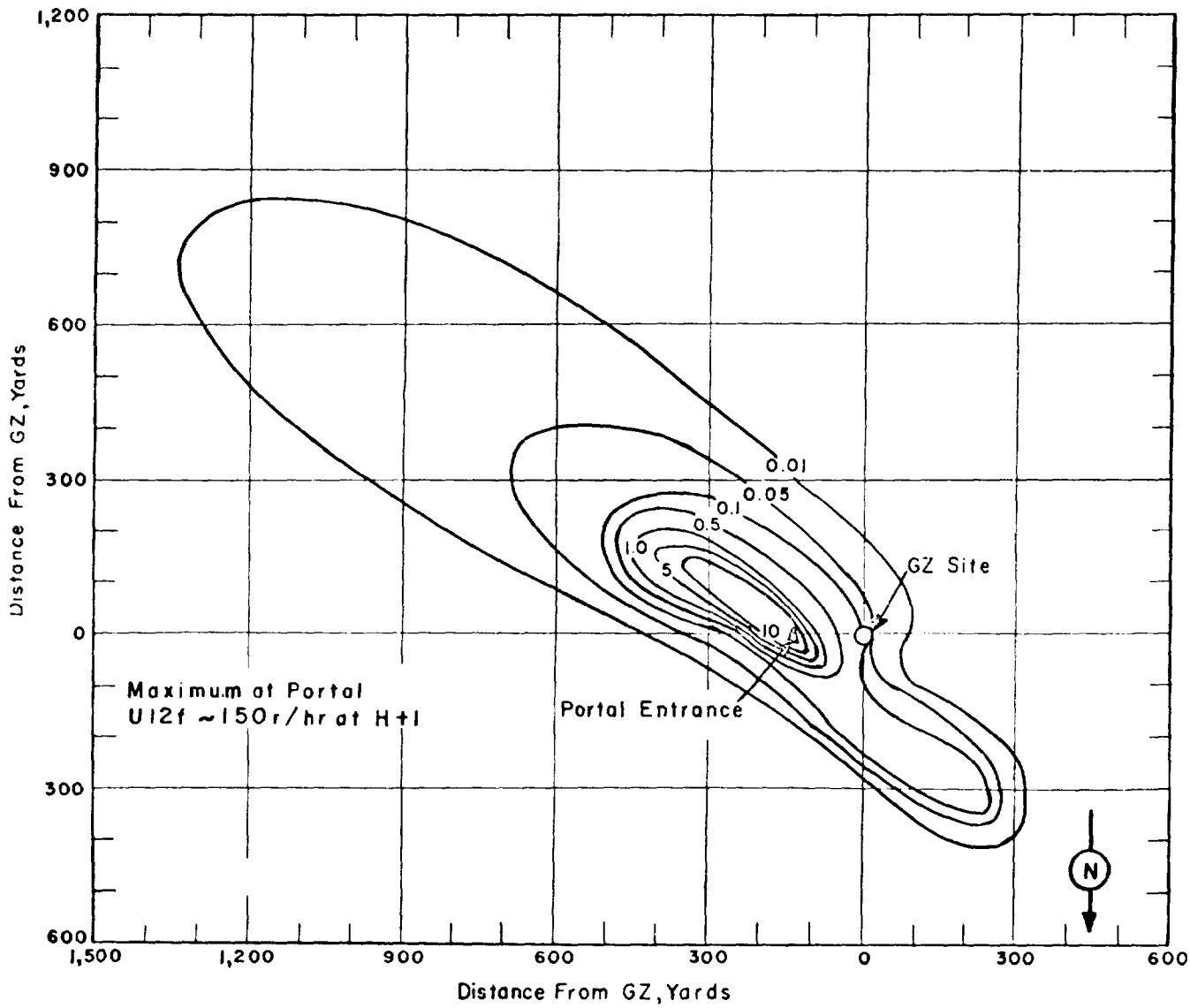


Figure 251. Operation HARDTACK II - Mars.
On-site dose rate contours in r/hr at H+1 hour.

TABLE 78 NEVADA WIND DATA FOR OPERATION HARDTACK II - MARS

TIME	SURFACE WINDS			
	9 foot mesa Slope Tower (Elev. 6,725 ft MSL)		100 foot mesa Mountain Tower (Elev. 7,465 ft MSL)	
	Dir	Speed	Dir	Speed
	degrees	mph	degrees	mph
H-hour	040	2	50	07
H+1 hour	320	8	25	21
H+2 hours	330	6	35	21
H+3 hours	320	5	45	20

OPERATION HARDTACK II - Mora

	PST	GMT
DATE:	29 Sep 1958	29 Sep 1958
TIME:	0605	1405

TOTAL YIELD: 2.0 kt

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

CLOUD TOP HEIGHT: 18,500 ft MSL
CLOUD BOTTOM HEIGHT: 10,000 ft MSL

Sponsor: LASL

SITE: NTS - Area 7b
37° 05' 12" N
116° 01' 25" W
Site elevation: 4,186 ft

HEIGHT OF BURST: 1,500 ft

TYPE OF BURST AND PLACEMENT:
Air burst from balloon over Nevada soil

CRATER DATA: No crater

REMARKS:

The on-site fallout documentation was performed by the Radiological Safety Division of the Reynolds Electrical and Engineering Company for purposes of personnel safety. Readings were taken with AN/PDR-39 or Tracerlab SU-10 instruments at H+½ hour, H+5 hours, D+1 day, D+2 days and D+3 days along eight radial roads. At shot time a dust cloud was formed and was observed to move toward the west over the Mercury Highway producing some activity. Since this event was fairly well documented, there is considerable confidence in the pattern presented. The sodium-24 decay rate was used to extrapolate the dose-rate readings to H+1 hour. This decay rate is not strictly applicable although it closely approximates the observed decay.

Only small areas of low level of radioactivity relative to background radiation were detected off site.

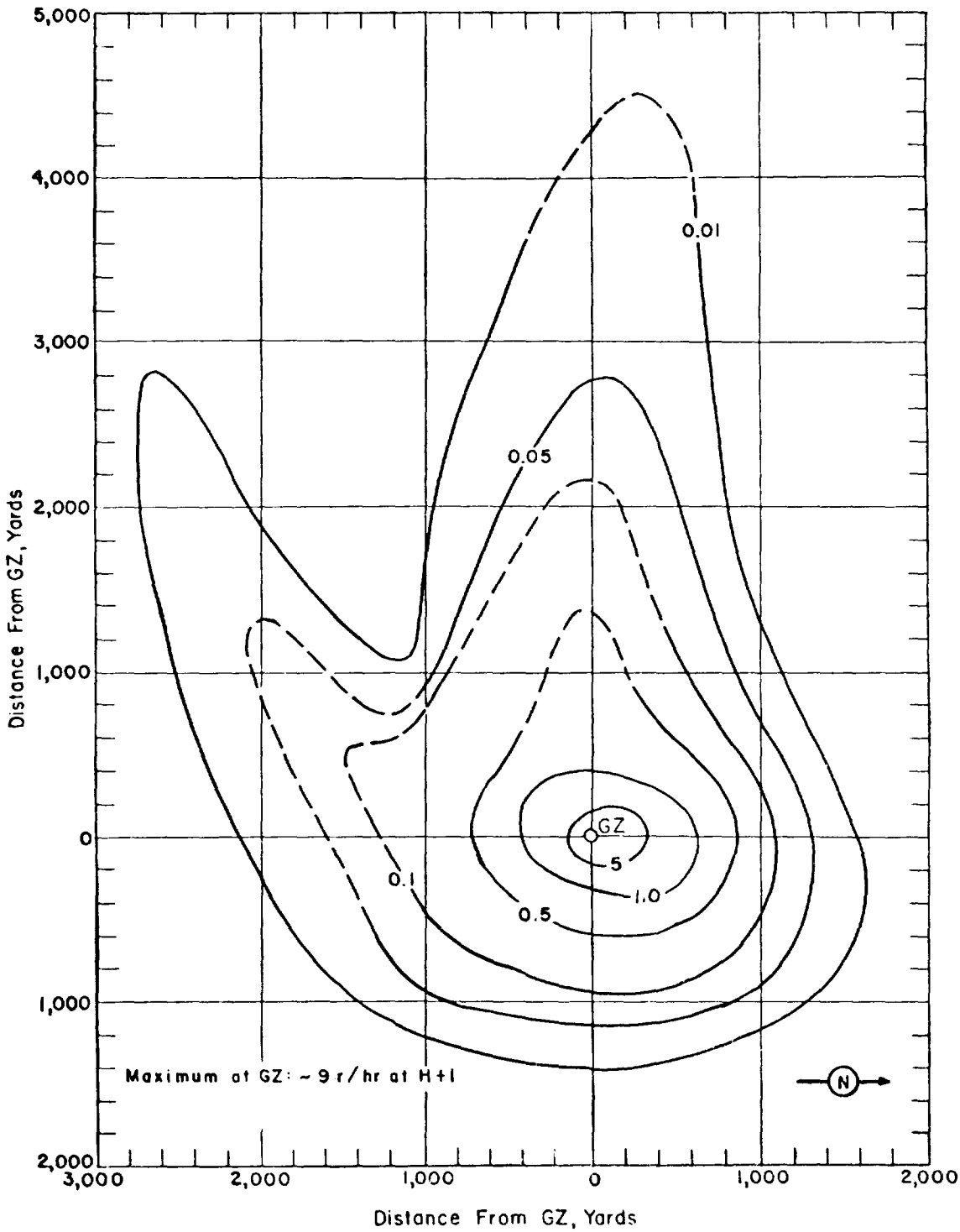


Figure 252. Operation HARDTACK II - Mora.
On-site dose rate contours in r/hr at H+1 hour.

TABLE 79 NEVADA WIND DATA FOR OPERATION HARDTACK II - MORA

Altitude (MSL)	H-hour Dir	H-hour Speed
feet	degrees	mph
Surface	Calm	Calm
5,000	320	02
6,000	340	05
7,000	360	09
8,000	020	14
9,000	030	15
10,000	020	15
11,000	010	15
12,000	360	18
13,000	350	22
14,000	360	23
15,000	010	24
16,000	010	28
17,000	010	31
18,000	020	35
19,000	020	36
20,000	020	36

NOTES:

1. Wind data was obtained from the Yucca weather station.
2. Tropopause height was 40,000 ft MSL.
3. The surface air pressure was 12.68 psi, the temperature 11.8°C, the dew point 6.5°C, and the relative humidity 70%.

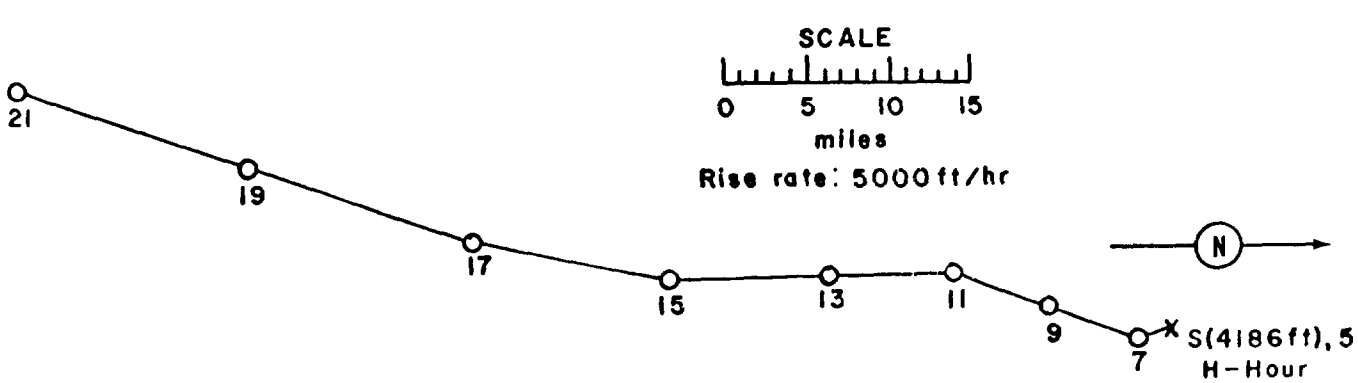


Figure 253. Hodograph for Operation HARDTACK II - Mora.

OPERATION HARDTACK II - Hidalgo Safety Experiment

	PST	GMT
DATE:	5 Oct 1958	5 Oct 1958
TIME:	0610	1410

TOTAL YIELD: 77 tons

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

CRATER DATA: No crater

Sponsor: LASL

SITE: NTS - Area 7b
37° 05' 12" N
116° 01' 25" W
Site elevation: 4,186 ft

HEIGHT OF BURST: 377 ft

TYPE OF BURST AND PLACEMENT:
Air burst from balloon over Nevada soil

CLOUD TOP HEIGHT: 12,000 ft MSL
CLOUD BOTTOM HEIGHT: 8,000 ft MSL

REMARKS:

The on-site fallout documentation was performed by the Radiological Safety Division of the Reynolds Electrical and Engineering Company for purposes of personnel safety. Readings were taken with AN/PDR-39 or Tracerlab SU-10 instruments at H+3 hours, H+8 hours, D+1 day, D+2 days and D+3 days along eight radial roads. The sodium-24 decay rate was used to extrapolate the dose-rate readings to H+1 hour. This decay rate is not strictly applicable although it closely approximates the observed decay.

The initial off-site survey did not reveal any activity above background. Approximately 24 hours after shot time, readings in the Hiko-Alamo-Caliente area indicated activity 2 to 4 times background levels.

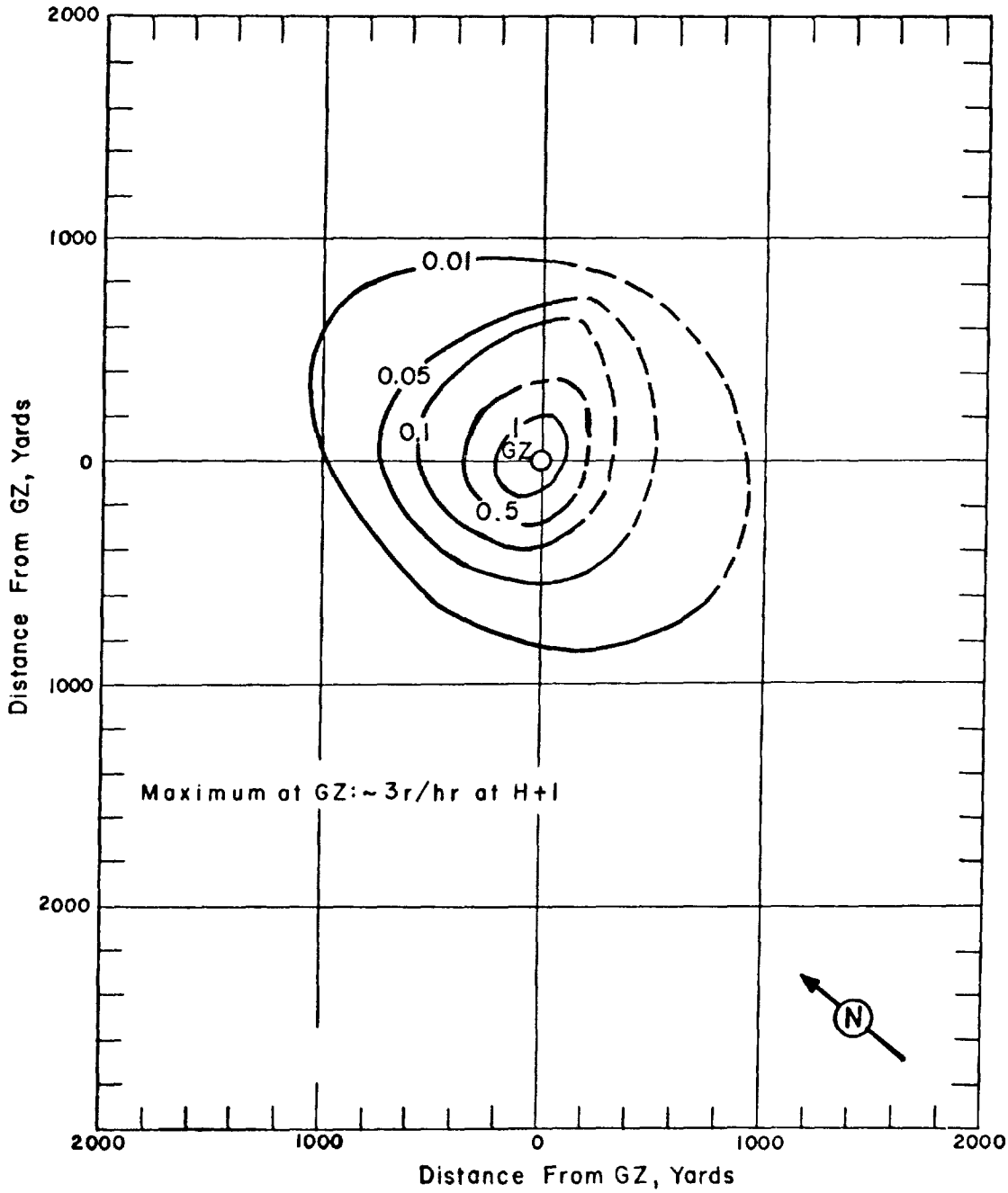


Figure 254. Operation HARDTACK II - Hidalgo.
On-site dose rate contours in r/hr at H+1 hour.

TABLE 80 NEVADA WIND DATA FOR OPERATION HARDTACK II - HIDALGO

Altitude (MSL)	H-hour		H+2 hours	
	Dir	Speed	Dir	Speed
feet	degrees	mph	degrees	mph
Surface	040	01	110	02
5,000	300	06	200	06
6,000	240	12	220	13
7,000	230	15	230	16
8,000	260	07	250	15
9,000	270	05	---	--
10,000	220	06	---	--
11,000	200	06	---	--
12,000	160	07	---	--

NOTE: Wind data was obtained from the Yucca weather station.

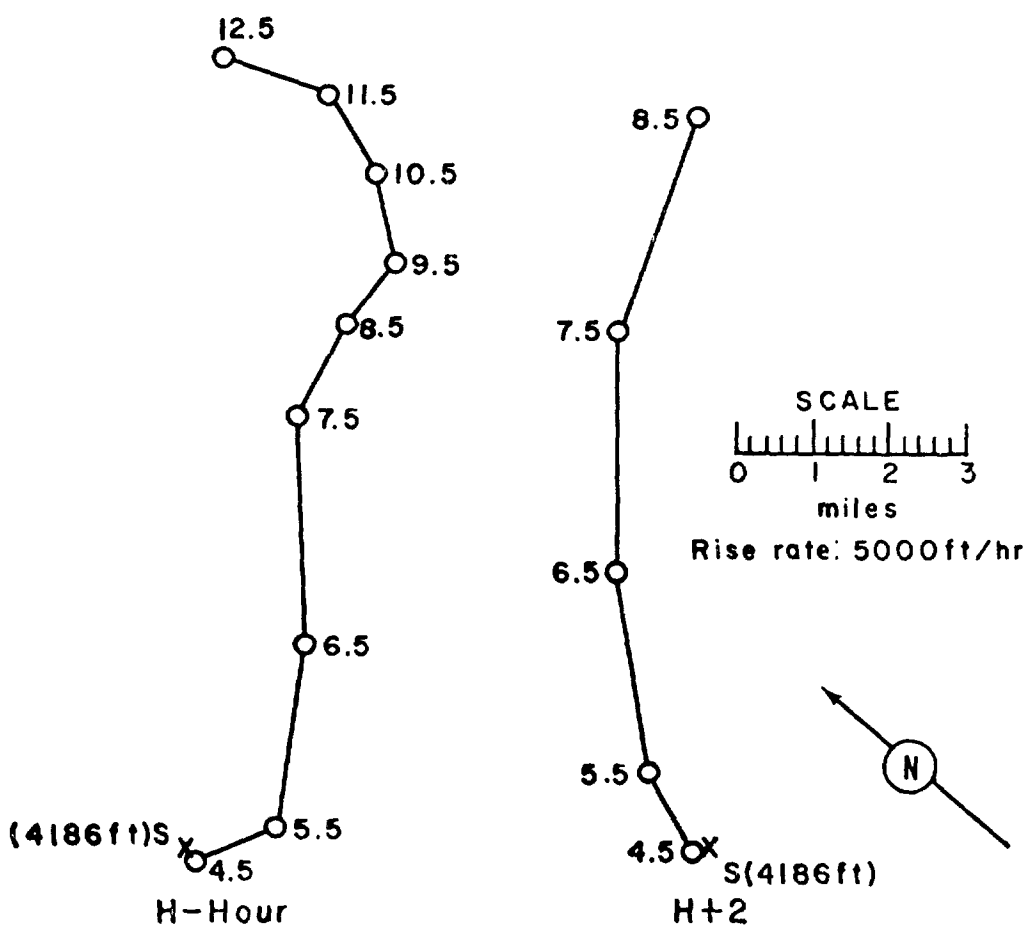


Figure 255. Hodographs for Operation HARDTACK II - Hidalgo.

OPERATION HARDTACK II - Colfax Safety Experiment

	PST	GMT
DATE:	5 Oct 1958	5 Oct 1958
TIME:	0815	1615

TOTAL YIELD: 5.5 tons

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

CLOUD TOP HEIGHT: 5,500 ft MSL
CLOUD BOTTOM HEIGHT: 4,500 ft MSL

Sponsor: LASL

SITE: NTS - Area 3k
37° 02' 56" N
116° 02' 03" W
Site elevation: 4,033 ft

HEIGHT OF BURST: -350 ft

TYPE OF BURST AND PLACEMENT:
Subsurface burst - Well in Nevada soil

CRATER DATA: Not available

REMARKS:

The on-site fallout documentation was performed by the Radiological Safety Division of the Reynolds Electrical and Engineering Company for purposes of personnel safety. Readings were taken with AN/PDR-39 or Tracerlab SU-10 instruments at H+$\frac{1}{2}$ hour, H+6 hours, D+1 day and D+2 days. The $t^{-1.2}$ decay approximation was used to extrapolate the dose-rate readings to H+1 hour. There was insufficient monitoring information from which to draw a complete pattern.

No off-site fallout.

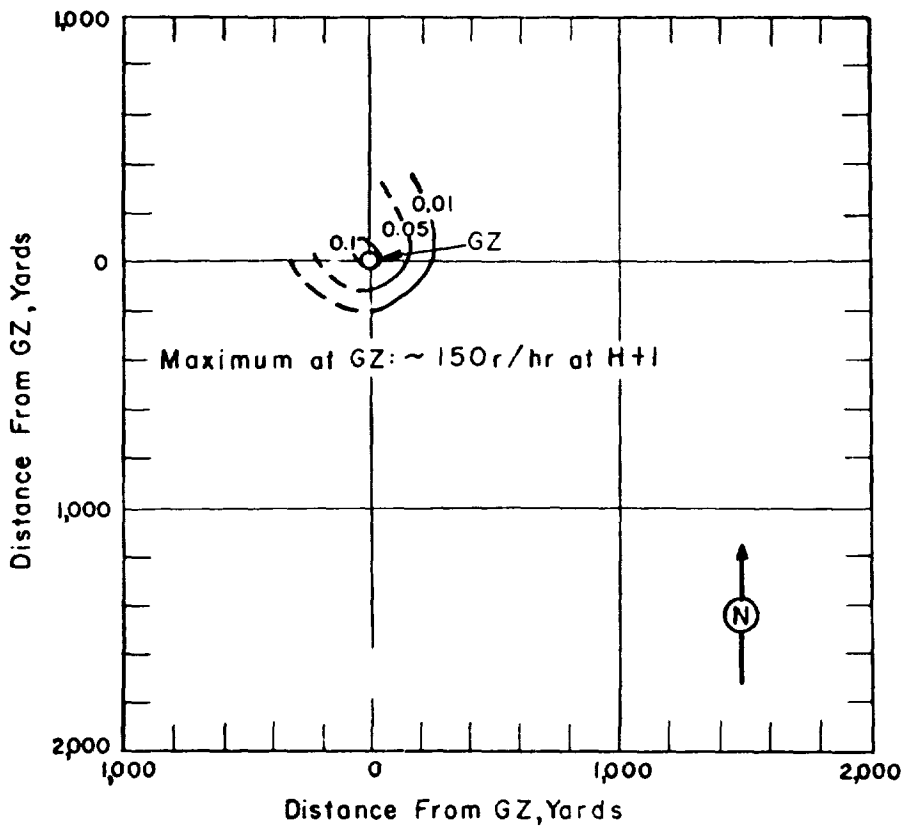


Figure 256. Operation HARDTACK II - Colfax.
On-site dose rate contours in r/hr at H+1 hour.

TABLE 81 NEVADA WIND DATA FOR OPERATION HARDTACK II- COLFAX

Altitude (MSL)	H-hour Dir	H-hour Speed
feet	degrees	mph
Surface	110	02
5,000	200	06
6,000	220	13
7,000	230	16
8,000	250	15

NOTE: Wind data was obtained from the Yucca weather station.

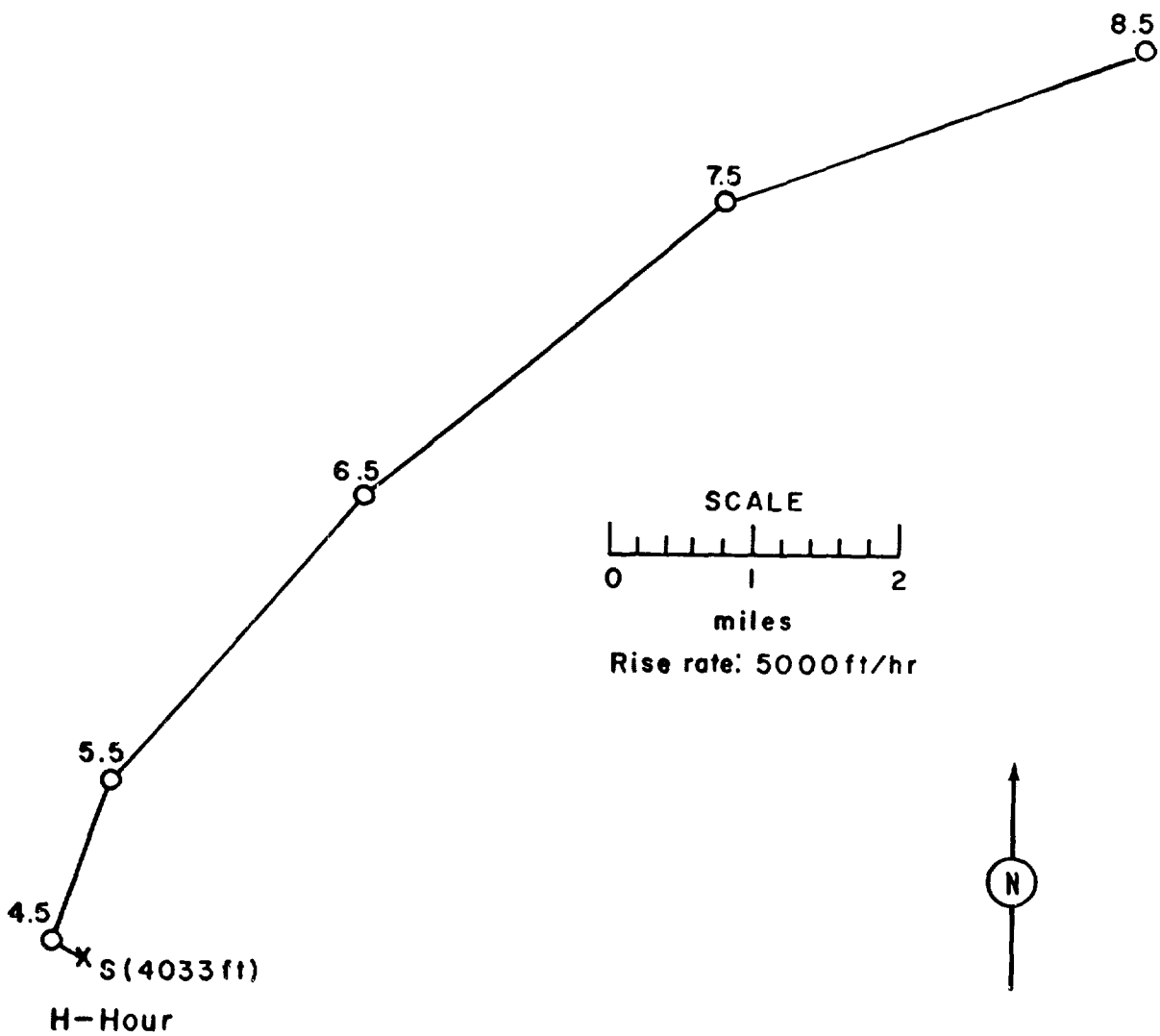


Figure 257. Hodograph for Operation HARDTACK II - Colfax.

OPERATION HARDTACK II - Tamalpais

	PST	GMT
DATE:	8 Oct 1958	8 Oct 1958
TIME:	1400	2200

TOTAL YIELD: 72 tons

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

CRATER DATA: Not available

Sponsor: UCRL

SITE: NTS - Area 12b.02
37° 11' 43" N
116° 12' 01" W
Site elevation: 6,650 ft

HEIGHT OF BURST: Vertical depth 407 ft. Slant distance to nearest surface 330 ft

HEIGHT OF BURST AND PLACEMENT: Subsurface burst - Tunnel in Nevada soil

CLOUD TOP HEIGHT: NM
CLOUD BOTTOM HEIGHT: NM

REMARKS:

The on-site fallout documentation was performed by the Radiological Safety Division of the Reynolds Electrical and Engineering Company for purposes of personnel safety. Readings were taken with AN/PDR-39 or Tracerlab SU-10 instruments at H+1 hour. No extrapolation for decay was necessary. There was only a minor amount of venting through the tunnel mouth. A channeling effect due to the canyon transported the debris toward the southeast. The pattern presented is very uncertain.

No activity above background was detected off-site.

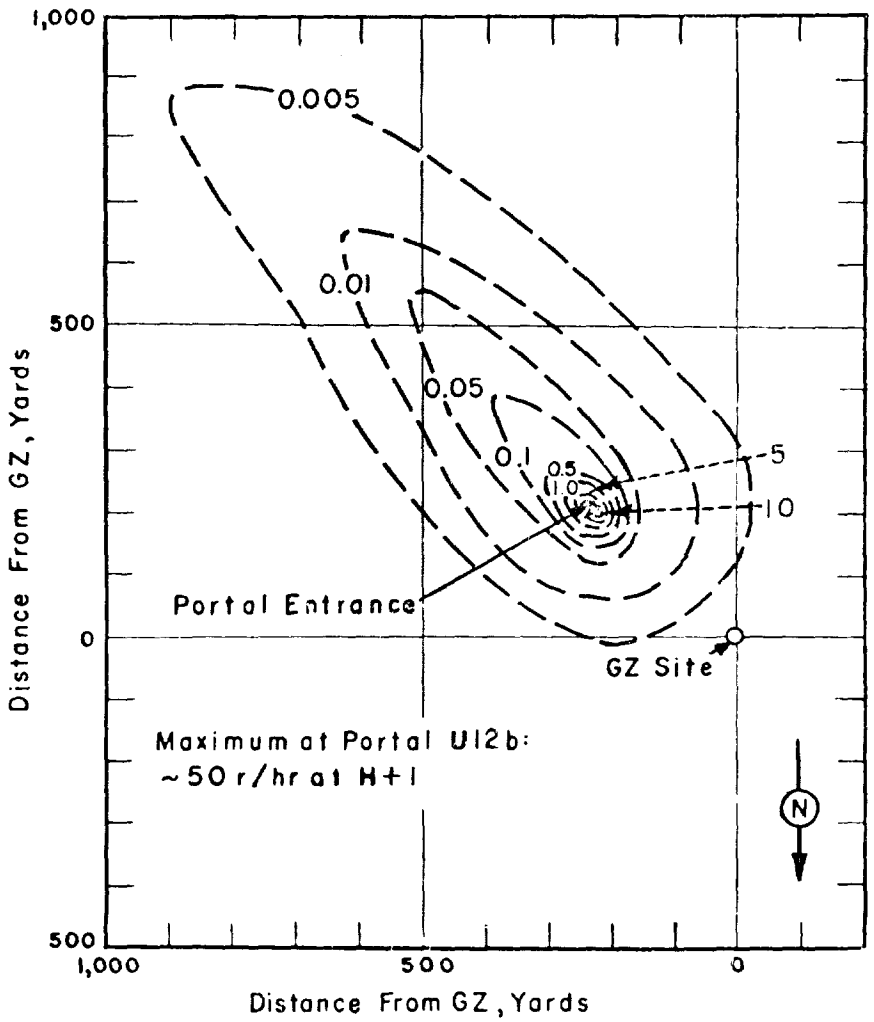


Figure 258. Operation HARDTACK II - Tamalpais.
On-site dose rate contours in r/hr at H+1 hour.

TABLE 82 NEVADA WIND DATA FOR OPERATION HARDTACK II- TAMALPAIS

TIME	SURFACE WINDS			
	9 foot Mesa Slope Tower (Elev. 6,725 ft MSL)		100 foot Mesa Mountain Tower (Elev. 7,465 ft MSL)	
	Dir	Speed	Dir	Speed
	degrees	mph	degrees	mph
H-hour	360	9	270	17
H+1 hour	360	9	280	17
H+2 hours	360	6	270	18

OPERATION HARDTACK II - Quay

	PST	GMT
DATE:	10 Oct 1958	10 Oct 1958
TIME:	0630	1430

TOTAL YIELD: 79 tons

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

CRATER DATA: No crater

Sponsor: LASL

SITE: NTS - Area 7c
37° 05' 41" N
116° 01' 25" W
Site elevation: 4,249 ft

HEIGHT OF BURST: 100 ft

TYPE OF BURST AND PLACEMENT:
Tower burst over Nevada soil

CLOUD TOP HEIGHT: 10,000 ft MSL
CLOUD BOTTOM HEIGHT: 7,500 ft MSL

REMARKS:

The on-site fallout documentation was performed by the Radiological Safety Division of the Reynolds Electrical and Engineering Company for purposes of personnel safety. Readings were taken with AN/PDR-39 or Tracerlab SU-10 instruments at H+1 hour, H+6 hours, D+1 day and D+2 days along eight radial roads. The $t^{-1.2}$ decay approximation was used to extrapolate the dose-rate readings to H+1 hour. The fallout was well documented and the pattern is considered fairly reliable.

The off-site fallout documentation was performed with Beckman MX-5 and AN/PDR-39 instruments by the U. S. Public Health Service for purposes of public safety. Readings were taken at about 10-mile intervals except in populated places or when the dose rate varied considerably with distance. The $t^{-1.2}$ decay approximation was used to extrapolate the dose-rate readings to H+1 hour. Since this event was well documented, the pattern is considered to be reliable.

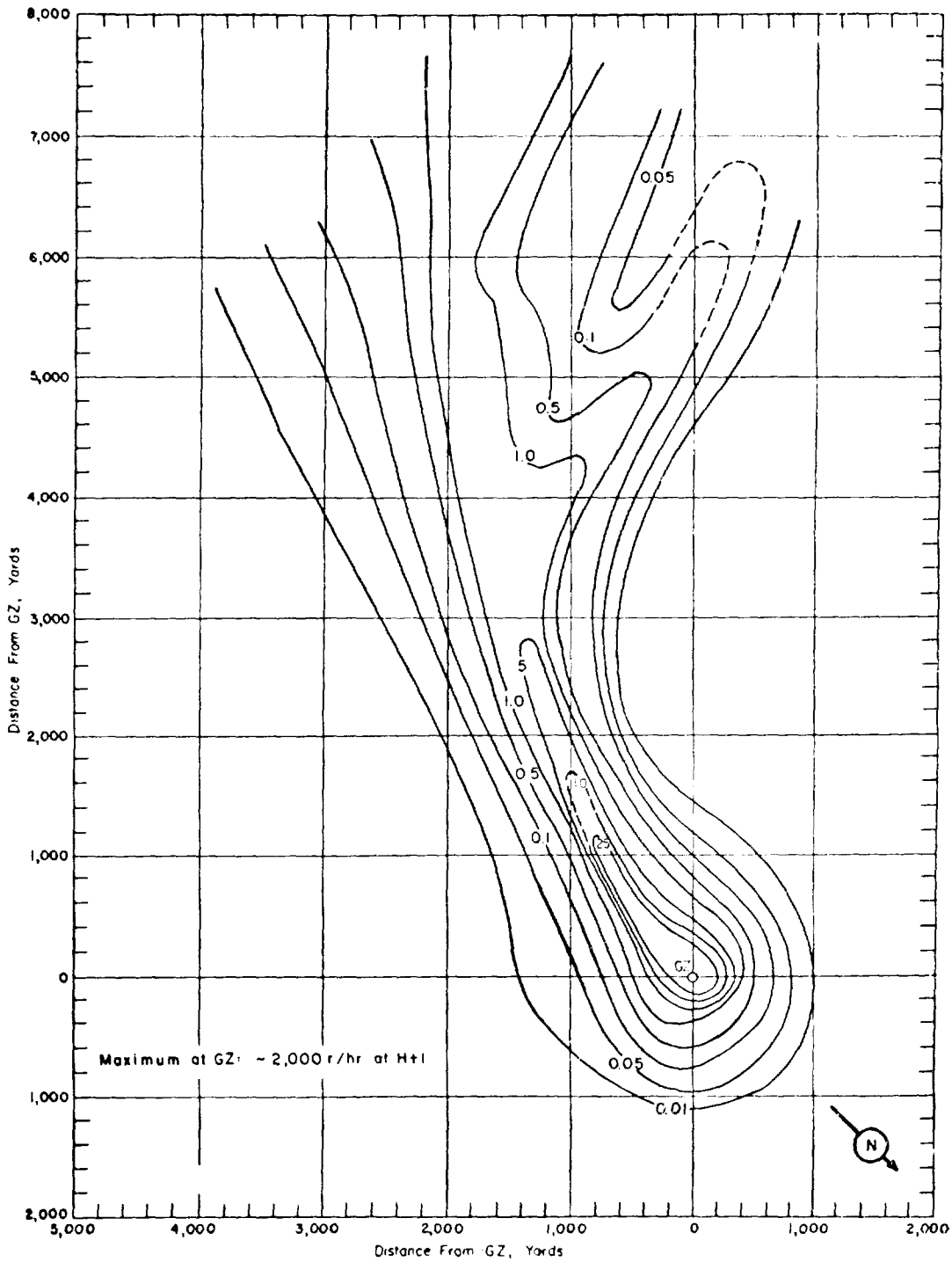


Figure 259. Operation HARDTACK II - Quay.
On-site dose rate contours in r/hr at H+1 hour.

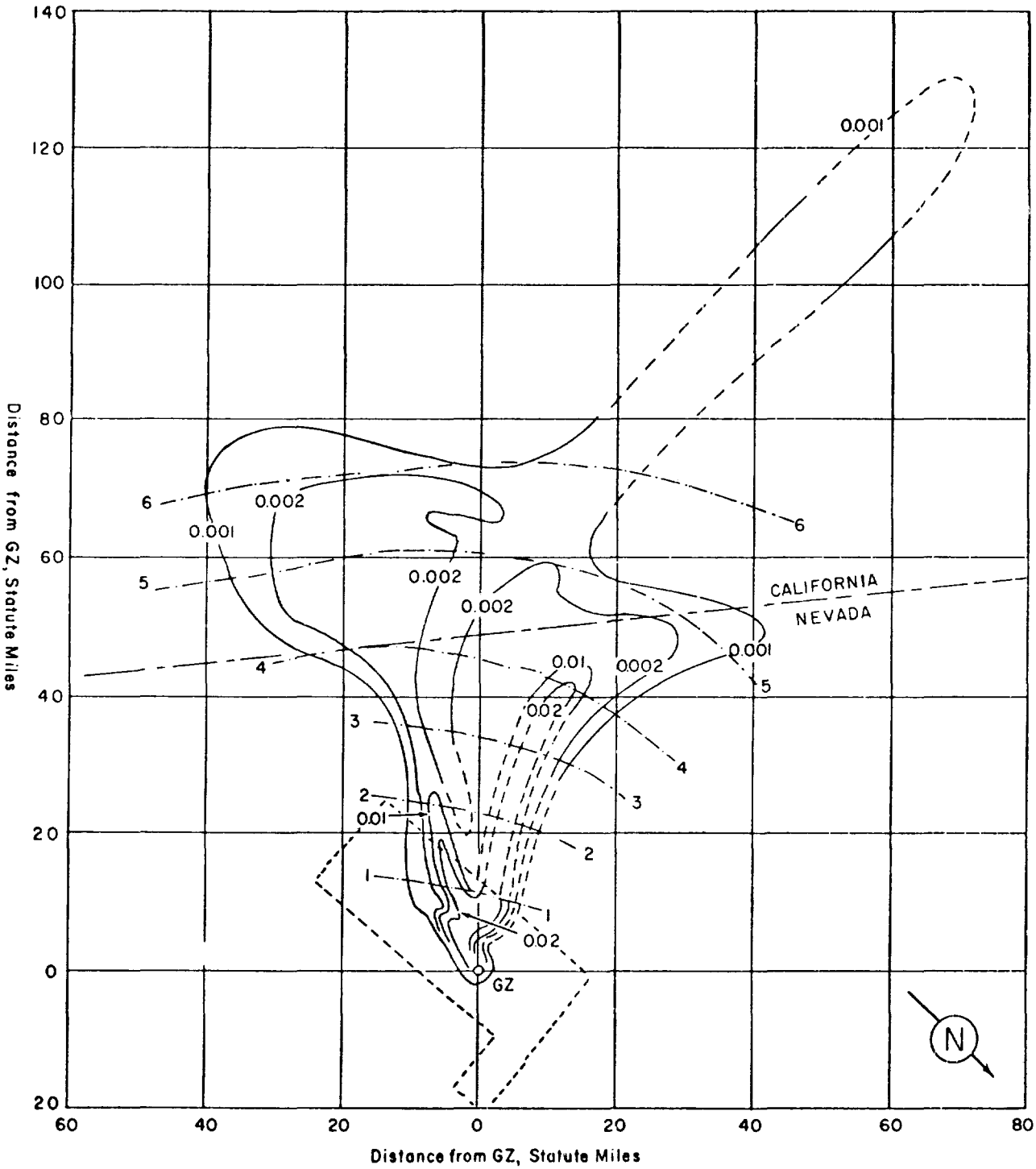


Figure 260. Operation HARDTACK II - Quay.
Off-site dose rate contours in r/hr at H+1 hour.

TABLE 83 NEVADA WIND DATA FOR OPERATION HARDTACK II - QUAY

Altitude (MSL)	H-hour Dir	H-hour Speed
feet	degrees	mph
Surface	300	08
5,000	020	18
6,000	030	22
7,000	040	22
8,000	070	14
9,000	090	09
10,000	060	15
11,000	020	13
12,000	020	05

NOTES:

1. Wind data was obtained from the Yucca weather station.
2. The surface air pressure was 12.70 psi, the temperature 15.3°C, the dew point 2.7°C, and the relative humidity 29%.

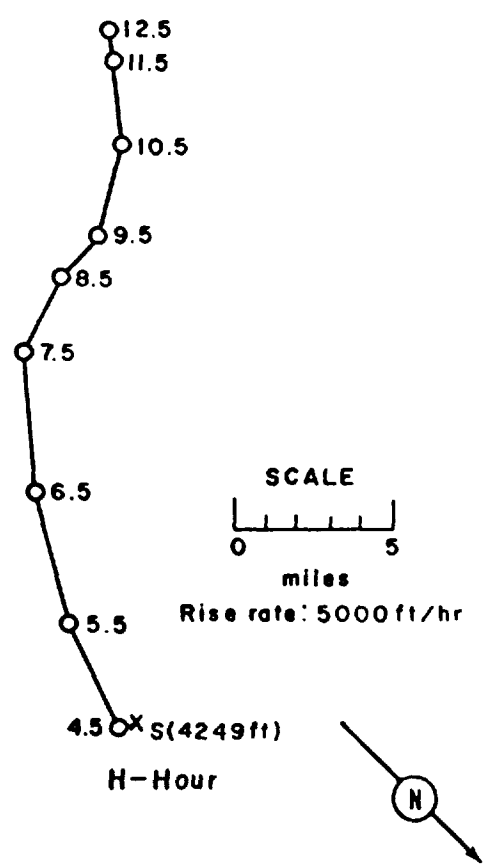


Figure 261. Hodograph for Operation HARDTACK II - Quay.

OPERATION HARDTACK II - Lea

	PST	GMT
DATE:	13 Oct 1958	13 Oct 1958
TIME:	0520	1320

TOTAL YIELD:

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

CRATER DATA: No crater

Sponsor: LASL

SITE: NTS - Area 7b
37° 05' 12" N
116° 01' 25" W
Site elevation: 4,186 ft

HEIGHT OF BURST: 1,500 ft

TYPE OF BURST AND PLACEMENT:
Airburst from balloon over Nevada soil

CLOUD TOP HEIGHT: 17,000 ft MSL
CLOUD BOTTOM HEIGHT: 12,000 ft MSL

REMARKS:

The on-site fallout documentation was performed by the Radiological Safety Division of the Reynolds Electrical and Engineering Company for purposes of personnel safety. Readings were taken with AN/PDR-39 or Tracerlab SU-10 instruments at H+$\frac{1}{2}$ hour, H+6 hours, D+1 day and D+2 days along eight radial roads. The sodium-24 decay rate was used to extrapolate the dose-rate readings to H+1 hour. This decay rate is not strictly applicable although it closely approximates the observed decay.

The off-site fallout documentation was performed with Beckman MX-5 and AN/PDR-39 instruments by the U. S. Public Health Service for purposes of public safety. Readings were taken at about 10-mile intervals except in populated places or when the dose rate varied considerably with distance. The $t^{-1.2}$ decay approximation was used to extrapolate the dose-rate readings to H+1 hour. The pattern is not reliable.

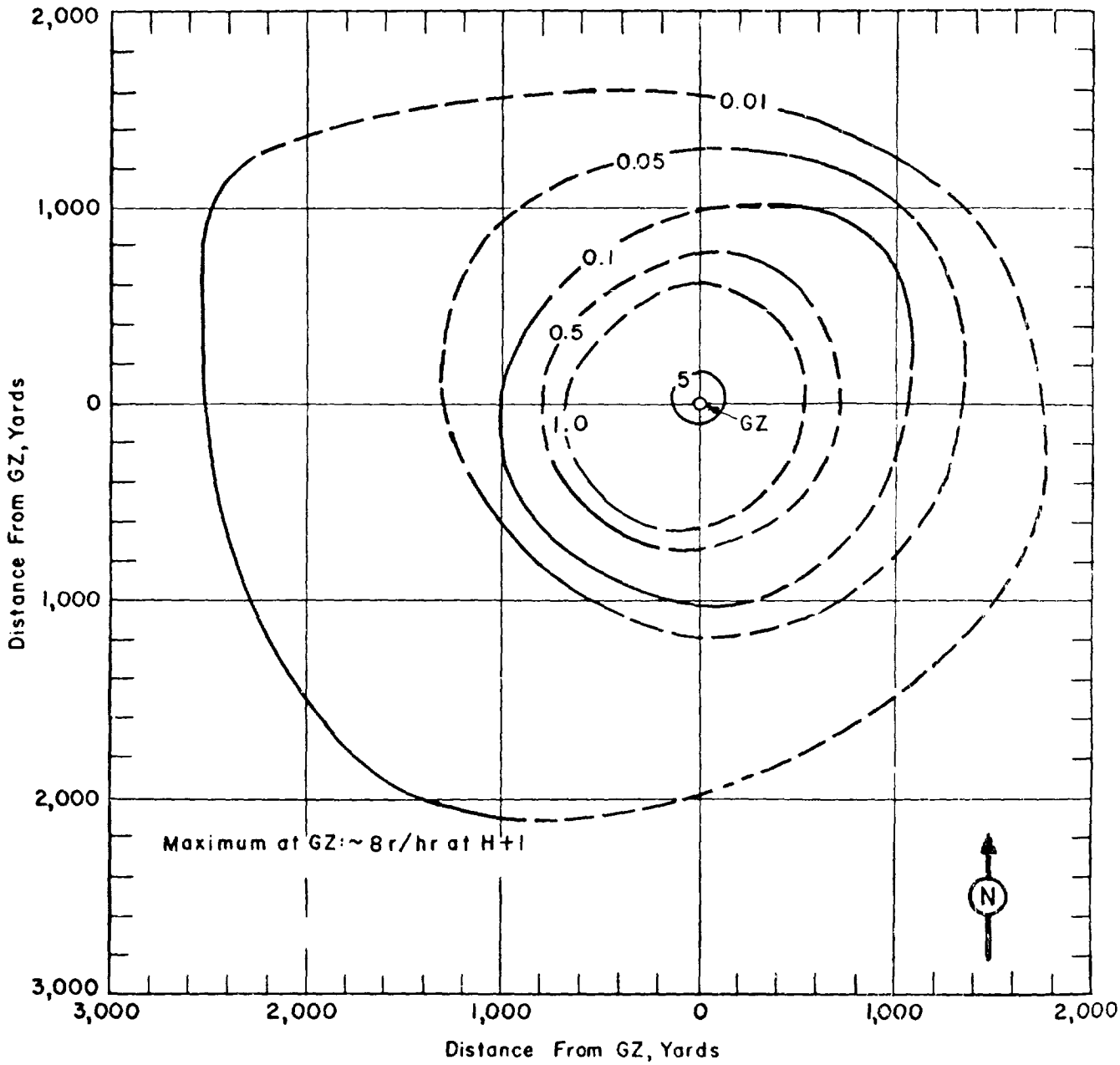


Figure 262. Operation HARDTACK II - Lea.
On-site dose rate contours in r/hr at H+1 hour.

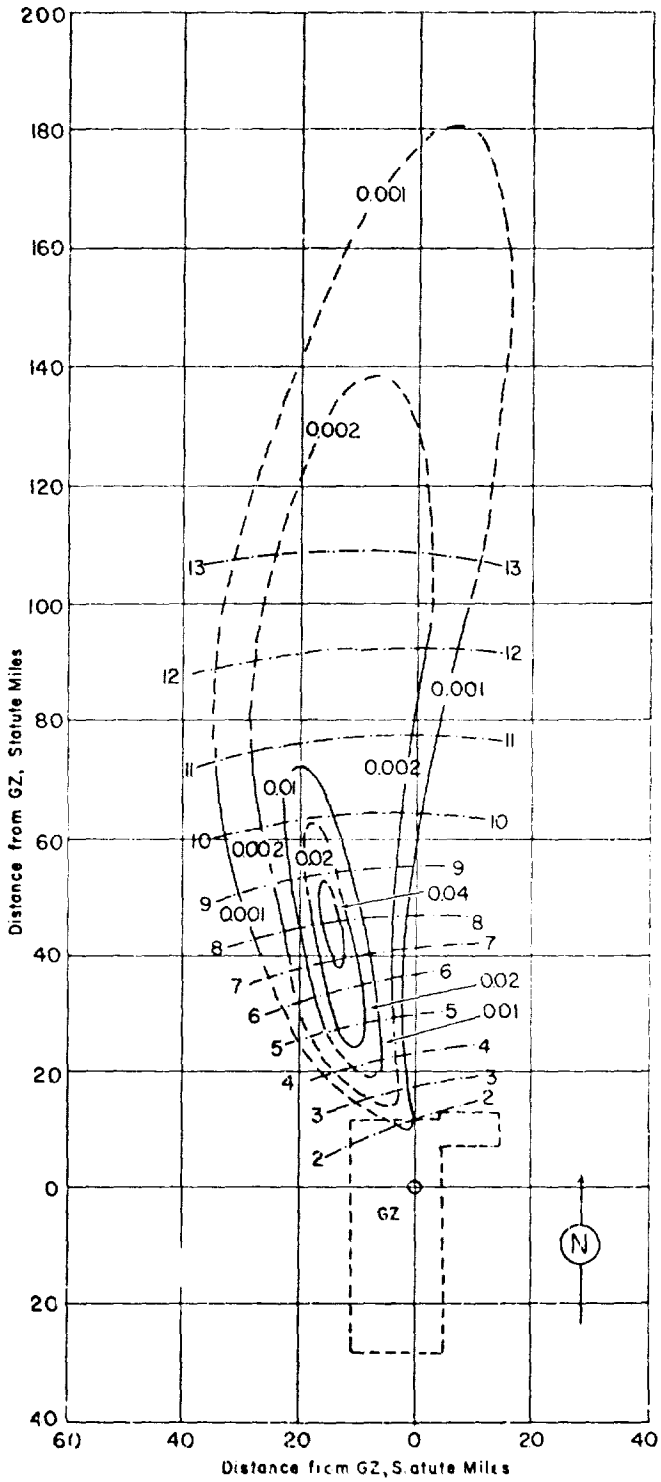


Figure 263. Operation HARDTACK II - Lea.
Off-site dose rate contours in r/hr at H+1 hour.

TABLE 84 NEVADA WIND DATA FOR OPERATION HARDTACK II- LEA

Altitude (MSL)	H-hour Dir	H-hour Speed
feet	degrees	mph
Surface	200	01
5,000	330	03
6,000	170	03
7,000	180	09
8,000	190	10
9,000	200	09
10,000	190	10
11,000	170	09
12,000	150	07
13,000	130	05
14,000	110	03
15,000	080	03
16,000	020	06
17,000	360	12
18,000	360	14
19,000	350	14
20,000	360	16

NOTES:

1. Wind data was obtained from the Yucca weather station.
2. The surface air pressure was 12.73 psi, the temperature 13.4°C, the dew point 4.3°C, and the relative humidity 29%.

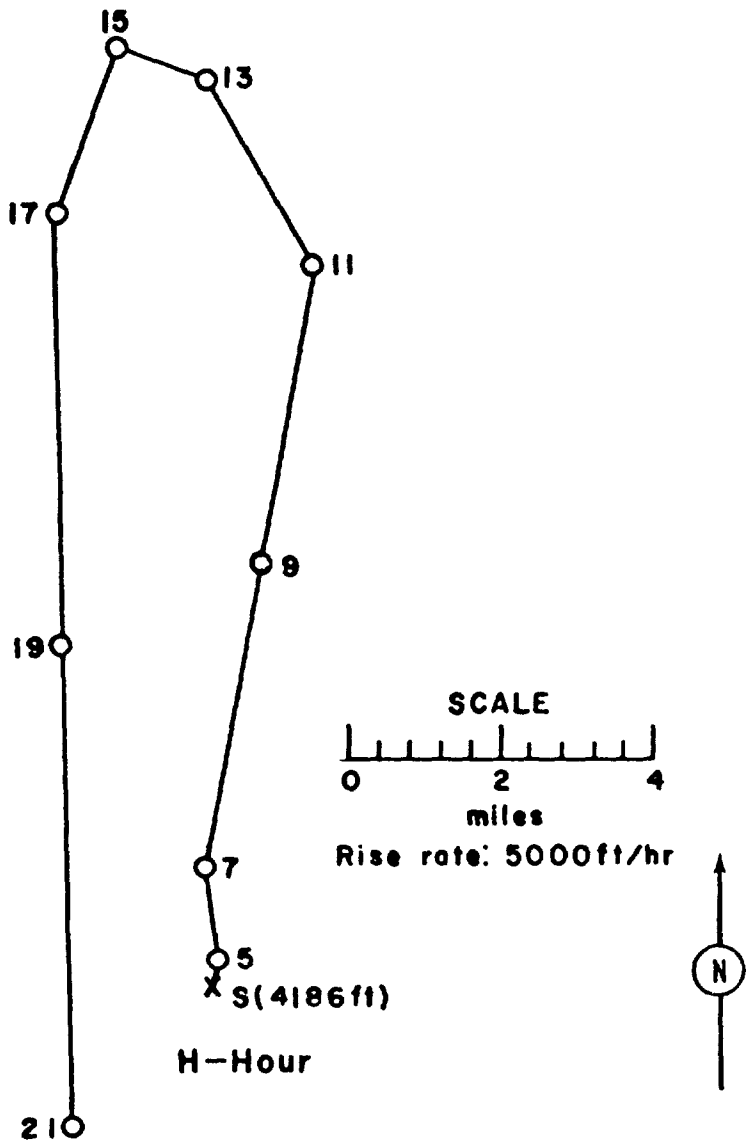


Figure 264. Hodograph for Operation HARDTACK II - Lea.

OPERATION HARDTACK II - Neptune Safety Experiment

	PST	GMT
DATE:	14 Oct 1958	14 Oct 1958
TIME:	1000	1800

TOTAL YIELD: 115 tons

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

CRATER DATA:
Mean Diameter: 200 ft
Maximum Depth: 35 ft
Crater located on a 30° slope

Sponsor: UCRL

SITE: NTS - Area 12c.03
37° 11' 38" N
116° 11' 59" W
Site elevation: 6,800 ft

HEIGHT OF BURST: -98.5 ft
below a 30° slope. Vertical
distance to the surface 110 ft

TYPE OF BURST AND PLACEMENT:
Subsurface burst - Tunnel in
Nevada soil (bedded tuff)

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

REMARKS:

The on-site fallout documentation was performed by the Radiological Safety Division of the Reynolds Electrical and Engineering Company for purposes of personnel safety. Readings were taken with AN/PDR-39 or Tracerlab SU-10 instruments. The $t^{-1.2}$ decay approximation was used to extrapolate the dose-rate readings to H+1 hour. The Neptune explosion vented through the mesa slope at an elevation of about 6,800 feet. The pattern is considered fairly reliable.

No activity above background levels was reported off site.

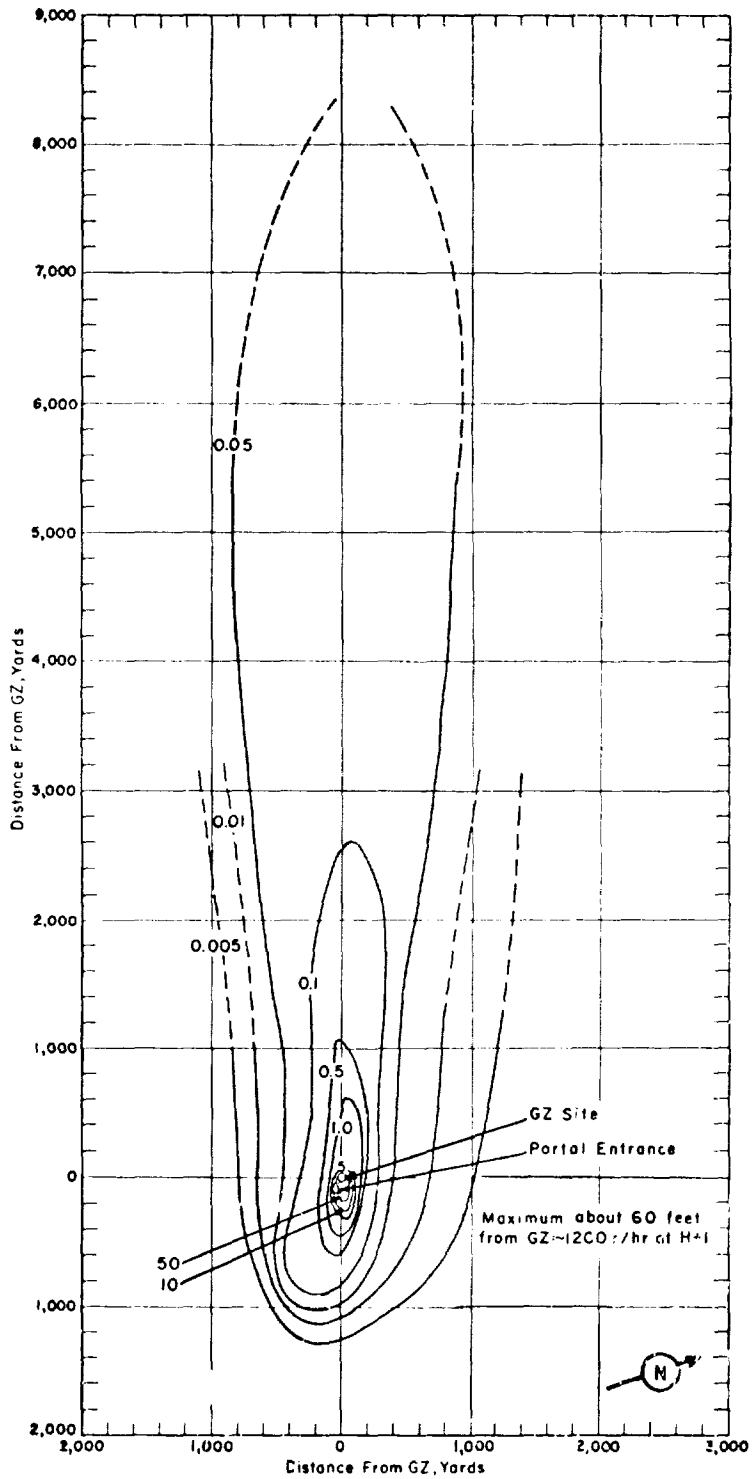


Figure 265. Operation HARDTACK II - Neptune.
On-site dose rate contours in r/hr at H+1 hour.

TABLE 85 NEVADA WIND DATA FOR OPERATION HARDTACK II- NEPTUNE

Altitude (MSL)	H-hour	
	Dir	Speed
feet	degrees	mph
Surface	060	02
5,000	080	03
6,000	110	07
7,000	150	09
8,000	160	08
9,000	150	08
10,000	130	12
11,000	140	13
12,000	150	13

NOTE: Wind data was obtained from the Yucca weather station.

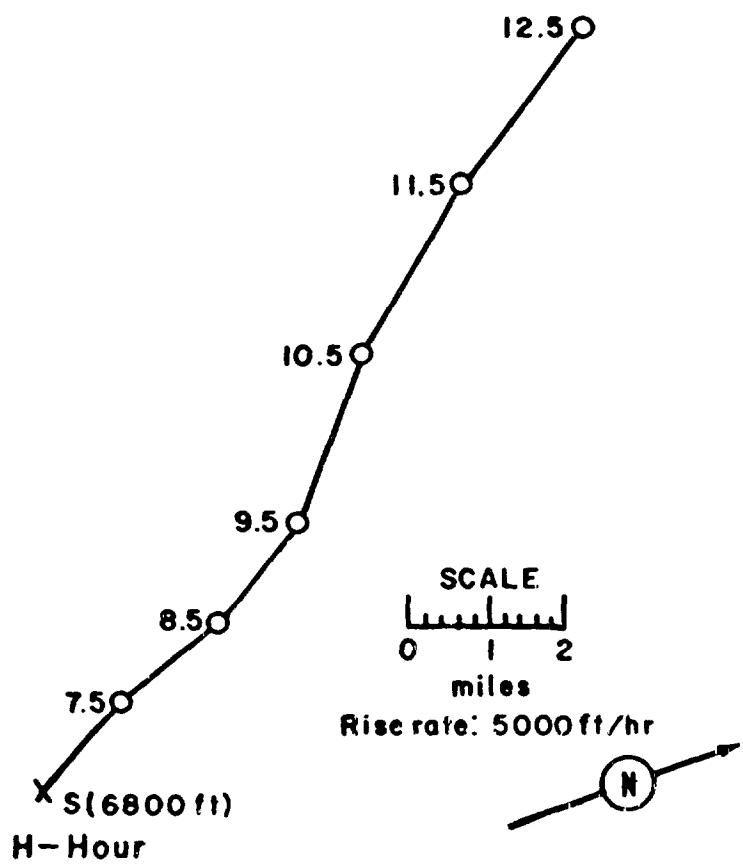


Figure 266. Hodograph for Operation HARDTACK II - Neptune.

OPERATION HARDTACK II - Hamilton

	PST	GMT
DATE:	15 Oct 1958	15 Oct 1958
TIME:	0800	1600

TOTAL YIELD: 1.2 tons

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

CRATER DATA: No crater

Sponsor: UCRL - DOD

SITE: NTS - Area F1
36° 48' 08" N
115° 55' 56" W
Site elevation: 3,080 ft

HEIGHT OF BURST: 50 ft

TYPE OF BURST AND PLACEMENT:
Tower burst over Nevada soil

CLOUD TOP HEIGHT: 6,000 ft MSL
CLOUD BOTTOM HEIGHT: 4,500 ft MSL

REMARKS:

The close-in fallout documentation was performed by the First Radiological Safety Support Unit. Measurements were made with AN/PDR-39 instruments along 12 equally spaced radial lines with GZ at the center. Survey points were determined by stakes placed at 100 yd intervals on each line out to 800 yd. The experimental field gamma-decay curves were utilized to construct the H+1-hour dose-rate contours. The field gamma dose-rate decay curves indicated the presence of significant fission-product contamination. The gamma dose-rate at H+1 hour from the neutron - induced activity was estimated to be from 20% to 30% of the total dose rate. The pattern presented is reliable. The downward extent of the .01 r/hr contour shown in figure 445 is uncertain but the rest of the pattern is considered to be reliable.

The off-site fallout documentation was performed with Beckman MX-5 and AN/PDR-39 instruments by the U. S. Public Health Service for purposes of public safety. "The pattern was relatively well documented and is consistent with the wind analysis" (Reference 138). The $t^{-1.2}$ decay approximation was used to extrapolate the dose-rate readings to H+1 hour.

The alpha contamination pattern was obtained from survey readings taken with Eberline 3G instruments.

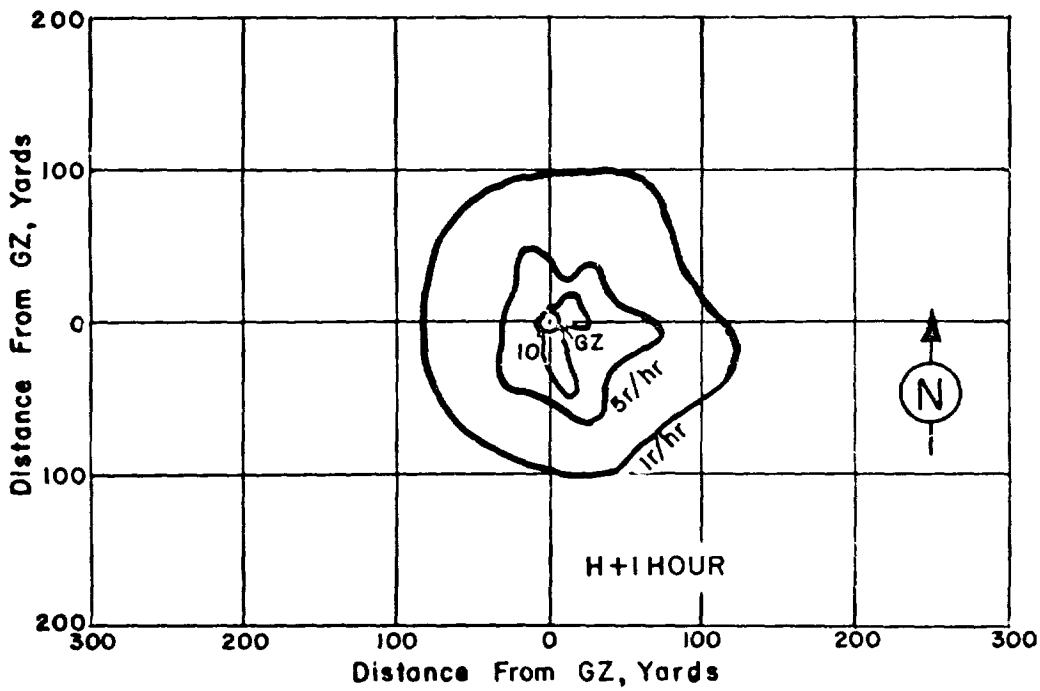


Figure 267. Operation HARDTACK II - Hamilton.
On-site dose rate contours in r/hr at H+1 hour.

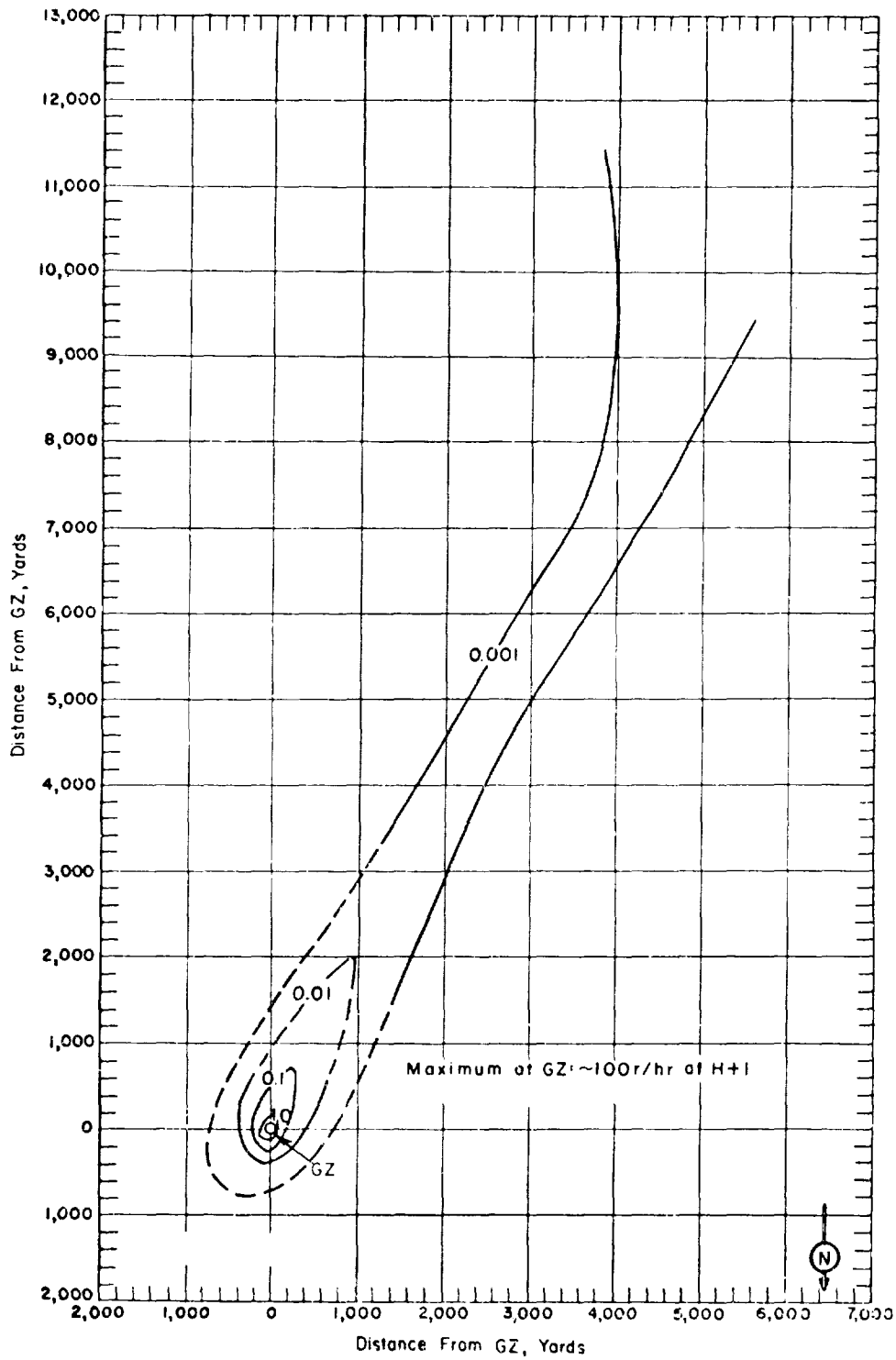


Figure 268 . Operation HARDTACK II - Hamilton.
On-site dose rate contours in r/hr at H+1 hour.

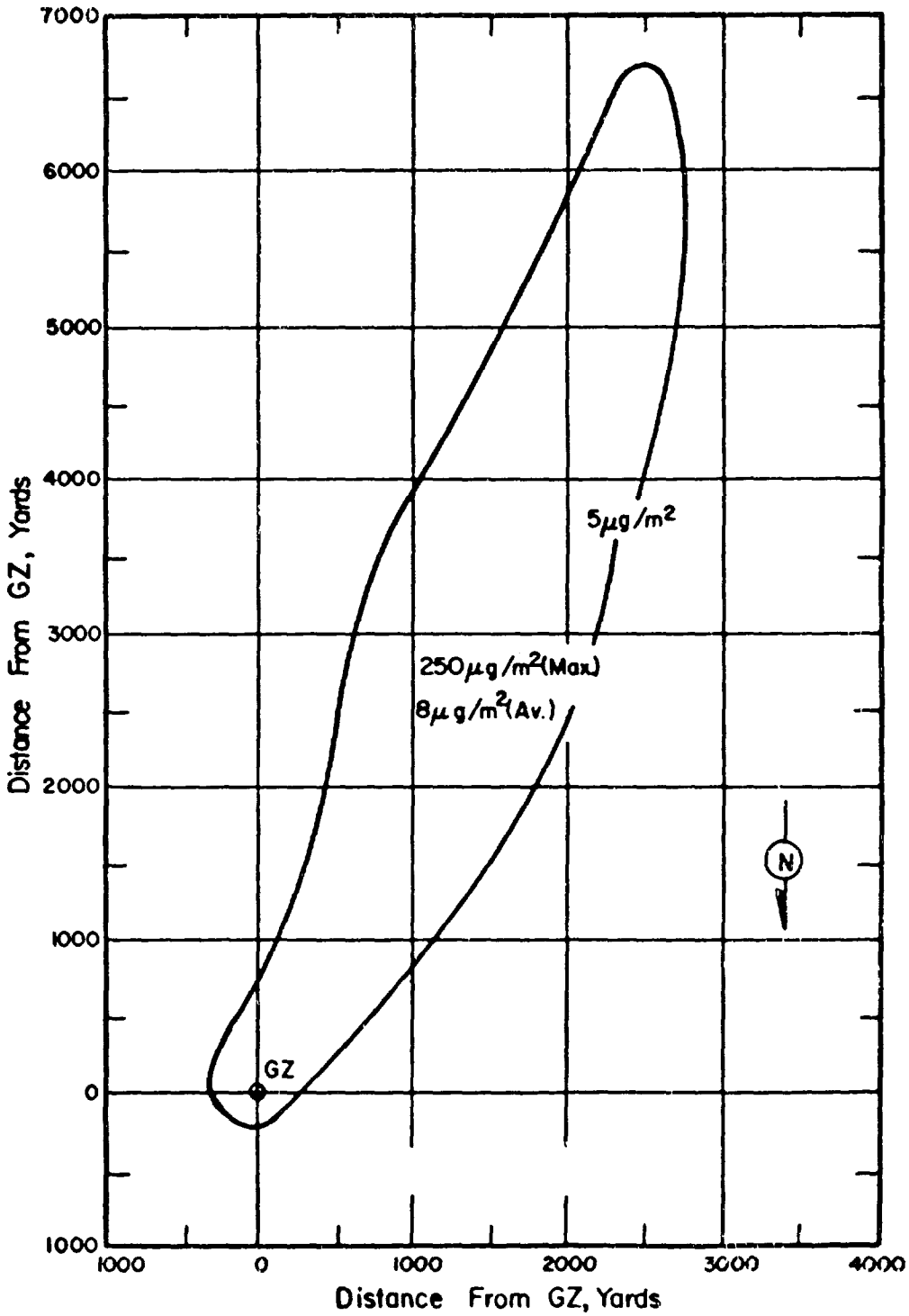


Figure 269. Operation HARDTACK II - Hamilton.
Alpha contamination in micrograms per square meter.

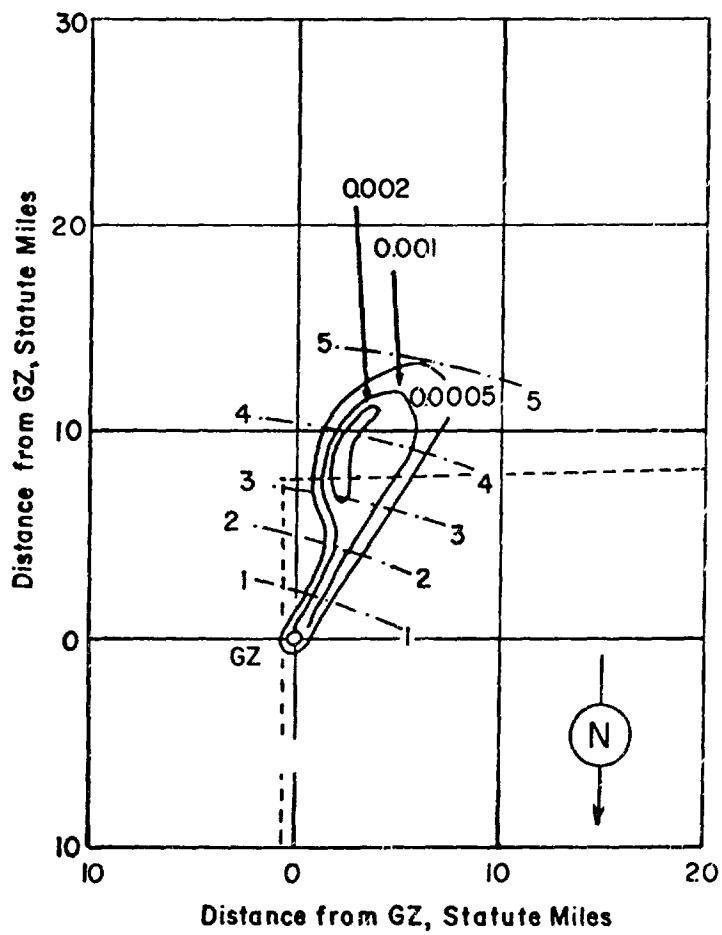


Figure 270. Operation HARDTACK II - Hamilton.
Off-site dose rate contours in r/hr at H+1 hour.

TABLE 86 NEVADA WIND DATA FOR OPERATION HARDTACK II - HAMILTON

Altitude (MSL)	H-hour		H+2 hours		H+5 hours	
	Dir	Speed	Dir	Speed	Dir	Speed
feet	degrees	mph	degrees	mph	degrees	mph
Surface	Calm	Calm	Calm	Calm	010	03
4,000	360	01	360	02	150	05
5,000	020	02	030	03	050	04
6,000	100	03	060	04	110	03
7,000	160	06	---	--	---	--
8,000	180	08	---	--	---	--

NOTE: Wind data was obtained from the Yucca weather station and may not be representative of the winds at Frenchman's Flat.

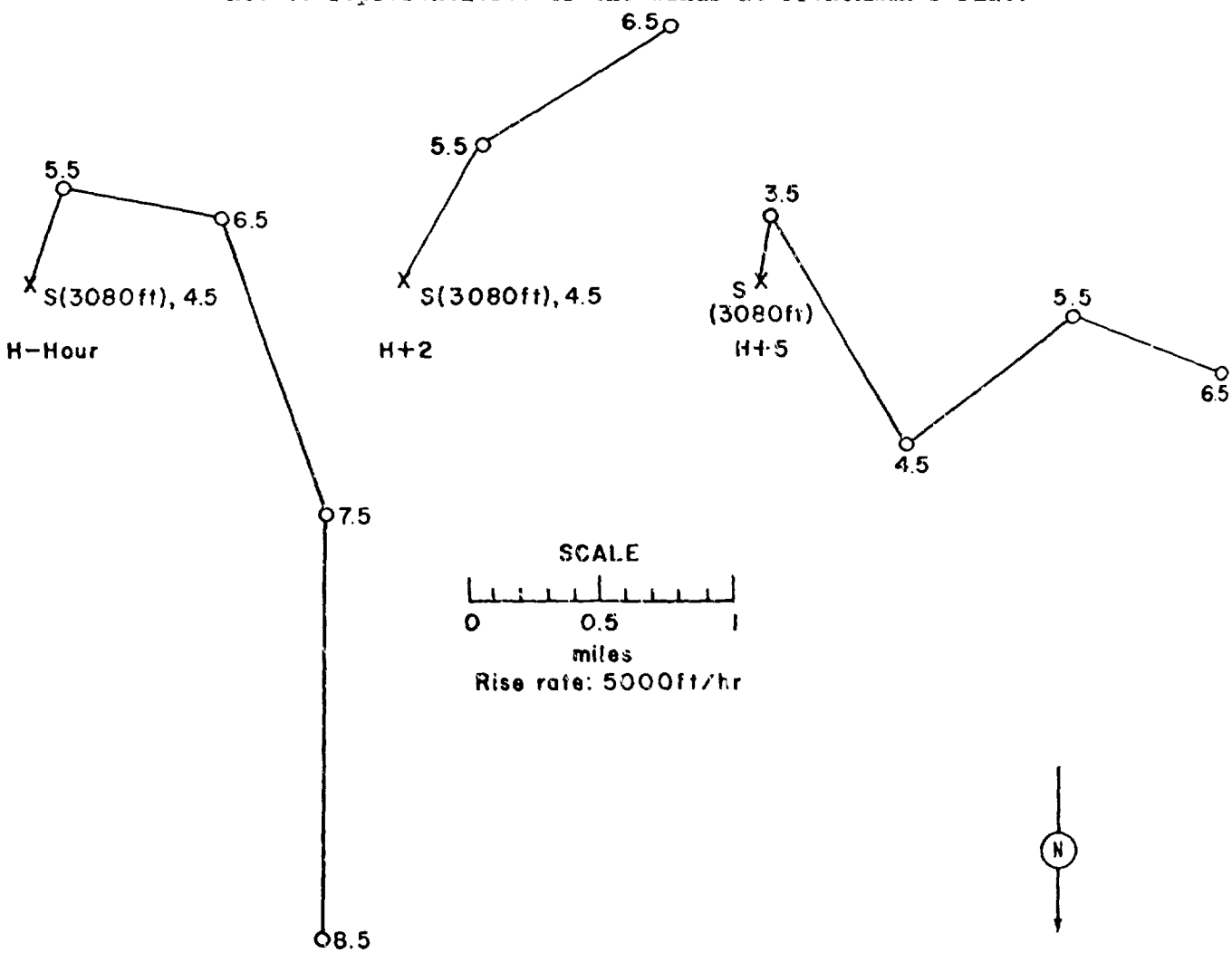


Figure 271. Hodographs for Operation HARDTACK II - Hamilton.

OPERATION HARDTACK II - Logan

	PST	GMT
DATE:	15 Oct 1958	16 Oct 1958
TIME:	2200	0600

TOTAL YIELD: 5.0 kt

Sponsor: UCRL

SITE: NTS - Area 12e.02
37° 11' 03" N
116° 12' 04" W
Site elevation: 6,140 ft

HEIGHT OF BURST: -830 ft
slant distance. Vertical depth 932 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 - Tunnel in Nevada soil

CRATER DATA: Not available

REMARKS:

The Logan burst was completely contained and therefore no radiation from this explosion was released into the air.

OPERATION HARDTACK II - Dona Ana

	PST	GMT
DATE:	16 Oct 1958	16 Oct 1958
TIME:	0620	1420

TOTAL YIELD: 37 tons

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

CRATER DATA: No crater

Sponsor: LASL

SITE: NTS - Area 7b
37° 05' 12" N
116° 01' 25" W
Site elevation: 4,186 ft

HEIGHT OF BURST: 450 ft

TYPE OF BURST AND PLACEMENT:
Air burst from balloon over Nevada soil

CLOUD TOP HEIGHT: 11,000 ft MSL
CLOUD BOTTOM HEIGHT: 6,500 ft MSL

REMARKS:

The on-site fallout documentation was performed by the Radiological Safety Division of the Reynolds Electrical and Engineering Company for purposes of personnel safety. Readings were taken at H+$\frac{1}{2}$ hour, H+8 hours and D+1 day along eight radial roads. The pattern is not reliable since the downwind extent of most of the isodose lines is not known and the area to the east of ground zero was not monitored. The sodium-24 decay rate was used to extrapolate the dose-rate readings to H+1 hour. This decay rate is not strictly applicable although it approximates the observed decay.

The off-site fallout documentation was performed with Beckman MX-5 and AN/PDR-39 instruments by the U. S. Public Health Service for purposes of public safety. The pattern as drawn is not considered to be very reliable because of the uncertainties in dealing with activity only two or three times the background value. The $t^{-1.2}$ decay approximation was used to extrapolate the dose-rate readings to H+1 hour.

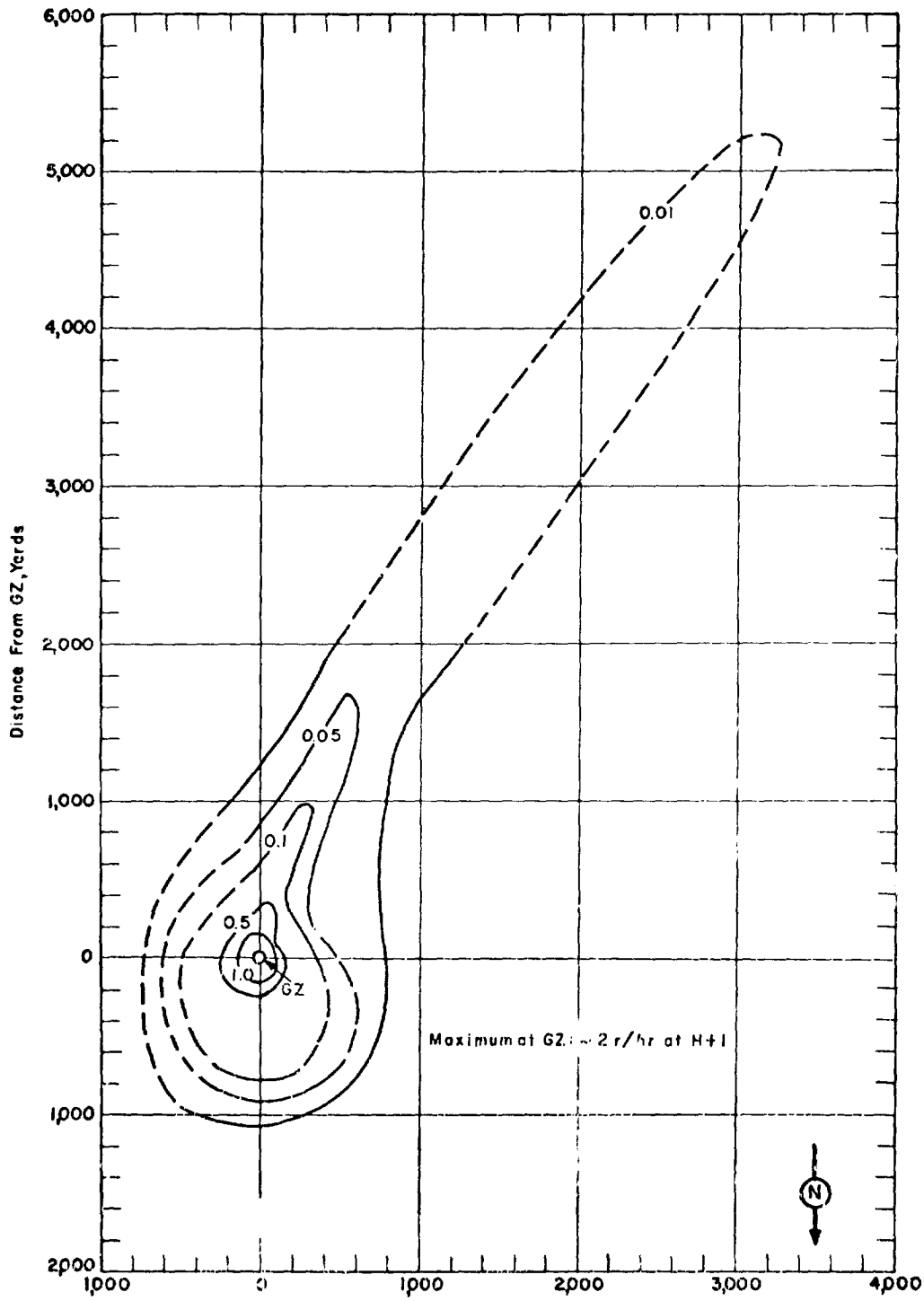


Figure 272. Operation HARDTACK II - Dona Ana.
On-site dose rate contours in r/hr at H+1 hour.

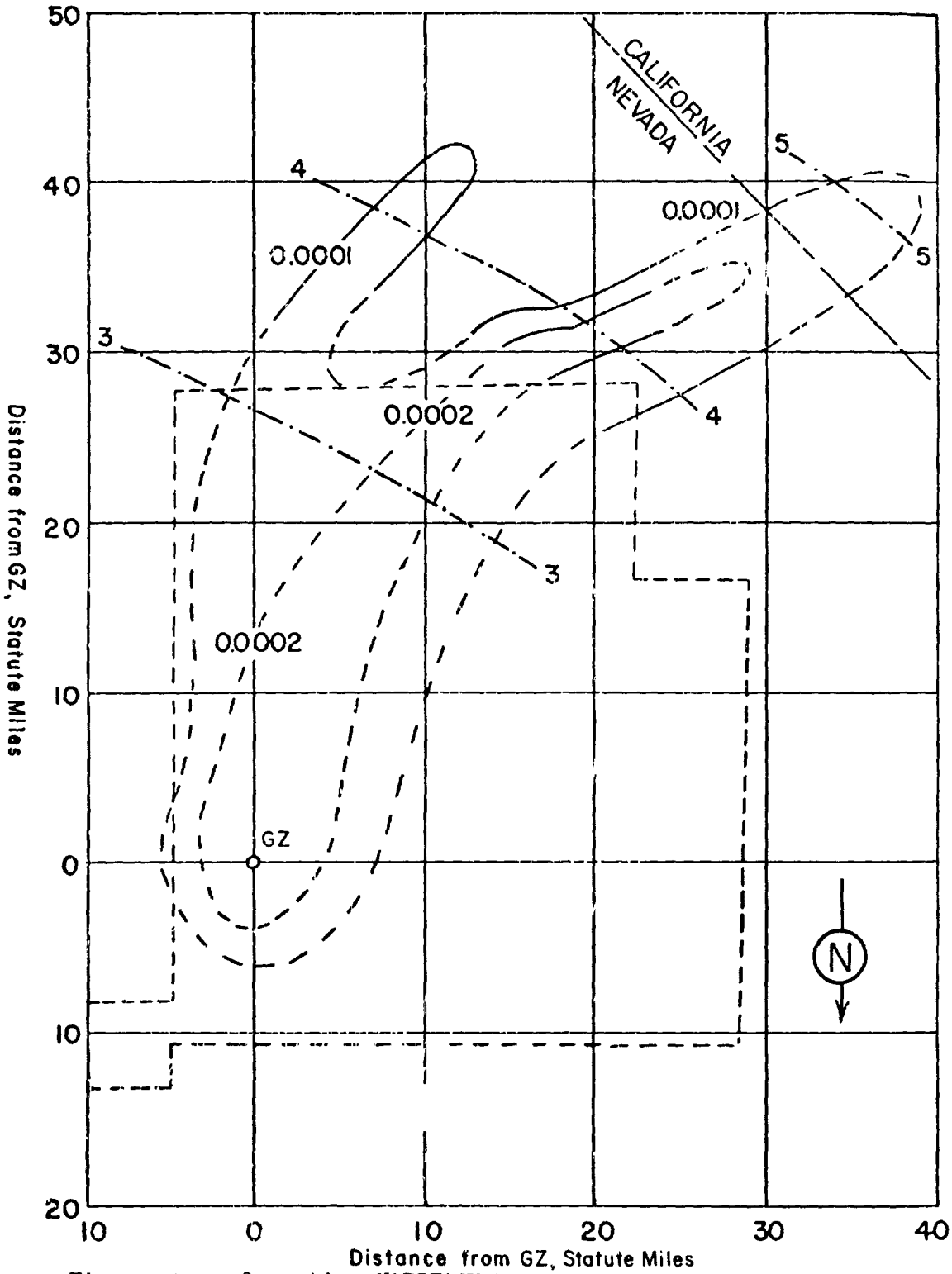


Figure 273. Operation HARDTACK II - Dona Ana.
Off-site dose rate contours in r/hr at H+1 hour.

TABLE 87 NEVADA WIND DATA FOR OPERATION HARDTACK II - DONA ANA

Altitude (MSL)	H-hour Dir	H-hour Speed
feet	degrees	mph
Surface	360	02
5,000	020	09
6,000	030	10
7,000	040	07
8,000	080	03
9,000	140	05
10,000	140	07
11,000	140	09
12,000	140	07

NOTES:

1. Wind data was obtained from the Yucca weather station.
2. Tropopause height was 49,000 ft MSL.
3. The surface air pressure was 12.76 psi, the temperature 13.7°C, the dew point -2.7°C, and the relative humidity 32%.

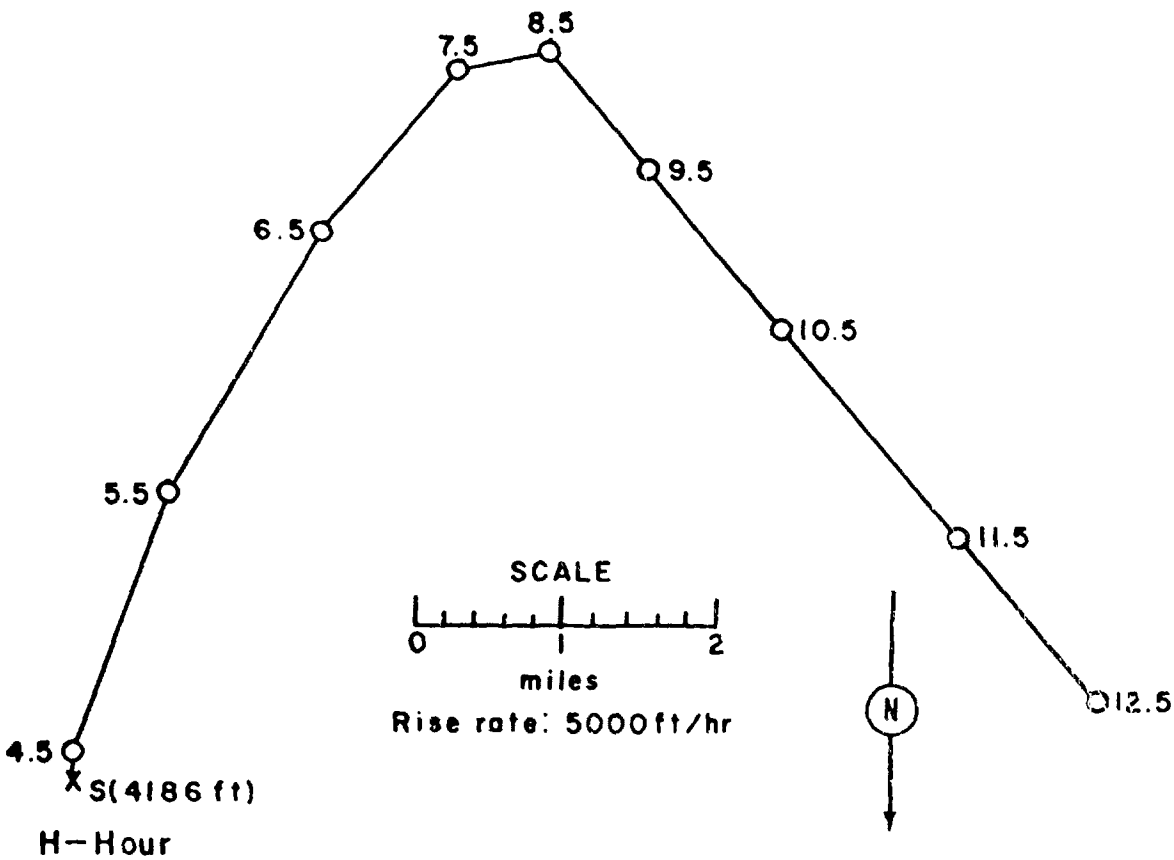


Figure 274. Hodograph for Operation HARDTACK II - Dona Ana.

OPERATION HARDTACK II - Vesta Safety Experiment

	PST	GMT
DATE:	17 Oct 1958	17 Oct 1958
TIME:	1500	2300

TOTAL YIELD: 24 tons

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

CRATER DATA: Not available

Sponsor: UCRL

SITE: NTS - Area 9e
37° 07' 21" N
116° 02' 05" W
Site elevation: 4,226 ft

HEIGHT OF BURST: Zero ft

TYPE OF BURST AND PLACEMENT:
Surface burst in wooden building with 20 ft of gravel over the building

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

REMARKS:

The on-site fallout documentation was performed by the Radiological Safety Division of the Reynolds Electrical and Engineering Company for purposes of personnel safety. Readings were taken with AN/PDR-39 or Tracerlab SU-10 instruments at H+1½ hours, D+1 day and D+2 days. The pattern was well documented and should be reliable. The $t^{-1.2}$ decay approximation was used to extrapolate the dose-rate readings to H+1 hour.

The off-site fallout documentation was performed with Beckman MX-5 and AN/PDR-39 instruments by the U. S. Public Health Service for purposes of public safety. The fallout pattern is considered rather uncertain, since there were few radiation measurements. The $t^{-1.2}$ decay approximation was used to extrapolate the dose-rate readings to H+1 hour.

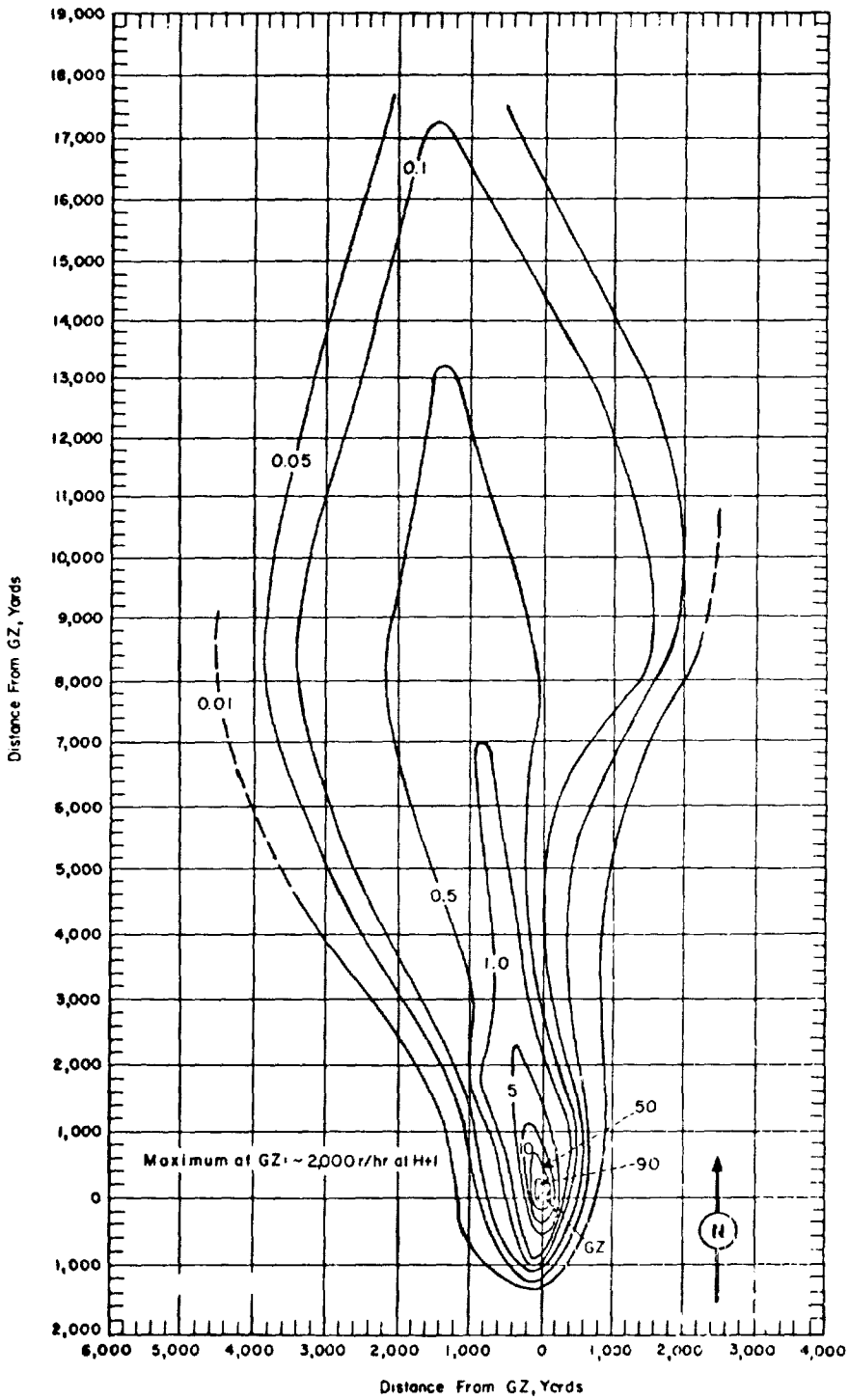


Figure 275. Operation HARDTACK II - Vesta.
On-site dose rate contours in r/hr at H+1 hour.

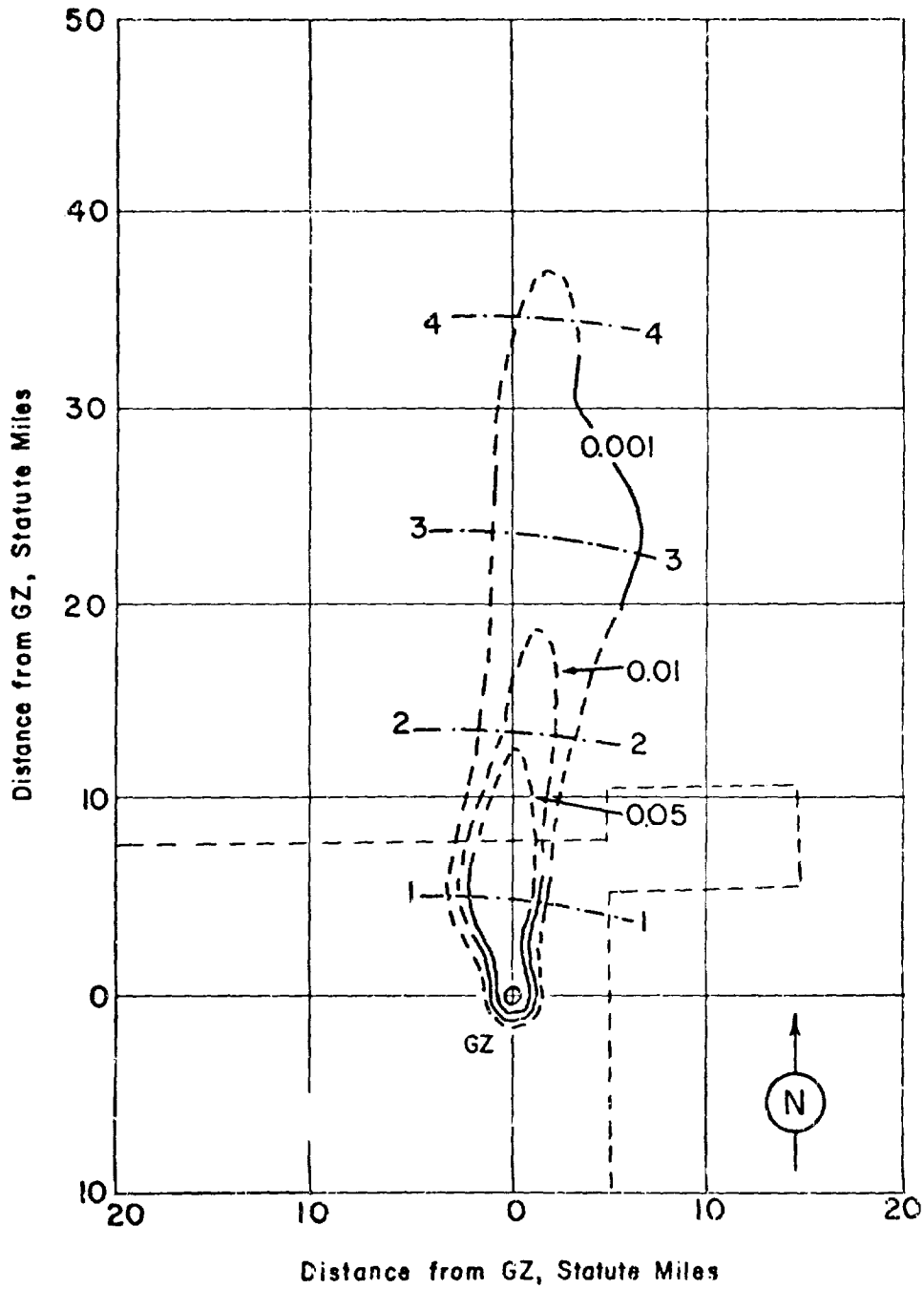


Figure 276. Operation HARDTACK II - Vesta.
Off-site dose rate contours in r/hr at H+1 hour.

TABLE 88 NEVADA WIND DATA FOR OPERATION HARDTACK II- VESTA

Altitude (MSL)	H-hour	
	Dir	Speed
feet	degrees	mph
Surface	160	07
5,000	180	12
6,000	190	14
7,000	190	14
8,000	200	12
9,000	210	10
10,000	210	08
11,000	200	09
12,000	180	07

NOTE: Wind data was obtained from the Yucca weather station.

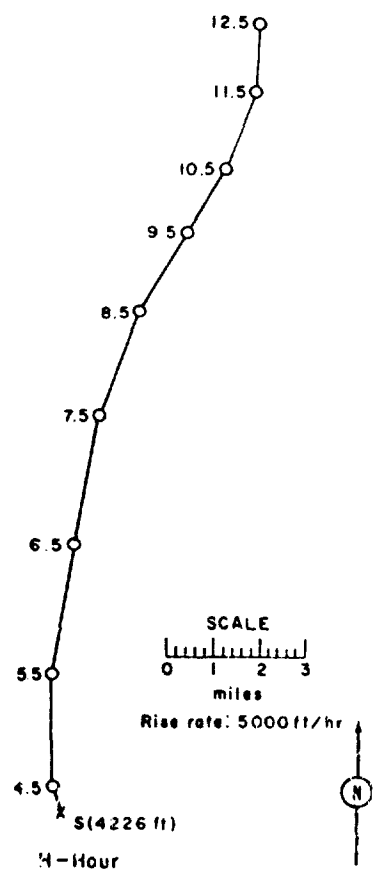


Figure 277. Hodograph for Operation HARDTACK II - Vesta

OPERATION HARDTACK II - Rio Arriba

	PST	GMT
DATE:	18 Oct 1958	18 Oct 1958
TIME:	0625	1425

TOTAL YIELD: 90 tons

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

CRATER DATA: Not available

Sponsor: LASL

SITE: NTS - Area 3s
37° 02' 28" N
116° 01' 33" W
Site elevation: 4,010 ft

HEIGHT OF BURST: 72.5 ft

TYPE OF BURST AND PLACEMENT:
Tower burst over Nevada soil

CLOUD TOP HEIGHT: 13,500 ft MSL
CLOUD BOTTOM HEIGHT: 11,000 ft MSL

REMARKS:

The on-site fallout documentation was performed by the Radiological Safety Division of the Reynolds Electrical and Engineering Company for purposes of personnel safety. Readings were taken with AN/PDR-39 or Tracerlab SU-10 instruments at H+1 hour, H+6 hours, D+1 day, D+2 days and D+3 days along eight radial roads. The fallout was well documented and the pattern presented is considered to be reliable. The $t^{-1.2}$ decay approximation was used to extrapolate the dose-rate readings to H+1 hour.

The off-site fallout documentation was performed with Beckman MX-5 and AN/PDR-39 instruments by the U. S. Public Health Service for purposes of public safety. Readings were taken at about 10-mile intervals except in populated places or when the dose-rate varied considerably with distance. The downwind extent of the 0.002 and 0.001 r/hr isodose rate lines is uncertain. The rest of the pattern was well documented and is reliable. The $t^{-1.2}$ decay approximation was used to extrapolate the dose-rate readings to H+1 hour.

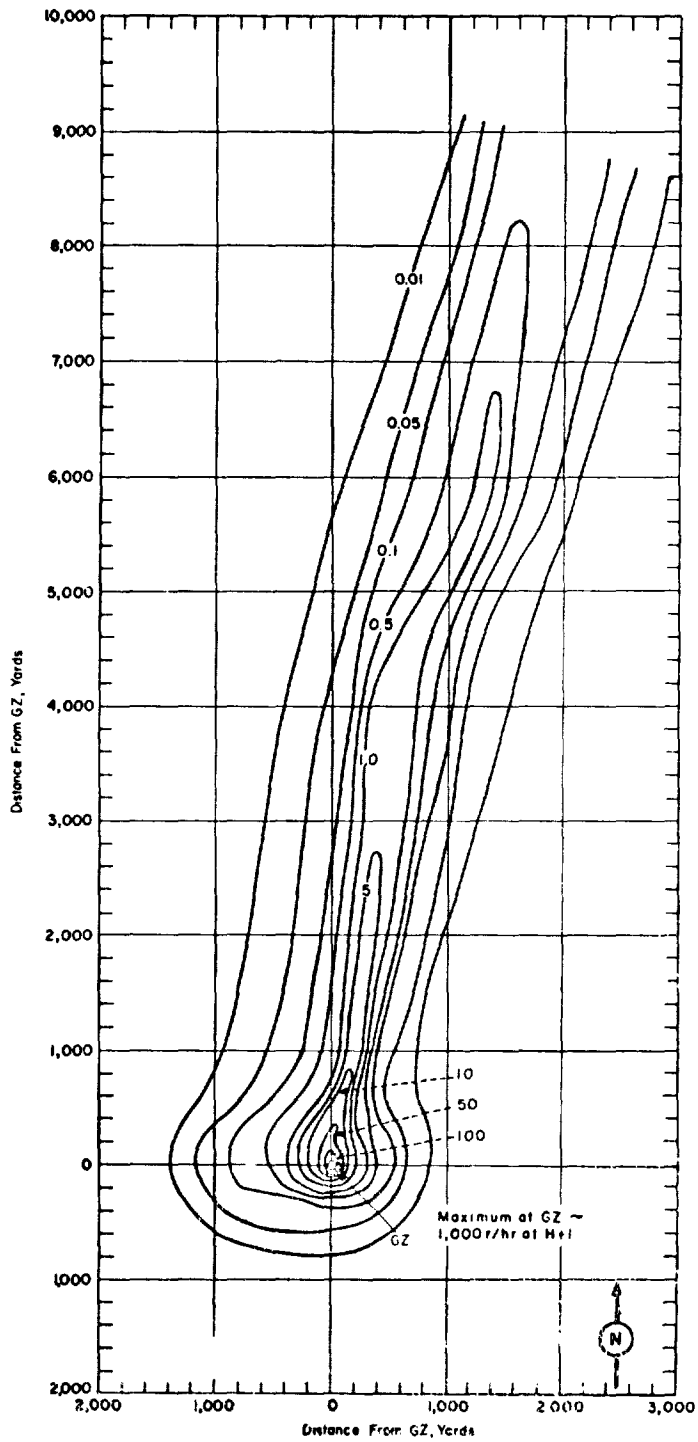


Figure 278. Operation HARDTACK II - Rio Arriba.
On-site dose rate contours in r/hr at H+1 hour.

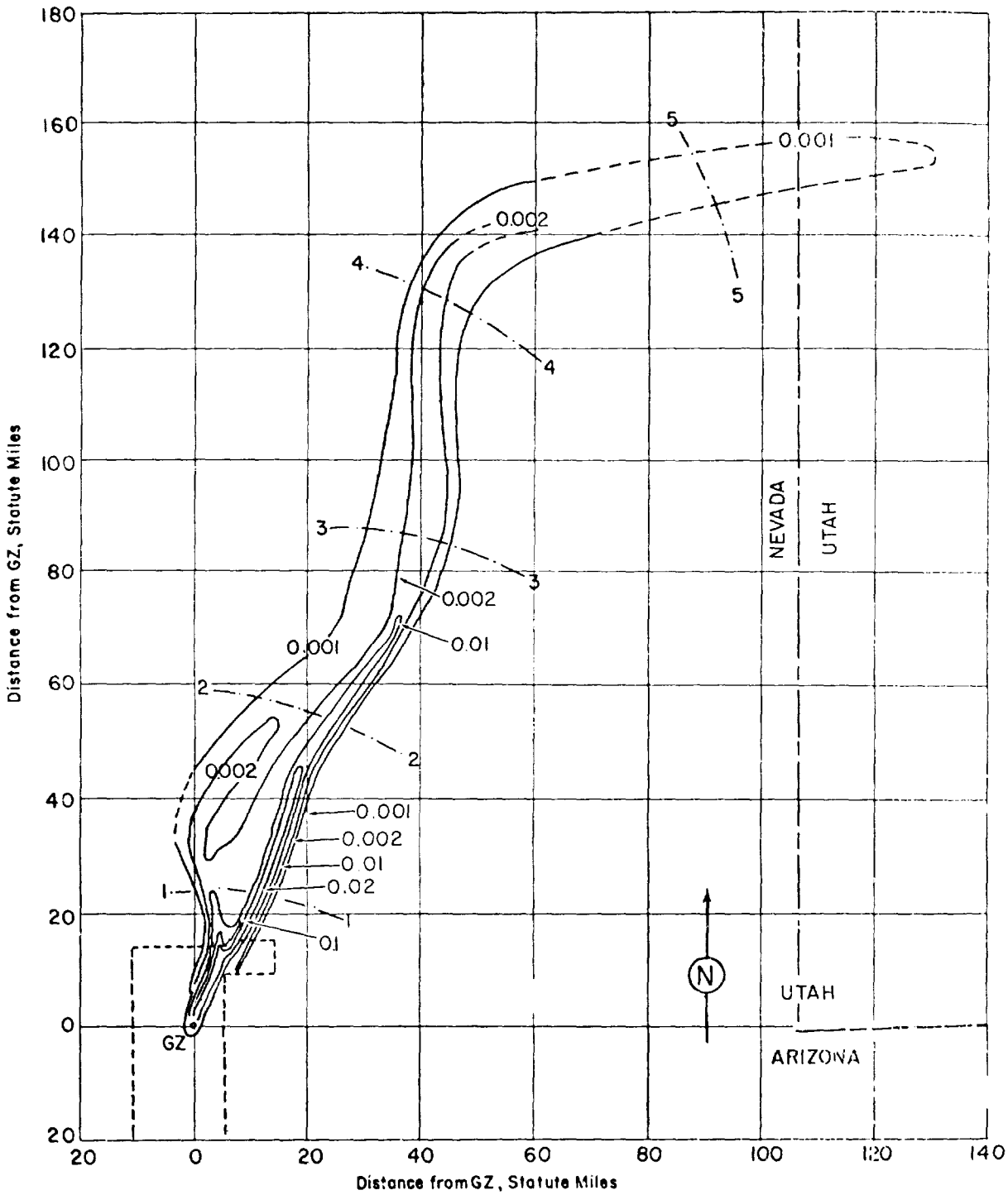


Figure 279. Operation HARDTACK II - Rio Arriba.
Off-site dose rate contours in r/hr at H+1 hour.

TABLE 89 NEVADA WIND DATA FOR OPERATION HARDTACK II – RIO ARRIBA

Altitude (MSL)	H-hour	
	Dir	Speed
feet	degrees	mph
Surface	170	02
5,000	180	09
6,000	200	24
7,000	200	35
8,000	200	37
9,000	200	33
10,000	210	35
11,000	210	38
12,000	210	40
13,000	210	40
14,000	210	38
15,000	210	36

NOTES:

1. Wind data was obtained from the Yucca weather station.
2. The surface air pressure was 12.75 psi, the temperature 9.3°C, the dew point -10.3°C, and the relative humidity 24%.

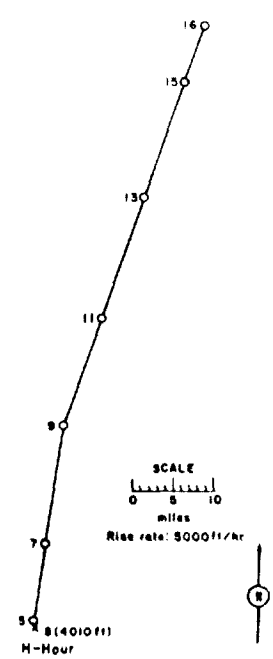


Figure 280 . Hodograph for Operation HARDTACK II - Rio Arriba.

OPERATION HARDTACK II - San Juan Safety Experiment

	PST	GMT
DATE:	20 Oct 1958	20 Oct 1958
TIME:	0630	1430

Sponsor: LASL

SITE: NTS - Area 3p
37° 03' 0" N
116° 01' 56" W
Site elevation: 4,033 ft

HEIGHT OF BURST: -234 ft

TYPE OF BURST AND PLACEMENT:
Subsurface burst - Well in Nevada soil

CLOUD TOP HEIGHT: NM
CLOUD BOTTOM HEIGHT: NM

REMARKS:

"There was essentially no nuclear yield from the San Juan explosion, and no visible venting occurred. There was, however, some alpha contamination detected in the immediate vicinity of the well in which this device was detonated"

OPERATION HARDTACK II - Socorro

	PST	GMT
DATE:	22 Oct 1958	22 Oct 1958
TIME:	0530	1330

TOTAL YIELD: 6 kt

Sponsor: LASL

SITE: NTS - Area 7b
37° 05' 12" N
116° 01' 25" W
Site elevation: 4,186 ft

HEIGHT OF BURST: 1,450 ft

TYPE OF BURST AND PLACEMENT:
Air burst from balloon over Nevada soil

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

CLOUD TOP HEIGHT: 26,000 ft MSL
CLOUD BOTTOM HEIGHT: 20,000 ft MSL

REMARKS:

The contamination was due primarily to induced activity. The on-site measurements were performed by the Radiological Safety Division of the Reynolds Electrical and Engineering Company for purposes of personnel safety. Readings were taken with AN/PDR-39 or Tracerlab SU-10 instruments at H+1 hour and D+3 days. The sodium-24 decay rate was used to extrapolate the dose-rate readings to H+1 hour. The pattern was relatively well documented and is considered to be fairly reliable. The decay rate used is not strictly applicable although it closely approximates the observed decay.

Socorro was the first of three nuclear detonations to occur on the same day. The trajectory analysis for these three events indicated that all the clouds should have been transported in the same general direction; therefore, no off-site pattern is presented for this shot.

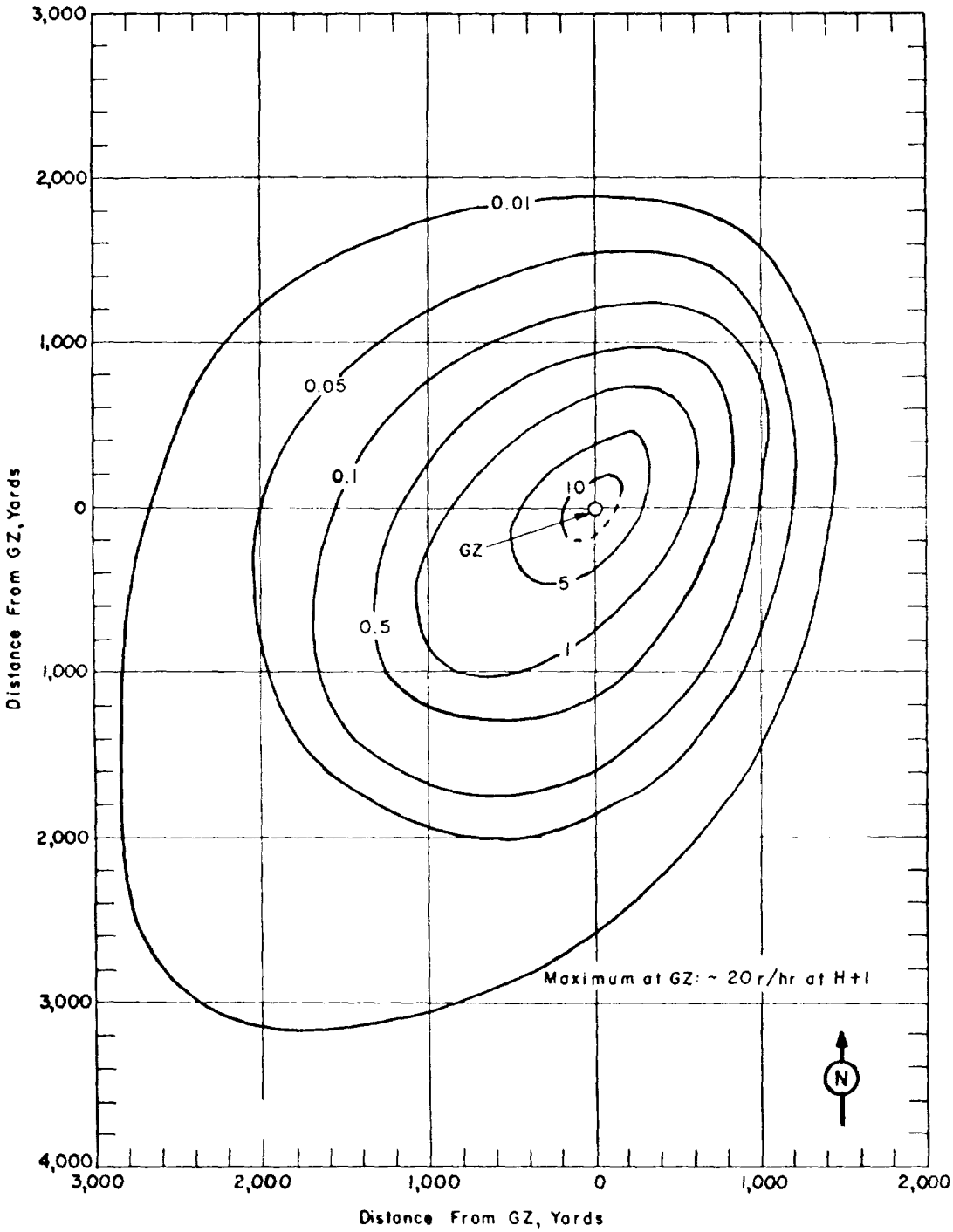


Figure 281. Operation HARDTACK II - Socorro.
On-site dose rate contours in r/hr at H+1 hour.

TABLE 90 NEVADA WIND DATA FOR OPERATION HARDTACK II– SOCORRO

Altitude (MSL)	H-hour		H+3¼ hours		H+10 hours	
	Dir	Speed	Dir	Speed	Dir	Speed
feet	degrees	mph	degrees	mph	degrees	mph
Surface	320	03	090	02	140	05
5,000	110	06	060	09	170	08
6,000	110	07	---	--	---	--
7,000	130	09	---	--	---	--
8,000	150	10	---	--	---	--
9,000	160	10	---	--	---	--
10,000	180	15	210	13	220	19
11,000	190	13	---	--	---	--
12,000	230	15	230	12	220	26
13,000	260	18	---	--	---	--
14,000	240	07	---	--	---	--
15,000	230	07	---	--	---	--
16,000	220	06	---	--	---	--
17,000	200	09	---	--	---	--
18,000	210	16	---	--	---	--
19,000	210	15	---	--	---	--
20,000	220	18	---	--	---	--
21,000	220	22	---	--	---	--
22,000	220	18	---	--	---	--
23,000	220	19	---	--	---	--
24,000	210	23	---	--	---	--
25,000	220	25	---	--	---	--
26,000	220	25	---	--	---	--
27,000	220	25	---	--	---	--

NOTES:

1. Wind data was obtained from the Yucca weather station.
2. The surface air pressure was 12.68 psi, the temperature 4.7°C, the dew point -14.7°C, and the relative humidity 13%.

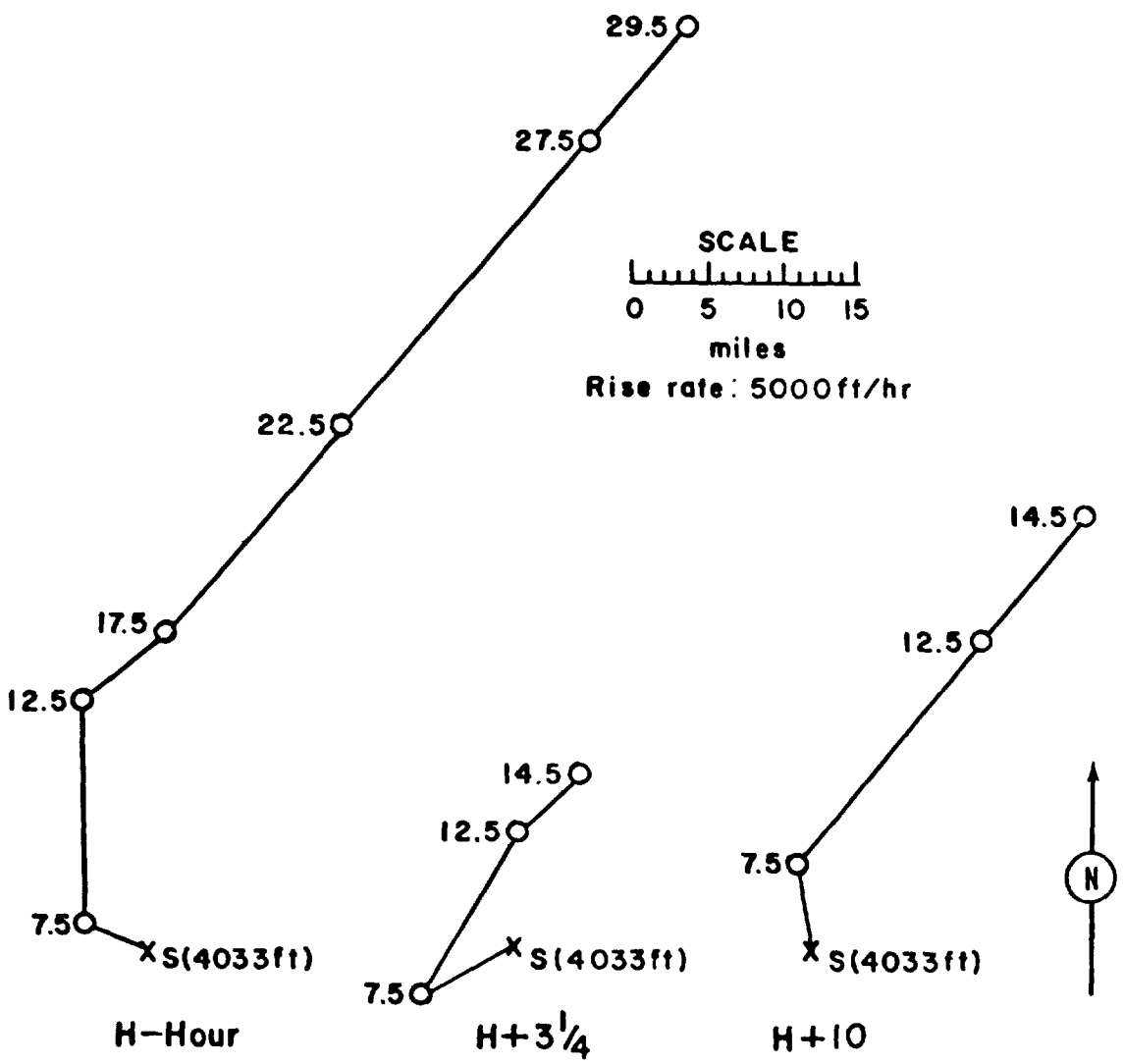


Figure 282. Hodographs for Operation HARDTACK II - Socorro.

OPERATION HARDTACK II - Wrangell

	PST	GMT
DATE:	22 Oct 1958	22 Oct 1958
TIME:	0850	1650

Sponsor: UCRL

TOTAL YIELD: 115 tons

SITE: NTS - Area Fa
36° 47' 53" N
115° 55' 44" W
Site elevation: 3,077 ft

HEIGHT OF BURST: 1,500 ft

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

TYPE OF BURST AND PLACEMENT:
Air burst from balloon over Nevada soil

CLOUD TOP HEIGHT: 10,000 ft MSL
CLOUD BOTTOM HEIGHT: 7,000 ft MSL

CRATER DATA: No crater

REMARKS:

The contamination was due primarily to induced activity. The on-site measurements were performed by the Radiological Safety Division of Reynolds Electrical and Engineering Company for purposes of personnel safety. Readings were taken with AN/PDR-39 or Tracerlab SU-10 instruments. The sodium-24 decay rate was used to extrapolate the dose-rate readings to H+1 hour. This decay rate is not strictly applicable although it closely approximates the observed decay. Because of the lack of data in some areas around ground zero there is not a high degree of confidence in the analysis of the on-site pattern.

The off-site fallout documentation was performed with Beckman MX-5 and AN/PDR-39 instruments by the U. S. Public Health Service for purposes of public safety. Three nuclear detonations occurred on the same day. Since the trajectories for these three events were in the same general direction, there was some difficulty in determining from which shots the observed fallout originated; therefore, no off-site pattern is presented for this shot.

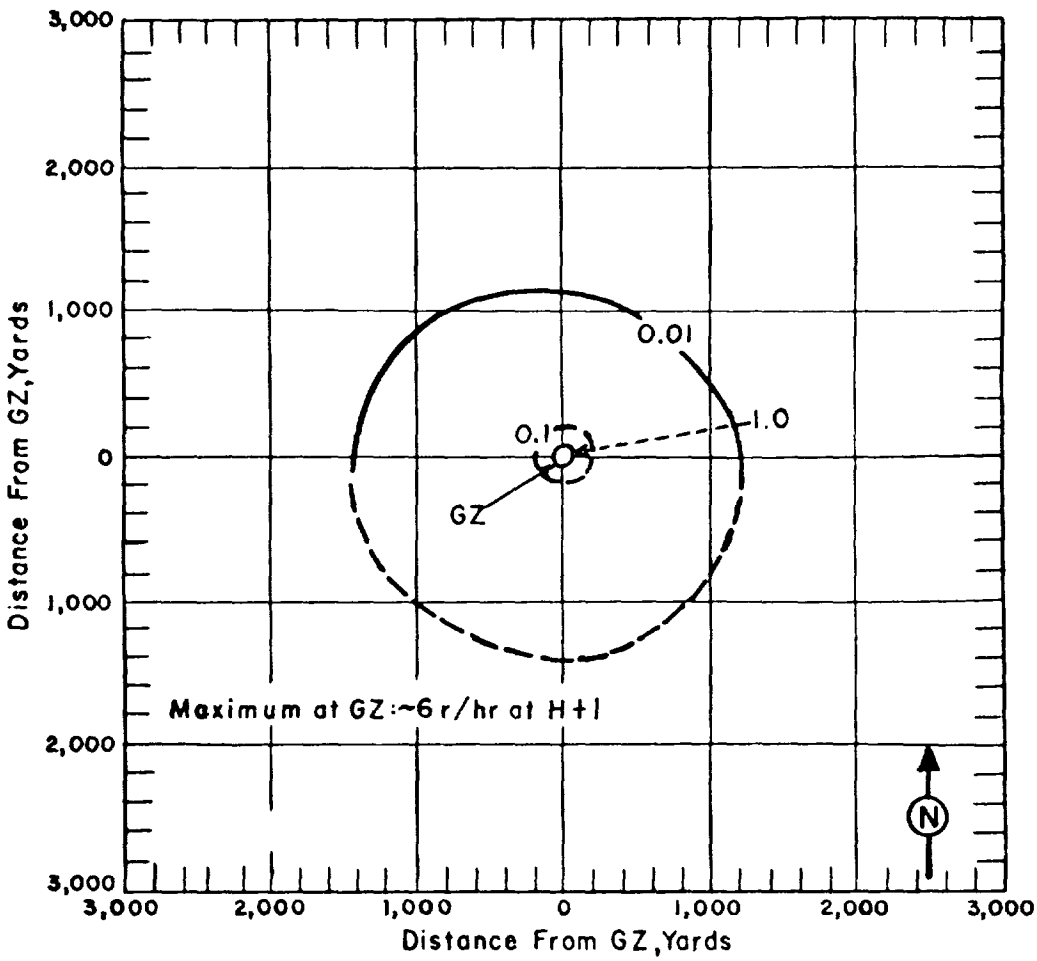


Figure 283. Operation HARDTACK II - Wrangell.
On-site dose rate contours in r/hr at H+1 hour.

TABLE 91 NEVADA WIND DATA FOR OPERATION HARDTACK II - WRANGELL

Altitude (MSL)	H-hour		H+3 hours	
	Dir	Speed	Dir	Speed
feet	degrees	mph	degrees	mph
Surface	090	02	140	05
5,000	060	09	170	08
6,000	110	14	190	10
7,000	140	14	210	14
8,000	170	13	220	16
9,000	190	13	230	17
10,000	210	13	220	19
11,000	220	14	220	23
12,000	230	12	220	26

NOTE: Wind data was obtained from the Yucca weather station.

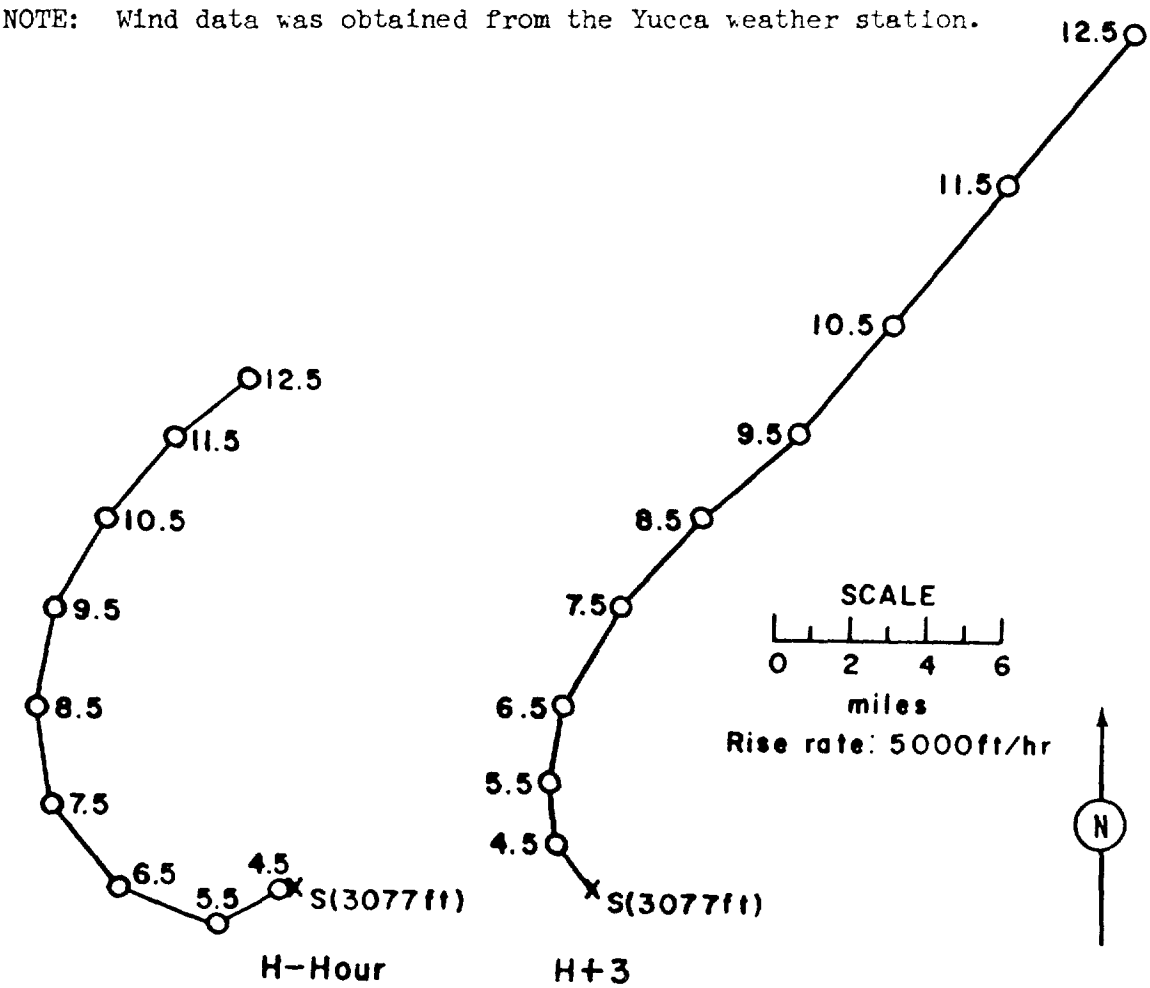


Figure 284. Hodographs for Operation HARDTACK II - Wrangell.

OPERATION HARDTACK II - Oberon Safety Experiment

	PST	GMT
DATE:	22 Oct 1958	22 Oct 1958
TIME:	1230	2030

Sponsor: UCRL

SITE: NTS - Area 8a
37° 10' 42" N
116° 04' 03" W
Site elevation: 4,446 ft

HEIGHT OF BURST: 25 ft

TYPE OF BURST AND PLACEMENT:
Tower burst over Nevada soil

CLOUD TOP HEIGHT: Very low
CLOUD BOTTOM HEIGHT: NM

REMARKS:

No fallout - some alpha contamination.

OPERATION HARDTACK II - Rushmore

	PST	GMT
DATE:	22 Oct 1958	22 Oct 1958
TIME:	1540	2340

TOTAL YIELD: 188 tons

FIREBALL DATA:
Time to 1st minimum: 2 msec
Time to 2nd maximum: 21 msec
Radius at 2nd maximum: NM

CRATER DATA: No crater

Sponsor: UCRL

SITE: NTS - Area 9a
37° 08' 05" N
116° 02' 27" W
Site elevation: 4,244 ft

HEIGHT OF BURST: 500 ft

TYPE OF BURST AND PLACEMENT:
Air burst from balloon over Nevada soil

CLOUD TOP HEIGHT: 1,500 ft MSL
CLOUD BOTTOM HEIGHT: Not available

REMARKS:

The contamination is due primarily to induced activity. The on-site measurements were performed by the Radiological Safety Division of Reynolds Electrical and Engineering Company for purposes of personnel safety. Readings were taken with AN/PDR or Tracerlab SU-10 instruments at H+½ hour, D+1 day and D+2 days. The sodium-24 decay rate was used to extrapolate the dose-rate readings to H+1 hour. This decay rate is not strictly applicable although it closely approximates the observed decay. Because of the lack of data in some areas around ground zero, there is not a high degree of confidence in the pattern.

Three nuclear detonations occurred on the same day. Since the trajectories for these three events were in the same general direction, there was some difficulty in determining from which shots the observed fallout originated; therefore no off-site pattern is presented for this shot.

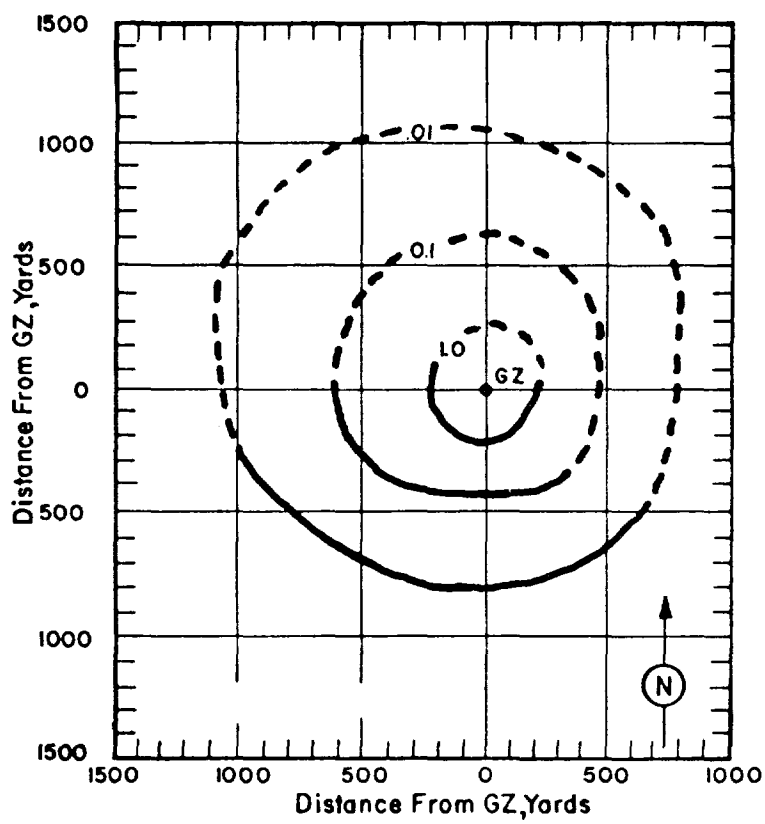


Figure 285. Operation HARDTACK II - Rushmore.
On-site dose rate contours in r/hr at H+1 hour.

TABLE 92 NEVADA WIND DATA FOR OPERATION HARDTACK II - RUSHMORE

Altitude (MSL)	H-hour	
	Dir	Speed
feet	degrees	mph
Surface	140	05
5,000	170	08
6,000	190	10
7,000	210	14
8,000	220	16
9,000	230	17
10,000	220	19
11,000	220	23
12,000	220	26

NOTES:

1. Wind data was obtained from the Yucca weather station.
2. Tropopause height was 42,000 ft MSL.
3. The surface air pressure was 12.66 psi, the temperature 17.8°C, and the relative humidity 12%.

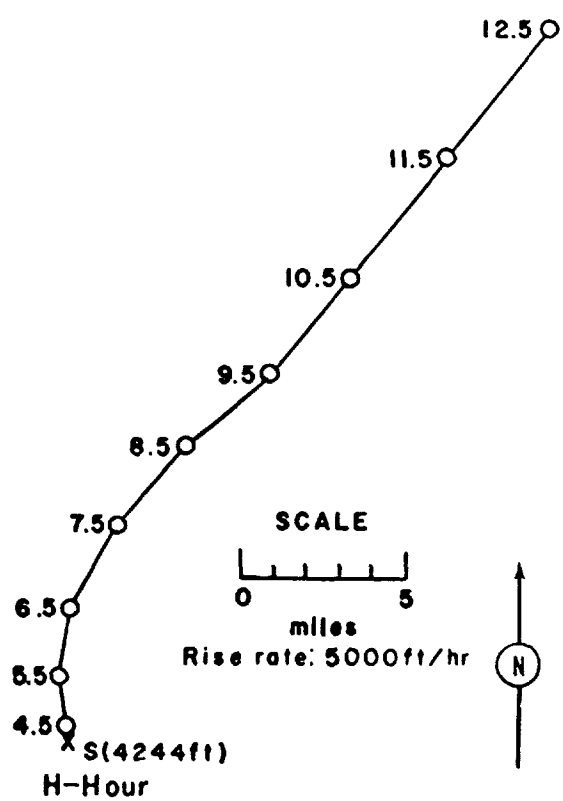


Figure 286 . Hodograph for Operation HARDTACK II - Rushmore.

OPERATION HARDTACK II - Catron Safety Experiment

	PST	GMT
DATE:	24 Oct 1958	24 Oct 1958
TIME:	0700	1500

TOTAL YIELD: 21 tons

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

Sponsor: LASL

SITE: NTS - Area 3t
37° 02' 35" N
116° 01' 37" W

HEIGHT OF BURST: 72.5 ft

TYPE OF BURST AND PLACEMENT:
Tower burst over Nevada soil

CLOUD TOP HEIGHT: 8,500 ft MSL
CLOUD BOTTOM HEIGHT: 5,000 ft MSL

REMARKS:

The on-site fallout documentation was performed by the Radiological Safety Division of the Reynolds Electrical and Engineering Company for purposes of personnel safety. Readings were taken with AN/PDR-39 or Tracerlab SU-10 instruments at H+$\frac{1}{2}$ hour, H+7 hours, D+1 day and D+2 days. The $t^{-1.2}$ decay approximation was used to extrapolate the dose-rate readings to H+1 hour. "The on-site fallout from Catron was well documented and the pattern presented is considered to be reliable. A special on-site survey was very helpful in distinguishing between the Catron fallout and the Juno fallout.

The off-site fallout documentation was performed with Beckman MX-5 and AN/PDR-39 instruments by the U. S. Public Health Service for purposes of public safety. The $t^{-1.2}$ decay approximation was used to extrapolate the dose-rate readings to H+1 hour. There is a great deal of uncertainty in the off-site fallout pattern because of the lack of data.

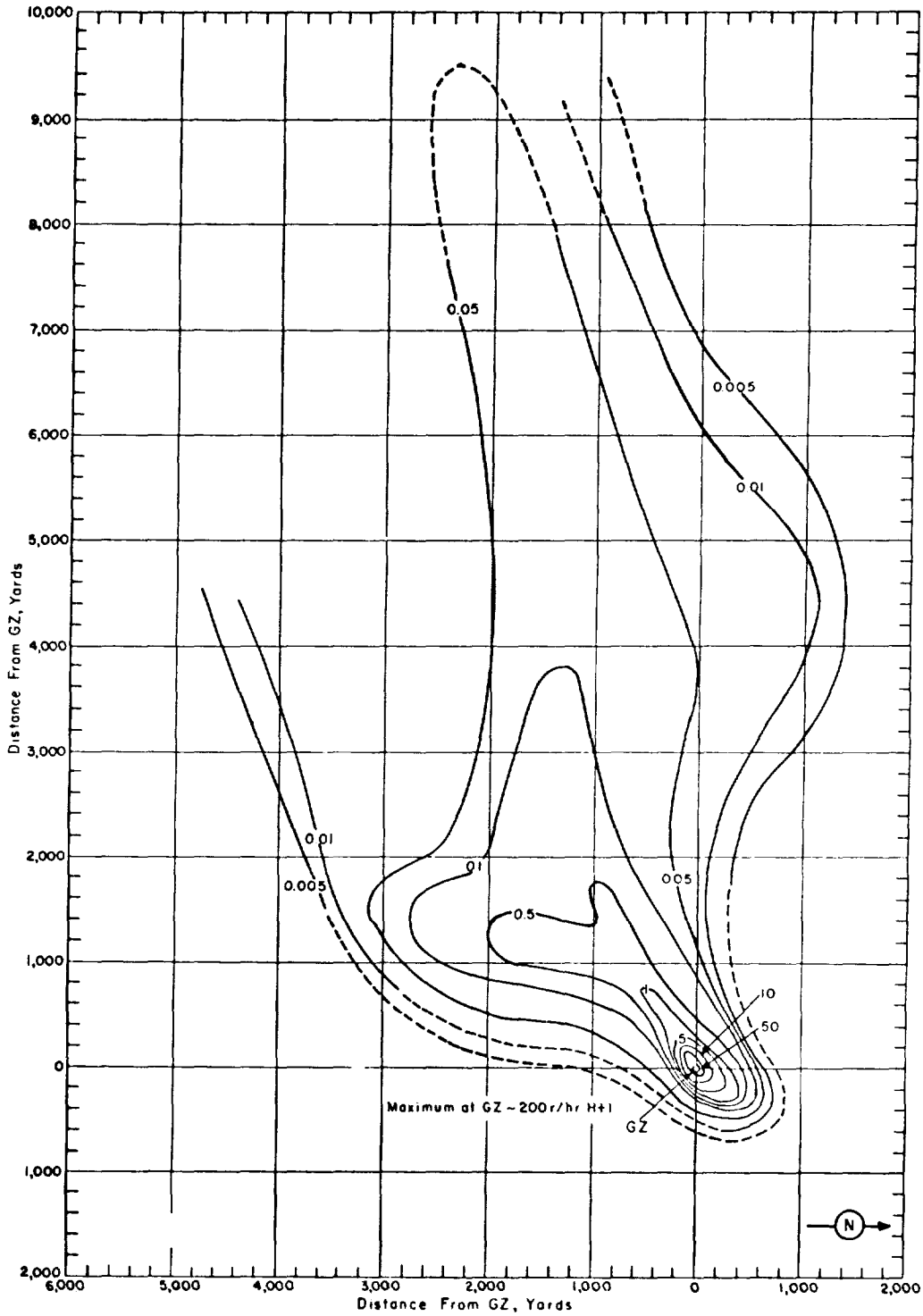


Figure 287. Operation HARDTACK II - Catron.
On-site dose rate contours in r/hr at H+1 hour.

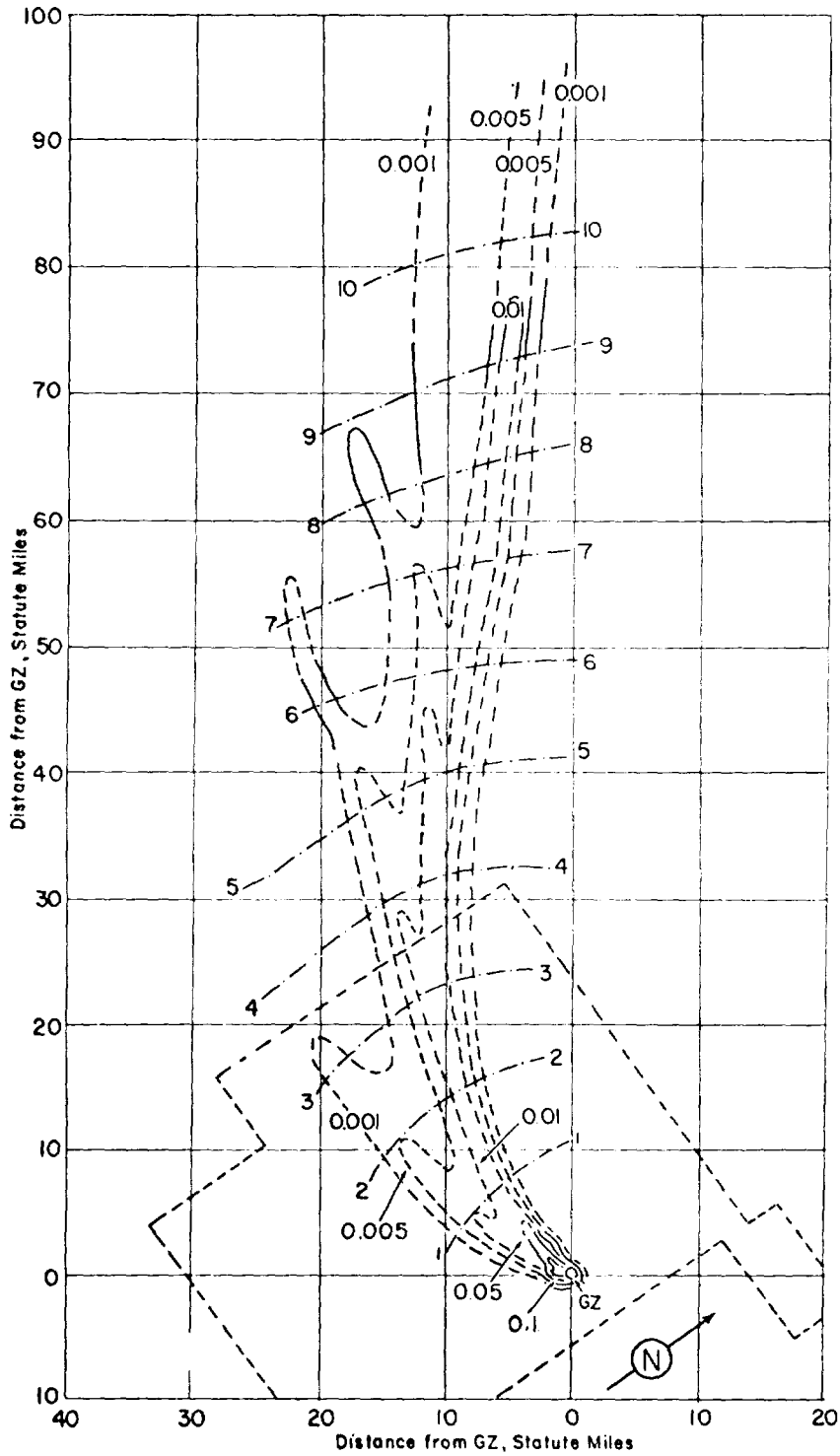


Figure 288. Operation HARDTACK II - Catron.
Off-site dose rate contours in r/hr at H+1 hour.

TABLE 93 NEVADA WIND DATA FOR OPERATION HARDTACK II— CATRON

Altitude (MSL)	H-hour		H+1½ hours	
	Dir	Speed	Dir	Speed
feet	degrees	mph	degrees	mph
Surface	030	02	360	05
5,000	040	09	030	07
6,000	060	09	070	08
7,000	090	09	100	10
8,000	110	12	110	14
9,000	120	16	120	16
10,000	120	18	120	17

NOTE: Wind data was obtained from the Yucca weather station.

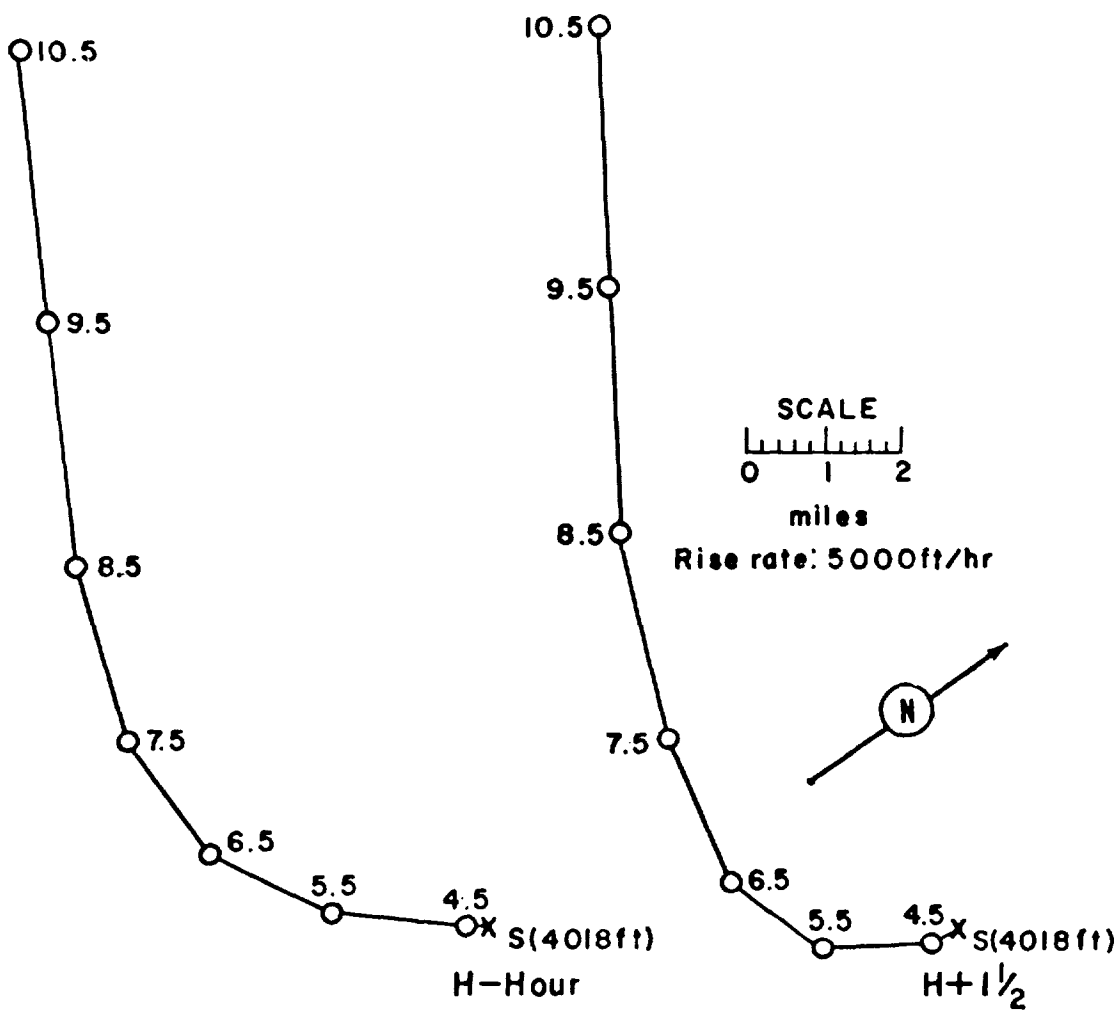


Figure 289. Hodographs for Operation HARDTACK II - Catron.

OPERATION HARDTACK II - Juno Safety Experiment

	PST	GMT
DATE:	24 Oct 1958	24 Oct 1958
TIME:	0801	1601

TOTAL YIELD: 1.7 tons

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

CRATER DATA: Not available

Sponsor: UCRL

SITE: NTS - Area 9f
37° 07' 24" N
116° 02' 16" W
Site elevation: 4,210 ft

HEIGHT OF BURST: Surface

TYPE OF BURST AND PLACEMENT:
Surface burst in wooden building with 20 ft of gravel over the building

CLOUD TOP HEIGHT: 5,500 ft MSL
CLOUD BOTTOM HEIGHT: NM

REMARKS:

The on-site fallout documentation was performed by the Radiological Safety Division of the Reynolds Electrical and Engineering Company for purposes of personnel safety. Readings were taken with AN/PDR-39 or Tracerlab SU-10 instruments at H+7 hours, D+1 day and D+2 days. The $t^{-1.2}$ decay approximation was used to extrapolate the dose-rate readings to H+1 hour. The on-site fallout was well documented and the pattern presented is considered to be reliable.

"No significant off-site radioactivity was reported that could be attributed to the Juno event".

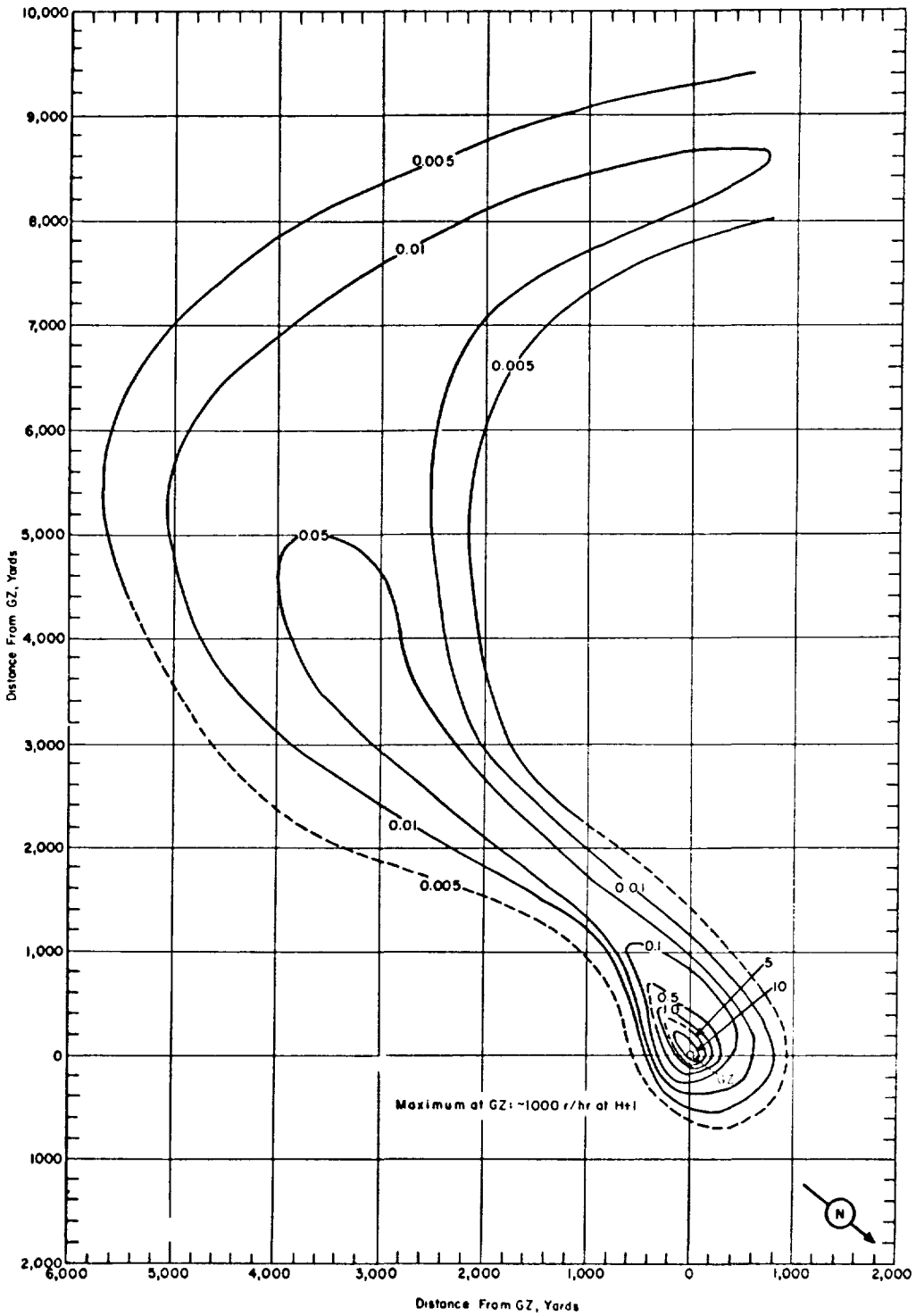


Figure 290. Operation HARDTACK II - Juno.
On-site dose rate contours in r/hr at H+1 hour.

TABLE 94 NEVADA WIND DATA FOR OPERATION HARDTACK II - JUNO

Altitude (MSL)	H+½ hour	
	Dir	Speed
feet	degrees	mph
Surface	360	05
5,000	030	07
6,000	070	08
7,000	100	10
8,000	110	14
9,000	120	16
10,000	120	17

NOTE: Wind data was obtained from the Yucca weather station.

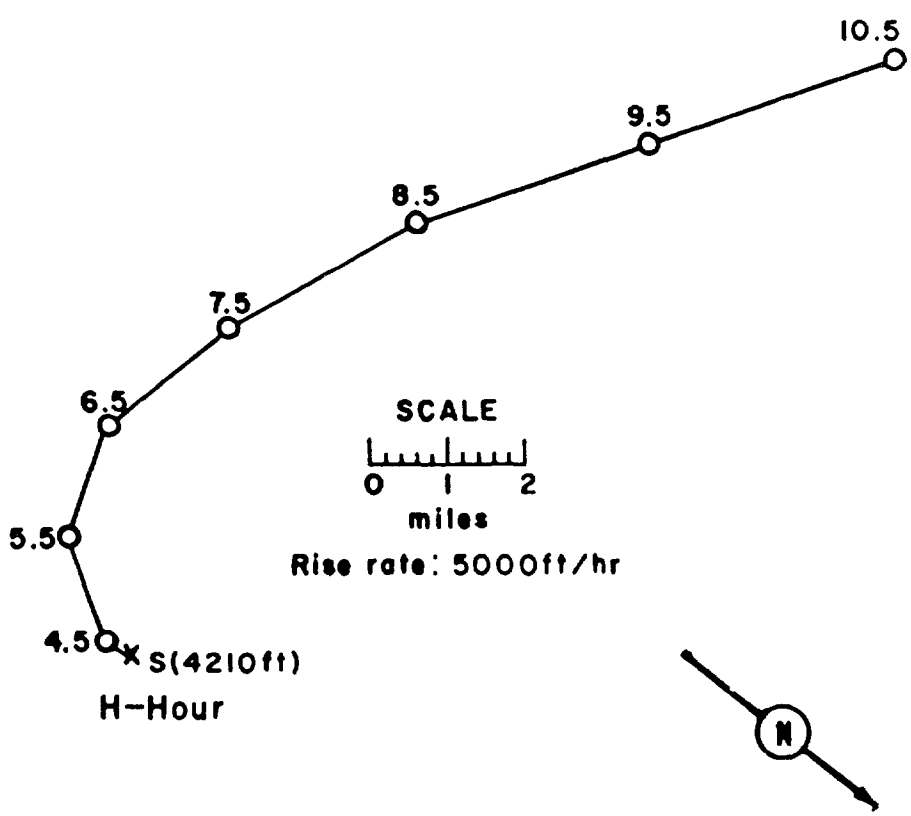


Figure 291. Hodograph for Operation HARDTACK II - Juno.

OPERATION HARDTACK II - Ceres Safety Experiment

	PST	GMT
DATE:	25 Oct 1958	26 Oct 1958
TIME:	2000	0400

TOTAL YIELD: 0.7 tons

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

Sponsor: UCRL

SITE: NTS - Area 8b
37° 10' 53" N
116° 04' 07" W
Site elevation: 4,428 ft

HEIGHT OF BURST: 25 ft

TYPE OF BURST AND PLACEMENT:
Tower burst over Nevada soil

CLOUD TOP HEIGHT: 6,000 ft MSL
CLOUD BOTTOM HEIGHT: NM

REMARKS:

The on-site fallout documentation was performed by the Radiological Safety Division of the Reynolds Electrical and Engineering Company for purposes of personnel safety. Readings were taken with AN/PDR-39 or Tracerlab SU-10 instruments at H+$\frac{1}{2}$ hour and H+16 hours. The $t^{-1.2}$ decay approximation was used to extrapolate the dose-rate readings to H+1 hour. The pattern is not reliable. A possible explanation of the discrepancy between the observed radiation field and the wind field is that, since the winds were rather light, the observed winds at the Yucca Lake Weather Station were probably not representative.

Off-site measurements detected no radioactivity above background.

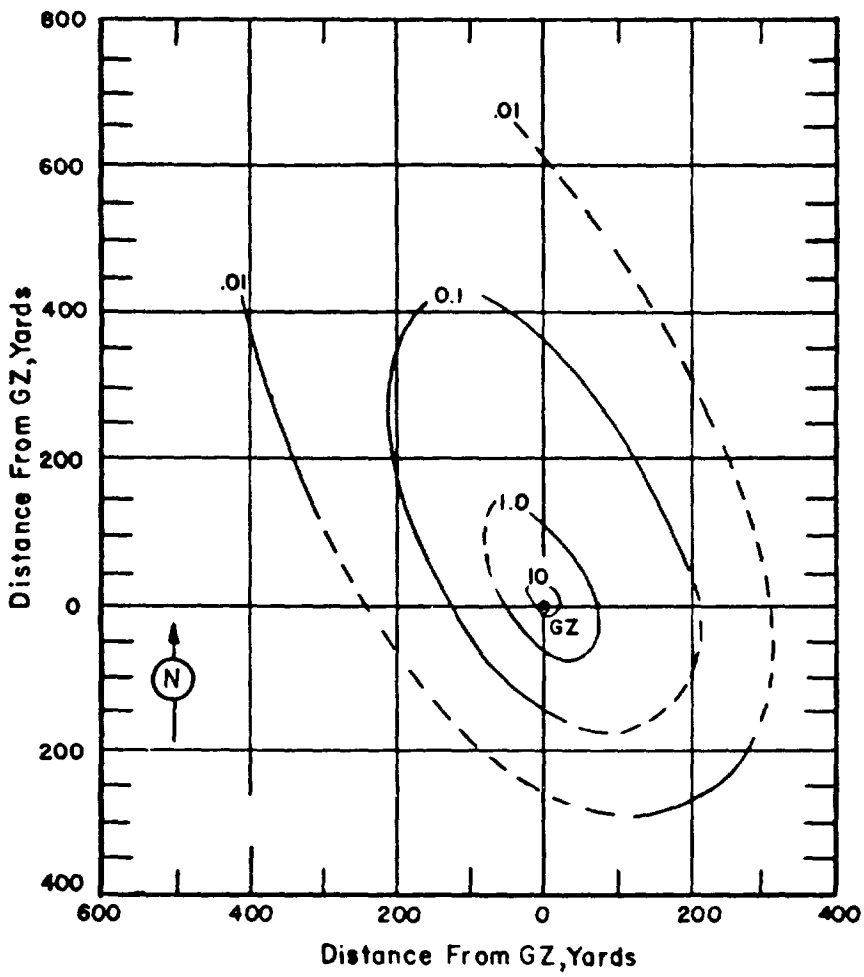


Figure 292. Operation HARDTACK II - Ceres.
On-site dose rate contours in r/hr at H+1 hour.

TABLE 95 NEVADA WIND DATA FOR OPERATION HARDTACK II — CERES

Altitude (MSL)	H-hour		H+1 hour	
	Dir	Speed	Dir	Speed
feet	degrees	mph	degrees	mph
Surface	330	2	310	6
5,000	220	5	---	-
6,000	200	6	---	-
7,000	160	7	---	-
8,000	140	7	---	-

NOTE: Wind data was obtained from the Yucca weather station.

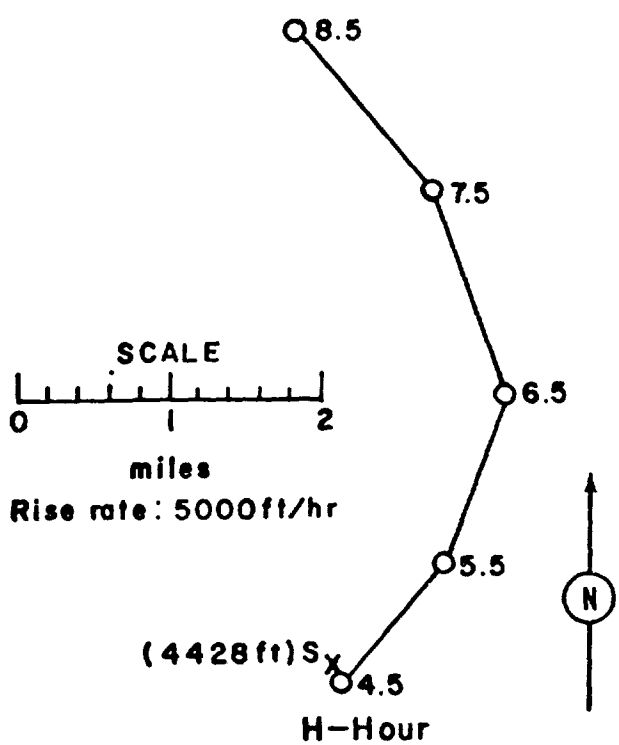


Figure 293. Hodograph for Operation HARDTACK II - Ceres.

OPERATION HARDTACK II - Sanford

	PST	GMT
DATE:	26 Oct 1958	26 Oct 1958
TIME:	0220	1020

TOTAL YIELD: 4.9 kt

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

CRATER DATA: No crater

Sponsor: UCRL

SITE: NTS - Area Fa
36° 47' 53" N
115° 55' 44" W
Site elevation: 3,077 ft

HEIGHT OF BURST: 1,500 ft

TYPE OF BURST AND PLACEMENT:
Air burst from balloon over Nevada soil

CLOUD TOP HEIGHT: 26,000 ft MSL
CLOUD BOTTOM HEIGHT: 12,500 ft MSL

REMARKS:

The contamination was due primarily to induced activity. The on-site measurements were performed by the Radiological Safety Division of the Reynolds Electrical and Engineering Company for purposes of personnel safety. Readings were taken with AN/PDR-39 or Tracerlab SU-10 instruments at H+½ hour, H+6 hours, D+1 day and D+2 days. The sodium-24 decay rate was used to extrapolate the dose-rate readings to H+1 hour. This decay rate is not strictly applicable although it closely approximates the observed decay. "Because of the lack of data in most of the areas around ground zero, there is not a very high degree of confidence in the analysis of the on-site pattern".

Very little radioactivity above background was detected off-site.

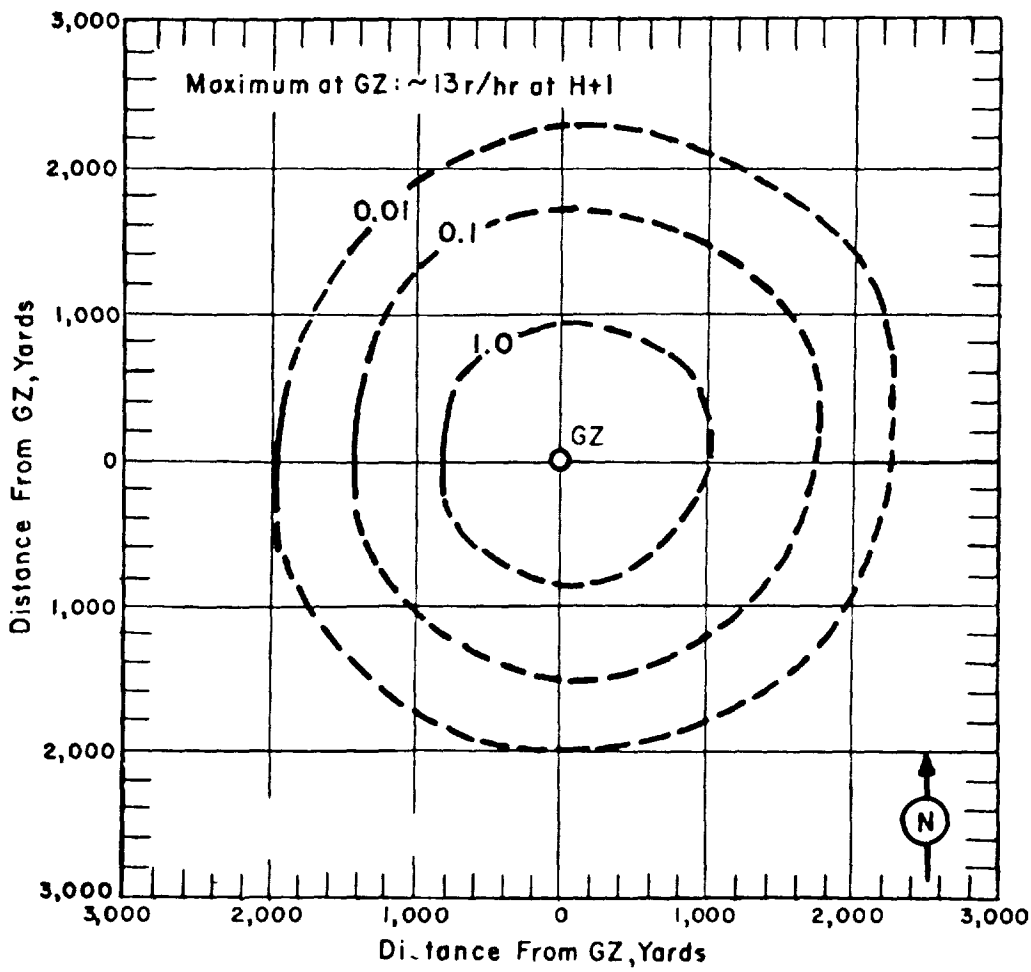


Figure 294. Operation HARDTACK II - Sanford
On-site dose rate contours in r/hr at H+1 hour.

TABLE 96 NEVADA WIND DATA FOR OPERATION HARDTACK II- SANFORD

Altitude (MSL)	H-hour		H+5¾ hours	
	Dir	Speed	Dir	Speed
feet	degrees	mph	degrees	mph
Surface	140	01	Calm	Calm
5,000	010	03	010	02
6,000	110	02	---	--
7,000	190	02	---	--
8,000	180	08	---	--
9,000	150	09	---	--
10,000	120	08	210	07
11,000	120	10	---	--
12,000	190	07	---	--
13,000	250	12	---	--
14,000	250	21	---	--
15,000	250	21	270	12
16,000	250	24	---	--
17,000	240	23	---	--
18,000	240	29	---	--
19,000	230	32	---	--
20,000	230	26	240	22
21,000	230	39	---	--
22,000	230	46	---	--
23,000	230	45	---	--
24,000	220	41	---	--
25,000	220	35	---	--
26,000	210	33	---	--
27,000	210	34	---	--

NOTE: Wind data was obtained from the Yucca weather station.

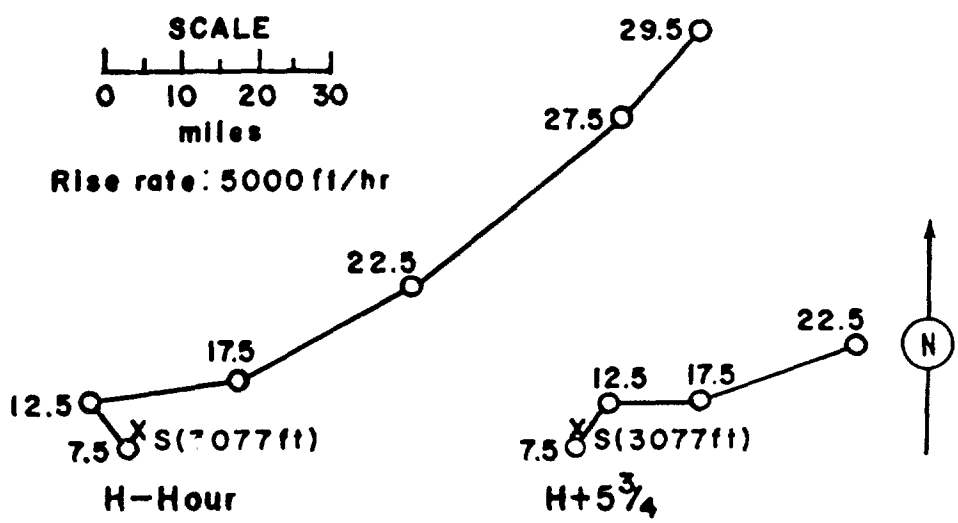


Figure 295. Hodographs for Operation HARDTACK II - Sanford.

OPERATION HARDTACK II - DeBaca

	PST	GMT
DATE:	26 Oct 1958	26 Oct 1958
TIME:	0800	1600

TOTAL YIELD: 2.2 kt

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

CRATER DATA: No crater

Sponsor: LASL

SITE: NTS - Area 7b
37° 05' 12" N
116° 01' 25" W
Site elevation: 4,186 ft

HEIGHT OF BURST: 1,500 ft

TYPE OF BURST AND PLACEMENT:
Air burst from balloon over Nevada soil

CLOUD TOP HEIGHT: 17,500 ft MSL
CLOUD BOTTOM HEIGHT: 10,000 ft MSL

REMARKS:

The contamination was due primarily to induced activity. The on-site measurements were performed by the Radiological Safety Division of the Reynolds Electrical and Engineering Company for purposes of personnel safety. Readings were taken with AN/PDR-39 or Tracerlab SU-10 instruments at H+½ hour, H+6 hours, D+1 day and D+2 days. The sodium-24 decay rate was used to extrapolate the dose-rate readings to H+1 hour. This decay rate is not strictly applicable although it closely approximates the observed decay. Because of the lack of data in most areas around ground zero the pattern is unreliable.

Very little radioactivity above background was detected off-site.

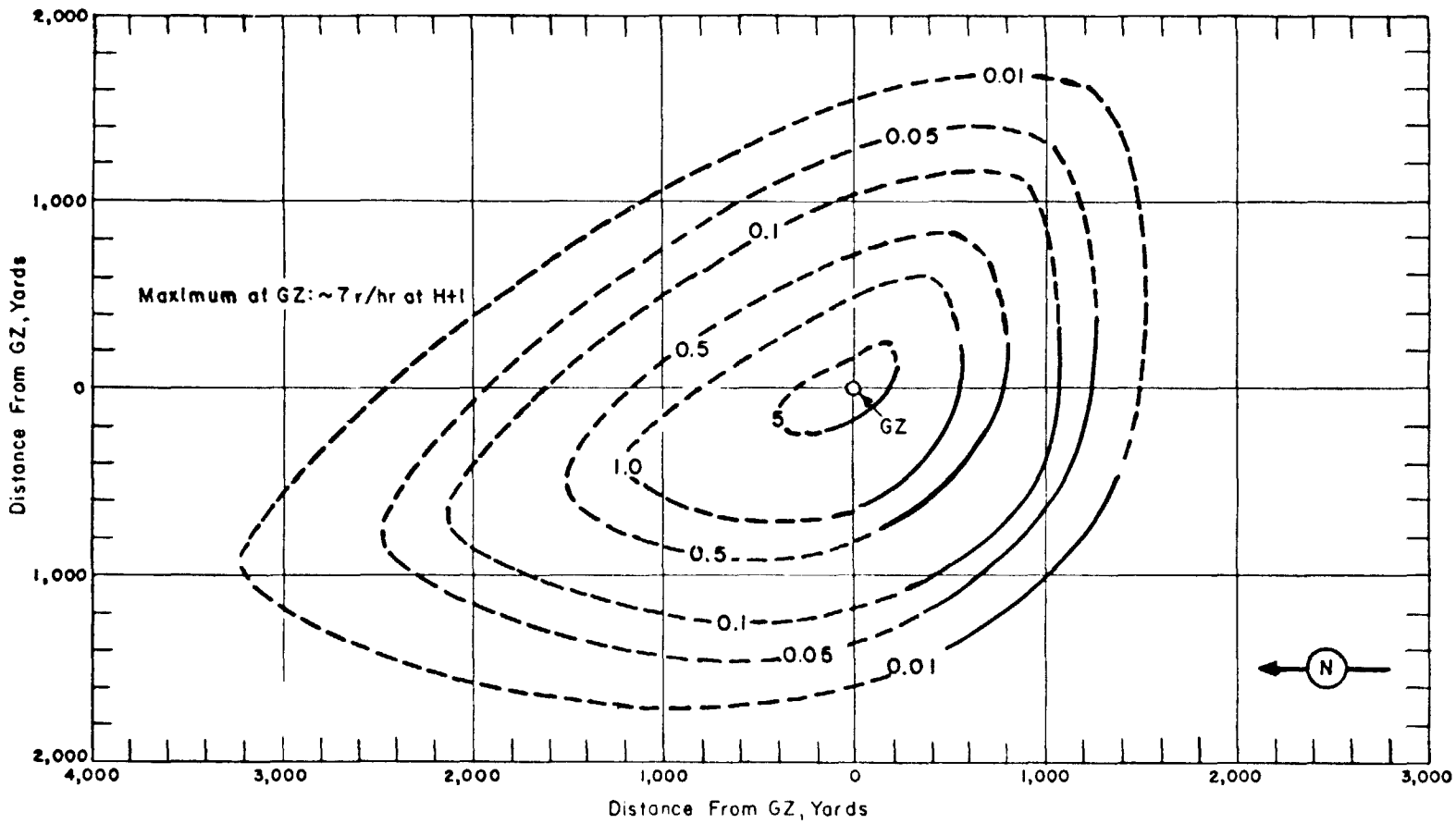


Figure 296. Operation HARDTACK II - DeBaca.
On-site dose rate contours in r/hr at H+1 hour.

TABLE 97 NEVADA WIND DATA FOR OPERATION HARDTACK II - DE BACA

Altitude (MSL)	H-hour Dir	H-hour Speed	Altitude (MSL)	H-hour Dir	H-hour Speed
feet	degrees	mph	feet	degrees	mph
Surface	Calm	Calm	12,000	260	14
5,000	010	02	13,000	270	14
6,000	030	02	14,000	280	13
7,000	020	01	15,000	270	12
8,000	070	02	16,000	260	13
9,000	130	03	17,000	200	17
10,000	210	07	18,000	230	21
11,000	250	12	19,000	240	22
			20,000	240	22

NOTES:

1. Wind data was obtained from the Yucca weather station.
2. The surface air pressure was 12.75 psi, the temperature 8.3°C, the dew point 5.1°C, and the relative humidity 80%.

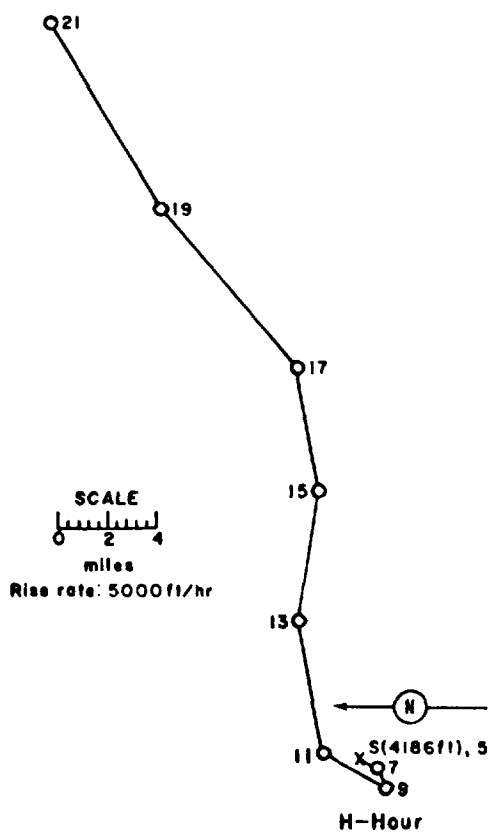


Figure 297. Hodograph for Operation HARDTACK II - De Baca.

OPERATION HARDTACK II - Chaves

	PST	GMT
DATE:	27 Oct 1958	27 Oct 1958
TIME:	0630	1430

TOTAL YIELD: 0.6 tons

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

Sponsor: LASL

SITE: NTS - Area 3u
37° 02' 41" N
116° 01' 47" W
Site elevation: 4,025 ft

HEIGHT OF BURST: 52.5 ft

TYPE OF BURST AND PLACEMENT:
Tower burst over Nevada soil

CLOUD TOP HEIGHT: 6,500 ft MSL
CLOUD BOTTOM HEIGHT: NM

REMARKS:
The on-site fallout documentation was performed by the Radiological Safety Division of the Reynolds Electrical and Engineering Company for purposes of personnel safety. Readings were taken with AN/PDR-39 or Tracerlab SU-10 instruments at H+$\frac{1}{2}$ hours, H+8 hours, and D+1 day. The $t^{-1.2}$ decay approximation was used to H+1 hour. "The downwind extent of the activity is only a rough approximation because of the limited number of measurements. The rest of the pattern was relatively well documented and should be fairly reliable".

No pattern is presented of the off-site fallout because of the limited area that was monitored and the relatively low readings obtained.

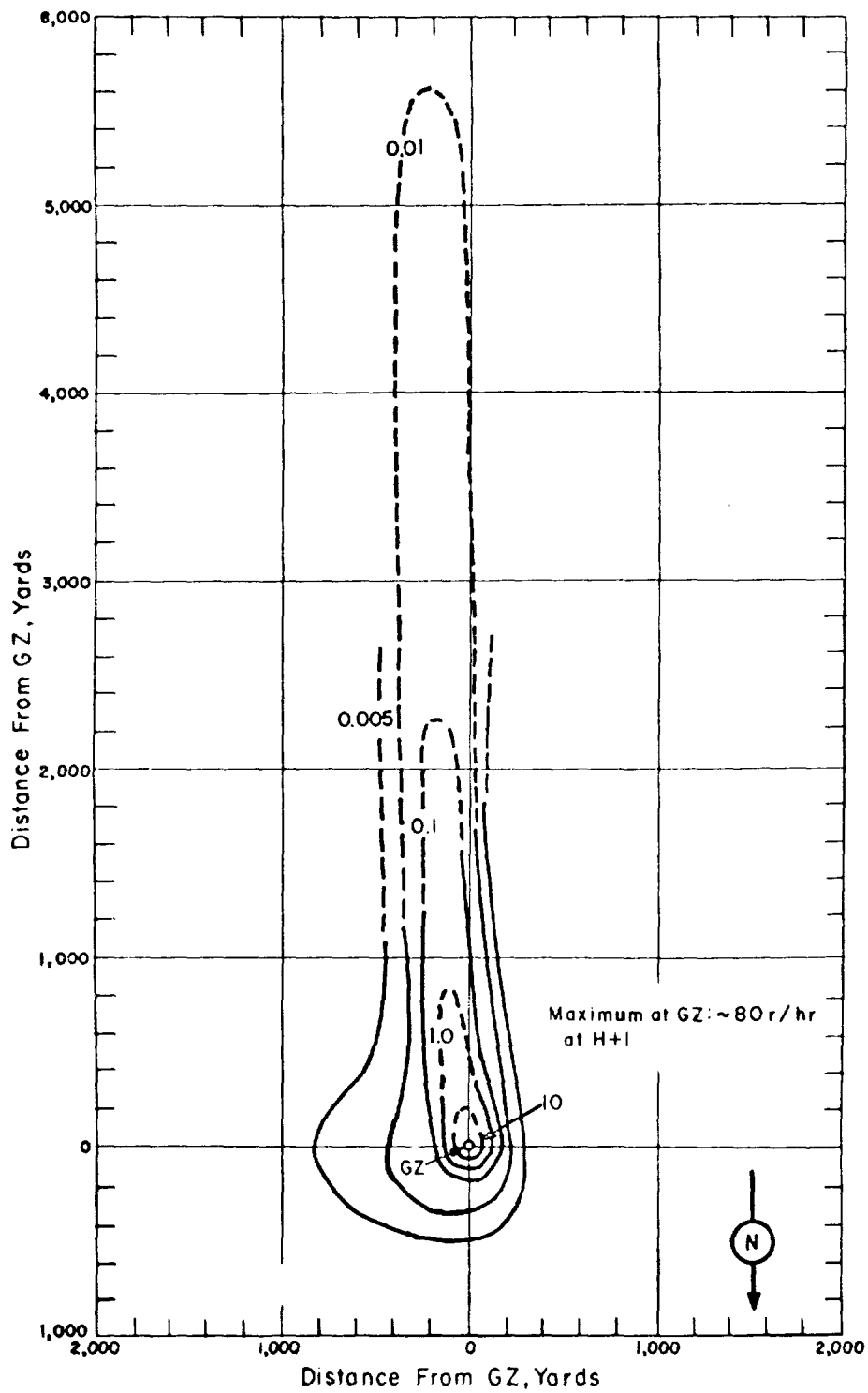


Figure 298. Operation HARDTACK II - Chaves.
On-site dose rate contours in r/hr at H+1 hour.

TABLE 98 NEVADA WIND DATA FOR OPERATION HARDTACK II — CHAVES

Altitude (MSL)	H-hour	
	Dir	Speed
feet	degrees	mph
Surface	350	09
5,000	360	16
6,000	010	18
7,000	030	18
8,000	030	15

NOTE: Wind data was obtained from the Yucca weather station.

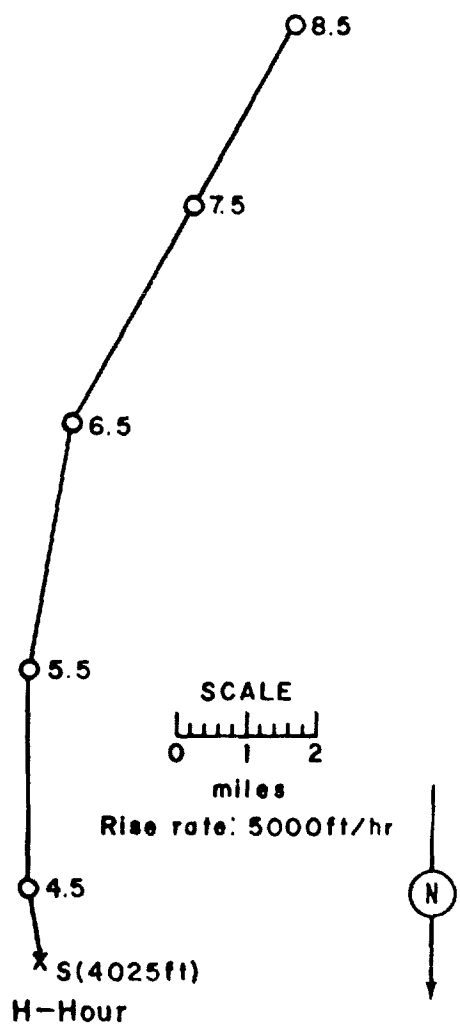


Figure 299. Hodograph for Operation HARDTACK II - Chaves.

OPERATION HARDTACK II - Evans

	PST	GMT
DATE:	28 Oct 1958	29 Oct 1958
TIME:	1600	2400

TOTAL YIELD: 55 tons

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

CRATER DATA: Not available

Sponsor: UCRL

SITE: NTS - Area 12b.04
37° 11' 41" N
116° 12' 17" W
Site elevation: 6,650 ft

HEIGHT OF BURST: Slant distance 848 ft. Vertical depth 852 ft

TYPE OF BURST AND PLACEMENT:
Subsurface burst - Tunnel in Nevada soil

REMARKS:

A small amount of smoke was seen to vent from the portal. This vented material produced very low levels of radiation at a few isolated points.

TABLE 99 NEVADA WIND DATA FOR OPERATION HARDTACK II - EVANS

TIME	SURFACE WINDS			
	9 foot Mesa Slope Tower (Elev. 6,725 ft MSL)		100 foot Mesa Mountain Tower (Elev. 7,465 ft MSL)	
	Dir degrees	Speed mph	Dir degrees	Speed mph
H-hour	290	8	360	Missing
H+1 hour	280	8	360	Missing
H+2 hours	260	5	360	Missing

NOTE: Wind data was obtained from the Yucca weather station.

OPERATION HARDTACK II - Humboldt

	PST	GMT
DATE:	29 Oct 1958	29 Oct 1958
TIME:	0645	1445

TOTAL YIELD: 7.8 tons

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

CRATER DATA: Not available

Sponsor: UCRL - DOD

SITE: NTS - Area 3v
37° 02' 52" N
116° 01' 29" W
Site elevation: 4,029 ft

HEIGHT OF BURST: 25 ft

TYPE OF BURST AND PLACEMENT:
Tower burst over Nevada soil

CLOUD TOP HEIGHT: 7,500 ft MSL
CLOUD BOTTOM HEIGHT: 6,000 ft MSL

REMARKS:

The on-site fallout documentation was severely limited by changes in the GZ location and the operational firing schedule. Readings for the very close-in pattern were taken by the Chemical Corps Radiological Safety Support Unit at points along the north, east, south, and west radial lines at times between 0.1 and 6.7 hours. Experimental dose-rate decay curves were used to extrapolate the readings to H+1 hour. Readings for the on-site fallout pattern were taken at H+$\frac{1}{2}$ hour, H+6 hours, H+27 hours and D+2 days. The $t^{-1.2}$ decay approximation was used to extrapolate the dose-rate readings to H+1 hour. "The on-site fallout from Humboldt was well documented and the pattern is considered reliable"

The off-site fallout documentation was performed with Beckman MX-5 and AN/PDR-39 instruments by the U. S. Public Health Service for purposes of public safety. The $t^{-1.2}$ decay approximation was used to extrapolate the dose-rate readings to H+1 hour. "Although there is some uncertainty in the downwind extent of some of the isolines, there is fair confidence in the width of the pattern and in the orientation of the fallout, which is consistent with the wind analysis".

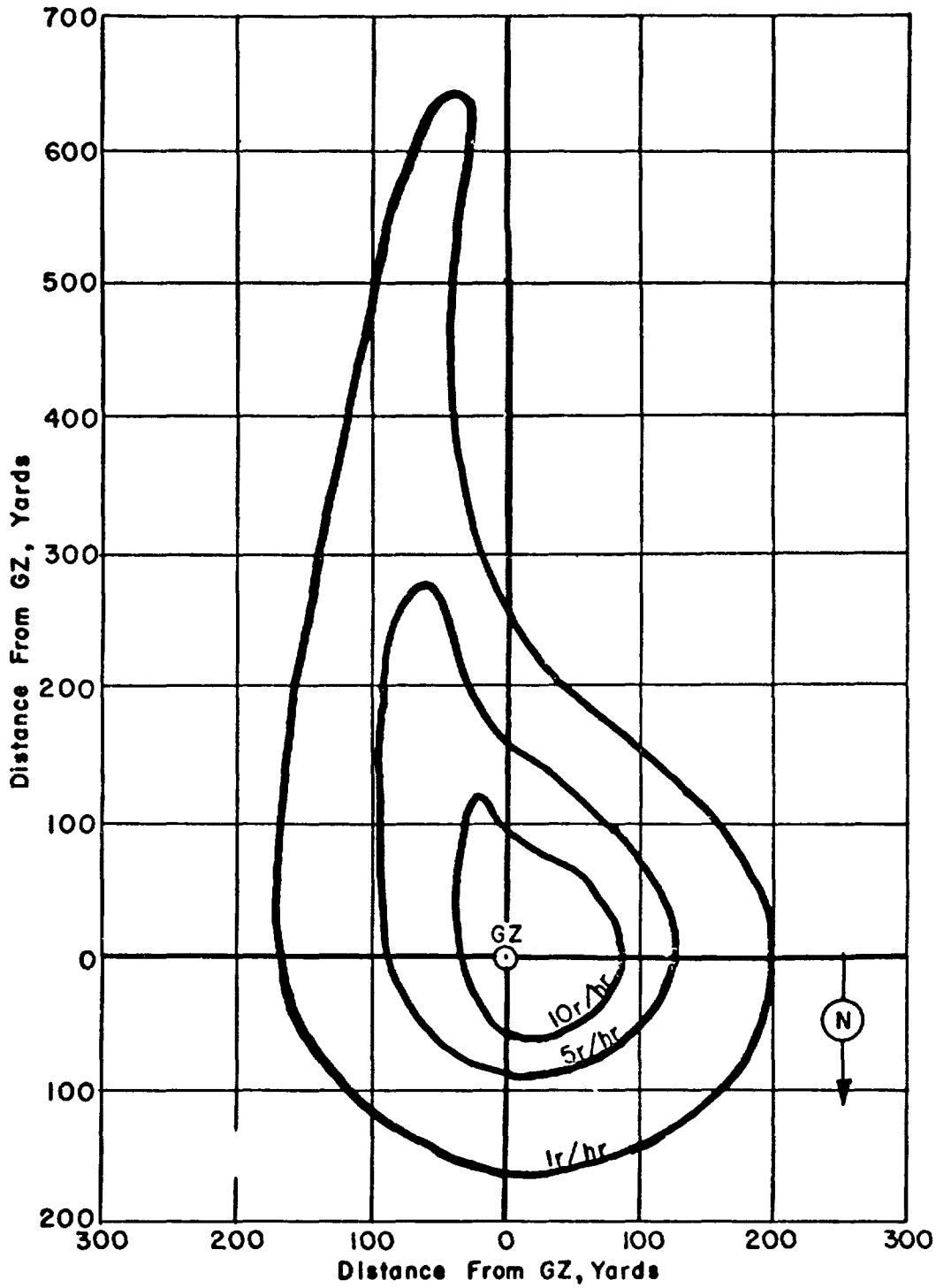


Figure 300. Operation HARDTACK II - Humboldt.
Very close-in dose rate contours in r/hr at H+1 hour.

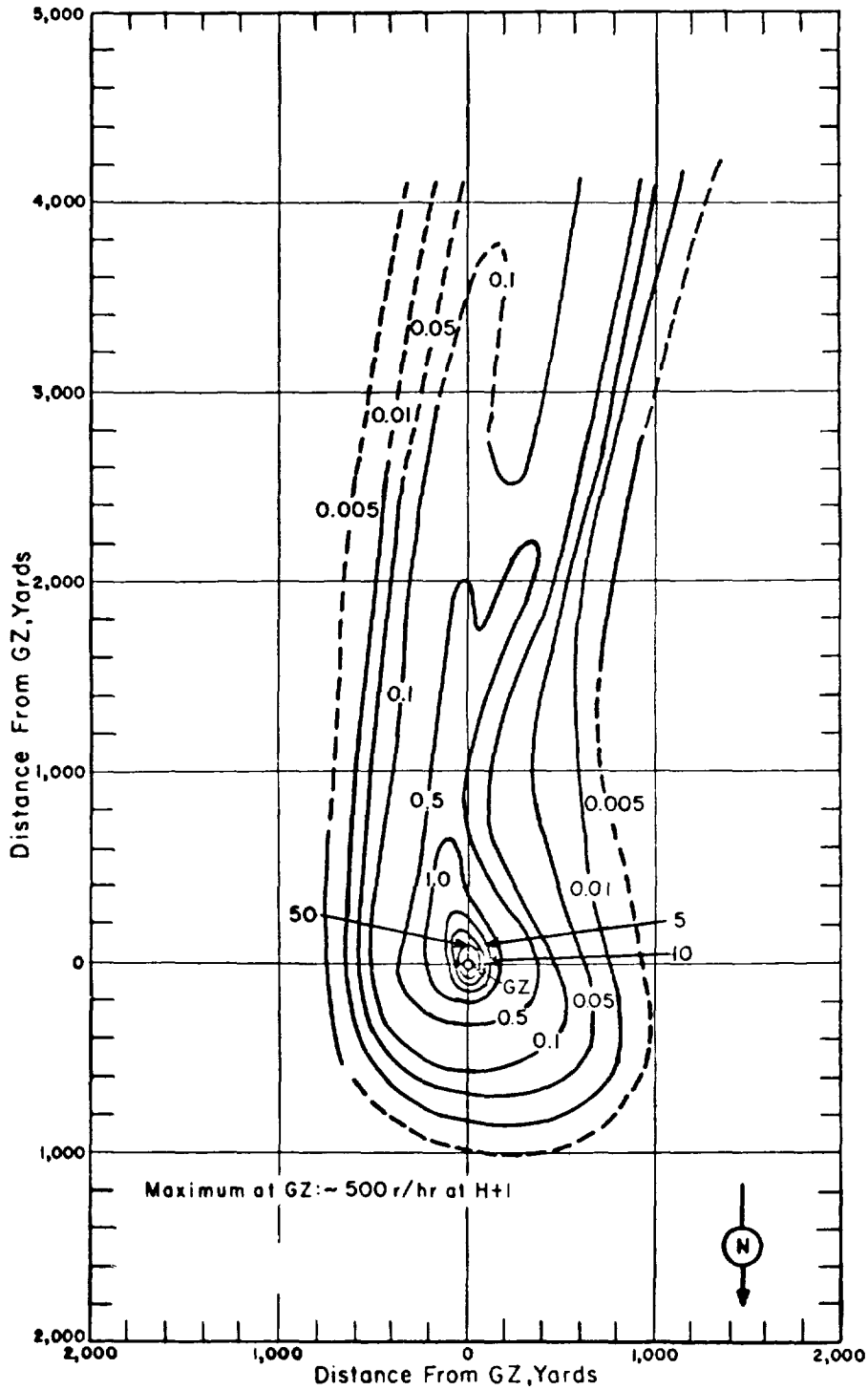


Figure 301. Operation HARDTACK II - Humboldt.
On-site dose rate contours in r/hr at H+1 hour.

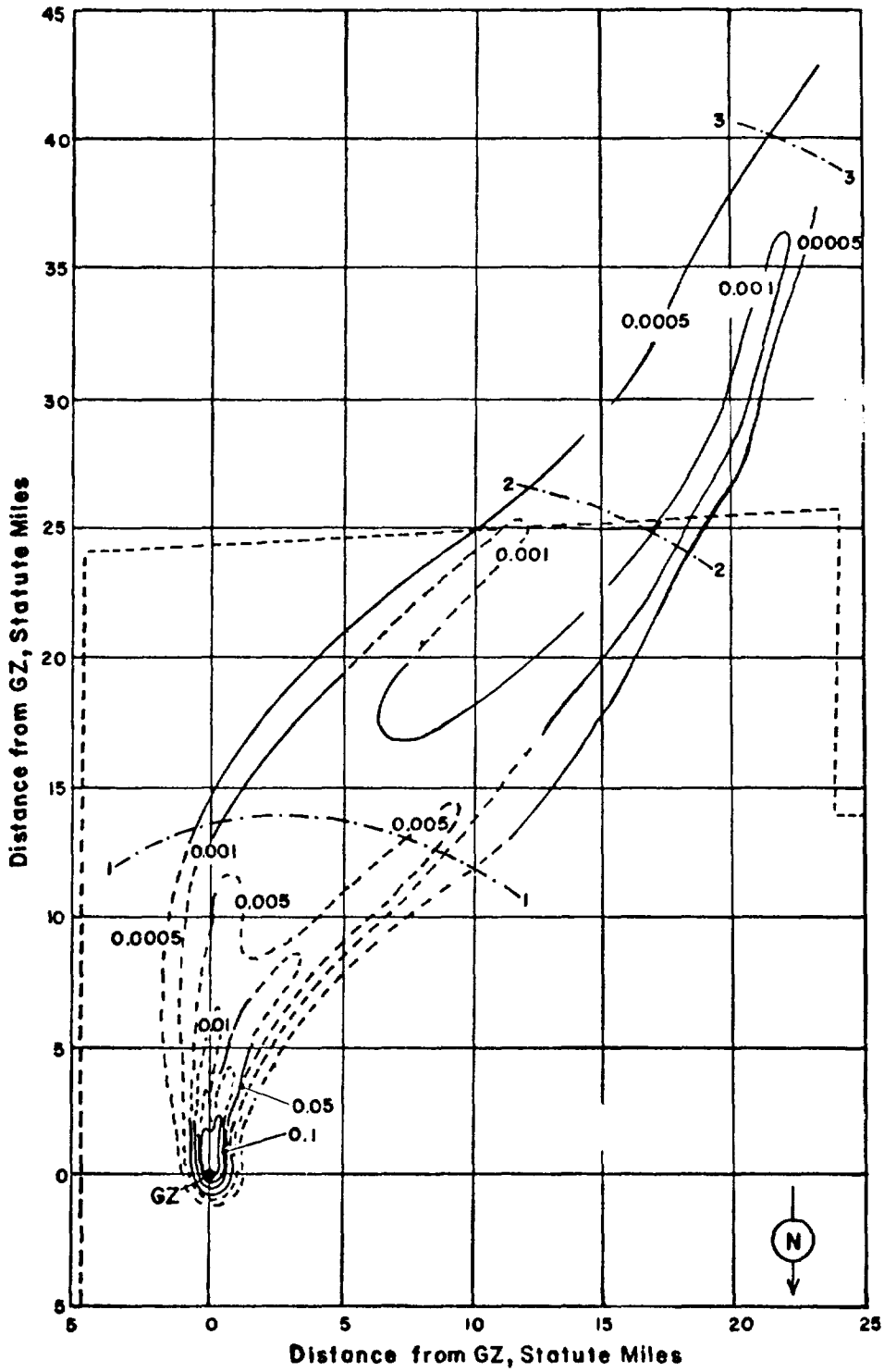


Figure 302. Operation HARDTACK II - Humboldt.
Off-site dose rate contours in r/hr at H+1 hour.

TABLE 100 NEVADA WIND DATA FOR OPERATION HARDTACK II - HUMBOLDT

Altitude (MSL)	H-hour	
	Dir	Speed
feet	degrees	mph
Surface	340	07
5,000	010	29
6,000	020	30
7,000	030	37
8,000	030	33
9,000	030	22
10,000	040	16

NOTES:

1. Wind data was obtained from the Yucca weather station.
2. The surface air pressure was 12.84 psi, the temperature 7.4°C, the dew point -3.2°C, and the relative humidity 46%.

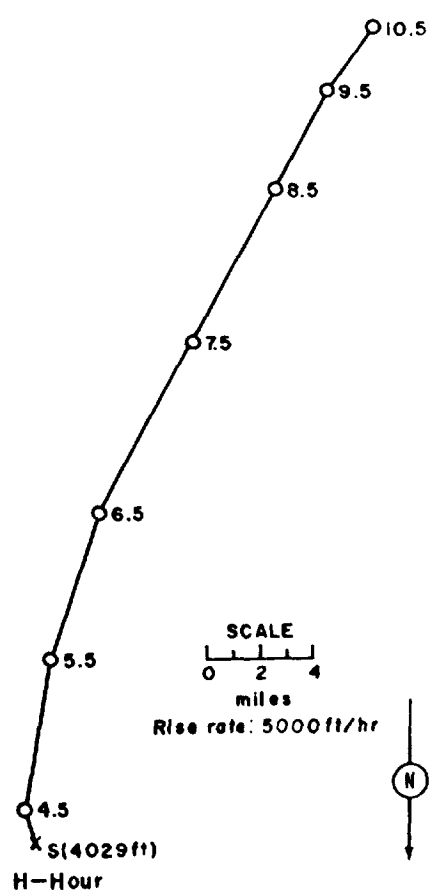


Figure 303. Hodograph for Operation HARDTACK II - Humboldt

OPERATION HARDTACK II - Santa Fe

	PST	GMT
DATE:	29 Oct 1958	30 Oct 1958
TIME:	1900	0300

TOTAL YIELD: 1.3 kt

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

CRATER DATA: No crater

Sponsor: LASL

SITE: NTS - Area 7b
37° 05' 12" N
116° 01' 25" W
Site elevation: 4,186 ft

HEIGHT OF BURST: 1,500 ft

TYPE OF BURST AND PLACEMENT:
Air burst from balloon over Nevada soil

CLOUD TOP HEIGHT: 18,000 ft MSL
CLOUD BOTTOM HEIGHT: 13,000 ft MSL

REMARKS:

The contamination was due primarily to induced activity. The on-site measurements were performed by the Radiological Safety Division of the Reynolds Electrical and Engineering Company for purposes of personnel safety. Readings were taken with AN/PDR-39 or Tracerlab SU-10 instruments at H+1 hour, H+16 hours, D+2 days and D+3 days. The sodium-24 decay rate was used to extrapolate the dose-rate readings to H+1 hour. This decay rate is not strictly applicable although it closely approximates the observed decay.

The off-site fallout was very light and no pattern is presented.

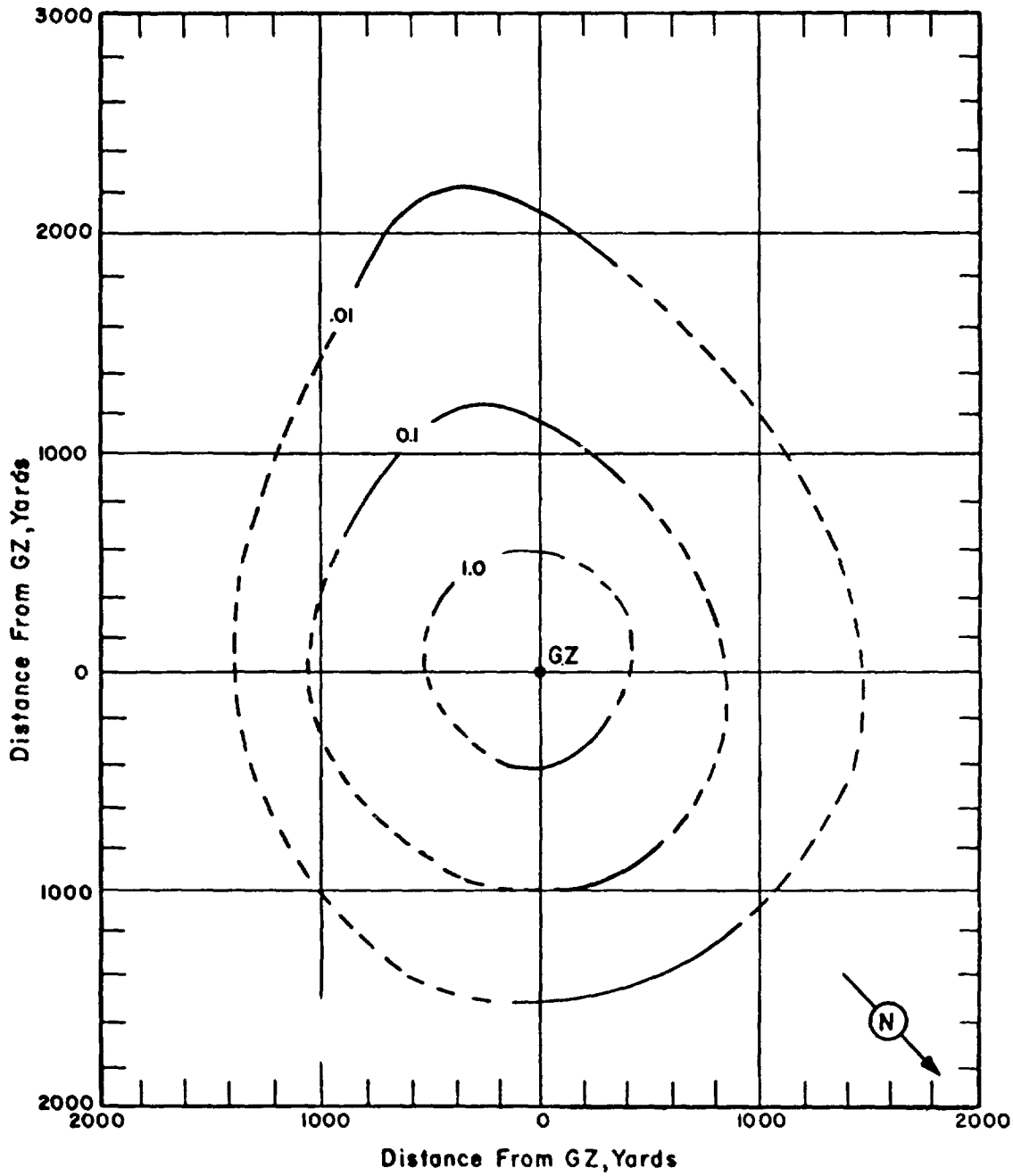


Figure 304. Operation HARDTACK II - Santa Fe.
On-site dose rate contours in r/hr at H+1 hour.

TABLE 101 NEVADA WIND DATA FOR OPERATION HARDTACK II - SANTA FE

Altitude (MSL)	H-hour Dir	H-hour Speed	Altitude (MSL)	H-hour Dir	H-hour Speed
feet	degrees	mph	feet	degrees	mph
Surface	350	04	13,000	030	36
5,000	018	13	14,000	040	40
6,000	040	17	15,000	040	43
7,000	040	20	16,000	040	43
8,000	040	22	17,000	030	44
9,000	040	25	18,000	030	44
10,000	030	28	19,000	028	46
11,000	020	28	20,000	020	51
12,000	030	31			

NOTES:

1. Wind data was obtained from the Yucca weather station.
2. Tropopause height was 39,000 ft MSL.
3. The surface air pressure was 12.70 psi, the temperature 12.1°C, the dew point -7.4°C, and the relative humidity 25%.

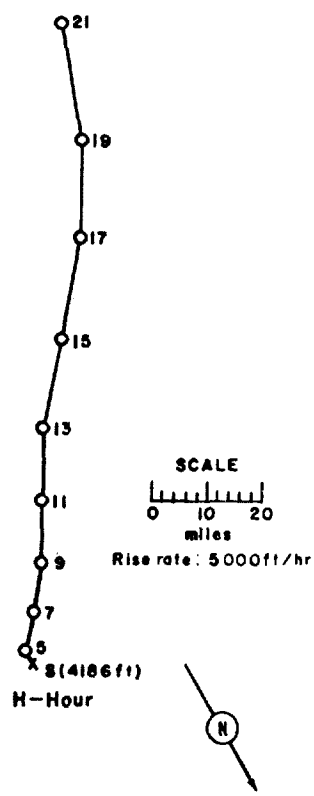


Figure 305. Hodograph for Operation HARDTACK II - Santa Fe.

OPERATION HARDTACK II - Ganymede Safety Experiment

	PST	GMT
DATE:	30 Oct 1958	30 Oct 1958
TIME:	0300	1100

Sponsor: UCRL

SITE: NTS - Area 9g
37° 07' 27" N
Site elevation: 4,193 ft

HEIGHT OF BURST: Surface

TYPE OF BURST AND PLACEMENT:
Surface burst in wooden building with 20 ft of gravel over the building

CLOUD TOP HEIGHT: NM
CLOUD BOTTOM HEIGHT: NM

REMARKS:

There was no nuclear yield for this event. There was some alpha contamination in the immediate vicinity of ground zero.

OPERATION HARDTACK II - Blanca

	PST	GMT
DATE:	30 Oct 1958	30 Oct 1958
TIME:	0700	1500

TOTAL YIELD: 19 kt

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

CRATER DATA: Not available

Sponsor: UCRL

SITE: NTS - Area 12e.05
37° 11' 09" N
116° 12' 07" W
Site elevation: 7,120 ft

HEIGHT OF BURST: -835 ft
Slant Distance. Vertical depth 987 ft.

TYPE OF BURST AND PLACEMENT:
Subsurface burst - Tunnel in Nevada soil

CLOUD TOP HEIGHT: 7,700 ft
CLOUD BOTTOM HEIGHT: NM

REMARKS:

The on-site fallout documentation was performed by the Radiological Safety Division of the Reynolds Electrical and Engineering Company for purposes of personnel safety. Readings were taken with AN/PDR-39 or Tracerlab SU-10 instruments at H+$\frac{1}{2}$ hour, H+6 hours, D+1 day and D+2 days. Due to inadequate mapping and the scarcity of good reference points there is considerable uncertainty in the dose-rate lines. A resurvey was made 7 months later with reference stakes available at half-mile intervals, so that the location of the fallout detected is much more certain than in the initial survey. However, because of the probable reduction in radiation by weathering and the errors probably attendant in assuming the $t^{-1.2}$ decay approximation to be valid for such a long period, the H+1 dose rates were estimated from the initial survey. There is an order of magnitude discrepancy in the estimation of the H+1 hour dose rates from the early to late survey; therefore there is very little confidence in the accuracy of the pattern.

Off-site air sampling showed a significant increase in alpha activity. The beta measurements indicate that some light fallout did occur off site.

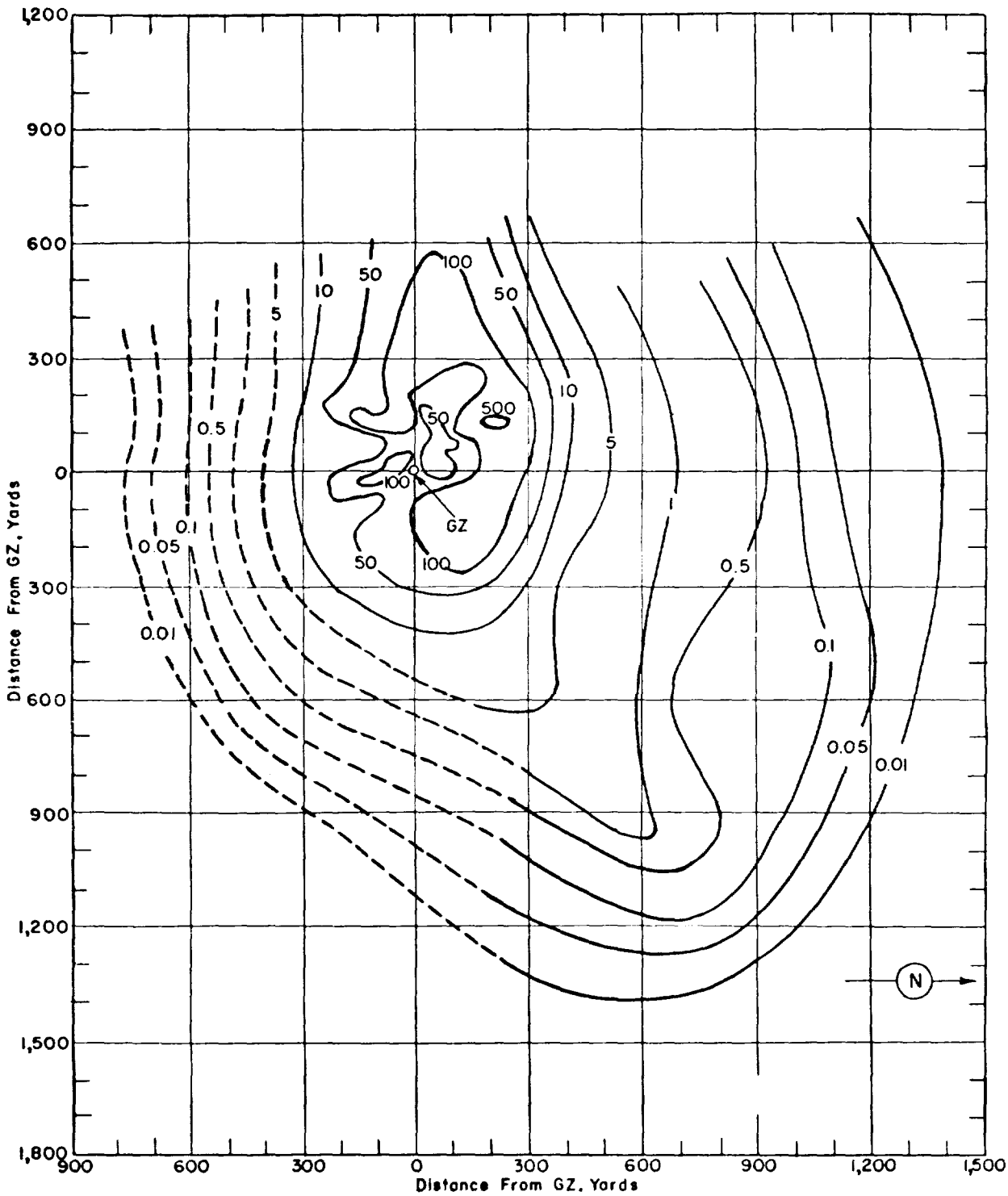


Figure 306. Operation HARDTACK II - Blanca.
Close-in dose rate contours in r/hr at H+1 hour.

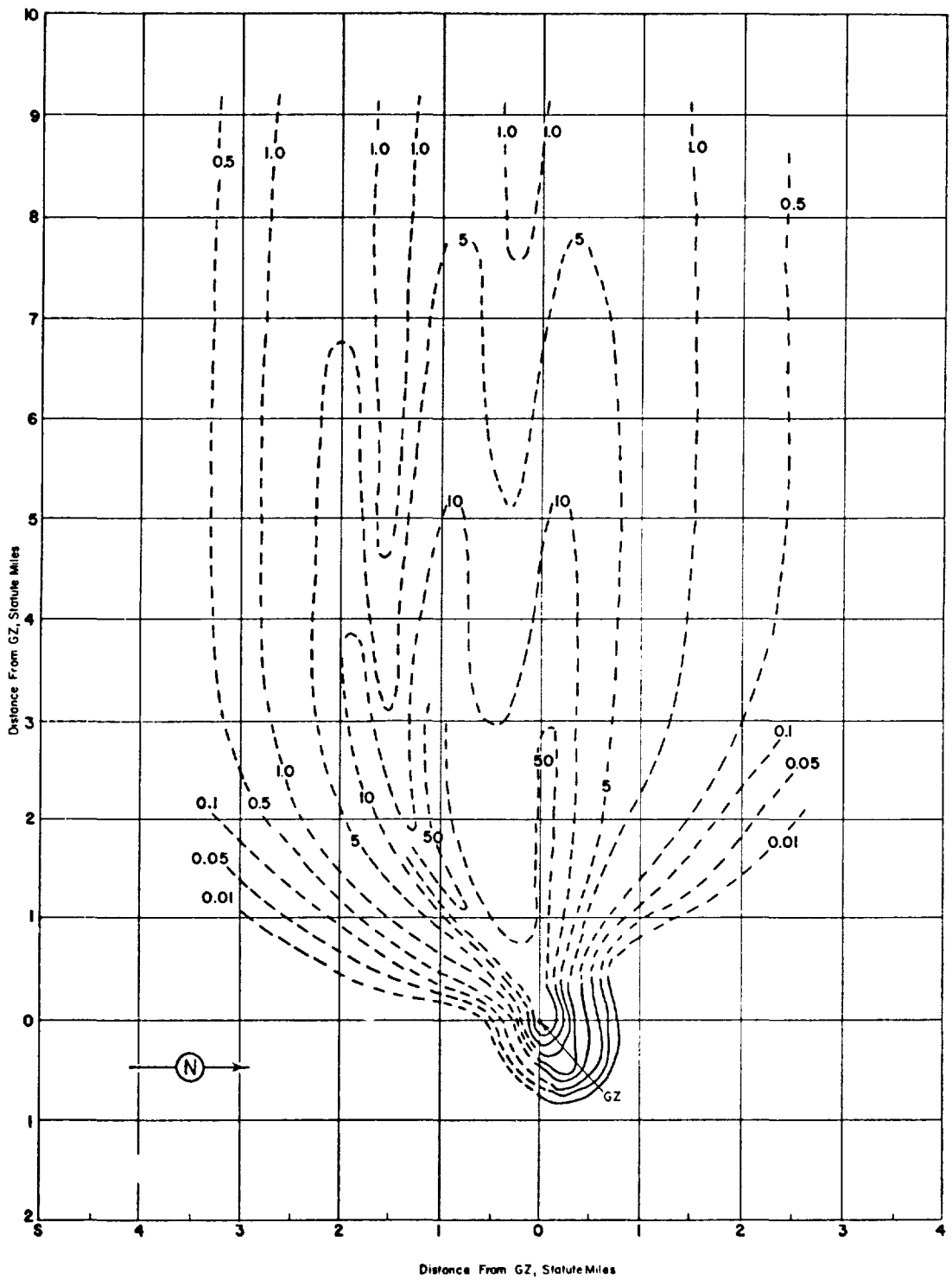


Figure 307. Operation HARDTACK II - Blanca.
On-site dose rate contours in r/hr at H+1 hour.

TABLE 102 NEVADA WIND DATA FOR OPERATION HARDTACK II - BLANCA

Altitude (MSL)	H+5½ hours	
	Dir	Speed
feet	degrees	mph
Surface	80	09
5,000	60	15
6,000	60	15
7,000	60	14
8,000	70	13

NOTE: Wind data was obtained from the Yucca weather station.

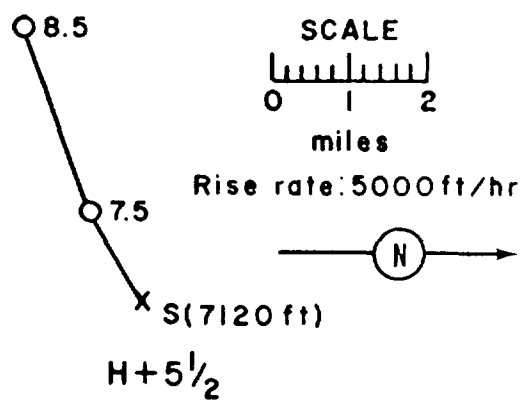


Figure 308. Hodograph for HARDTACK II - Blanca.

OPERATION HARDTACK II - Titania Safety Experiment

	PST	GMT
DATE:	30 Oct 1958	30 Oct 1958
TIME:	1234	2034

TOTAL YIELD: 0.2 tons

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

Sponsor: UCRL

SITE: NTS - Area 8c
37° 10' 38" N
116° 04' 09" W
Site elevation: 4,403 ft

HEIGHT OF BURST: 25 ft

TYPE OF BURST AND PLACEMENT:
Tower burst over Nevada soil

CLOUD TOP HEIGHT: 6,000 ft MSL
CLOUD BOTTOM HEIGHT: NM

REMARKS:

The on-site fallout documentation was performed by the Radiological Safety Division of the Reynolds Electrical and Engineering Company for purposes of personnel safety. Readings were taken with AN/PDR-39 or Tracerlab SU-10 instruments at H+$\frac{1}{2}$ hour. The $t^{-1.2}$ decay approximation was used to extrapolate the readings to H+1 hour. The pattern presented is not reliable.

No off-site contamination was detected.

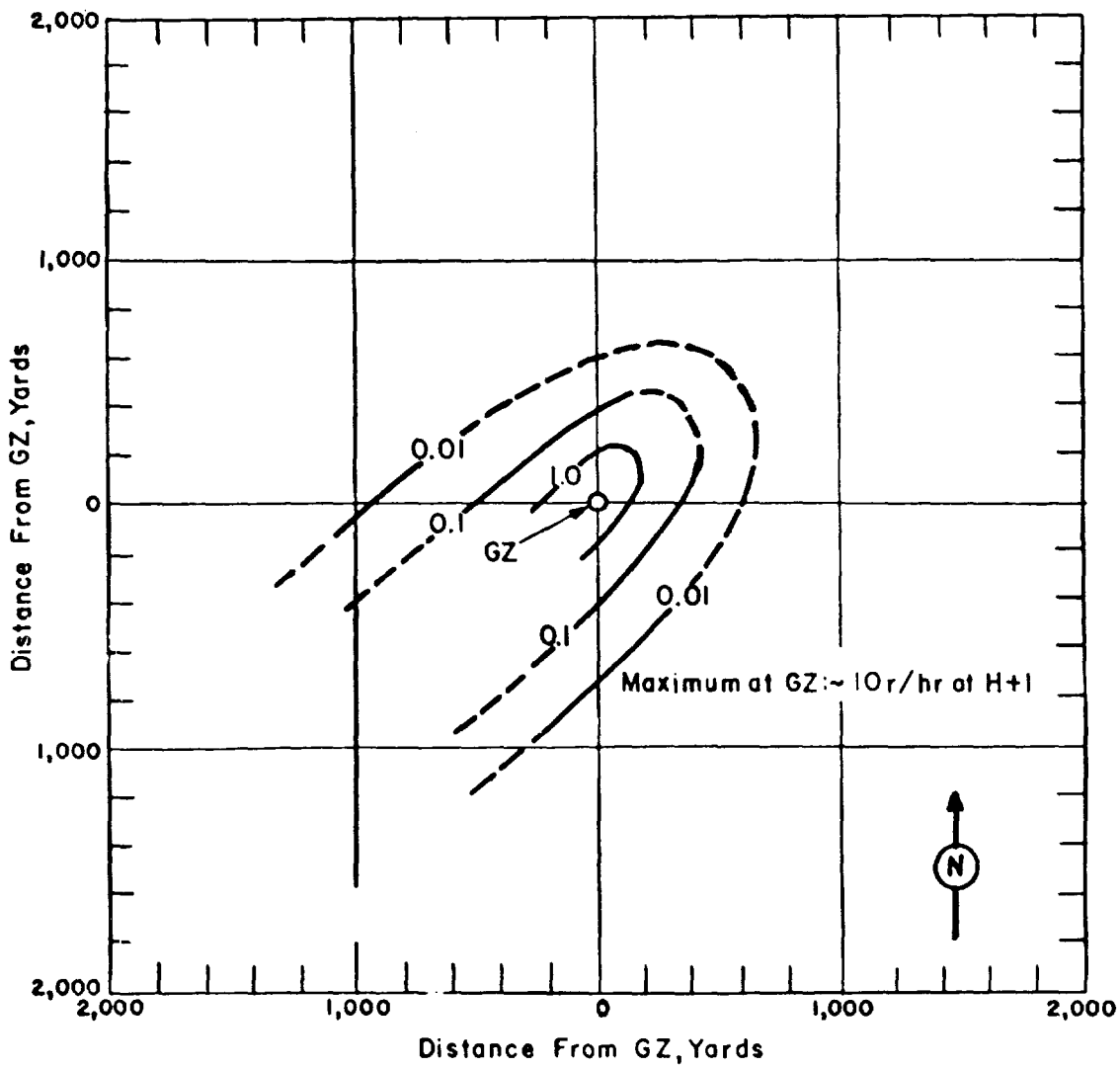


Figure 309. Operation HARDTACK II - Titania.
On-site dose rate contours in r/hr at H+1 hour.

TABLE 103 NEVADA WIND DATA FOR OPERATION HARDTACK II - TITANIA

Altitude (MSL)	H-hour		H+½ hour		H+1½ hours	
	Dir	Speed	Dir	Speed	Dir	Speed
feet	degrees	mph	degrees	mph	degrees	mph
Surface	80	09	80	12	90	11
5,000	60	15	--	--	--	--
6,000	60	15	--	--	--	--
7,000	60	14	--	--	--	--
8,000	70	13	--	--	--	--

NOTES:

1. H-hour data taken from Yucca Lake Weather Station (Elevation 3,924 ft MSL).
2. H+½ hour and H+1½ hours data from 20-foot tower at Station 353 (Surface Elevation about 4,325 ft MSL).

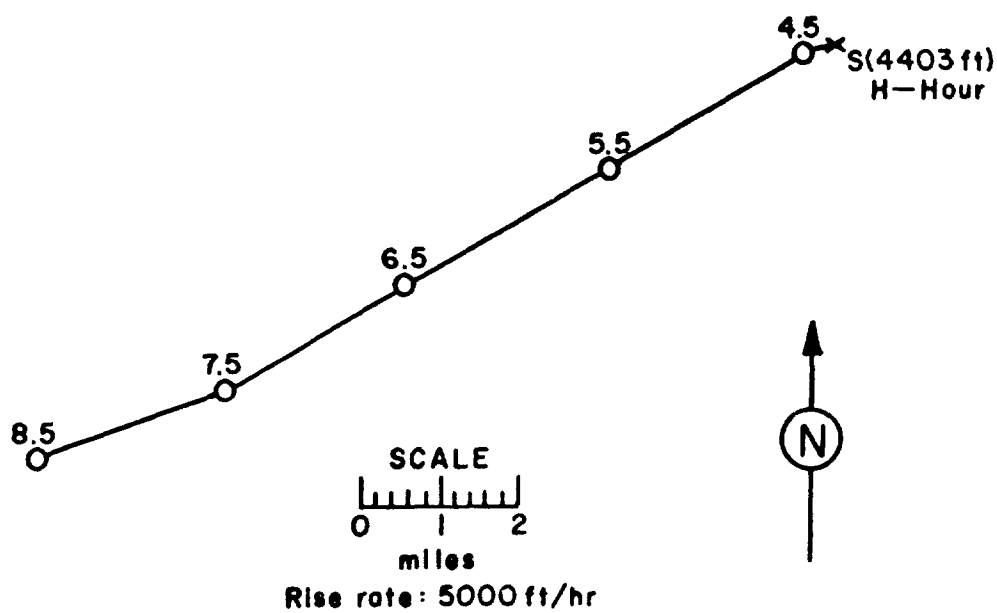


Figure 310. Hodograph for Operation HARDTACK II - Titania.

OPERATION NOUGAT - Antler

	PST	GMT
DATE:	15 Sep 1961	15 Sep 1961
TIME:	0900	1700

TOTAL YIELD: 2.4 kt

CRATER DATA: No crater

SPONSOR: LRL

SITE: NTS - U12e.03a
37° 11' 16.6430" N
116° 12' 27.9248" W

SITE ELEVATION: 7428 ft MSL

DEPTH OF BURST: 1319 ft

TYPE OF BURST AND PLACEMENT:
Tunnel, in semiwelded tuff

STEMMING MATERIAL:

Tunnel - bedded tuff rhyolite to quartz latite and bedded tuff well-cemented.

VENTING:

Venting occurred at the tunnel portal at H+2 seconds for an unknown duration. A secondary steam explosion was observed from 8 to 10 minutes following the detonation.

The estimated dose rate at the tunnel portal, normalized to H+1 hour, was 50 R/hr. The estimated total release, normalized to H+1 minute, was 5×10^8 curies and contained the following isotopes: I^{131}, I^{133}, I^{135}, $Ba\text{-}La^{140}$.

REMARKS:

Some radioactivity was detected in off-site areas. No radiation was detected at the worksite or any other location, from releases of gaseous radioactivity during post-shot drilling or tunnel re-entry operations.

OPERATION NOUGAT - Shrew

	PST	GMT
DATE:	16 Sep 1961	16 Sep 1961
TIME:	1145	1945

SPONSOR: LASL

SITE: NTS - U3ac
37° 02' 54.4373" N
116° 01' 29.5908" W

DEPTH OF BURST: 322 ft

TYPE OF BURST AND PLACEMENT:
Underground, in slightly consolidated alluvium

VENTING:

This event released small visible quantities of radioactive steam and/or gases.

REMARKS:

Radiation was detected on-site from radioactivity released by this detonation, but no radiation levels above background were detected off the NTS in populated areas. No radiation was detected at the worksite or any other location, from releases of gaseous radioactivity during post-shot drilling.

OPERATION NOUGAT - Chena

	PST	GMT
DATE:	10 Oct 1961	10 Oct 1961
TIME:	1000	1800

SPONSOR: LRL

SITE: NTS - U12b.09
37° 11' 39.4418" N
116° 12' 25.2736" W

SITE ELEVATION: 7472 ft MSL

DEPTH OF BURST: 838 ft

TYPE OF BURST AND PLACEMENT:
Tunnel, in slightly competent tuff

VENTING:

Venting occurred at the tunnel portal at H+2 seconds and continued for approximately 20 minutes.

The estimated dose rate at the tunnel portal, normalized to H+1 hour, was 35 R/hr. The estimated total release, normalized to H+1 minute, was 2×10^6 curies. The identities of the release products are not available.

REMARKS:

No radiation levels above background were detected off the NTS in populated areas from radioactivity released by this detonation. No radiation was detected at the worksite or at any other location, from releases of gaseous radioactivity during post-shot drilling or tunnel re-entry operations.

OPERATION NOUGAT - Mink

	PST	GMT
DATE:	29 Oct 1961	29 Oct 1961
TIME:	1030	1830

SPONSOR: LASL

SITE: NTS - U3ae
37° 02' 54.8432" N
116° 01' 51.9485" W

SITE ELEVATION: 4028 ft MSL

DEPTH OF BURST: 630 ft
DEPTH OF EMPLACEMENT HOLE: 640 ft
TYPE OF BURST AND PLACEMENT:
Underground, in alluvium

VENTING:

Some gas seepage was evidenced at H+25 minutes.

REMARKS:

Radiation was detected on-site from radioactivity released by this detonation. Produced measurable contamination of off-site milk supplies caused levels of contamination in milk in Hiko, Nevada, to jump to 720 pc/ℓ, 4 days after the shot. Some radiation was detected in the areas surrounding SZ from gaseous radioactivity released during post-shot drilling. No radiation was detected off the NTS from post-shot operations.

OPERATION NOUGAT - Fisher

	PST	GMT
DATE:	3 Dec 1961	3 Dec 1961
TIME:	1504	2304

TOTAL YIELD: 13.5 kt

CRATER DATA:
Subsidence crater
Diameter: 650 ft
Depth: 70 ft

SPONSOR: LASL

SITE: NTS - U3ah
37° 02' 45.0854" N
116° 01' 39.6325" W

DEPTH OF BURST: 1193 ft

TYPE OF BURST AND PLACEMENT:
Underground, in alluvium

VENTING:

This event released small visible quantities of radioactive steam and/or gases.

REMARKS:

Radiation was detected on-site from radioactivity released by this detonation. No radiation levels above background were detected off the NTS in populated areas from radioactivity released by this detonation.

Some radiation was detected in the area surrounding SZ from gaseous radioactivity released during post-shot drilling.

PROJECT GNOME

	MST	GMT
DATE:	10 Dec 1961	10 Dec 1961
TIME:	1200	1900

TOTAL YIELD: 3.1 kt

CRATER DATA:
No crater

SPONSOR: LRL

SITE: Near Carlsbad, New Mexico
32° 15' 49" N
103° 5' 57" W

SITE ELEVATION: 3395 ft MSL

DEPTH OF BURST: 1184 ft

TYPE OF BURST AND PLACEMENT:
Underground, in bedded rock salt

VENTING:

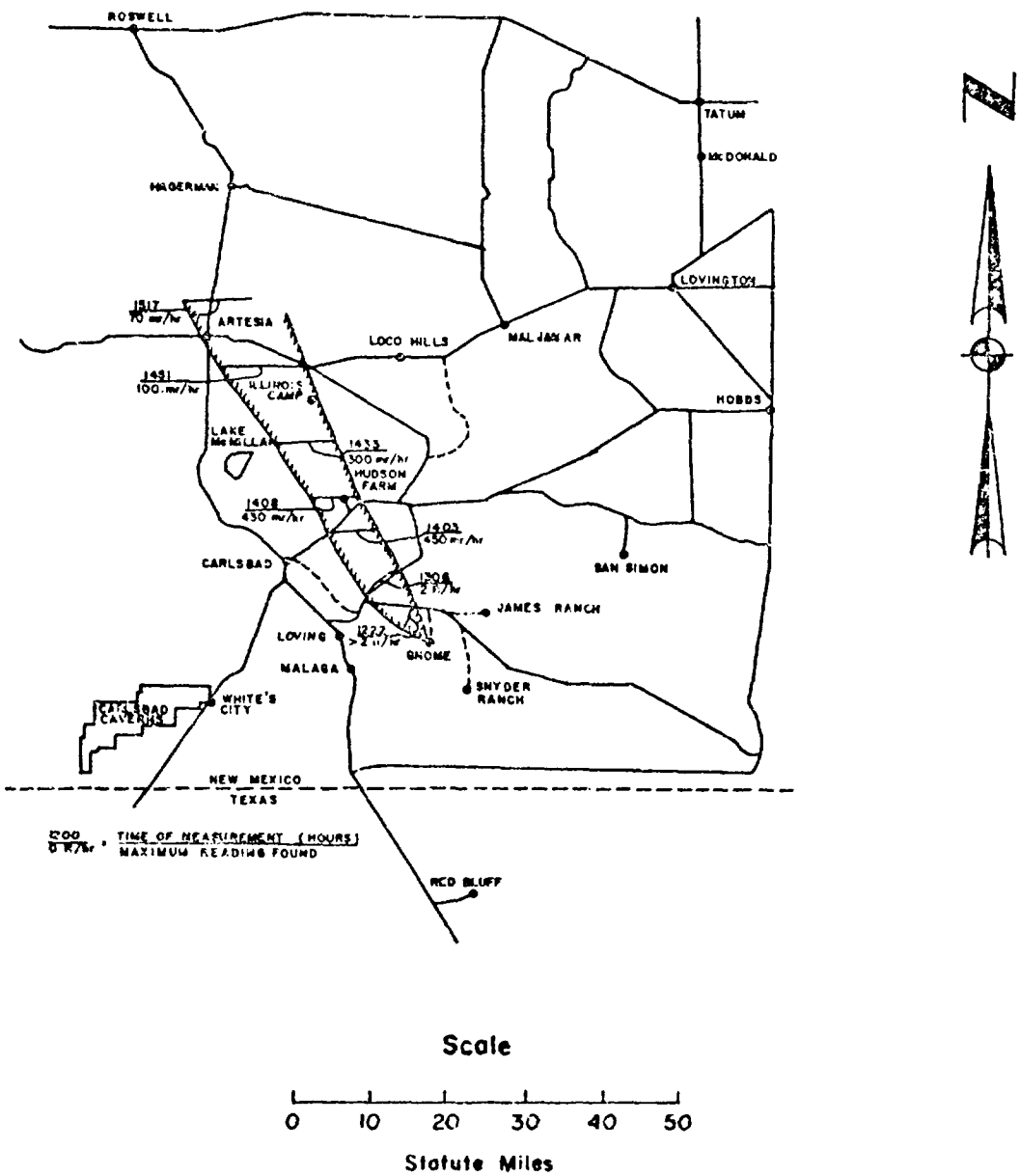
Radiation was detected at the blast door at the bottom of the shaft less than one minute following the explosion; and at the shaft collar, 3 minutes and 40 seconds after the detonation. At approximately 7 minutes after the detonation, gray smoke, steam, and associated radioactivity surged from the shaft opening. By 11 minutes following the explosion, copious quantities of steam were issuing from both shaft and ventilation lines. A large flow continued for about 30 minutes before gradually decreasing. A small flow was still detected the following day. The radioactive elements that vented through the shaft were volatile and noble gases.

REMARKS:

Figure 8 shows the measured cloud pattern and times of measurement. All readings are gross gamma measured inside the aircraft. Attenuation of radiation by the aircraft structure was not determined, but was probably in the range of 30 to 50 percent.

Meteorological Information:

Wind at the surface: 150 degrees - 4.6 mph
Wind at 100 feet: 140 degrees - 16 mph
Surface air temperature: 45.3°F
Surface relative humidity: 72%
Surface atmospheric pressure: 26.74 inches of mercury



Scale

0 10 20 30 40 50

Statute Miles

Figure 311. Project Gnome - Cloud pattern as found by Aerial Monitoring

OPERATION NOUGAT - Mad

	PST	GMT
DATE:	13 Dec 1961	13 Dec 1961
TIME:	1000	1800

TOTAL YIELD: 0.43 kt

CRATER DATA: No crater

SPONSOR: LRL

SITE: NTS - U9a
37° 07' 35.77" N
116° 02' 55.54" W

DEPTH OF BURST: 594 ft

TYPE OF BURST AND PLACEMENT:
Underground, in slightly consolidated alluvium

VENTING:

This event released small visible quantities of radioactive steam and/or gases.

REMARKS:

Radiation was detected on-site from radioactivity released by this detonation. No radiation levels above background were detected off the NTS in populated areas from radioactivity released by this detonation.

No radiation was detected at the worksite or any other location, from releases of gaseous radioactivity during post-shot drilling.

OPERATION NOUGAT - Ringtail

	PST	GMT
DATE:	17 Dec 1961	17 Dec 1961
TIME:	0835	1635

SPONSOR: LASL

SITE: NTS - U3ak
37° 02' 35.38" N
116° 01' 31.13" W

DEPTH OF BURST: 1191 ft

TYPE OF BURST AND PLACEMENT:
Underground, in alluvium

VENTING:

This event released small visible quantities of radioactive steam and/or gases.

REMARKS:

Radiation was detected on-site from radioactivity released by this detonation. No radiation levels above background were detected off the NTS in populated areas, from radioactivity released by this detonation.

No radiation was detected at the worksite or any other location from releases of gaseous radioactivity during post-shot drilling.

OPERATION NOUGAT - Feather

	PST	GMT
DATE:	22 Dec 1961	22 Dec 1961
TIME:	0830	1630

SPONSOR: LRL

SITE: NTS - U12b.08
37° 11' 41.76" N
116° 12' 29.84" W

SITE ELEVATION: 7449 ft MSL

DEPTH OF BURST: 812 ft

TYPE OF BURST AND PLACEMENT:
Tunnel, in competent to incompetent tuff.

VENTING:

At H hour a small cloud which appeared to be typical gas-venting, rose from a tunnel portal and vent pipes on top of the mesa and endured for 11 minutes.

The estimated dose rate at the tunnel portal, normalized to H+1 hour, was 18 R/hr. The estimated total release, normalized to H+1 minute, was 1×10^6 curies. The isotope identities are not available.

REMARKS:

At H+30 minutes a branch tunnel was monitored at 40 mR/hr, and a location 1/2 mile southwest and downwind from the venting origin was monitored to be 100 mR/hr at the same time.

Some radioactivity was detected in off-site areas. No radiation was detected at the worksite or any other location, from releases of gaseous radioactivity during post-shot drilling or tunnel re-entry operations.

OPERATION NOUGAT - Stoat

	PST	GMT
DATE:	9 Jan 1962	9 Jan 1962
TIME:	0830	1630

TOTAL YIELD: 4.5 kt

CRATER DATA:
Subsidence crater
Diameter: 356 ft
Depth: 7 ft

VENTING:
Vented

SPONSOR: LASL

SITE: NTS - U3ap
37° 02' 40.70" N
116° 02' 06.23" W

DEPTH OF BURST: 992 ft

TYPE OF BURST AND PLACEMENT:
Underground, in alluvium

REMARKS:

Radiation was detected on-site from radioactivity released by this detonation. No radiation levels above background were detected off the NTS in populated areas, from radioactivity released by this detonation.

Some radiation was detected in the area surrounding SZ from gaseous radioactivity released during post-shot drilling. No radioactivity was detected off the NTS from post-shot operations.

OPERATION NOUGAT - Agouti

	PST	GMT
DATE:	18 Jan 1962	18 Jan 1962
TIME:	1000	1800

TOTAL YIELD: 5.9 kt

CRATER DATA:
Subsidence crater
Diameter: 500 ft
Depth: 50 ft

VENTING:
None

SPONSOR: LASL

SITE: NTS - U3ao
37° 02' 50.08" N
116° 02' 03.69" W

DEPTH OF BURST: 856 ft

TYPE OF BURST AND PLACEMENT:
Underground, in alluvium

REMARKS:

No radiation levels above background were detected on or off the NTS, from radioactivity released by this detonation.

No radiation was detected at the worksite or any other location, from releases of gaseous radioactivity during post-shot drilling.

OPERATION NOUGAT - Dormouse

	PST	GMT
DATE:	30 Jan 1962	30 Jan 1962
TIME:	1000	1800

SPONSOR: LASL

SITE: NTS - U3aq
37° 02' 48.64" N
116° 02' 22.14" W

DEPTH OF BURST: 1191 ft

TYPE OF BURST AND PLACEMENT:
Underground, in alluvium

VENTING:

This event released small visible quantities of radioactive steam and/or gases.

REMARKS:

Radiation was detected on-site from radioactivity released by this detonation. No radiation levels above background were detected off the NTS in populated areas from radioactivity released by this detonation.

Some radiation was detected in the area surrounding SZ from gaseous radioactivity released during post-shot drilling. No radioactivity was detected off the NTS from post-shot operations.

OPERATION NOUGAT - Stillwater

	PST	GMT
DATE:	8 Feb 1962	8 Feb 1962
TIME:	1000	1800

TOTAL YIELD: 2.7 kt

CRATER DATA:
Subsidence crater
Diameter: 450 ft
Depth: 32 ft

VENTING:
None, except during post-shot drilling

SPONSOR: LRL

SITE: NTS - U9c
37° 07' 38.09" N
116° 03' 09.15" W

SITE ELEVATION: 4208 ft MSL

DEPTH OF BURST: 625 ft

TYPE OF BURST AND PLACEMENT:
Underground, in slightly consolidated alluvium

REMARKS:

No radiation levels were detected above background on or off the NTS, from radioactivity released by this detonation.

Some radiation was detected in the area surrounding SZ from gaseous radioactivity released during post-shot drilling. No radioactivity was detected off the NTS from post-shot operations.

OPERATION NOUGAT - Armadillo

	PST	GMT
DATE:	9 Feb 1962	9 Feb 1962
TIME:	1000	1800

TOTAL YIELD: 6.6 kt

CRATER DATA:
Subsidence crater
Diameter: 500 ft
Depth: 35 ft

VENTING:
Vented

SPONSOR: LASL

SITE: NTS - U3ar
37° 02' 36.88" N
116° 02' 20.24" W

DEPTH OF BURST: 786 ft

TYPE OF BURST AND PLACEMENT:
Underground, in alluvium

REMARKS:

Radiation was detected on-site from radioactivity released by this detonation. No radiation levels above background were detected off the NTS in populated areas from radioactivity released by this detonation.

Some radiation was detected in the area surrounding SZ from gaseous radioactivity released during post-shot drilling. No radioactivity was detected off the NTS from post-shot operations.

OPERATION NOUGAT - Hardhat

	PST	GMT
DATE:	15 Feb 1962	15 Feb 1962
TIME:	1000	1800

TOTAL YIELD: 5.9 kt

CRATER DATA:
No crater

VENTING:
Vented

SPONSOR: DOD

SITE: NTS - U15a
37° 13' 34.7140" N
116° 03' 33.5234" W

SITE ELEVATION: 5114 ft MSL

DEPTH OF BURST: 943 ft

TYPE OF BURST AND PLACEMENT:
Underground, bottom of 36-inch-diameter shaft in grandodiorite

REMARKS:

Radiation was detected on-site from radioactivity released by this detonation. No radiation levels above background were detected off the NTS in populated areas from radioactivity released by this detonation.

Some radiation was detected in the area surrounding SZ from gaseous radioactivity released during post-shot drilling. No radioactivity was detected off the NTS from post-shot operations.

OPERATION NOUGAT - Chinchilla I

	PST	GMT
DATE:	19 Feb 1962	19 Feb 1962
TIME:	0830	1630

TOTAL YIELD: 1.8 kt

CRATER DATA:
Subsidence crater
Diameter: 300 ft
Depth: 50 ft

SPONSOR: LASL

SITE: NTS - U3ag
37° 02' 56.5909" N
116° 01' 46.3128" W

DEPTH OF BURST: 492 ft

TYPE OF BURST AND PLACEMENT:
Underground, in alluvium

VENTING:

This event released small visible quantities of radioactive steam and/or gases.

REMARKS:

Radiation was detected on-site from radioactivity released by this detonation. No radiation levels above background were detected off the NTS in populated areas from radioactivity released by this detonation.

Some radiation was detected in the area surrounding SZ from gaseous radioactivity released during post-shot drilling. No radioactivity was detected off the NTS from post-shot operations

OPERATION NOUGAT - Codsaw

	PST	GMT
DATE:	19 Feb 1962	19 Feb 1962
TIME:	0950	1750

SPONSOR: LRL

SITE: NTS - U9g
37° 07' 38.8308" N
116° 02' 13.63" W

SITE ELEVATION: 4218 ft MSL

DEPTH OF BURST: 696 ft

TYPE OF BURST AND PLACEMENT:
Underground, in semiwelded tuff

VENTING:
Vented

REMARKS:

Radiation levels were detected near SZ, above normal background, from radioactivity released by this detonation. No other radiation levels were detected on or off the NTS, from radioactivity released by this detonation.

No radiation was detected at the worksite or any other location from releases of gaseous radioactivity during post-shot drilling.

OPERATION NOUGAT - Cimarron

	PST	GMT
DATE:	23 Feb 1962	23 Feb 1962
TIME:	1000	1800

TOTAL YIELD: 11.2 kt

CRATER DATA:
Subsidence crater
Diameter: 500 ft
Depth: 40 ft

VENTING:
None except during post-shot drilling

SPONSOR: LRL

SITE: NTS - U9h
37° 07' 43.88" N
116° 02' 53.91" W

SITE ELEVATION: 4208 ft MSL

DEPTH OF BURST: 1000 ft

TYPE OF BURST AND PLACEMENT:
Underground, in slightly consolidated alluvium

REMARKS:

No radiation levels above background were detected on or off the NTS, from radioactivity released by this detonation.

Some radiation was detected in the area surrounding SZ from gaseous radioactivity released during post-shot drilling. No radioactivity was detected off the NTS, from post-shot operations.

OPERATION NOUGAT - Platypus

	PST	GMT
DATE:	24 Feb 1962	24 Feb 1962
TIME:	0830	1630

SPONSOR: LASL

SITE: NTS - U3ad
37° 02' 54" N
116° 01' 54.85" W

DEPTH OF BURST: 190 ft

TYPE OF BURST AND PLACEMENT:
Underground, in alluvium

VENTING:
Vented

REMARKS:

Radiation was detected on-site from radioactivity released by this detonation. No radiation levels above background were detected off the NTS in populated areas from radioactivity released by this detonation.

No radiation was detected at the worksite or any other location from releases of gaseous radioactivity during post-shot drilling.

OPERATION NOUGAT - Pampas

	PST	GMT
DATE:	1 Mar 1962	1 Mar 1962
TIME:	1110	1910

SPONSOR: LASL/UK

SITE: NTS - U3al
37° 02' 30.34" N
116° 01' 44.799" W

SITE ELEVATION: 4012 ft MSL

DEPTH OF BURST: 1191 ft

DEPTH OF EMPLACEMENT HOLE:
1201 ft

TYPE OF BURST AND PLACEMENT:
Underground, in alluvium

VENTING:

Immediately after detonation, two small clouds floated around in Area 3.

REMARKS:

A maximum dose rate reading of 37 mR/hr at H+45 minutes was evidenced at the BUSTER JANGLE Y (BJY) of the NTS road network. Some radioactivity was detected in off-site areas. Some radiation was detected in the area surrounding SZ from gaseous radioactivity released during post-shot drilling. No radioactivity was detected off the NTS from post-shot operations.

OPERATION NOUGAT — Danny Boy

	PST	GMT
DATE:	5 Mar 1962	5 Mar 1962
TIME:	1015	1815

TOTAL YIELD: 0.42 kt

CRATER DATA:
Diameter: 214 ft
Depth: 62 ft

SPONSOR: LRL/DOD

SITE: NTS - Area 18
37° 06' 39.79" N
116° 21' 53.82" W

SITE ELEVATION: 5477 ft MSL

DEPTH OF BURST: 110 ft

TYPE OF BURST AND PLACEMENT:
Underground, in basalt

VENTING:

A persistent cloud was produced containing appreciable quantities of radioactivity associated with particulates

REMARKS:

The close-in and distant fallout documentation (Figures 1 and 2) was performed by the NDL. AN/PDR-39A ion-chamber instruments were used to measure field gamma dose rates. Most of the measurements from 2,500 ft to 25,000 ft from GZ were accomplished from H+2 hours to H+29 hours. Ground surveys beyond 2,500 ft downwind from GZ continued through D+9 days. The area from GZ to a distance of 2,500 ft downwind was surveyed at later times. The dose-rate readings were extrapolated to H+1 hour using a decay approximation. The dotted portions of the patterns indicate uncertainty.

The off-site patterns (Figs.314 & 315) were constructed from aerial survey measurements performed by EG&G and the USGS. The EG&G survey which took place from H+5 to H+7 hours, defines the pattern from miles to approximately 25 miles. Two days later the long-range survey out to 140 miles was made by the USGS.

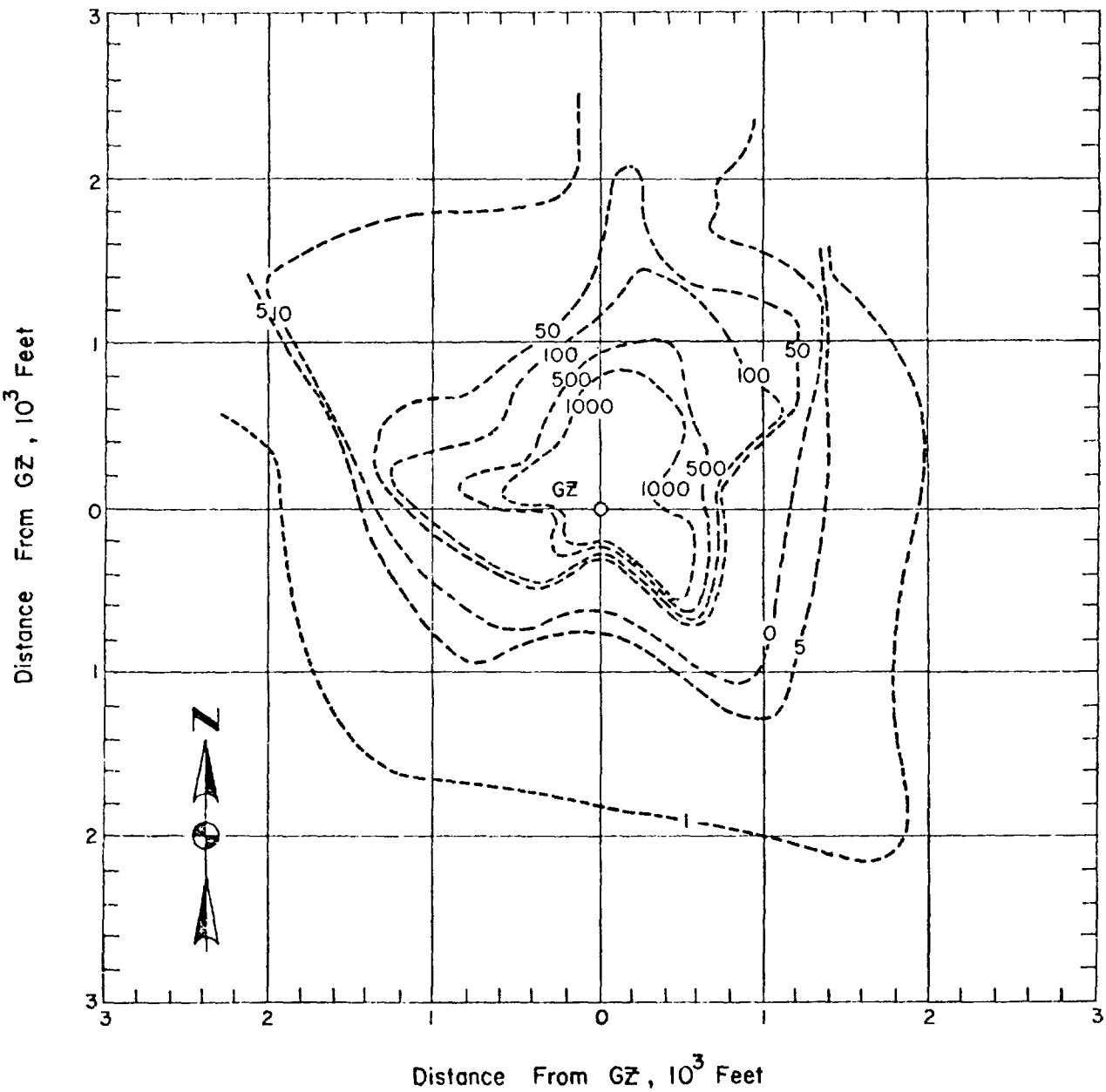


Figure 312 OPERATION NOUGAT - Danny Boy contours of residual radiation in R/hr at H+1 hour to 2,000 feet downwind

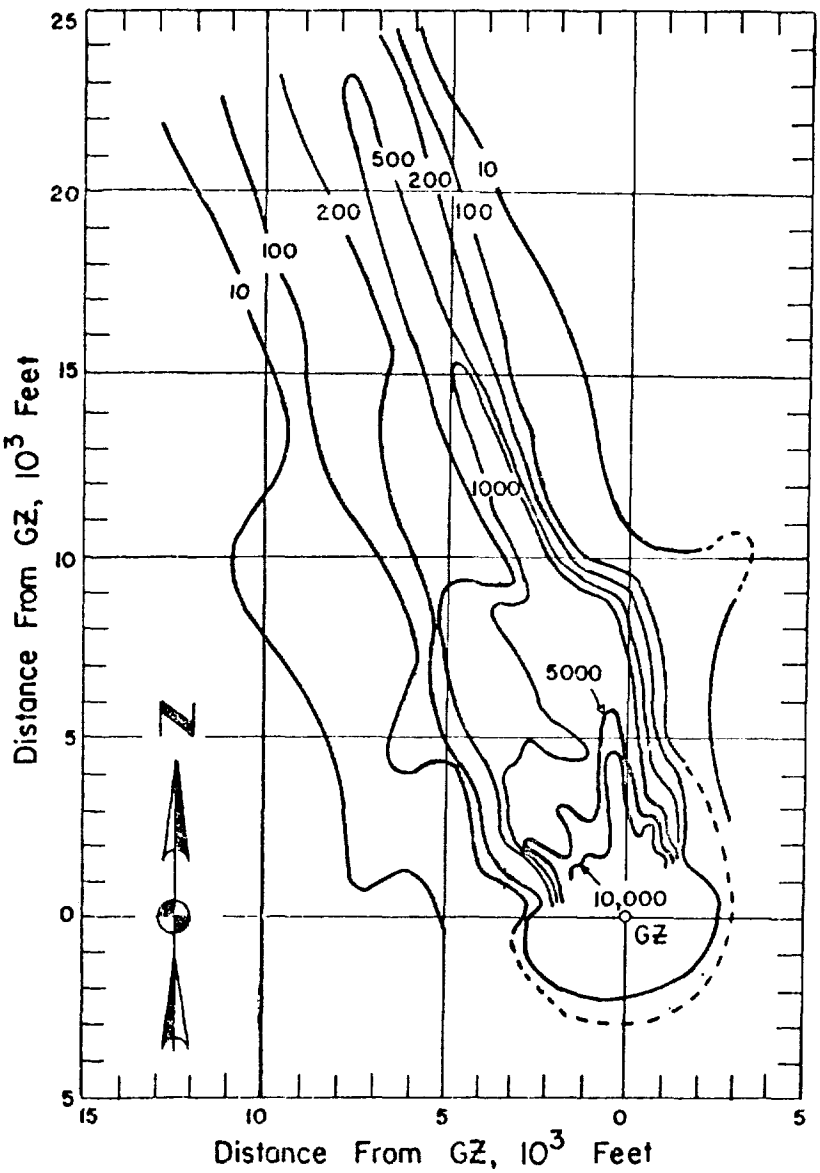


Figure 313 OPERATION NOUGAT - Danny Boy contours of residual gamma radiation in mR/hr at H+1 hour to 25,000 feet downwind

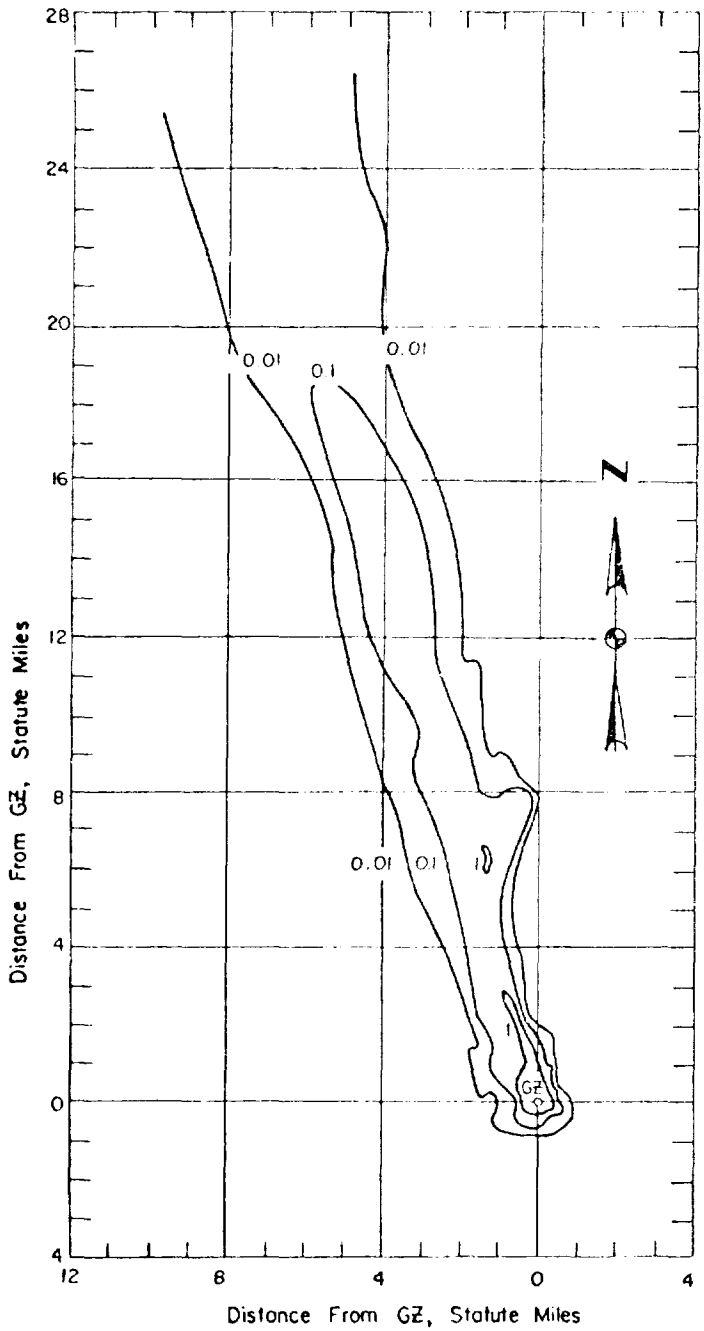


Figure 314 OPERATION NOUGAT - Danny Boy contours of residual gamma radiation in R/hr at H+1 hour to 26 miles downwind

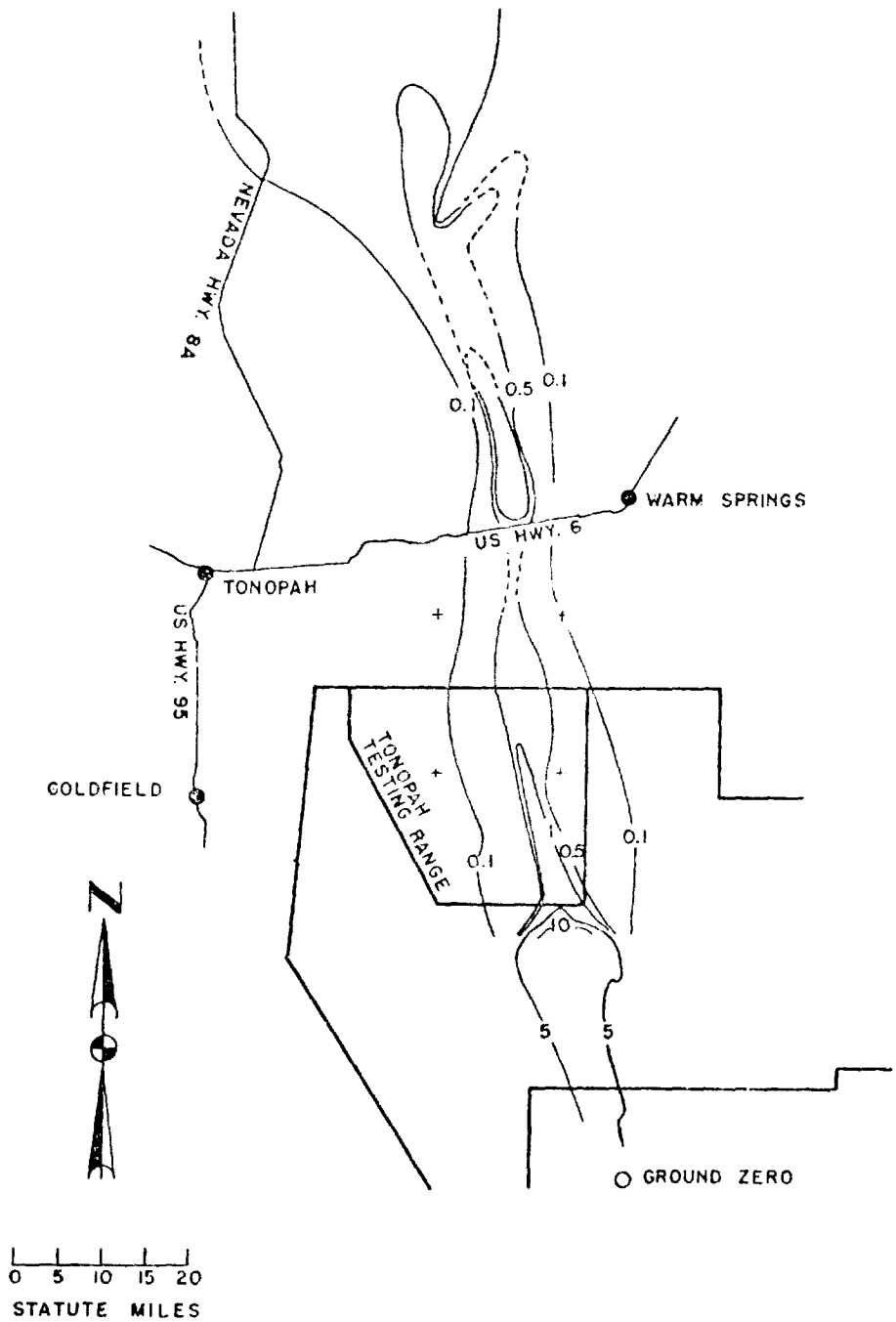


Figure 315. OPERATION NOUGAT - Danny Boy contours of residual gamma radiation in mR/hr at H+1 hour to 140 miles downwind

TABLE 104 NEVADA WIND DATA FOR OPERATION NOUGAT – DANNY BOY

Altitude (MSL)	H+10 minutes Direction	Speed
feet	degrees	mph
5,477	170	13.8
6,000	171	15.0
7,000	178	17.3
8,000	184	23.0
9,000	190	31.1
10,000	191	34.5
11,000	195	39.1
12,000	199	42.6
13,000	202	52.9
14,000	206	54.1

Notes

1. Observations made at Area 18 radar site.

2. Atmospheric pressure was 832 millibars, the temperature was 5.3°C, the dew point temperature was -12.2°C, and the relative humidity was 27% at GZ at 1015 PST.

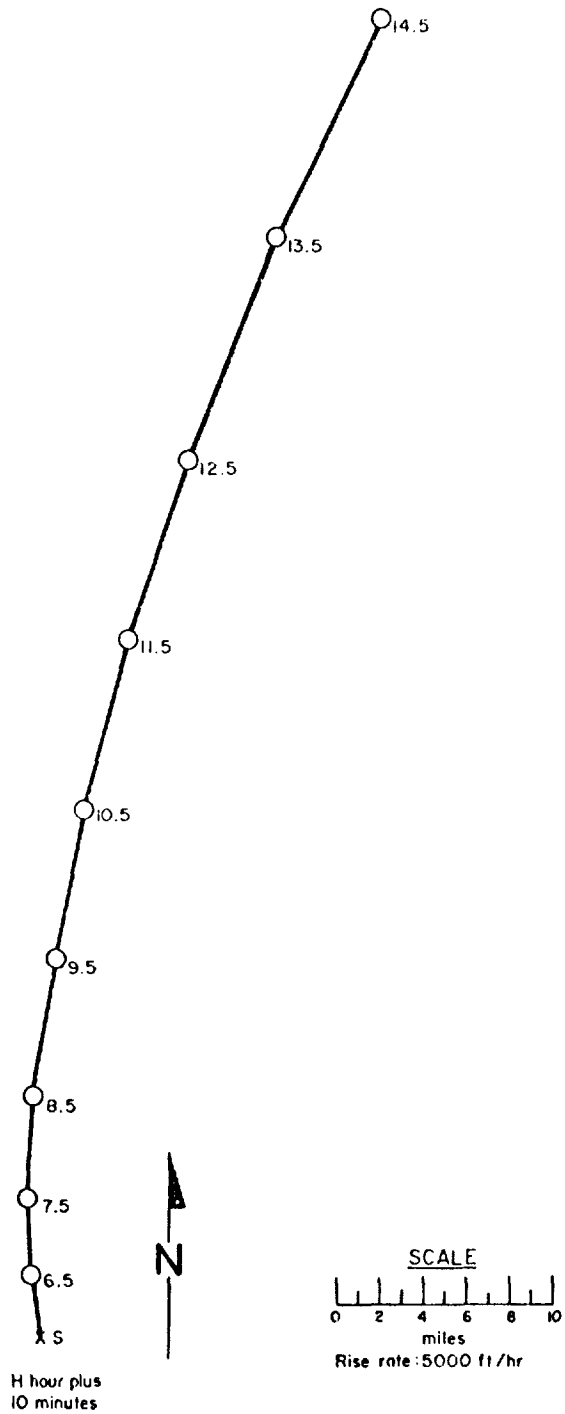


Figure 316. Hodograph for OPERATION NOUGAT - Danny Boy.

OPERATION NOUGAT - Ermine

	PST	GMT
DATE:	6 Mar 1962	6 Mar 1962
TIME:	0830	1630

SPONSOR: LASL

SITE: NTS - U3ab
37° 02' 54.233" N
116° 02' 01.165" W

DEPTH OF BURST: 240 ft

TYPE OF BURST AND PLACEMENT:
Underground, in alluvium

VENTING:
None except during post-shot drilling

REMARKS:

No radiation levels were detected above background on or off the NTS from radioactivity released by this detonation.

Some radiation was detected in the area surrounding SZ from gaseous radioactivity released during post-shot drilling. No radioactivity was detected off the NTS from post-shot operations.

OPERATION NOUGAT - Brazos

	PST	GMT
DATE:	8 Mar 1962	8 Mar 1962
TIME:	1000	1800

TOTAL YIELD: 7.6 kt

CRATER DATA:
Subsidence crater
Diameter: 450 ft
Depth: 40 ft

SPONSOR: LRL

SITE: NTS - U9d
37° 07' 19.7891" N
116° 02' 55.9678" W

SITE ELEVATION: 4201 ft MSL

DEPTH OF BURST: 841 ft

TYPE OF BURST AND PLACEMENT:
Underground, in slightly consolidated alluvium

VENTING:

This event released small visible quantities of radioactive steam and/or gases.

REMARKS:

Radiation was detected on-site from radioactivity released by this detonation. No radiation levels above background were detected off the NTS in populated areas from radioactivity released by this detonation. Some radiation was detected in the area surrounding SZ from gaseous radioactivity released during post-shot drilling. No radioactivity was released from post-shot operation.

OPERATION NOUGAT - Hognose

	PST	GMT
DATE:	15 Mar 1962	15 Mar 1962
TIME:	0830	1630

SPONSOR: LASL

SITE: NTS - U3aj
37° 02' 38.269" N
116° 01' 51.774" W

DEPTH OF BURST: 789 ft

TYPE OF BURST AND PLACEMENT:
Underground, in alluvium

VENTING:
None except during post-shot drilling

REMARKS:

No radiation levels were detected above background on or off the NTS from radioactivity released by this detonation. Some radiation was detected in the area surrounding SZ from gaseous radioactivity released during post-shot drilling. No radioactivity was detected off the NTS from post-shot operations.

OPERATION NOUGAT - Hoosic

	PST	GMT
DATE:	28 Mar 1962	28 Mar 1962
TIME:	1000	1800

TOTAL YIELD: 3 kt

CRATER DATA:
Subsidence crater
Diameter: 310 ft
Depth: 25.3 ft

SPONSOR: LRL

SITE: NTS - U9j
37° 07' 27.5474" N
116° 02' 01.9685" W

SITE ELEVATION: 4235 ft MSL

DEPTH OF BURST: 614 ft

TYPE OF BURST AND PLACEMENT:
Underground, in tuff below alluvium

VENTING:
None except during post-shot drilling

REMARKS:

No radiation levels were detected above background on or off the NTS from radioactivity released by this detonation. Some radiation was detected in the area surrounding SZ from gaseous radioactivity released during post-shot drilling. No radioactivity was detected off the NTS from post-shot operations.

OPERATION NOUGAT - Chinchilla II

	PST	GMT
DATE:	31 Mar 1962	31 Mar 1962
TIME:	1000	1800

SPONSOR: LASL

SITE: NTS - U3as
37° 02' 48.874" N
116° 02' 12.850" W

SITE ELEVATION: 4026 ft MSL

DEPTH OF BURST: 448 ft

DEPTH OF EMPLACEMENT HOLE: 458 ft

CLOUD TOP HEIGHT: 5500 ft MSL

TYPE OF BURST AND PLACEMENT: Underground, in alluvium

VENTING:

A dust cloud was observed at H hour.

REMARKS:

A maximum radiation reading of 20 mR/hr was located at SZ at H+4 minutes. Some other radiation levels above normal background were detected near SZ. No other radiation levels were detected on or off the NTS from radioactivity released by this detonation. Some radiation was detected in the area surrounding SZ from gaseous radioactivity released during post-shot drilling. No radioactivity was detected off the NTS from post-shot operations.

OPERATION NOUGAT - Dormouse II

	PST	GMT
DATE:	5 Apr 1962	5 Apr 1962
TIME:	1000	1800

TOTAL YIELD: 10 kt

CRATER DATA:
Subsidence crater
Diameter: 560 ft
Depth: 87 ft

VENTING:
None except during post-shot drilling

SPONSOR: LASL

SITE: NTS - U3az
37° 02' 40.219" N
116° 01' 24.720" W

DEPTH OF BURST: 856 ft

TYPE OF BURST AND PLACEMENT:
Underground, in alluvium

REMARKS:

No radiation levels were detected above background on or off the NTS from radioactivity released by this detonation. Some radiation was detected in the area surrounding SZ from gaseous radioactivity released during post-shot drilling. No radioactivity was detected off the NTS from post-shot operations.

OPERATION NOUGAT - Passaic

	PST	GMT
DATE:	6 Apr 1962	6 Apr 1962
TIME:	1000	1800

SPONSOR: LRL

SITE: NTS-U9i
37° 07' 03.6276" N
116° 02' 38.4413" W

SITE ELEVATION: 4183 ft MSL

DEPTH OF BURST: 764 ft

TYPE OF BURST AND PLACEMENT:
Underground, alluvium tuff contact

VENTING:
None, except during post-shot drilling

REMARKS:

No radiation levels were detected above background on or off the NTS, from radioactivity released by this detonation. Some radiation was detected in the area surrounding SZ from gaseous radioactivity released during post-shot drilling. No radioactivity was detected off the NTS from post-shot operations.

OPERATION NOUGAT - Hudson

	PST	GMT
DATE:	12 Apr 1962	12 Apr 1962
TIME:	1000	1800

SPONSOR: LRL

SITE: NTS - U9h
37° 07' 37.8426" N
116° 02' 41.5226" W

SITE ELEVATION: 4200 ft MSL

DEPTH OF BURST: 480 ft

VENTING:
None, except during post-shot drilling

TYPE OF BURST AND PLACEMENT:
Underground, in slightly consolidated alluvium

REMARKS:

No radiation levels were detected above background on or off the NTS from radioactivity released by this detonation. Some radiation was detected in the area surrounding SZ from gaseous radioactivity released during post-shot drilling. No radioactivity was detected off the NTS from post-shot operations.

OPERATION NOUGAT - Platte

	PST	GMT
DATE:	14 Apr 1962	14 Apr 1962
TIME:	1000	1800

TOTAL YIELD: 1.7 kt

CRATER DATA: No crater

CLOUD TOP HEIGHT: 8000 ft MSL

SPONSOR: LRL

SITE: NTS - U12k.01
37° 13' 19.26" N
116° 09' 26.77" W

SITE ELEVATION: 6281 ft MSL

DEPTH OF BURST: 628 ft

SLANT DEPTH: 560 ft

TYPE OF BURST AND PLACEMENT:
Tunnel, in weakly consolidated tuff

STEMMING MATERIAL:

Tunnel - interbedded brown sandy tuff and yellow-gray lapilli tuff

VENTING:

Venting occurred at the tunnel portal, through fissures, and at a vent hole at H+1.5 seconds. The fissures were created on the side of the hill, and radial cracks formed on top of the hill A persistent cloud was produced containing appreciable quantities of radioactivity associated with particles The estimated dose rate at the tunnel portal, normalized to H+1 hour, was 20 R/hr and the estimated total release, normalized to H+1 minute, was 5×10^7 curies. The release products contained the following known isotopes: Ru^{103}, Ru^{105}, $Zr\text{-}Nb^{95}$, Ca^{141}, Ca^{144}, K^{40}, I^{131}, I^{133}, I^{135}, Te^{132}.

REMARKS:

The cloud drifted in a northerly direction. The radiation area at H+4.5 hours extended upwind approximately one mile from GZ and was monitored at 10 mR/hr. Some radioactivity was detected in off-site areas. No radiation was detected at the worksite or any other location from releases of gaseous radioactivity during post-shot drilling or tunnel re-entry operations.

OPERATION NOUGAT - Dead

	PST	GMT
DATE:	21 Apr 1962	21 Apr 1962
TIME:	1040	1840

SPONSOR: LRL

SITE: NTS - U9k
37° 07' 08.4176" N
116° 01' 53.4847" W

SITE ELEVATION: 4261 ft MSL

DEPTH OF BURST: 634 ft

TYPE OF BURST AND PLACEMENT:
Underground, in alluvium

VENTING:
None, except during post-shot drilling

REMARKS:

No radiation levels were detected above background on or off the NTS from radioactivity released by this detonation. Some radiation was detected in the area surrounding SZ from gaseous radioactivity released during post-shot drilling. No radioactivity was detected off the NTS from post-shot operations.

OPERATION NOUGAT - Black

	PST	GMT
DATE:	27 Apr 1962	27 Apr 1962
TIME:	1000	1800

SPONSOR: LRL

SITE: NTS-U9p
37° 07' 06.4610" N
116° 02' 15.9730" W

SITE ELEVATION: 4217 ft MSL

DEPTH OF BURST: 714 ft

TYPE OF BURST AND PLACEMENT:
Underground, in tuff below alluvium

VENTING:
None, except during post-shot drilling

REMARKS:

No radiation levels were detected above background on or off the NTS from radioactivity released by this detonation. Some radiation was detected in the area surrounding SZ from gaseous radioactivity released during post-shot drilling. No radioactivity was detected off the NTS from post-shot operations.

OPERATION NOUGAT - Paca

	PST	GMT
DATE:	7 May 1962	7 May 1962
TIME:	1133	1933

SPONSOR: LASL

SITE: NTS - U3ax
37° 02' 47.6237" N
116° 01' 30.0318" W

DEPTH OF BURST: 848 ft

TYPE OF BURST AND PLACEMENT:
Underground, in alluvium

VENTING:
None, except during post-shot drilling

REMARKS:

No radiation levels were detected above background on or off the NTS from radioactivity released by this detonation. Some radiation was detected in the area surrounding SZ from gaseous radioactivity released during post-shot drilling. No radioactivity was detected off the NTS from post-shot operation.

OPERATION NOUGAT - Aardvark

	PST	GMT
DATE:	12 May 1962	12 May 1962
TIME:	1100	1900

TOTAL YIELD: 38 kt

CRATER DATA:
Subsidence crater
Diameter: 950 ft
Depth: 75 ft

VENTING:
Vented

SPONSOR: LASL

SITE: NTS - U3ams
37° 03' 54.6976" N
116° 01' 49.3656" W

DEPTH OF BURST: 1424 ft

TYPE OF BURST AND PLACEMENT:
Underground, in tuff

REMARKS:

Radiation was detected on-site from radioactivity released by this detonation. No radiation levels above background were detected off the NTS in populated areas from radioactivity released by this detonation. Some radiation was detected in the area surrounding SZ from gaseous radioactivity released during post-shot drilling. No radioactivity was detected off the NTS from post-shot operations.

OPERATION NOUGAT - Eel

	PST	GMT
DATE:	19 May 1962	19 May 1962
TIME:	0700	1500

SPONSOR: LRL

SITE: NTS - U9m
37° 07' 21.49" N
116° 02' 49.9561" W

SITE ELEVATION: 4199 ft MSL

DEPTH OF BURST: 714 ft

TYPE OF BURST AND PLACEMENT:
Underground, in alluvium

VENTING:

Venting in the form of a geyser, occurred at H+10 seconds at vent hole U9m-2 and continued steadily until H+19 minutes 42 seconds. A similar venting occurred at H+15 seconds at vent hole U9-m3 and lasted until H+21 minutes. The venting ceased with crater subsidence The normalized H+1 hour estimated dose rate at 500 feet from SZ and the normalized H+1 minute estimated total releases respectively are: 7 R/hr and 5×10^9 curies. The known isotopes are: Ru^{103}, Ru^{106}, Rh^{105}, $Zr\text{-}Nb^{95}$, Ce^{141}, Ce^{144}, I^{131}, I^{132}, I^{135}, Te^{132}, and $Ba\text{-}La^{140}$.

REMARKS:

Some radioactivity was detected in off-site areas. No radiation was detected at the worksite or any other location from releases of gaseous radioactivity during post-shot drilling. At H+30 minutes readings at 1000 feet from SZ varied between 250 and 500 mR/hr with the exception of a location 1000 feet north of SZ where readings continued at more than 100 R/hr contrary to prediction.

OPERATION NOUGAT - White

	PST	GMT
DATE:	25 May 1962	25 May 1962
TIME:	0700	1500

SPONSOR: LRL

SITE: NTS - U9b
37° 07' 29.4725" N
116° 03' 07.1518" W

SITE ELEVATION: 4200 ft MSL

DEPTH OF BURST: 635 ft

TYPE OF BURST AND PLACEMENT:
Underground, in alluvium (tuff)

VENTING:
None, except during post-shot drilling

REMARKS:

No radiation levels were detected above background on or off the NTS from radioactivity released by this detonation. Some radiation was detected in the area surrounding SZ from gaseous radioactivity released during post-shot drilling. No radioactivity was detected off the NTS from post-shot operations.

OPERATION NOUGAT - Raccoon

	PST	GMT
DATE:	1 Jun 1962	1 Jun 1962
TIME:	0900	1700

SPONSOR: LASL

SITE: NTS - U3ajs
37° 02' 44.206" N
116° 02' 04.059" W

DEPTH OF BURST: 539 ft

TYPE OF BURST AND PLACEMENT:
Underground, in alluvium

VENTING:
None

REMARKS:

No radiation levels were detected above background on or off the NTS from radioactivity released by this detonation. No radiation was detected at the worksite or any other location from releases of gaseous radioactivity during post-shot drilling.

OPERATION NOUGAT - Packrat

	PST	GMT
DATE:	6 Jun 1962	6 Jun 1962
TIME:	0900	1700

SPONSOR: LASL

SITE: NTS - U3aw
37° 02' 44.5761" N
116° 02' 01.4312" W

DEPTH OF BURST: 860 ft

TYPE OF BURST AND PLACEMENT:
Underground, in alluvium

VENTING:
Vented

REMARKS:

Radiation levels were detected near SZ above normal background from radioactivity released by this detonation. No other radiation levels were detected on or off the NTS from radioactivity released by this detonation. Some radiation was detected in the area surrounding SZ from gaseous radioactivity released during post-shot drilling. No radioactivity was detected off the NTS from post-shot operations.

OPERATION NOUGAT - Des Moines

	PST	GMT
DATE:	13 Jun 1962	13 Jun 1962
TIME:	1300	2100

SPONSOR: LRL

SITE: NTS - U12j.01
37° 13' 20.00" N
116° 09' 43.78" W

SITE ELEVATION: 6301 ft MSL

DEPTH OF BURST: 660 ft

SLANT DEPTH: 610 ft

TYPE OF BURST AND PLACEMENT:
Tunnel, in weakly consolidated tuff

VENTING:

Venting began at H+0.2 seconds on top of the hill at SZ, then from a vent hole at the face of the hill and finally through the portal. The duration of the release was approximately 5 minutes.

The estimated dose rate at Access Road normalized to H+1 hour, was 100 R/hr, and the estimated total release, normalized to H+1 minute, was 3×10^{10} curies. The release products contained the following isotopes: I^{131}, I^{133}, I^{135}, Te^{132}, Ru^{103}, $Ba\text{-}La^{140}$, and $Ru\text{-}Rh^{105}$
Remote radiation measurements just inside the trailer shelter (see REMARKS) indicate about 100 R/hr at H+2.5 hours and 45 R/hr at H+6.5 hours. The maximum reading a short distance from the portal at H+3 minutes was 30 R/hr.

REMARKS:

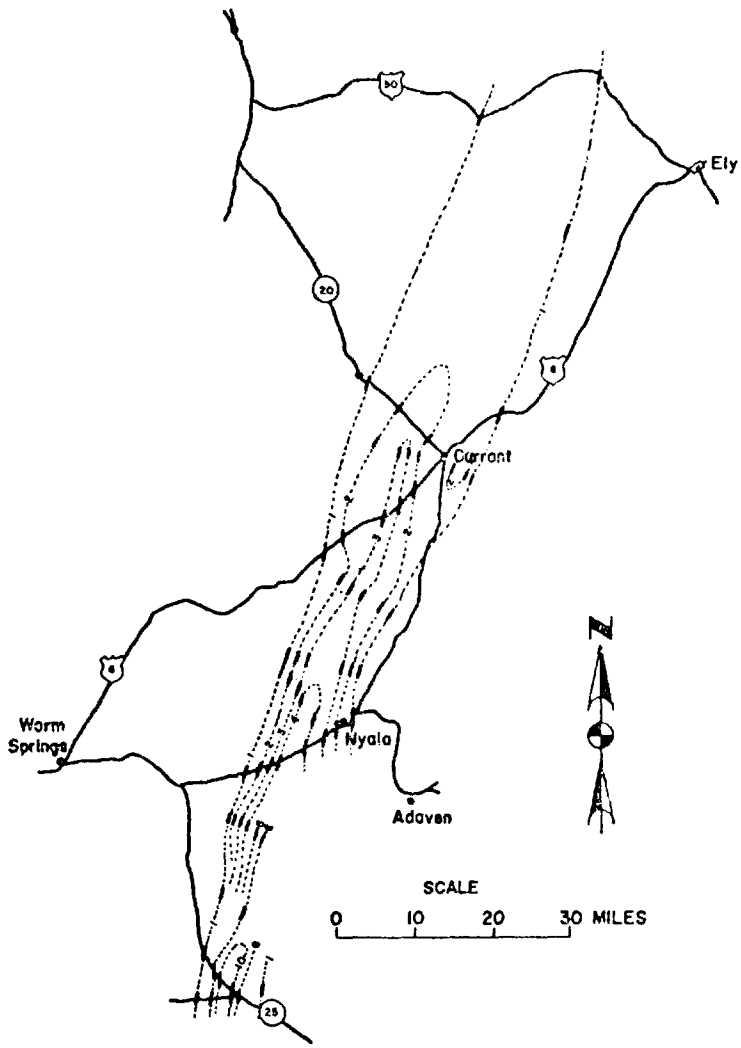
The shot vented out of the tunnel mouth with sufficient pressure and flow rate that radioactive debris was projected entirely across the canyon and deposited on the slope behind a trailer shelter. This shelter was not shielded from fallout. The entrance to the shelter faced away from the tunnel but the door was open.

OPERATION NOUGAT - Des Moines

The shot caused I^{131} milk contamination in the following locations: Adavan, Nevada, 360 pc/ℓ on 20 June; Elko, Nevada, 610 pc/ℓ on 22 June; and Spokane, Washington, 1,240 pc/ℓ on 20 June. All measurements were made from samples taken from fresh milk except those at Spokane which were made from pooled milk at a pasteurizing plant.

Figure 317 shows contours of residual gamma radiation in units of thousands of counts per second at 500 feet above the ground and are dashed where estimated. Pre-Des Moines background is assumed to be 1,000 counts per second. The aerial surveys were performed by ARMS-1 (USGS) on 27, 28, and 30 June 1962.

No radiation was detected at the worksite or any other location from releases of gaseous radioactivity during post-shot drilling and tunnel re-entry operations.



GZ

Figure 317 OPERATION NOUGAT - Des Moines contours of residual gamma radiation in thousands of counts per second at 500 feet above the ground at H+14 days

TABLE 105 NEVADA WIND DATA FOR OPERATION NOUGAT - DES MOINES

Altitude (MSL)	H-hour (Note 1)	
	Direction	Speed
feet	degrees	mph
5,635	204	32.2
6,000	200	32.2
7,000	198	33.4
8,000	200	33.4
9,000	204	29.9
10,000	206	29.9
11,000	206	29.9
12,000	204	29.9
13,000	205	28.8
14,000	206	28.8
15,000	206	29.9

Notes

1. Observations made at Yucca weather station.

2. Surface data (from RAOB) at level of GZ over Area 12, H-hour: Atmospheric pressure 819 millibars, temperature 20.3°C, relative humidity 12%.

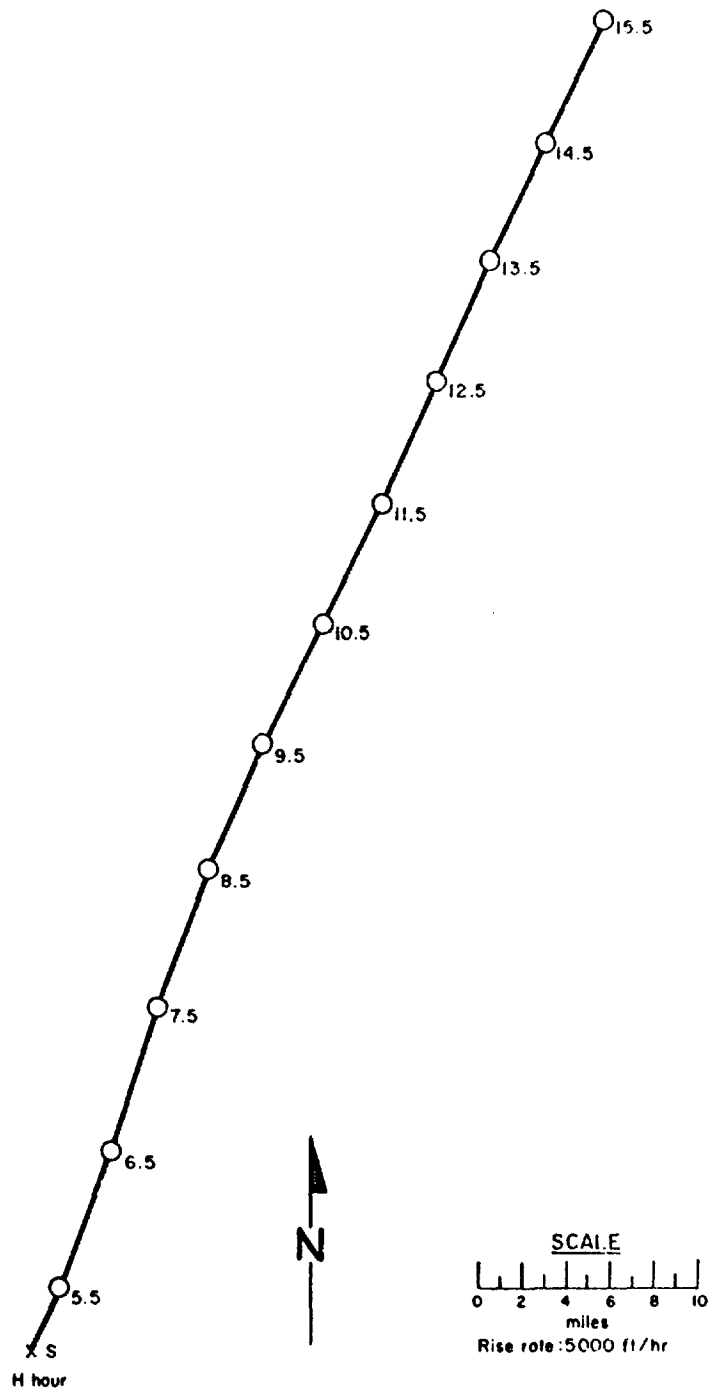


Figure 318. Hodograph for OPERATION NOUGAT - Des Moines

OPERATION NOUGAT - Daman I

	PST	GMT
DATE:	21 Jun 1962	21 Jun 1962
TIME:	0900	1700

SPONSOR: LASL

SITE: NTS - U3be
37° 02' 35.0325" N
116° 01' 49.9090" W

DEPTH OF BURST: 854 ft

TYPE OF BURST AND PLACEMENT:
Underground, in alluvium

VENTING:
Vented

REMARKS:

Radiation levels were detected near SZ above normal background from radioactivity released by this detonation. No other radiation levels were detected on or off the NTS from radioactivity released by this detonation. Some radiation was detected in the area surrounding SZ, from gaseous radioactivity released during post-shot drilling. No radioactivity was detected off the NTS from post-shot operations.

OPERATION NOUGAT - Haymaker

	PST	GMT
DATE:	27 Jun 1962	27 Jun 1962
TIME:	1000	1800

TOTAL YIELD: 56 kt

CRATER DATA:
Subsidence crater
Diameter: 950 ft
Depth: 70 ft

SPONSOR: LASL

SITE: NTS - U3aus
37° 02' 29.7466" N
116° 02' 06.8826" W

DEPTH OF BURST: 1340 ft

TYPE OF BURST AND PLACEMENT:
Underground, in alluvium

VENTING:

Small visible quantities of radioactive steam and/or gas were released.

REMARKS:

Fractionation of debris made analysis of yield difficult.

Some radiation was detected on-site from radioactivity released by this detonation. The shot produced detectable I^{131} contamination in milk. It produced levels of 180 pc/ℓ in milk on 30 June at Austin, Nevada Some radiation was detected in the area surrounding SZ from gaseous radioactivity released during post-shot drilling. No radioactivity was detected off the NTS from post-shot operations.

OPERATION NOUGAT - Marshmallow

	PST	GMT
DATE:	28 Jun 1962	28 Jun 1962
TIME:	0900	1700

SPONSOR: DOD

SITE: NTS - U16a
37° 00' 32.7636" N
116° 12' 03.7533" W

SITE ELEVATION: 6443 ft, MSL

DEPTH OF BURST: 1050 ft

SLANT DEPTH: 900 ft

VENTING:
Vented

TYPE OF BURST AND PLACEMENT:
Tunnel, in semiwelded tuff

REMARKS:

Radiation was detected on-site from radioactivity released by this detonation. No radiation levels above background were detected off the NTS in populated areas from radioactivity by this detonation. No radiation was detected at the worksite or any other location from releases of gaseous radioactivity during post-shot drilling and tunnel re-entry operations.

OPERATION NOUGAT - Sacramento

	PST	GMT
DATE:	30 Jun 1962	30 Jun 1962
TIME:	1330	2130

SPONSOR: LRL

SITE: NTS - U9v
37° 07' 02.6885" N
116° 02' 50.6975" W

SITE ELEVATION: 4178 ft MSL

DEPTH OF BURST: 500 ft

TYPE OF BURST AND PLACEMENT:
Underground, in slightly consolidated alluvium

VENTING:
None

REMARKS:

No radiation levels were detected above background on or off the NTS from radioactivity released by this detonation. No radiation was detected at the worksite or any other location from releases of gaseous radioactivity during post-shot drilling.

PROJECT SEDAN

	PST	GMT
DATE:	6 Jul 1962	6 Jul 1962
TIME:	0900	1700

TOTAL YIELD: 110 kt

SPONSOR: LRL

SITE: NTS - U10h
37° 10' 37.2249" N
116° 02' 43.3593" W

SITE ELEVATION: 4317 ft MSL

DEPTH OF BURST: 635 ft

TYPE OF BURST AND PLACEMENT:
Underground, in alluvium

CRATER DATA:
Diameter: 1214 ±15 ft
Depth: 320 ft

CLOUD TOP HEIGHT:
16,000 ft MSL

STEMMING MATERIAL:

A 36-inch diameter cased drill hole backfilled with dry sand

VENTING:

A persistent cloud was produced containing appreciable quantities of radioactivity associated with particulates.

REMARKS:

The fallout was documented to a distance of approximately 140 statute miles downwind. The bulk of the data was taken in the period H+20 to H+28 hours and, since the decay was unknown, by referencing these data to H+24 hours using $t^{-1.2}$ decay, the error introduced is relatively small. The values thus obtained are considered reasonably reliable both on-site and off-site.

The significant contributors to the H+24-hour gamma dose rate were fission products, W^{187}, and Na^{24}. Approximately 42% of the gamma dose rate (H+24 hour) was due to fission products, 55% due to W^{187}, 2% due to Na^{24} and <1% due to W^{181}, W^{188}, Be^{7}, Mn^{56} and tracers.
It was assumed that there was no fractionation and that like fractions of components escaped from the crater.

Figs. 319 & 320 present the gamma dose-rate contours at H+1 hour for the close-in and distant areas respectively. Dashed portions of contours indicate uncertainty. The patterns were reduced to show dose rate from fission products at H+1 hour, by multiplying the H+24-hour contour values by 0.42 and extrapolating those values to H+1 hour.

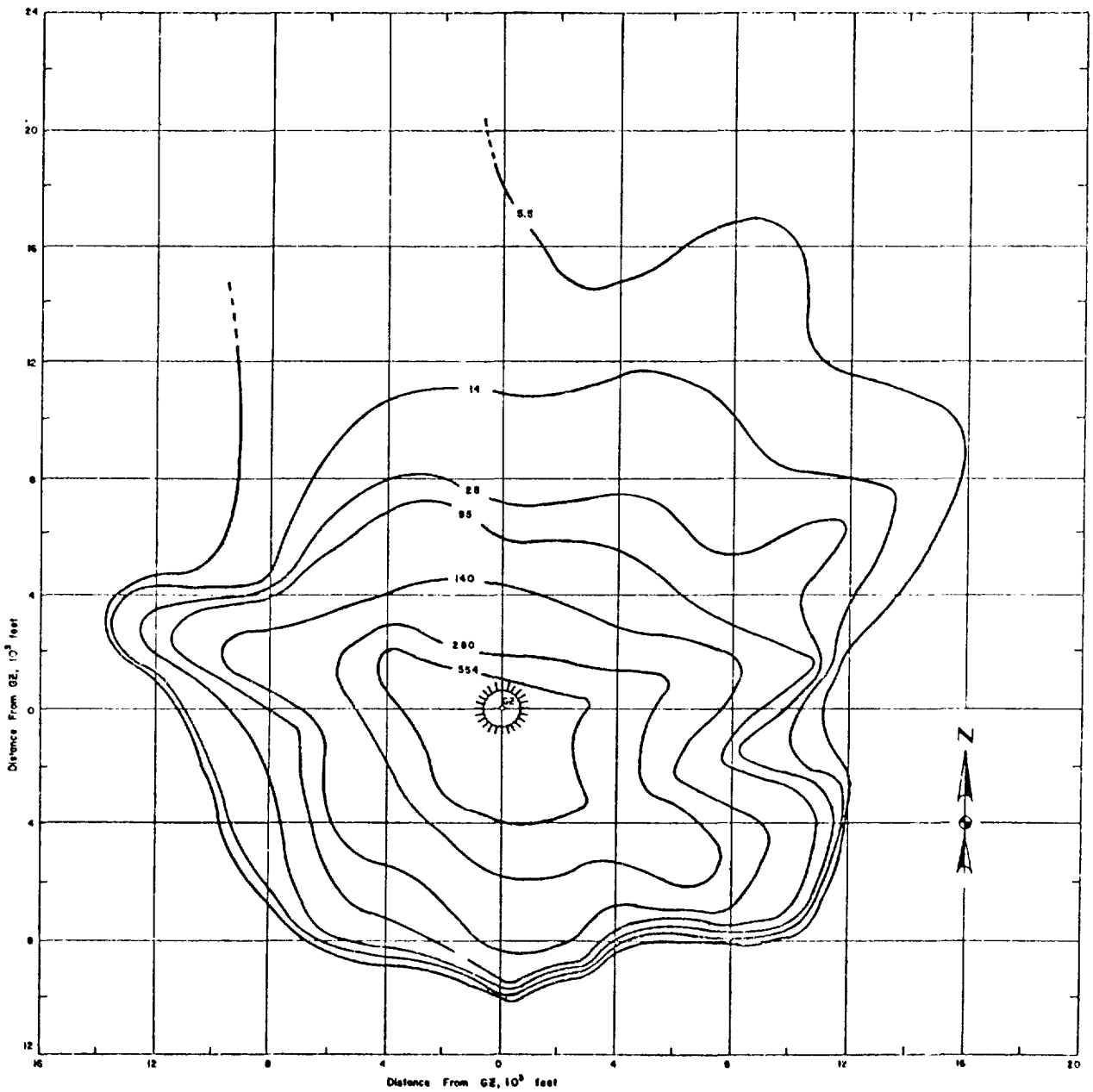


Figure 319 Project Sedan - Contours of residual gamma radiation (for fission products) in R/hr at H+1 hour to 20,000 feet

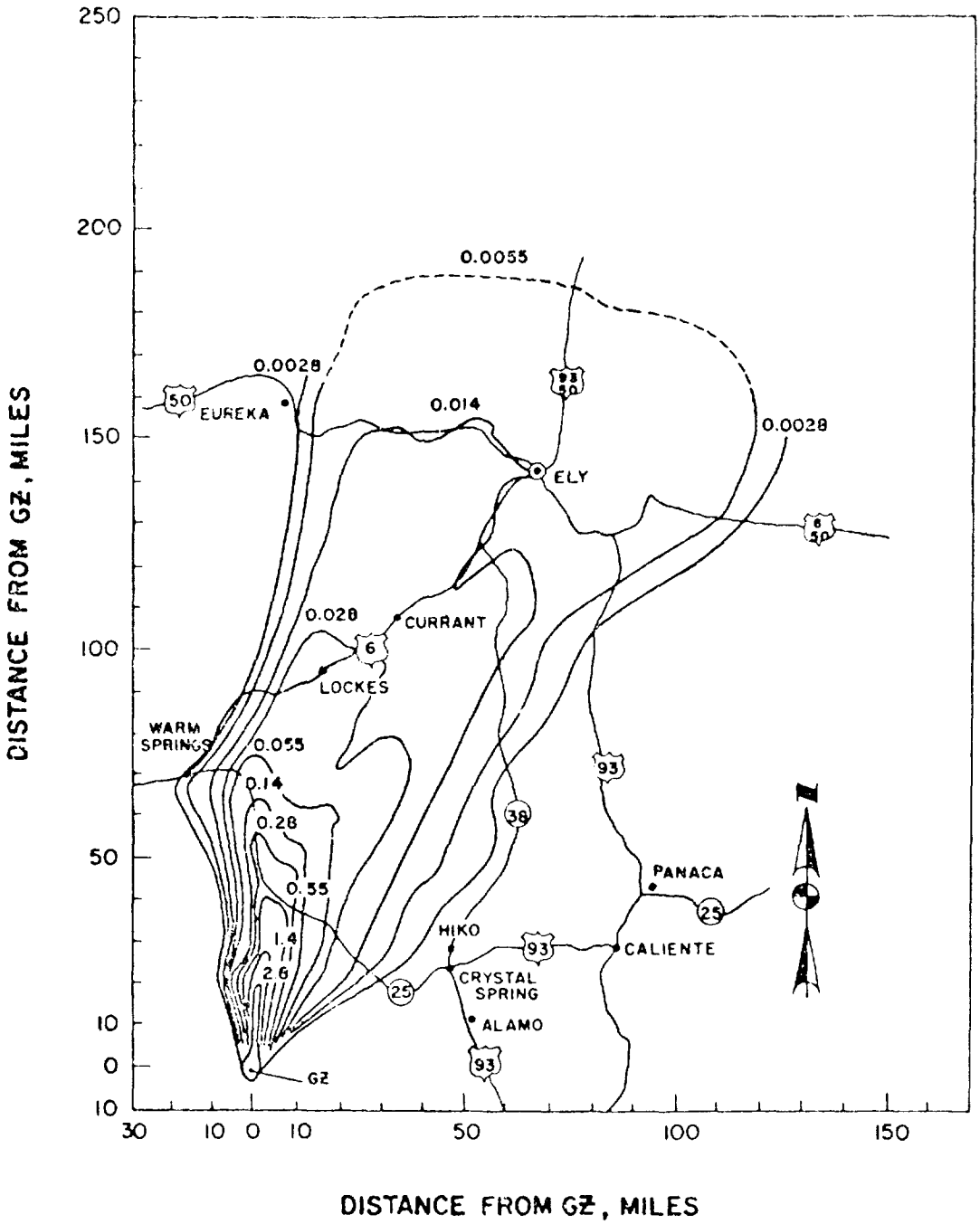


Figure 320. Project Sedan - Contours of residual gamma radiation (for fission products) in R/hr at H+1 hour to 140 miles downwind

TABLE 106 NEVADA WIND DATA AT BJY FOR PROJECT SEDAN

Altitude (MSL)	H+13 minutes	
	Direction	Speed
feet	degrees	mph
Surface	160	11.5
5,000	150	11.5
6,000	170	10.4
7,000	200	10.4
8,000	210	12.7
9,000	220	15.0
10,000	210	18.4
11,000	200	23.0
12,000	200	30.0
13,000	190	26.5
14,000	190	19.6
15,000	190	15.0
16,000	180	9.2
17,000	220	6.9
18,000	220	6.9
19,000	250	6.9

Notes

1. Observation point: BJY, 4076 ft MSL; 4200 ft south of GZ.

2. Surface data for Area 10 at H+22 minutes:

Atmospheric pressure: 868 millibars
Temperature: 28.5°C
Dew point temperature: below instrumental threshold.
Relative humidity: below instrumental threshold.

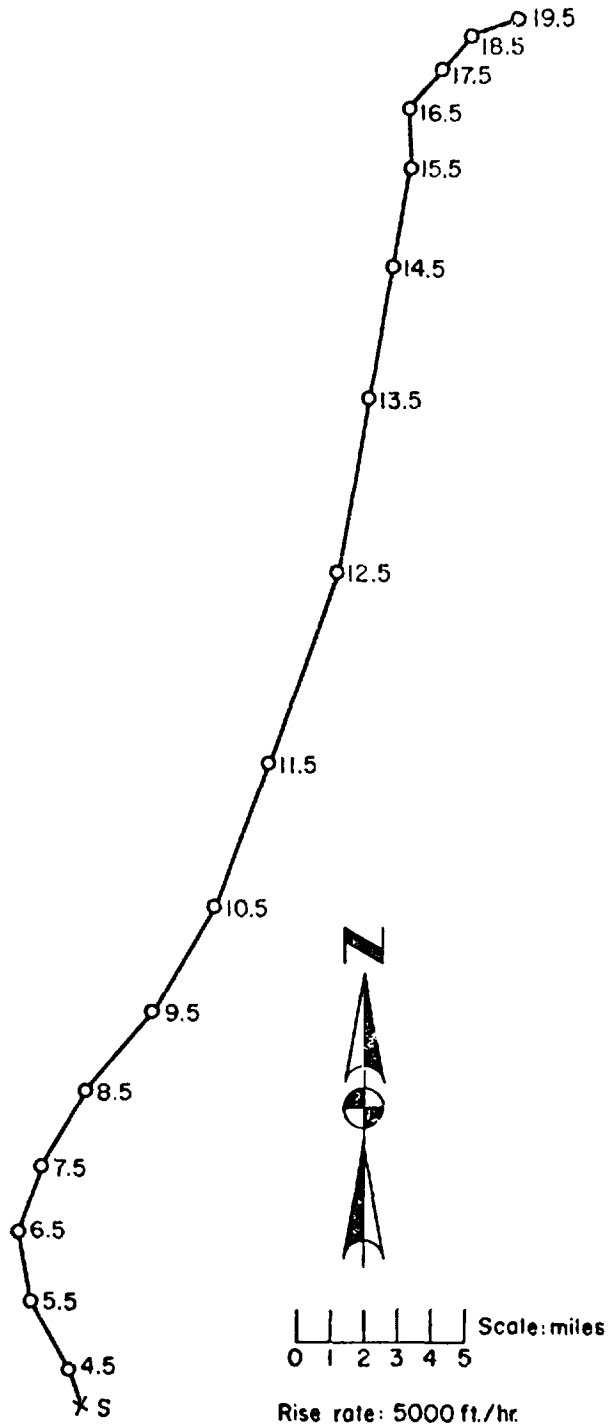


Figure 321. Hodograph for project Sedan

OPERATION SUNBEAM - Little Feller II

	PST	GMT
DATE:	7 Jul 1962	7 Jul 1962
TIME:	1100	1900

SPONSOR: DOD

SITE: NTS - Area 18
37° 07' 09.1611" N
116° 18' 10.3321" W

SITE ELEVATION: 5129 ft MSL

HEIGHT OF BURST: 3 ft

TYPE OF BURST AND PLACEMENT:
Near-surface, over Nevada soil. Device supported by a cable suspended between two posts.

CLOUD TOP HEIGHT:
11,000 ft MSL

REMARKS:

The close-in and distant contours of residual radiation are shown in Figures 322 thru 324. All the contours are considered reliable. The contours in Figures 322 thru 324 were supplemented by data from REECo Rad-Safe Group and other projects.

The REECo D-Day and D+1 day data used were corrected to H+1 hour. Dashed portions of contours indicate uncertainty.

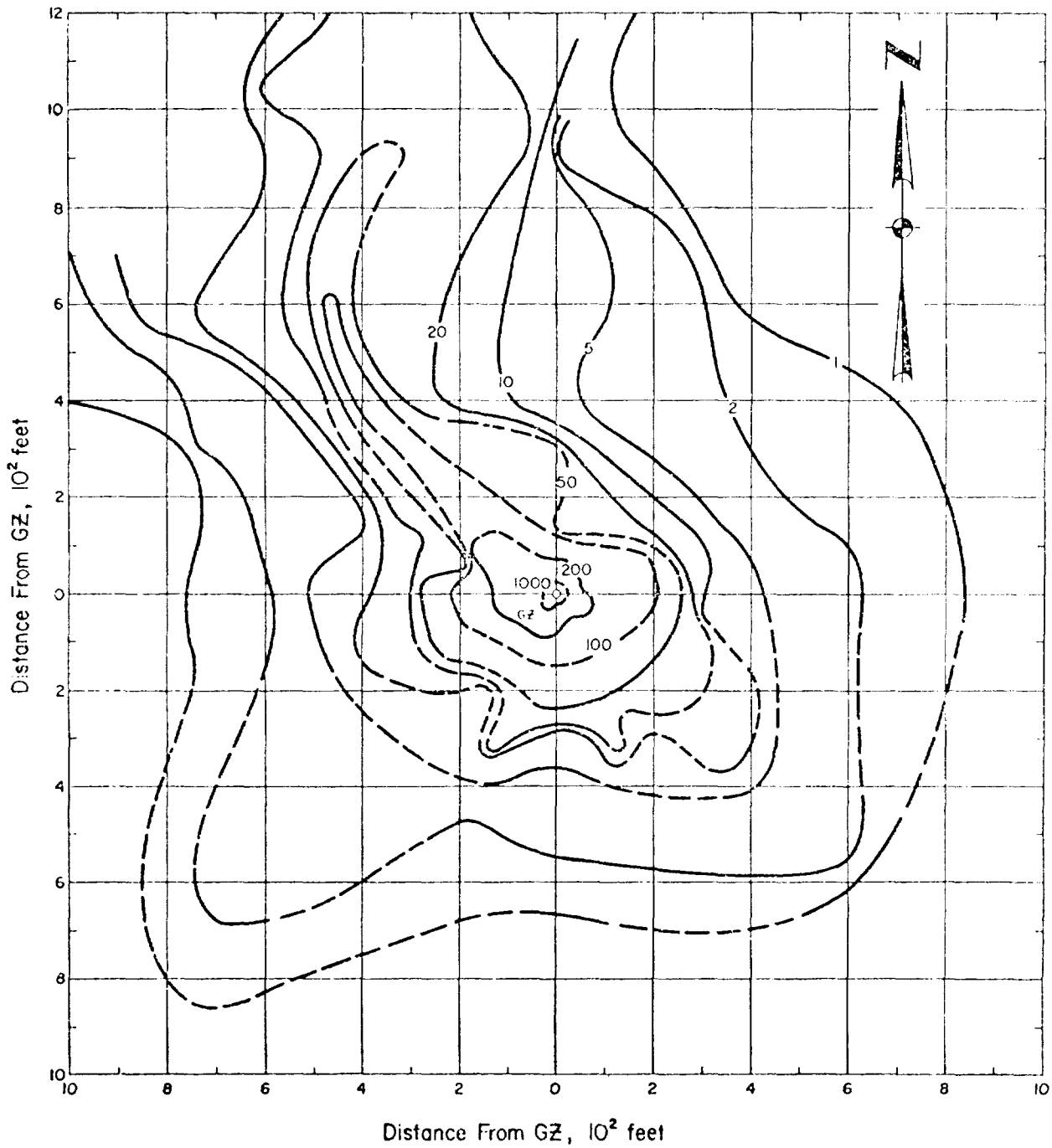


Figure 322. OPERATION SUNBEAM - Little Feller II contours of residual gamma radiation in R/hr at H+1 hour to 1,200 feet downwind

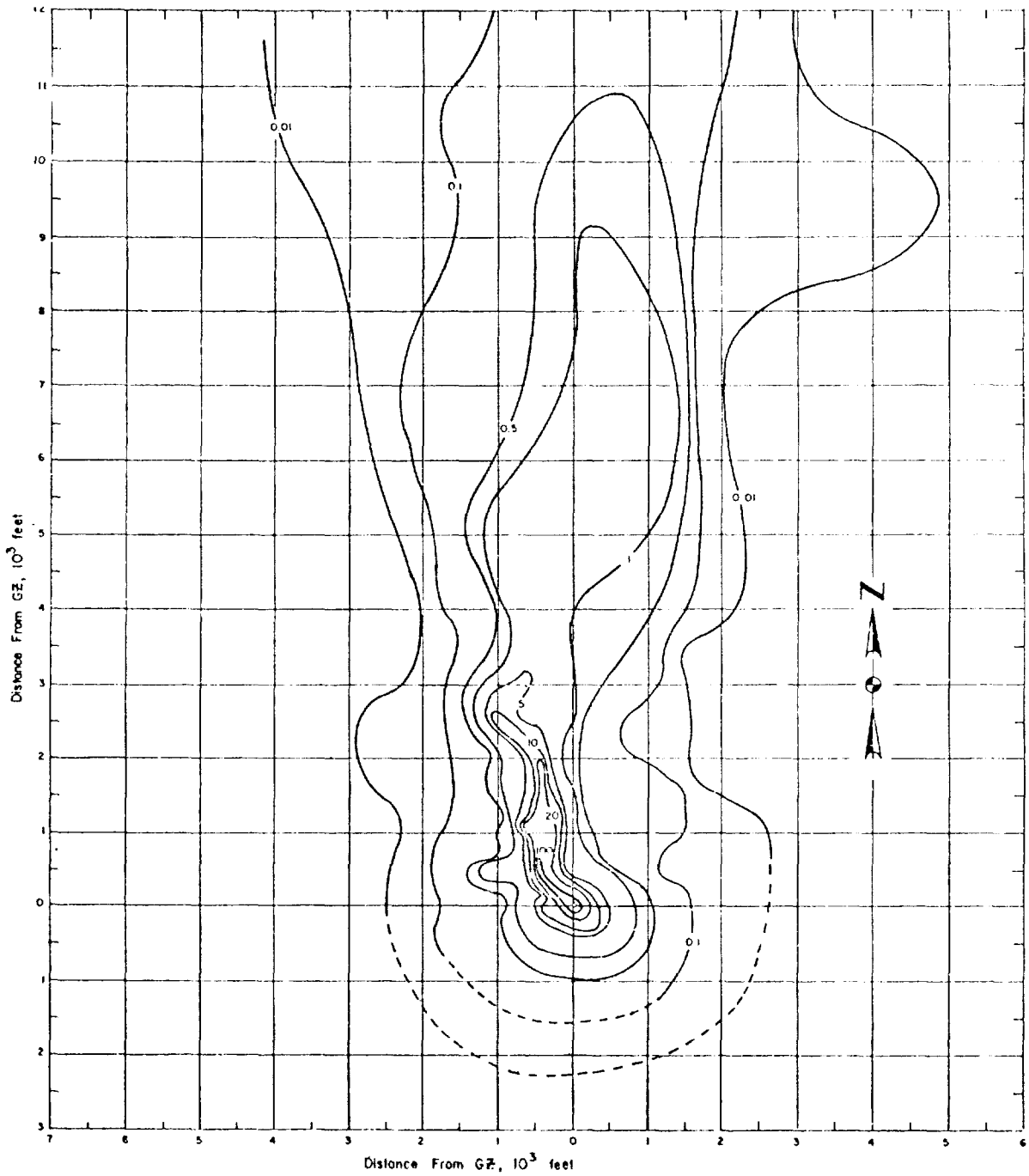


Figure 323. OPERATION SUNBEAM - Little Feller II contours of residual gamma radiation in R/hr at H+1 hour to 12,000 feet downwind

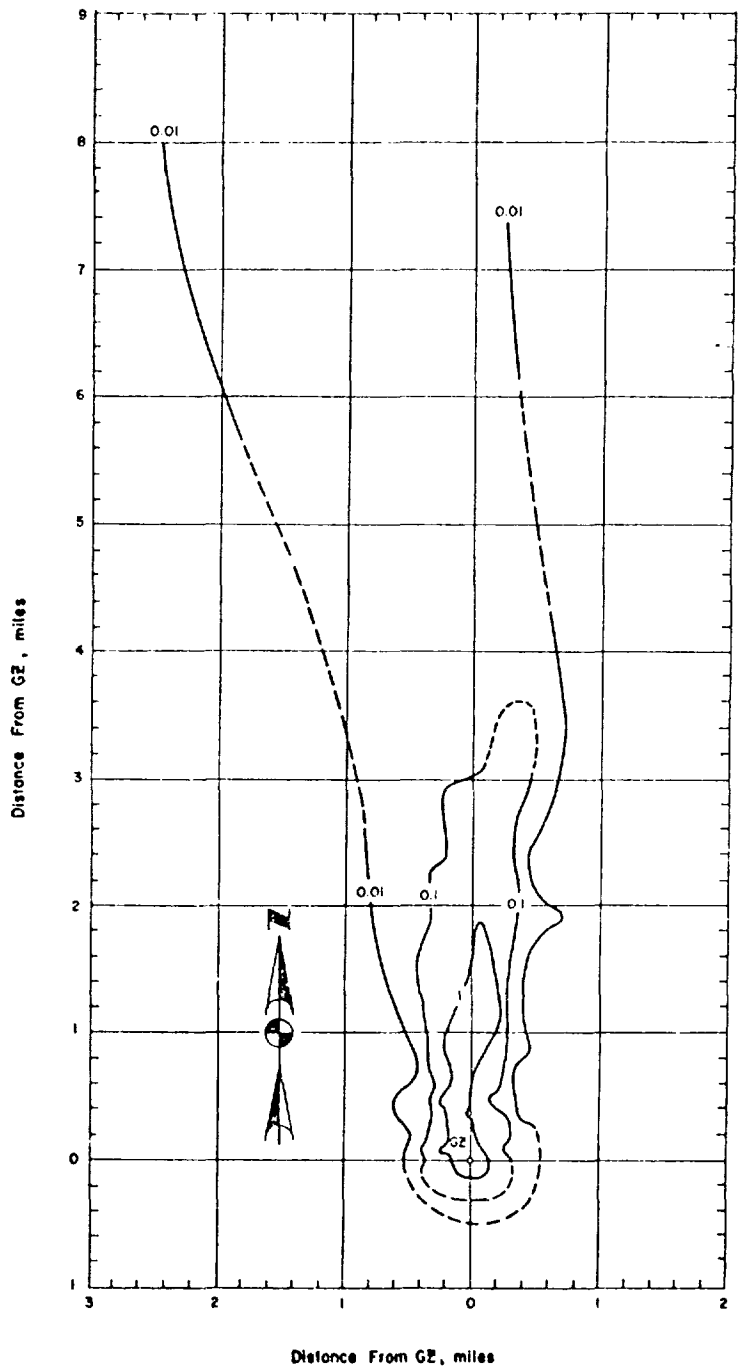


Figure 324. OPERATION SUNBEAM -- Little Feller II contours of residual gamma radiation in R/hr at H+1 hour to 8 miles downwind

TABLE 107 NEVADA WIND DATA FOR OPERATION SUNBEAM — LITTLE FELLER II

Altitude (MSL)	H-hour	
	Direction	Speed
feet	degrees	mph
Surface	171	8.1
6,000	190	16.1
7,000	180	19.6
8,000	180	15.0
9,000	180	11.5
10,000	180	11.5
11,000	140	8.1
12,000	120	15.0
13,000	110	21.9
14,000	100	18.4
15,000	90	10.4
16,000	140	3.5
17,000	200	8.1
18,000	200	9.2

Notes:

1. Observations made at forward control point, Area 18.

2. Air temperature at the surface was 35.5°C, and the relative humidity was too low to measure.

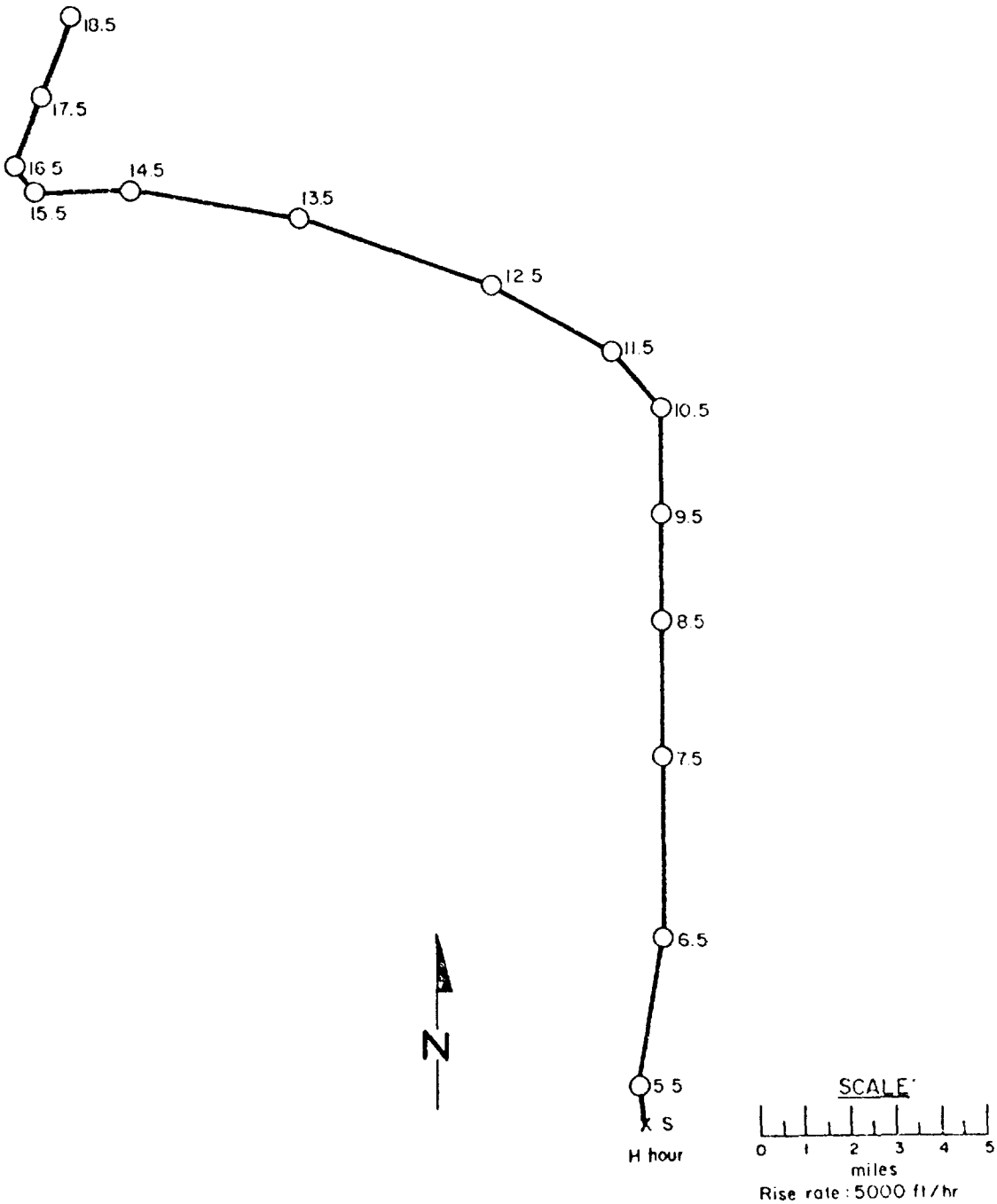


Figure 325. Hodograph for OPERATION SUNBEAM - Little Feller II.

OPERATION SUNBEAM - Johnie Boy

	PST	GMT
DATE:	11 Jul 1962	11 Jul 1962
TIME:	0845	1645

TOTAL YIELD: 0.5 kt

CRATER DATA:
Diameter: 122 ft
Depth: 30.6 ft

CLOUD TOP HEIGHT: 17,000 ft MSL

CLOUD BOTTOM HEIGHT: 12,500 ft MSL

SPONSOR: DOD

SITE: NTS - Area 18
37° 07' 20.9852" N
116° 19' 58.9362" W

SITE ELEVATION: 5153 ft MSL

DEPTH OF BURST: 23 inches

TYPE OF BURST AND PLACEMENT:
Shallow underground, in Nevada soil

VENTING:

A persistent cloud was produced containing appreciable quantities of radioactivity associated with particulates

REMARKS:

The close-in and distant contours of residual radiation are shown in Figures 326 & 327. Both contours are considered reliable. The close-in pattern of Figure 326 was supplemented by data from NRDL Project 2.9, NDL Project 2.20, and the REECo Rad-Safe unit. Decay corrections were made using the composite decay curve.

Figure 327 was supplemented in the distant portion by REECo Rad-Safe Group data taken on D-day and by the Public Health Service on D+1 day. Decay corrections in the distant regions were made using a decay exponent of 1.2.

Dashed portions of contours indicate uncertainty.

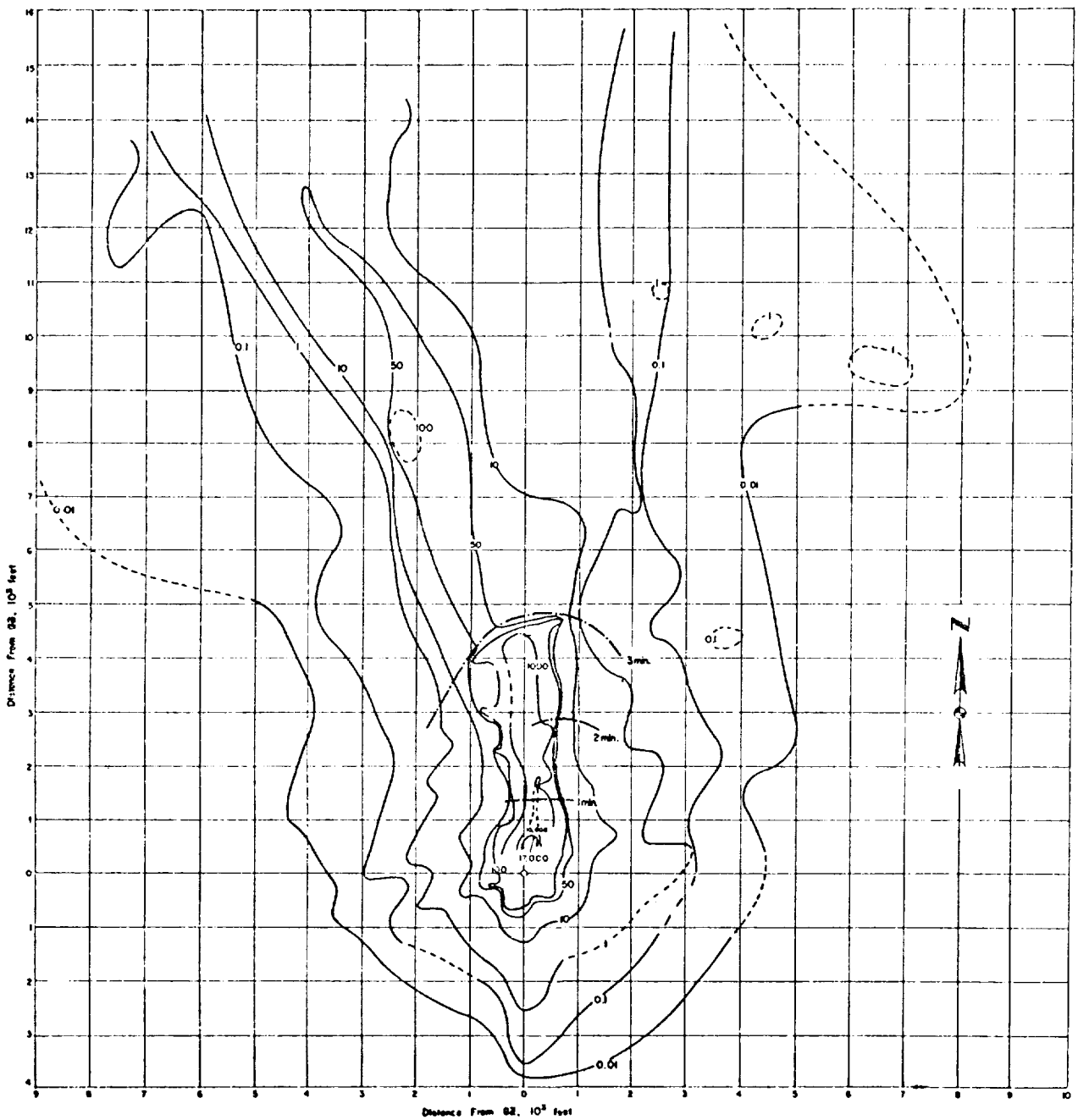


Figure 326. OPERATION SUNBEAM— Johnie Boy contours of residual gamma radiation in R/hr at H+ 1 hour to 16,000 feet downwind, together with times of arrival based on experimental data

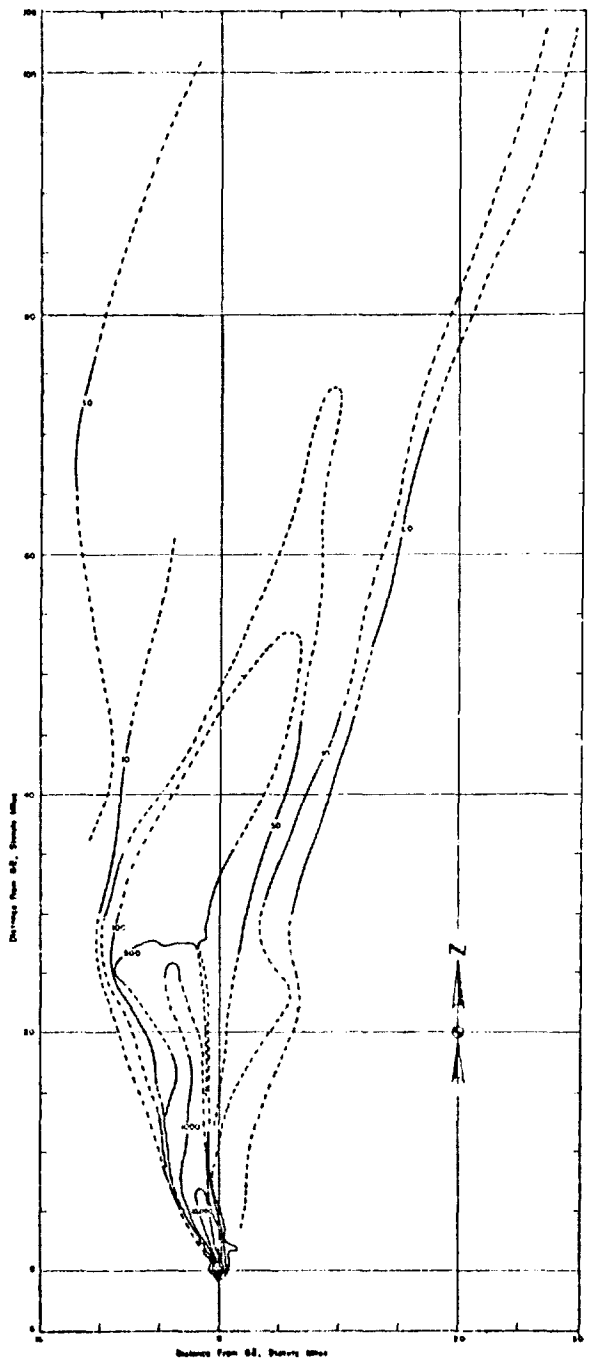


Figure 327. OPERATION SUNBEAM - Johnie Boy contours of residual gamma radiation in mR/hr at H+1 hour to 100 miles downwind

TABLE 108 NEVADA WIND DATA FOR OPERATION SUNBEAM - JOHNIE BOY

Altitude (MSL)	H-hour		H+1 hour	
	Direction	Speed	Direction	Speed
feet	degrees	mph	degrees	mph
Surface	195	8.1	210	17.3
6,000	170	8.1	210	11.5
7,000	160	8.1	170	10.4
8,000	160	12.7	150	12.7
9,000	160	18.4	170	12.7
10,000	170	17.3	190	11.5
11,000	180	13.8	200	11.5
12,000	180	17.3	200	17.3
13,000	190	20.0	200	25.3
14,000	200	24.2	200	25.3
15,000	200	25.3	210	29.9
16,000	200	25.3	210	29.9
17,000	200	31.1		
18,000	200	31.1		
19,000	210	29.9		
20,000	200	26.5		

Notes:

1. Observations made at forward control point, Area 18.

2. Air temperature at the surface was 24.3°C and the relative humidity was 12%.

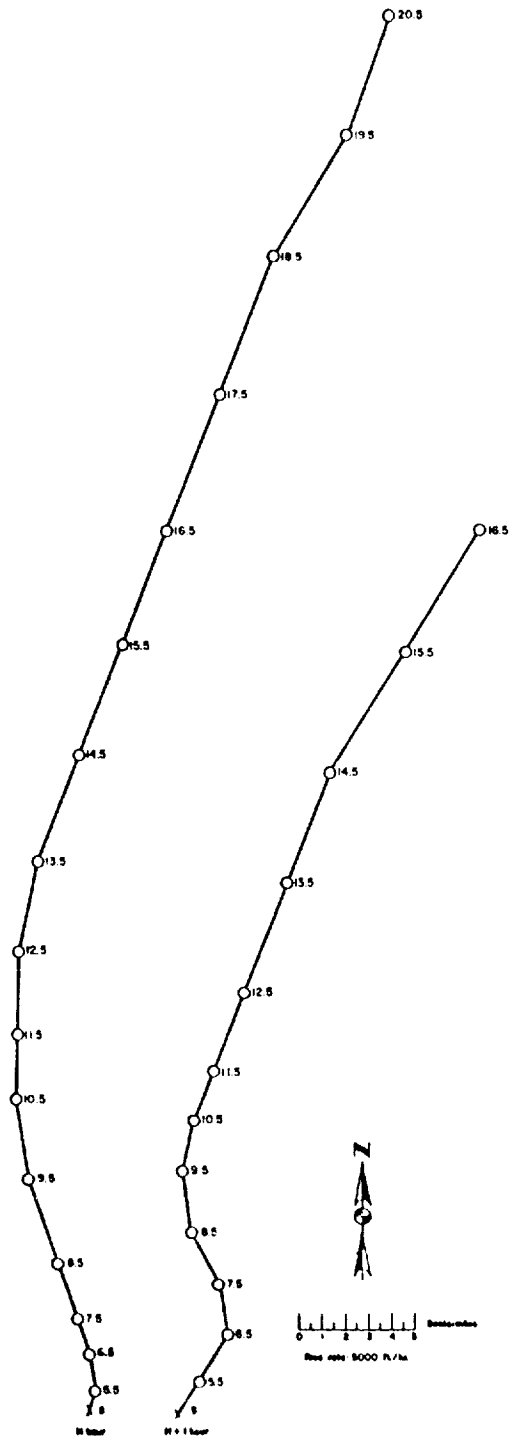


Figure 328. Hodograph for OPERATION SUNBEAM - Johnie Boy

OPERATION STORAX - Merrimac

	PST	GMT
DATE:	13 Jul 1962	13 Jul 1962
TIME:	0800	1600

SPONSOR: LRL

SITE: NTS - U3bd
37° 03' 18.2331" N
116° 02' 00.2205" W

SITE ELEVATION: 4040 ft MSL

DEPTH OF BURST: 1356 ft

TYPE OF BURST AND PLACEMENT:
Underground, in slightly consolidated alluvium.

VENTING:

This event released small visible quantities of radioactive steam and/or gases.

REMARKS:

Radiation was detected on-site from radioactivity released by this detonation. No radiation levels above background were detected off the NTS in populated areas from radioactivity released by this detonation.

Some radiation was detected in the area surrounding SZ, from gaseous radioactivity released during post-shot drilling. No radioactivity was detected off the NTS from post-shot operations.

OPERATION SUNBEAM - Small Boy

	PST	GMT
DATE:	14 Jul 1962	14 Jul 1962
TIME:	1030	1830

SPONSOR: DOD

SITE: NTS - Area 5
36° 48' 08.9942" N
115° 55' 89.2031" W

SITE ELEVATION: 3078 ft MSL

HEIGHT OF BURST:

TYPE OF BURST AND PLACEMENT:
Tower, over Nevada soil

CLOUD TOP HEIGHT: 19,000 ft MSL

REMARKS:

The close-in and distant contours of residual radiation are shown in Figures 329 thru 332 The estimated Small Boy GZ contours of Figure 329 are based on data taken from D-day to D+3 days by NDL, NRDL, and REECo. The composite decay curve of NDL Project 2.8 was used to correct the data to H+1 hour. The close-in contours of Figure 330 are revisions of those with data from NRDL Project 2.11 included and supplemented by data from the REECo Rad Safe Group and NDL Project 2.9.

The two off-site contour patterns are shown in Figure 331 (out to 29 miles) and Figure 332 (out to 300 miles). The middle portion of Figure 331 (around 15 miles downwind) was constructed using data from NDL, UCLA, NRDL, and the PHS. The portion farthest downwind was constructed from data obtained by NDL and UCLA. The contours were corrected to H+1 hour using a decay constant of 1.27. Figure 332 is based almost entirely on ground monitor surveys conducted by NDL, UCLA, and the PHS, supplemented by aerial surveys by CETO Project 62.80. The data were extrapolated back to H+1 hour by $t^{-1.2}$. The fallout started arriving at 250 to 400 miles downwind sometime in the latter part of D+1 day reaching a peak at D+2 days. Figure 333 shows the probable path of the Small Boy cloud as determined by exposure rate measurements as far as western Nebraska.

In all the figures the dashed portions indicate uncertainty.

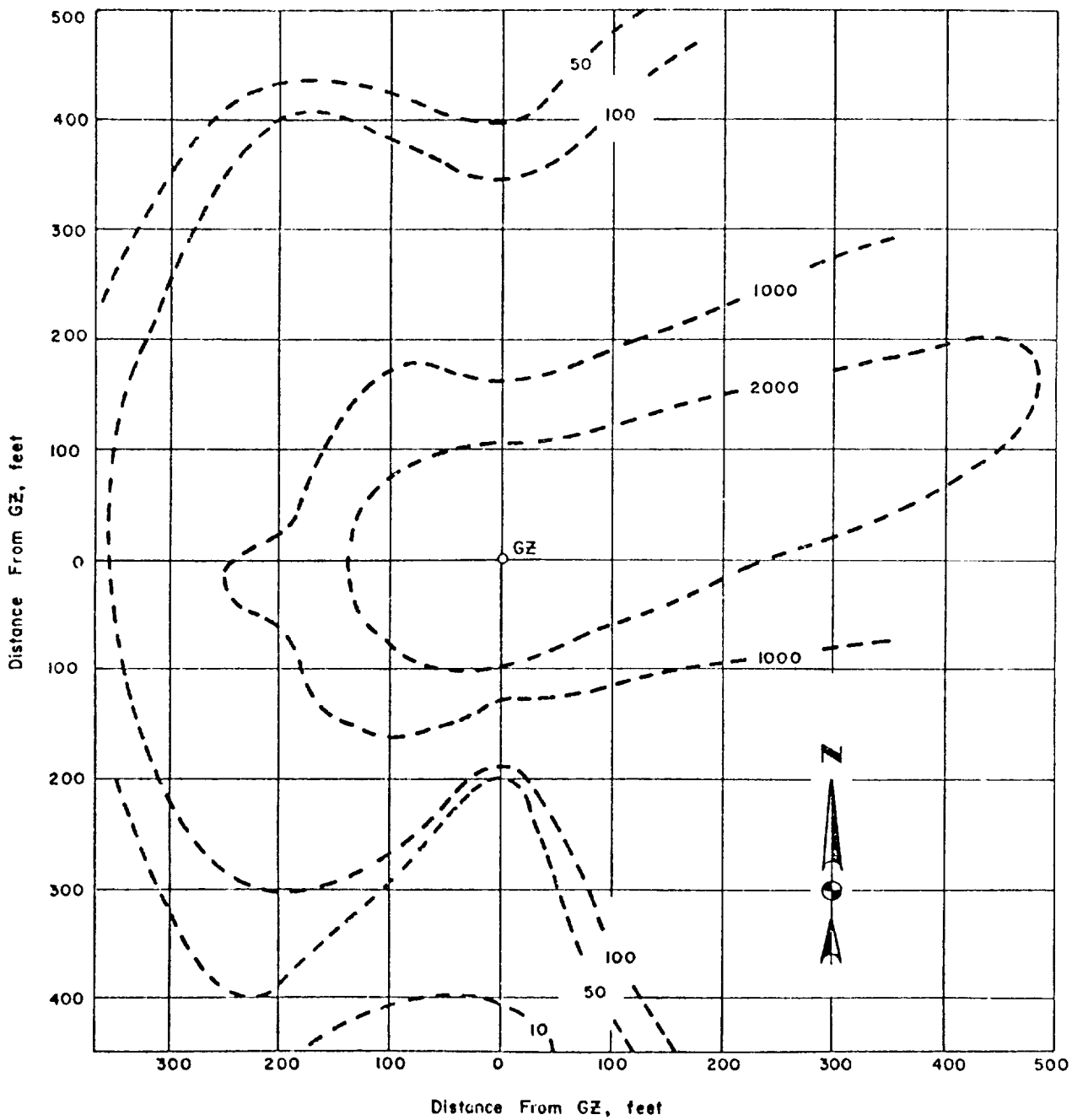


Figure 329. OPERATION SUNBEAM - Small Boy GZ area contours in R/hr at H+1 hour

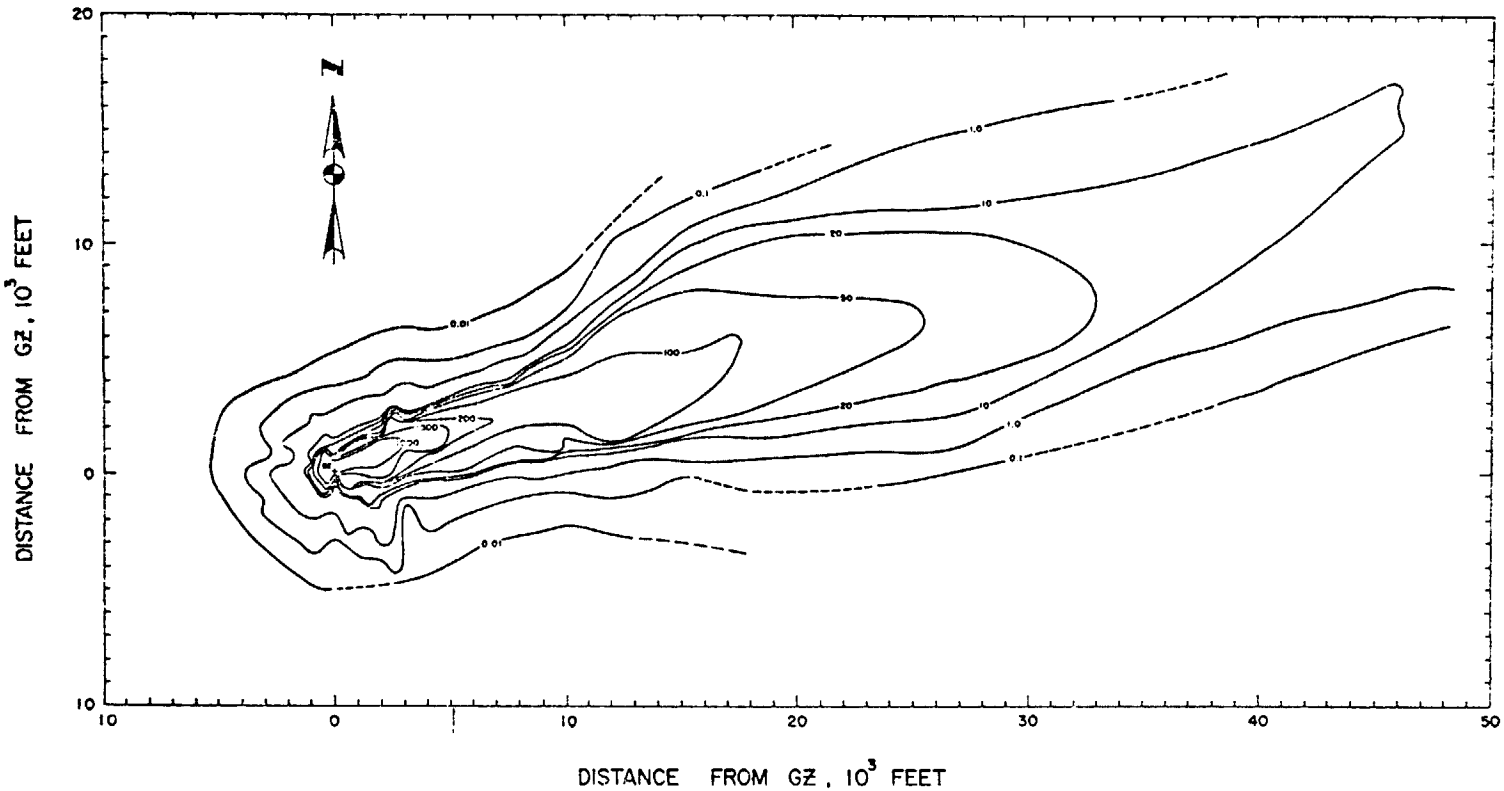


Figure 330. OPERATION SUNBEAM - Small Boy contours of residual gamma radiation in R/hr at H+1 hour to 50,000 feet downwind

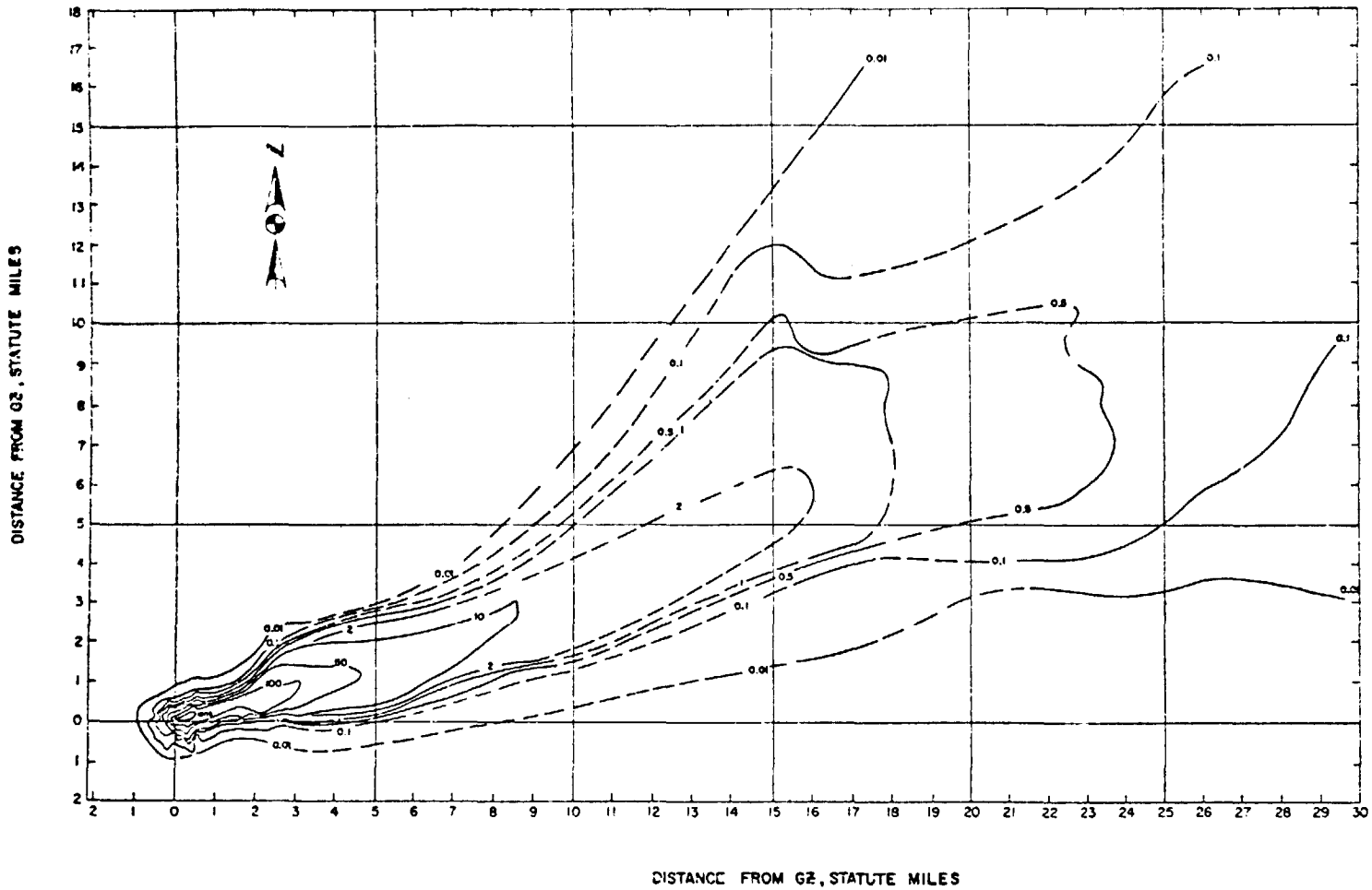


Figure 331. OPERATION SUNBEAM - Small Boy contours of residual gamma radiation in R/hr at H+1 hour to 29 miles downwind

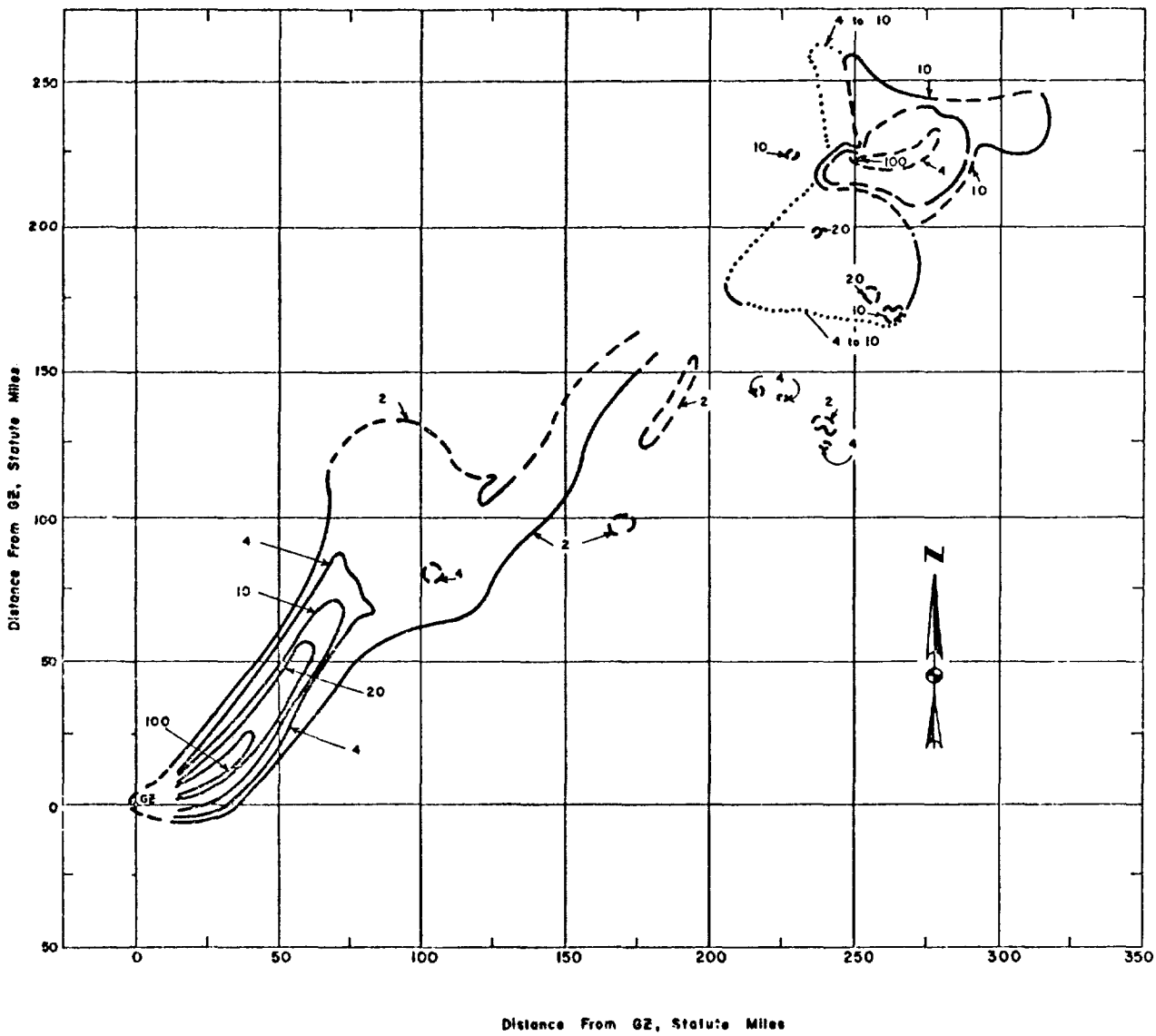


Figure 332. OPERATION SUNBEAM - Small Boy contours of residual gamma radiation in R/hr at H+1 hour to 300 miles downwind

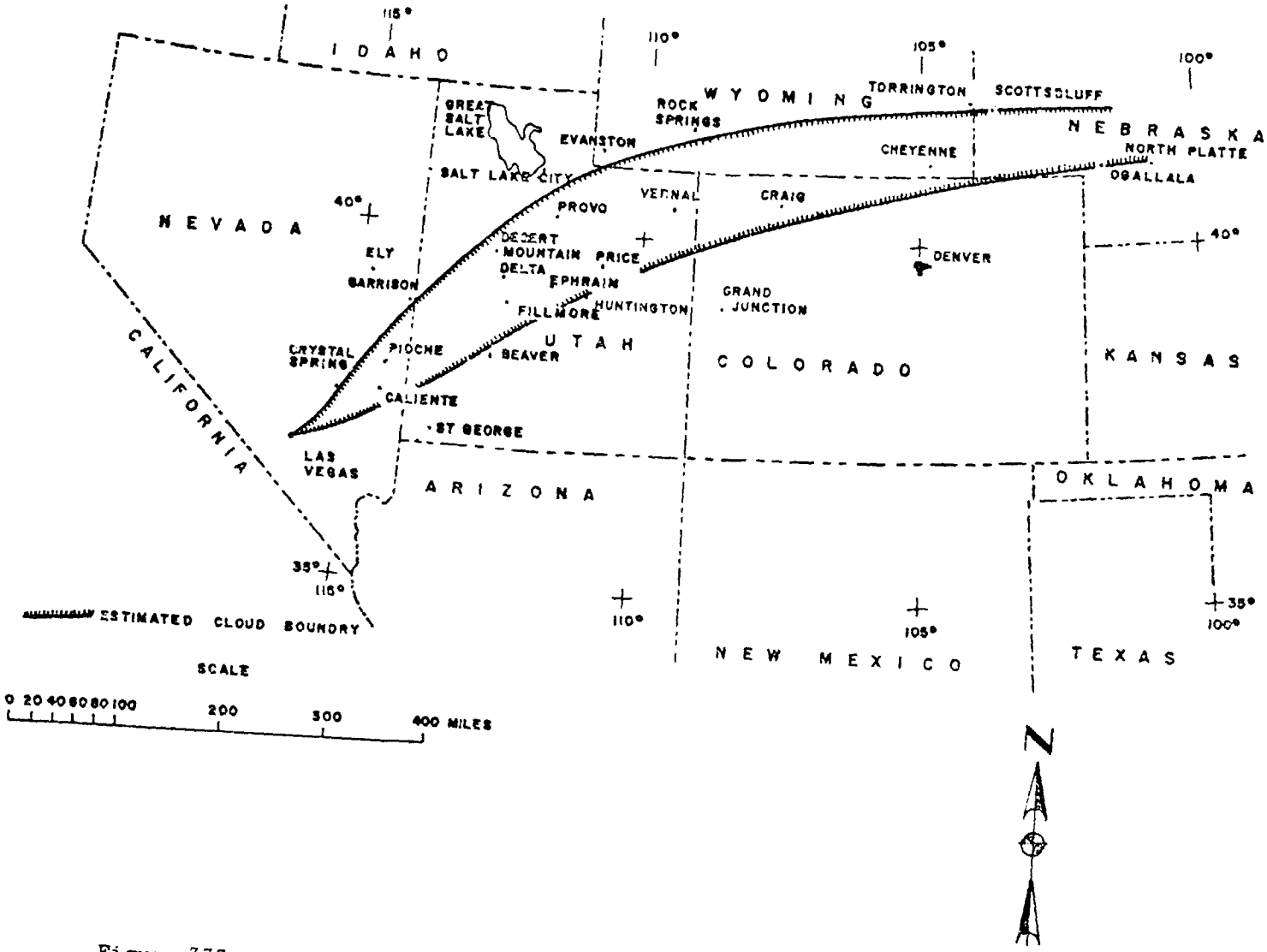


Figure 333. OPERATION SUNBEAM - Small Boy cloud path

TABLE 109 NEVADA WIND DATA FOR OPERATION SUNBEAM - SMALL BOY

Altitude (MSL)	H+5 Minutes		H+1/4 Hour		H+70 Minutes	
	Direction	Speed	Direction	Speed	Direction	Speed
feet	degrees	mph	degrees	mph	degrees	mph
3,078	135	2.3	120	12.3	180	6.9
4,000	300	1.2	145	4.6	185	6.9
5,000	310	1.2	170	5.8	188	8.1
6,000	330	2.3	180	6.9	212	9.2
7,000	280	2.3	170	6.9	224	11.5
8,000	250	6.9	180	3.5	237	11.5
9,000	240	13.8	230	5.8	245	12.7
10,000	240	18.4	240	12.7	240	15.0
12,000	240	9.2	235	10.4	225	9.2
14,000	240	9.2	230	9.2	280	8.1
15,000	-	-	-	-	265	4.6
16,000	240	9.2	230	8.1		
18,000	280	16.1	260	15.0		
20,000	280	28.8	280	26.5		

Notes:

1. Observations made at Frenchman's Flat.

2. Air temperature at the surface was 31.7°C; the relative humidity was 16%.

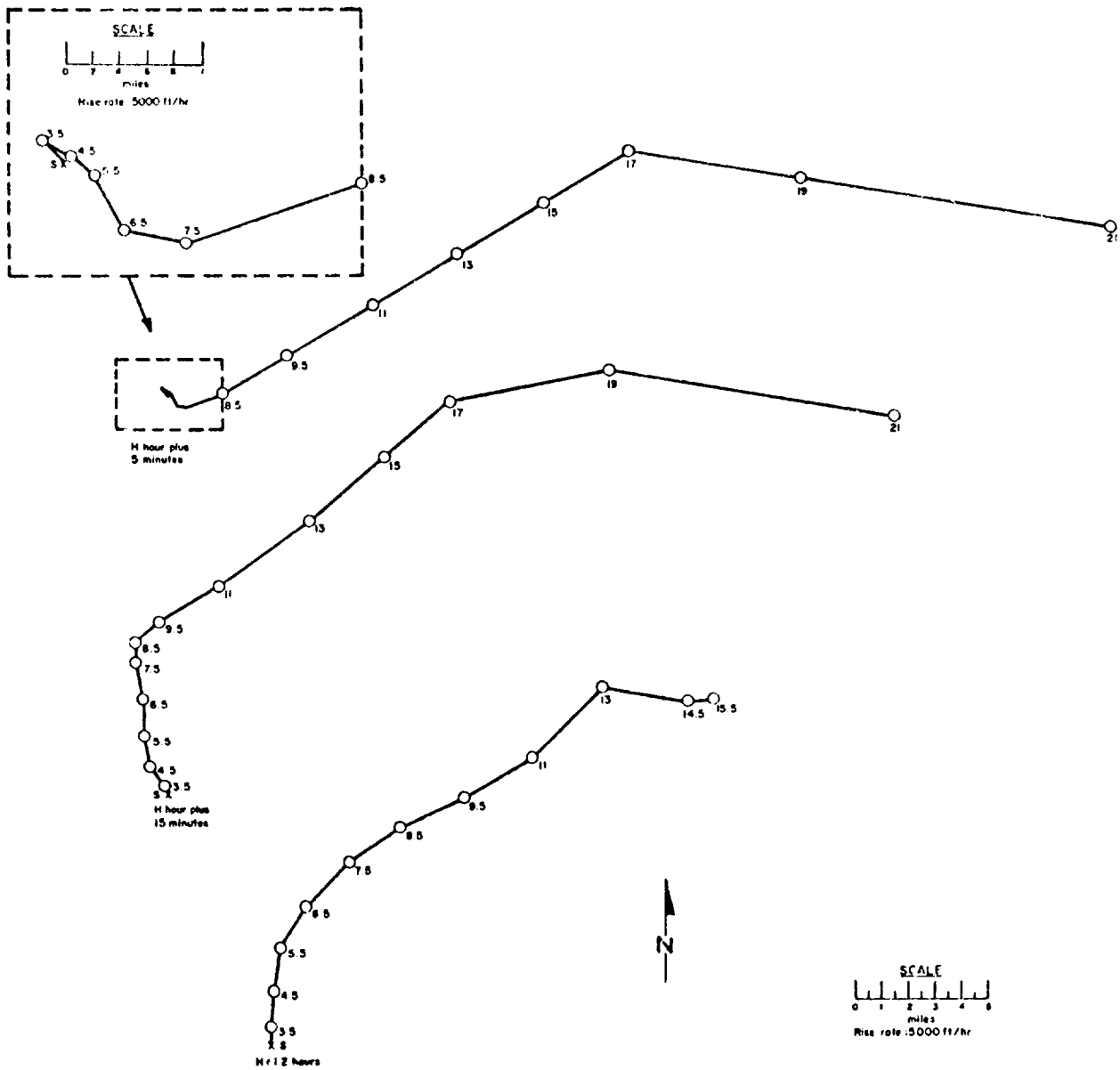


Figure 334. Hodograph for OPERATION SUNBEAM - Small Boy.

OPERATION SUNBEAM - **Little Feller I**

	PST	GMT
DATE:	17 Jul 1962	17 Jul 1962
TIME:	0900	1700

CLOUD TOP HEIGHT: 11,000 ft MSL

SPONSOR: DOD

SITE: NTS - Area 18
37° 06' 30.7784" N
116° 19' 02.1775" W

SITE ELEVATION: 5194 ft MSL

HEIGHT OF BURST:

TYPE OF BURST AND PLACEMENT:
Near surface, over Nevada soil. Warhead fired from Davy Crockett weapon system.

REMARKS:

The close-in and distant contours of residual radiation are shown in Figures 335 thru 338. The very close-in contours are shown in Figure 335 Figure 337 shows contours of residual gamma radiation at H+4 hours to 12,000 feet downwind. The earliest readings were not taken until approximately H+4 hours because troop exercises were executed in the area of interest at earlier times. The application of an average decay exponent to the overall pattern or representative portions of the pattern did not appear to be justified; therefore the H+4-hour patterns are presented as the basic patterns and are considered reliable. The H+4-hour patterns were constructed from data obtained by NDL, REECo Rad Safe Group remote units, and PHS off-site surveys. Figures 336 and 338 are the result of arbitrarily applying a decay exponent of 1.2 to produce H+1-hour patterns. These patterns are given only to represent the order of magnitude of the H+1-hour dose rates and are considered to be much less reliable than the ones representing H+4 hours.

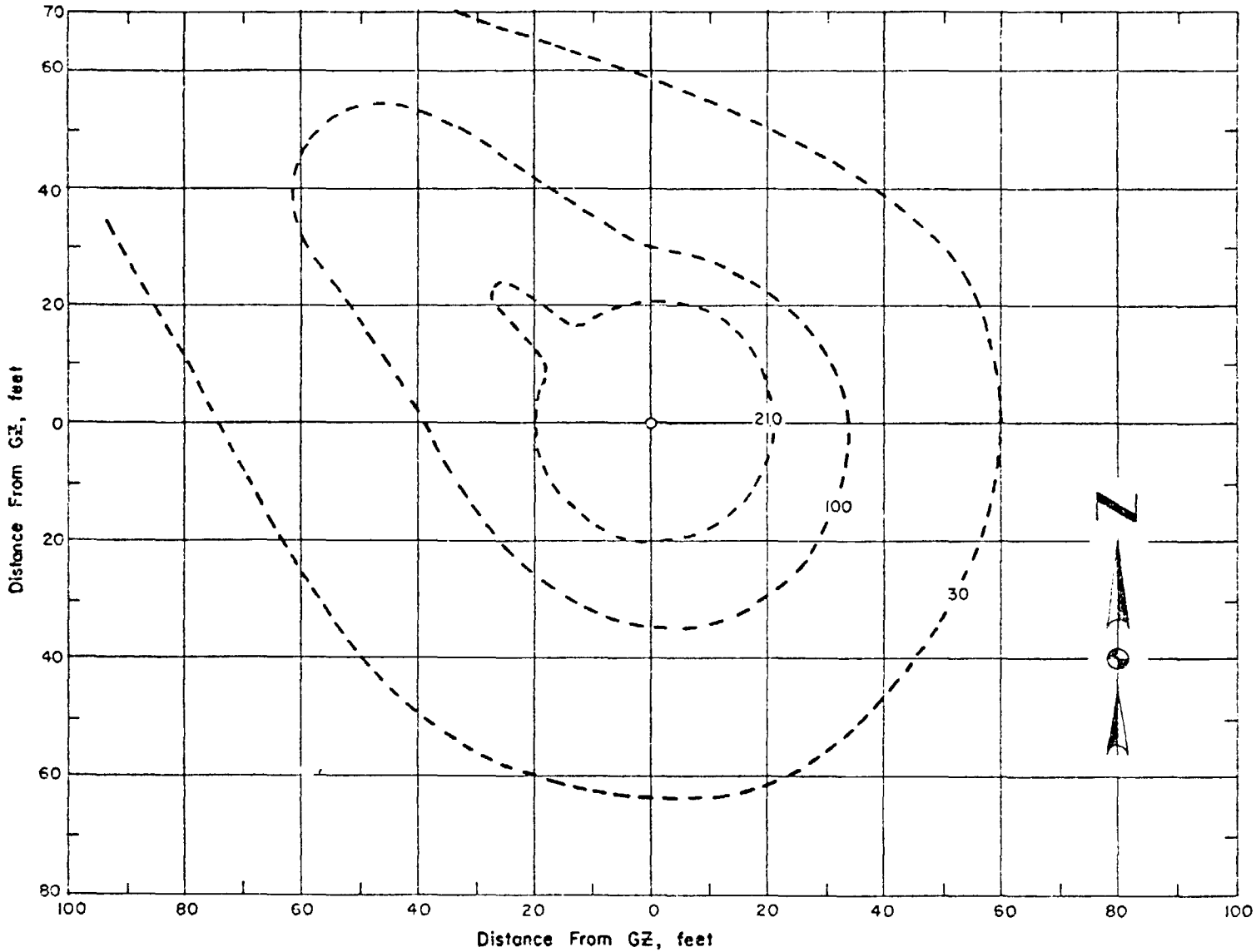


Figure 335. OPERATION SUNBEAM - Little Feller I contours of residual gamma radiation in R/hr at H+4 hours to 70 feet downwind.

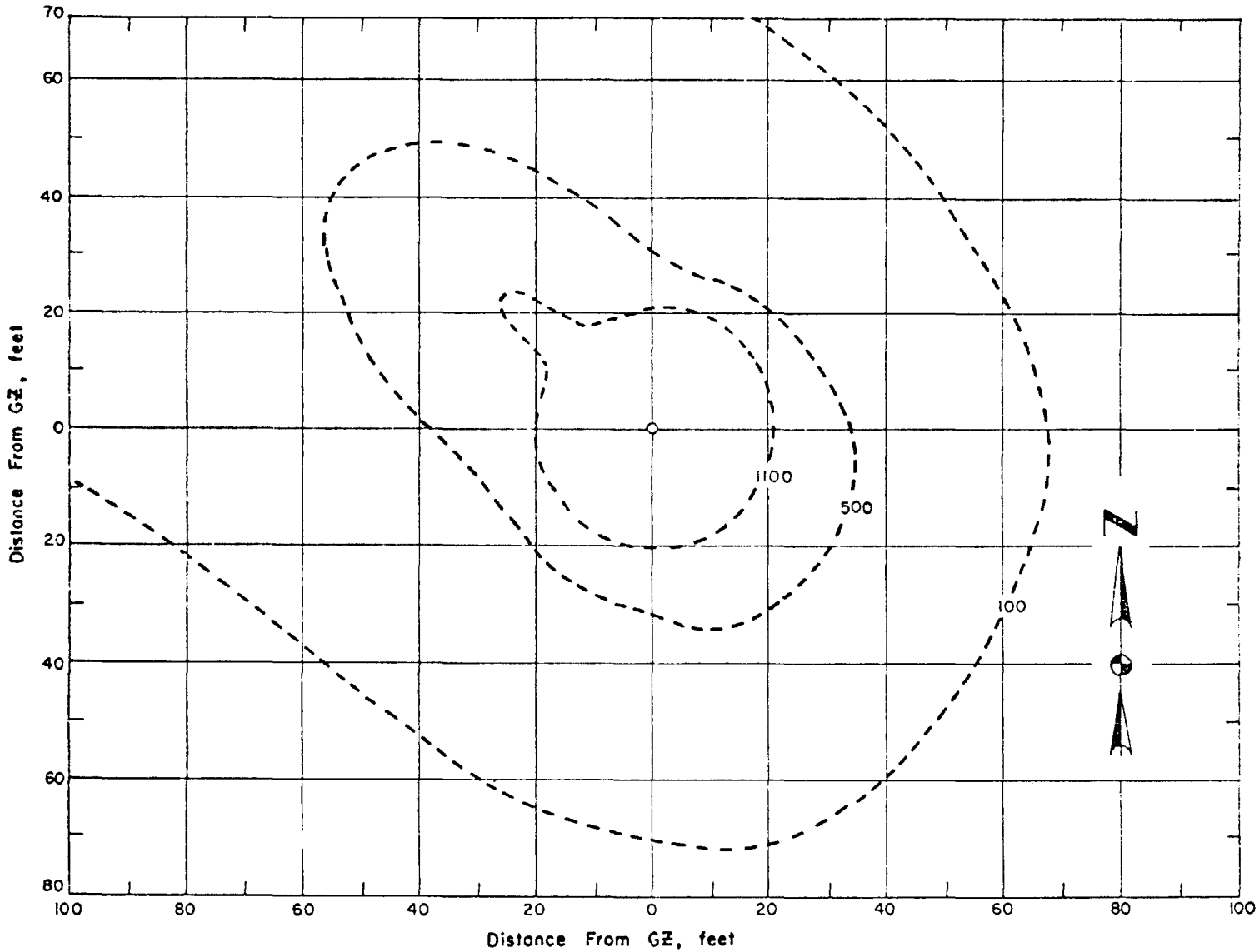


Figure 336. OPERATION SUNBEAM - Little Feller I contours of residual gamma radiation in R/hr at H+1 hour to 70 feet.

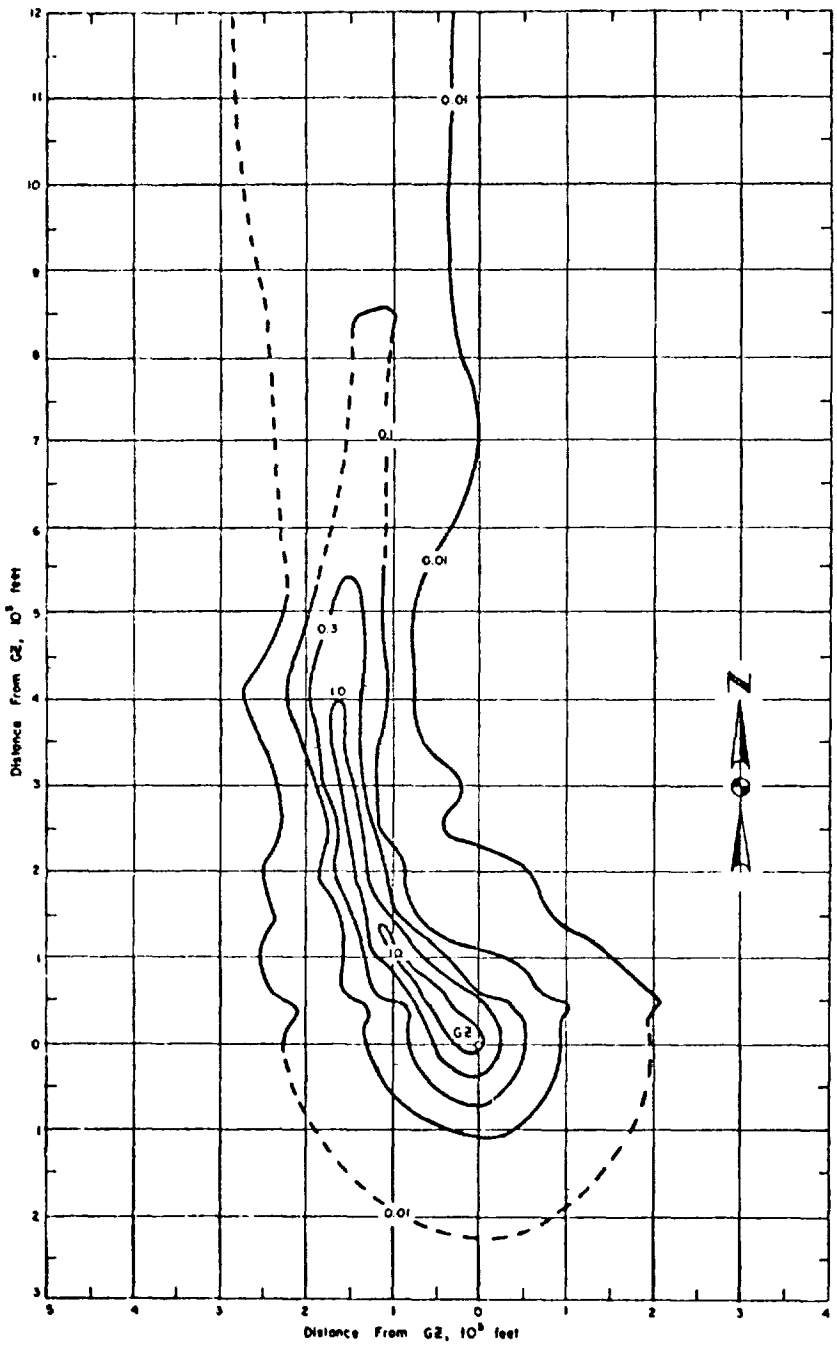


Figure 337. OPERATION SUNBEAM - Little Feller I contours of residual gamma radiation in R/hr at H+4 hours to 12,000 feet downwind.

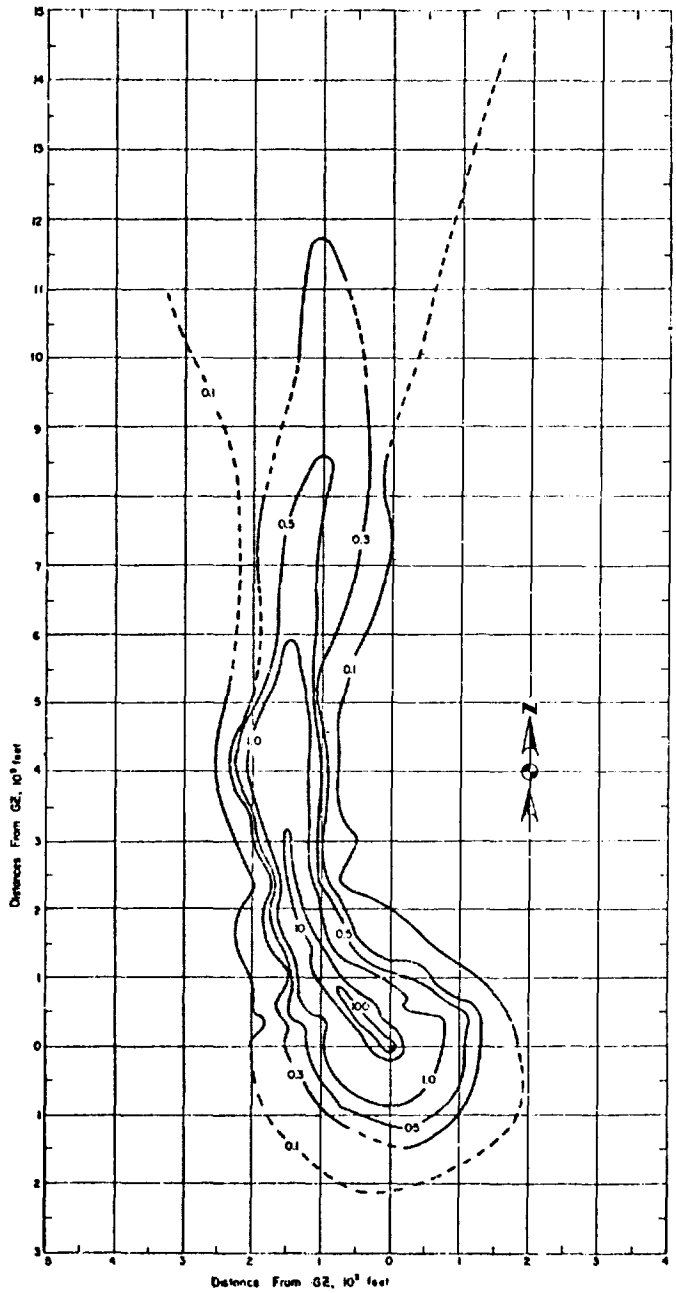


Figure 338. OPERATION SUNBEAM - Little Feller I contours of residual gamma radiation in R/hr at H+1 hour to 12,000 feet downwind.

TABLE 110 NEVADA WIND DATA FOR OPERATION SUNBEAM - LITTLE FELLER I

Altitude (MSL)	H-Hour	
	Direction	Speed
feet	degrees	mph
Surface	200	17.3
6,000	200	15.0
7,000	190	13.8
8,000	170	13.8
9,000	170	12.7
10,000	150	12.7
11,000	140	12.7
12,000	150	15.0
13,000	180	17.3
14,000	180	23.0
15,000	180	26.5
16,000	190	28.8

Notes:

1. Observations made at forward control point, Area 18.

2. Air temperature at the surface was 29.7°C and the relative humidity was 17 percent.

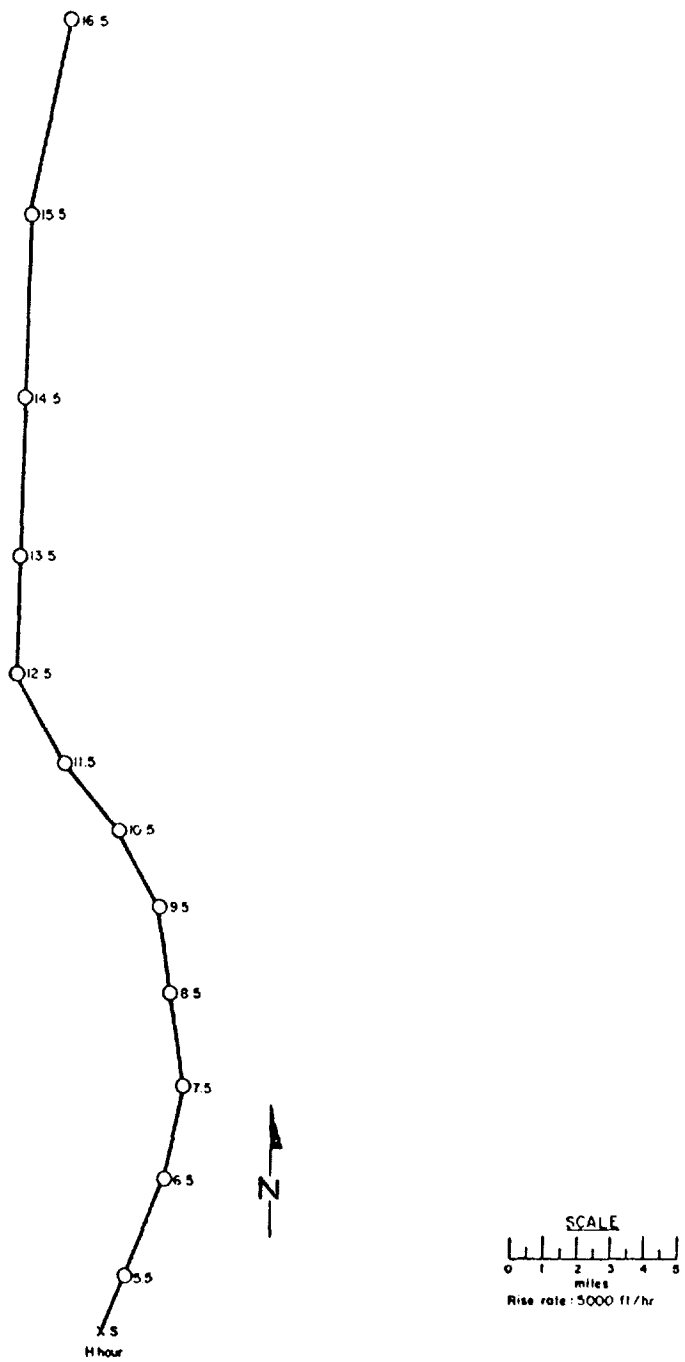


Figure 339. Hodograph for OPERATION SUNBEAM - Little Feller I.

OPERATION STORAX - Wichita

	PST	GMT
DATE:	27 Jul 1962	27 Jul 1962
TIME:	1300	2100

SPONSOR: LRL

SITE: NTS - U9y
37° 07' 46.9592" N
116° 03' 23.3114" W

SITE ELEVATION: 4238 ft MSL

DEPTH OF BURST: 493 ft

TYPE OF BURST AND PLACEMENT:
Underground, in slightly consolidated alluvium.

VENTING:

Low-velocity venting was observed at H+0.5 second with an initial height of 200-500 feet. AT H+26 seconds, gas vented from a fissure in the earth approximately 50 feet north of the emplacement hole and continued for 5 minutes. The estimated dose rate at 500 feet from GZ, normalized to H+1 hour was > 10 R/hr, and the estimated total release normalized to H+1 minute was 2×10^6 curies. The only isotope identified in the release products was I^{131}

REMARKS:

Radiation was detected on-site from radioactivity released by this detonation. No radiation levels above background were detected off the NTS in populated areas from radioactivity released by this detonation. No radiation was detected at the worksite or any other location from releases of gaseous radioactivity during post shot drilling

OPERATION STORAX - York

	PST	GMT
DATE:	24 Aug 1962	24 Aug 1962
TIME:	0700	1500

SPONSOR: LRL

SITE: NTS-U9z
37° 07' 07.085" N
116° 02' 22.145" W

SITE ELEVATION: 4208 ft MSL

DEPTH OF BURST: 747 ft

TYPE OF BURST AND PLACEMENT:
Underground, in alluvium

VENTING:
None, except during post-shot drilling

REMARKS:

No radiation levels were detected above background on or off the NTS from radioactivity released by this detonation. Some radiation was detected in the area surrounding SZ from gaseous radioactivity released during post-shot drilling. No radioactivity was detected off the NTS from post-shot operations

OPERATION STORAX - Bobac

	PST	GMT
DATE:	24 Aug 1962	24 Aug 1962
TIME:	0900	1700

SPONSOR: LASL

SITE: NTS - U3b1
37° 02' 46.112" N
116° 01' 25.818" W

DEPTH OF BURST: 674 ft

TYPE OF BURST AND PLACEMENT:
Underground, in alluvium

VENTING:
None, except during post-shot drilling

REMARKS:

No radiation levels were detected above background on or off the NTS from radioactivity released by this detonation. Some radiation was detected in the area surrounding SZ from gaseous radioactivity released during post-shot drilling. No radioactivity was detected off the NTS from post-shot drilling. No radioactivity was detected off the NTS from post-shot operations

OPERATION STORAX - Hyrax

	PST	GMT
DATE:	14 Sep 1962	14 Sep 1962
TIME:	0900	1700

SPONSOR: LASL

SITE: NTS - U3bh
37° 02' 38.1654" N
116° 01' 16.0105" W

DEPTH OF BURST: 709 ft

TYPE OF BURST AND PLACEMENT:
Underground, in alluvium

VENTING:
Vented

REMARKS:

Radiation levels were detected near SZ above normal background from radioactivity released by this detonation. No other radiation levels were detected on or off the NTS, from radioactivity released by this detonation. Some radiation was detected in the area surrounding SZ from gaseous radioactivity released during post-shot drilling. No radioactivity was detected off the NTS from post-shot operation

OPERATION STORAX - Peba

	PST	GMT
DATE:	20 Sep 1962	20 Sep 1962
TIME:	0900	1700

SPONSOR: LASL

SITE: NTS - U3bb
37° 03' 18.1538" N
116° 01' 45.4169" W

DEPTH OF BURST: 792 ft

TYPE OF BURST AND PLACEMENT:
Underground, in alluvium

VENTING:
No venting

OPERATION STORAX - Allegheny

	PST	GMT
DATE:	29 Sep 1962	29 Sep 1962
TIME:	0900	1700

SPONSOR: LRL

SITE: NTS - U9x
37° 07' 00.0368" N
116° 01' 57.9995" W

SITE ELEVEATION: 4258 ft MSL

DEPTH OF BURST: 692 ft

TYPE OF BURST AND PLACEMENT:
Underground, in semiwelded tuff

VENTING:

This event released small visible quantities of radioactive steam and/or gases

REMARKS:

Radiation was detected on-site from radioactivity released by this detonation. No radiation levels above background were detected off the NTS in populated areas from radioactivity released by this detonation. No radiation was detected at the worksite or any other location from releases of gaseous radioactivity during post-shot drilling

OPERATION STORAX - Mississippi

	PST	GMT
DATE:	5 Oct 1962	5 Oct 1962
TIME:	0900	1700

TOTAL YIELD: 110 kt

CRATER DATA:
Subsidence crater
Diameter: 900 ft
Depth: 160 ft

VENTING:
None, except during post-shot drilling

SPONSOR: LRL

SITE: NTS - U9ad
37° 08' 21.8516" N
116° 03' 01.1677" W

SITE ELEVATION: 4234 ft MSL

DEPTH OF BURST: 1622 ft

TYPE OF BURST AND PLACEMENT:
Underground, in semiwelded tuff

REMARKS:

No radiation levels were detected above background on or off the NTS from radioactivity released by this detonation. Some radiation was detected in the area surrounding SZ, from gaseous radioactivity released during post-shot drilling. No radioactivity was detected off the NTS from post-shot operations

OPERATION STORAX - Roanoke

	PST	GMT
DATE:	12 Oct 1962	12 Oct 1962
TIME:	0700	1500

SPONSOR: LRL

SITE: NTS - U9q
37° 07' 21.8364" N
116° 03' 02.8917" W

SITE ELEVATION: 4198 ft MSL

DEPTH OF BURST: 514 ft

TYPE OF BURST AND PLACEMENT:
Underground, in alluvium

VENTING:

Gas-venting and minor gaseous release occurred at H+7 minutes at SZ through the emplacement hole casing and air dielectric signal and diagnostic cables, and lasted for 128 minutes. The estimated dose rate at 1000 feet from SZ, normalized to H+1 hour, was 22 mR/hr and the estimated total release, normalized to H+1 minute, was 5×10^4 curies. The identification of isotopes is not available. The maximum radiation reading outside the crater area was 25 mR/hr at 1000 feet north of SZ at H+2 hours. The greater part of the radiation was confined to the vicinity of SZ. The venting was stopped by preparations for post-shot drilling

REMARKS:

No other radiation levels were detected on or off the NTS from radioactivity released by this detonation. Some radiation was detected in the area surrounding SZ from gaseous radioactivity released during post-shot drilling. No radioactivity was detected off the NTS from post-shot operations

OPERATION STORAX - Bandicoot

	PST	GMT
DATE:	19 Oct 1962	19 Oct 1962
TIME:	1000	1800

SPONSOR: LASL

SITE: NTS - U3bj
37° 02' 22.3431" N
116° 01' 16.1267" W

SITE ELEVATION: 4009 ft MSL

DEPTH OF BURST: 792 ft

DEPTH OF EMPLACEMENT HOLE: 800 ft

TYPE OF BURST AND PLACEMENT:
Underground, in alluvium

CLOUD TOP HEIGHT: 10,500 ft MSL

VENTING:

Immediately following the event a persistent cloud was produced containing appreciable quantities of radioactivity associated with particulates

The intensity of the H-hour release activity was > 7500 R/hr. This value was reduced in 5 hours to a minimum of 150 R/hr. The cloud diffused to the north and south and deposited a maximum dose rate of 20 mR/hr at 1410 hours at Area 16 and was reduced to 9 mR/hr at 1445 hours. The Camp Mercury maximum dose rate was 5.75 mR/hr at 1335 hours and was reduced to 1.5 mR/hr at 1450 hours.

OPERATION STORAX - Bandicoot

REMARKS:

The radioactive cloud split into two portions. The lower portion of the cloud traveled in a NNE direction to Area 9 where it remained stagnant, then went slowly across Flat Top Mesa and north to the Area 12 compound The cloud dispersed in the valleys north of the test site and no exposures to people were detected

The upper portion of the cloud traveled in a southern direction and traversed a course over the CP Compound, Camp Mercury, Cactus Springs, Indian Springs, Lathrop Wells and Highway 95 The cloud was first detected over Highway 95 at H+2 hours Upon crossing Highway 95, the cloud was 9 miles wide, was diffusing rapidly, and was proceeding SW. The intensity at ground level was approximately twice background. A maximum intensity of 50 mR/hr was detected at 4 miles west of the Mercury junction on Highway 95 A 20-mR/hr dose rate was recorded 7 miles west of the Mercury junction at H+3.5 hours Maximum intensities by portable instruments (3 feet aboveground) were recorded for Johnie, 12 mR/hr; Ash Meadows, 16 mR/hr; Death Valley Junction, 3 mR/hr and Camp Mercury, 5 mR/hr. No radiation was detected off-site at Area 51, Indian Springs and Pahrump The highest reading at ground level at Cactus Springs (36 miles from SZ) was approximately 0.6 mR/hr

Figure 340 shows contours of residual gamma activity in mR/hr for a midtime of H+24 hours. The contours were constructed from Rad-Safe Group survey performed by the REECo

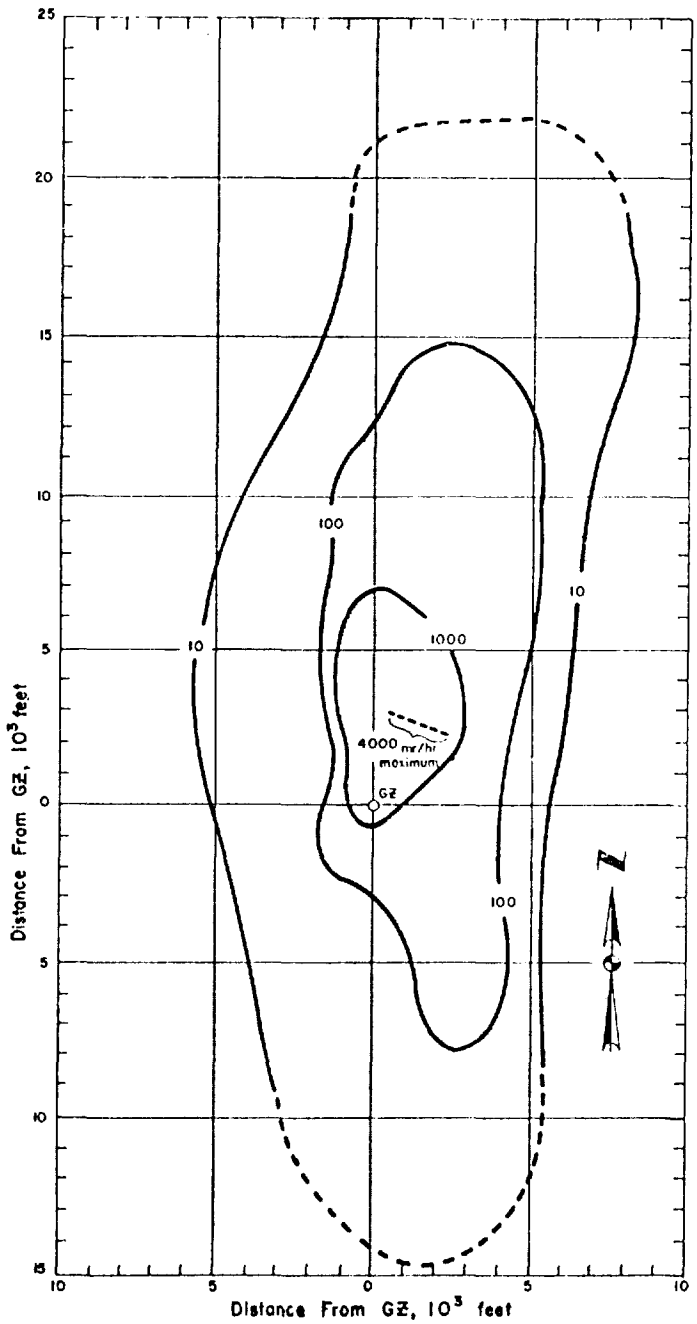


Figure 340. OPERATION STORAX - Bandicoot contours of residual gamma radiation in mR/hr at a midtime of H+24 hours to 22,000 feet downwind.

TABLE 111 NEVADA WIND DATA FOR OPERATION STORAX - BANDICOOT

Altitude (MSL)	H-hour (Note 1) Direction	Speed
feet	degrees	mph
4,010	calm	calm
5,000	191	2.3
6,000	305	4.6
7,000	353	12.7
8,000	10	17.3
9,000	9	20.7
10,000	14	26.5
11,000	23	29.9
12,000	27	23.0
13,000	27	38.0
14,000	22	39.1
15,000	24	39.1

Notes:

1. Observations made at Yucca weather station.

2. Surface data (from RAOB) at level of GZ over Area 3, H-hour: Atmospheric pressure 878 millibars, temperature 13.0°C, dew point temperature 3.8°C, relative humidity 54%.

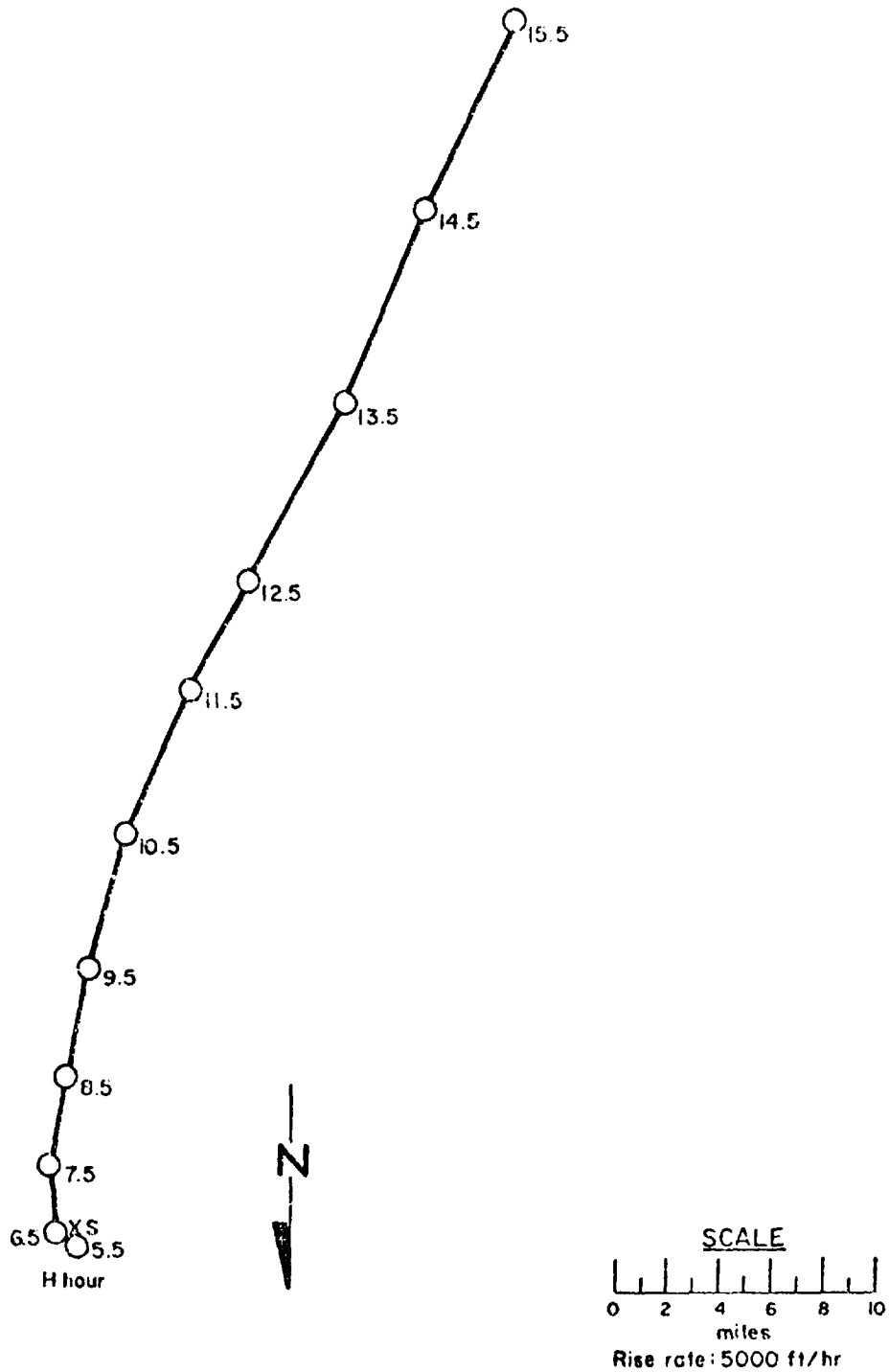


Figure 341. Hodograph for OPERATION STORAX - Bandicoot

OPERATION STORAX - Santee

	PST	GMT
DATE:	27 Oct 1962	27 Oct 1962
TIME:	0700	1500

SPONSOR: LRL

SITE: NTS - U10f
37° 08' 57.5068" N
116° 03' 12.6102" W

SITE ELEVATION: 4254 ft MSL

DEPTH OF BURST: 1048 ft

TYPE OF BURST AND PLACEMENT:
Underground, in alluvium

VENTING:
None, except during post-shot drilling

REMARKS:

No radiation levels were detected above background on or off the NTS from radioactivity released by this detonation. Some radiation was detected in the area surrounding SZ from gaseous radioactivity released during post-shot drilling. No radioactivity was detected off the NTS from post-shot operations

OPERATION STORAX - Anacostia

	PST	GMT
DATE:	27 Nov 1962	27 Nov 1962
TIME:	1000	1800

SPONSOR: LRL

SITE: NTS - U9i
37° 07' 22.1140" N
116° 01' 44.4795" W

SITE ELEVATION: 4268 ft MSL

DEPTH OF BURST: 747 ft

TYPE OF BURST AND PLACEMENT:
Underground, in semiwelded tuff

VENTING:

Venting occurred at H+8 seconds at the radiochemistry sampling area and at H+35 seconds between the emplacement pipe and the prompt sampling pipe. The release endured for 23.7 minutes

The estimated dose rate at SZ normalized to H+1 hour, was 8.1 R/hr and the estimated total release, normalized to H+1 minute, was 5×10^5 curies. The isotope identities are not available.

REMARKS:

The effluent gas gave a maximum reading of 95 mR/hr on the ground one mile downwind from SZ at H+0.5 hour. The most significant radiation was confined to the crater and radiochemistry sampling area

OPERATION STORAX - Tendrac

	PST	GMT
DATE:	7 Dec 1962	7 Dec 1962
TIME:	1100	1900

SPONSOR: LASL/UK

SITE: NTS - U3ba
37° 06' 06.2914" N
116° 01' 45.5161" W

SITE ELEVATION: 4033 ft MSL

DEPTH OF BURST: 1001 ft

TYPE OF BURST PLACEMENT:
Underground, in alluvium

VENTING:
None

OPERATION STORAX - Madison

	PST	GMT
DATE:	12 Dec 1962	12 Dec 1962
TIME:	0925	1725

SPONSOR: LRL

SITE: NTS - U12 G.01
37° 10' 07.23" N
116° 12' 21.87" W

SITE ELEVATION: 7477 ft MSL

DEPTH OF BURST: 1317 ft

SLANT DEPTH: 1160 ft

VENTING:
Vented

TYPE OF BURST AND PLACEMENT:
Tunnel, in semiwelded tuff

REMARKS:

Radiation levels were detected near SZ above normal background from radioactivity released by this detonation. No other radiation levels were detected on or off the NTS from radioactivity released by this detonation. Some radiation was detected in the area surrounding SZ from gaseous radioactivity released during post-shot drilling or tunnel re-entry operations. No radioactivity was detected off the NTS from post-shot operations

OPERATION STORAX - Numbat

	PST	GMT
DATE:	12 Dec 1962	12 Dec 1962
TIME:	1045	1845

SPONSOR: LASL

SITE: NTS - U3bu
37° 02' 49.9726" N
116° 00' 56.1881" W

SITE ELEVATION: 4030 ft MSL

DEPTH OF BURST: 761 ft

TYPE OF BURST AND PLACEMENT:
Underground, in alluvium

VENTING:
Vented

REMARKS:

Radiation levels were detected near SZ above normal background from radioactivity released by this detonation. No other radiation levels were detected on or off the NTS. Some radiation was detected in the area surrounding SZ from gaseous radioactivity released during post-shot drilling. No radioactivity was detected off the NTS from post-shot operations

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	07/16/45	ALAMOGORDO	TOWER	WEAPONS RELATED	19KT
FIRST TEST OF AN A-BOMB					
WORLD WAR II	08/05/45	JAPAN	AIRDROP	COMBAT	13 KT
FIRST COMBAT USE-HIROSHIMA					
WORLD WAR II	08/09/45	JAPAN	AIRDROP	COMBAT	23 KT
SECOND COMBAT USE-NAGASAKI					
		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	CRATER	WEAPONS RELATED	1.2KT
		OPERATION TUMBLER-SNAPPER			
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	TOWER	WEAPONS RELATED	14KT
		OPERATION IVY			
MIKE EXPERIMENTAL THERMONUCLEAR DEVICE	10/31/52	ENIWETOK	SURFACE	WEAPONS RELATED	10.4MT
KING	11/15/52	ENIWETOK	AIRDROP	WEAPONS RELATED	500 KT
		OPERATION UPSHOT-KNOTHOLE			
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	AIRDROP	WEAPONS RELATED	61KT
		OPERATION CASTLE			
BRAVO EXPERIMENTAL THERMONUCLEAR DEVICE	02/28/54	BIKINI	SURFACE	WEAPONS RELATED	15MT

ANNOUNCED UNITED STATES NUCLEAR DETONATIONS

EVENT NAME	DATE(GCT)	LOCATION	TYPE	PURPOSE	YIELD RANGE
ROMEO	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 DEGREESN-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	140TONS
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
SMOKY	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	09/19/57	NTS	TUNNEL	WEAPONS RELATED	1.7KT
FIRST TUNNEL EMPLACEMEN					
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	04/28/58		BALLOON	WEAPONS RELATED	
12 DEGREES 37 MIN N-163 DEGREES 01 MIN E					
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	06/10/58	BIKINI	BARGE	WEAPONS RELATED	
ASPEN	06/14/58	BIKINI	BARGE	WEAPONS RELATED	
WALNUT	06/14/58	ENIWETOK	BARGE	WEAPONS RELATED	
LINDEN	06/18/58	ENIWETOK	BARGE	WEAPONS RELATED	
REDWOOD	06/27/58	BIKINI	BARGE	WEAPONS RELATED	
ELDER	06/27/58	ENIWETOK	BARGE	WEAPONS RELATED	
OAK	06/28/58	ENIWETOK	BARGE	WEAPONS RELATED	8.9 MT
HICKORY	06/29/58	BIKINI	BARGE	WEAPONS RELATED	
SEQUOIA	07/01/58	ENIWETOK	BARGE	WEAPONS RELATED	
CEDAR	07/02/58	BIKINI	BARGE	WEAPONS RELATED	
DOGWOOD	07/05/58	ENIWETOK	BARGE	WEAPONS RELATED	
POPLAR	07/12/58	BIKINI	BARGE	WEAPONS RELATED	
PISONIA	07/17/58	ENIWETOK		WEAPONS RELATED	
JUNIPER	07/22/58	BIKINI	BARGE	WEAPONS RELATED	
OLIVE	07/22/58	ENIWETOK	BARGE	WEAPONS RELATED	
PINE	07/26/58	ENIWETOK	BARGE	WEAPONS RELATED	
TEAK	08/01/58	JOHNSTON ISL AREA	ROCKET	WEAPONS RELATED	MEGATON RANGE
QUINCE	08/06/58	ENIWETOK		WEAPONS RELATED	
ORANGE	08/12/58	JOHNSTON ISL AREA	ROCKET	WEAPONS RELATED	MEGATON RANGE
FIG	08/18/58	ENIWETOK		WEAPONS RELATED	
		OPERATION ARGUS			
ARGUS I ABOUT 300 MILES ALTITUDE	08/27/58	SOUTH ATLANTIC	ROCKET	WEAPONS RELATED	1-2KT
ARGUS II ABOUT 300 MILES ALTITUDE	08/30/58	SOUTH ATLANTIC	ROCKET	WEAPONS RELATED	1-2KT
ARGUS III ABOUT 300 MILES ALTITUDE	09/06/58	SOUTH ATLANTIC	ROCKET	WEAPONS RELATED	1-2KT
		OPERATION HARDTACK II			
EDDY	09/19/58	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 160-170 FT.DIAMETER 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
1962 PACIFIC TESTS WERE DESIGNATED OPERATION DOMINIC I					
ADOBE	04/25/62	CHRISTMAS ISL AREA	AIRDROP	WEAPONS RELATED	INTERMEDIATE
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
MUSKEGON	05/11/62	CHRISTMAS ISL AREA	AIRDROP	WEAPONS RELATED	INTERMEDIATE
SWORDFISH	05/11/62	EASTERN PACIFIC	UW	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
SWANEE	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 DOD 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 EXCAVATION EXPERIMENT-CRATER 1280 FT.DIAM 320 FT.DEEP-THERMONUCLEAR DEV.	07/06/62	NTS	CRATER	PLOWSHARE	100KT
LITTLE FELLERII SLIGHTLY ABOVE GROUND. DOMINIC II SERIES.	07/07/62	NTS	SURFACE	WEAPONS RELATED	LOW
STARFISH PRIME HIGH ALTITUDE-450 KM	07/09/62	JOHNSTON ISL AREA	ROCKET	WEAPONS RELATED	1.4 MEGATONS
SUNSET	07/10/62	CHRISTMAS ISL AREA	AIRDROP	WEAPONS RELATED	INTERMEDIATE
PAMLICO	07/11/62	CHRISTMAS ISL AREA	AIRDROP	WEAPONS RELATED	LOW MEGATON
JOHNNY BOY SLIGHTLY ABOVE GROUND. DOMINIC II SERIES.	07/11/62	NTS	SURFACE	WEAPONS RELATED	0.5
MERRIMAC	07/13/62	NTS	SHAFT	WEAPONS RELATED	LOW
SMALL BOY SLIGHTLY ABOVE GROUND. DOMINIC II SERIES.	07/14/62	NTS	SURFACE	WEAPONS RELATED	LOW
LITTLE FELLER I TROOP PARTICIPATION. SLIGHTLY ABOVE GROUND. DOMINIC II SERIES.	07/17/62	NTS	SURFACE	WEAPONS RELATED	LOW
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

SAFETY EXPERIMENTS

Since 1955, the U.S. Atomic Energy Commission has conducted a number of safety experiments at the Nevada Test Site to determine the safety of nuclear weapons in case of accident. The following list includes those experiments which resulted in a measurable nuclear yield.

Name	Date (GCT)	Time (GCT)	Location of Shot	Height of Burst (Feet)	Type of Burst	Mean Sea Level (Feet) Cloud Top	Cloud Base	Tropo-pause	Yield	Remarks
1956	18/01/56	2130	Nevada		Surface					
PLUMBBOB										
Pascal A	26/07/57	0800	Nevada		UG	6,000				Slight nuclear yield
Coulomb B	6/09/57	2005	Nevada		Surface	18,000		50,000	0.3 KT	
1957:										
Pascal C	6/12/57	2015	Nevada		Vertical shaft					Slight yield
Coulomb C	9/12/57	2000	Nevada		Surface				0.5 KT	
HARDTACK PHASE II:										
Otero	12/09/58	2000	Nevada	-480	UG	9,000			38 T	
Bernalillo	17/09/58	1930	Nevada	-456	UG	7,500	5,500		15 T	
Luna	21/09/58	1900	Nevada	-484	UG	Low diffuse cloud			1.5 T	
Valencia	26/09/58	2000	Nevada	-484	UG	5,500			2 T	
Mars	28/09/58	0000	Nevada		UG	Low diffuse cloud			13 T	Shot vented through tunnel
Hidalgo	5/10/58	1410	Nevada	377	Balloon	12,000	8,000		77 T	
Colfax	5/10/58	1615	Nevada	-350	UG	5,500	4,500		5.5 T	
Neptune	14/10/58	1800	Nevada	-98.5	UG	11,000			115 T	Shot vented
Vesta	17/10/58	2300	Nevada		Surface	10,000			24 T	
Catron	24/10/58	1500	Nevada	72.5	Tower	8,500	5,000		21 T	
Juno	24/10/58	1601	Nevada		Surface	5,500			1.7 T	
Ceres	26/10/58	0400	Nevada	25	Tower	6,000			0.7 T	
Chavez	27/10/58	1430	Nevada	52.5	Tower	6,500			0.6 T	
Titania	30/10/58	2034	Nevada	25	Tower	6,000			0.2 T	

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