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NDL-TR-34

DASA 1251

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LOCAL FALLOUT FROM NUCLEAR TEST DETONATIONS (U)

VOLUME II

COMPILATION OF FALLOUT PATTERNS AND RELATED TEST DATA (U)

SUPPLEMENT

FOREIGN NUCLEAR TESTS.(U)

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JUN 17 1992
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OCTOBER 1964

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PREPARED FOR DASA

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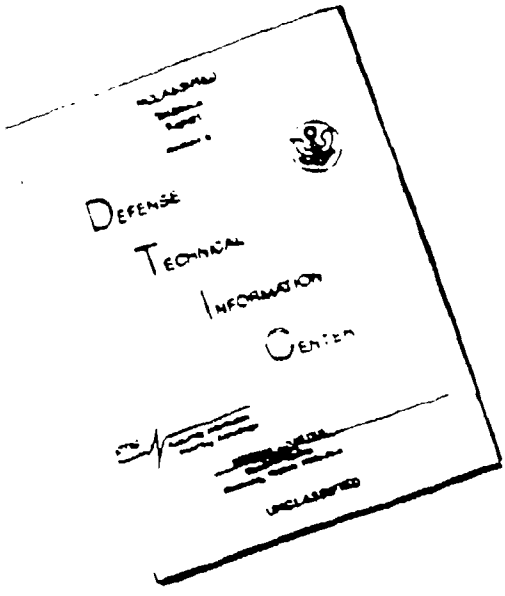

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FOREWORD

"Compilation of Fallout Patterns and Related Test Data (U)" is the second volume of a series to be published by the US Army Nuclear Defense Laboratory and the US Naval Radiological Defense Laboratory under the inclusive title, "Local Fallout From Nuclear Test Detonations (U)." This work is sponsored by the Defense Atomic Support Agency under DASA Project 10.013, "Fallout Data Compilation, Collation, Evaluation, and Presentation."

This volume is a supplement to Volume II; it includes nuclear tests conducted by the United Kingdom through 1958, the Republic of France through 1961, and the Union of Soviet Socialist Republics through 1962.

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DIGEST

The available fallout patterns and related test data for nuclear weapon tests conducted by the United Kingdom, the Republic of France, and the Union of Soviet Socialist Republics, are included in this supplement to NDL-TR-34. The related test data for the British and French tests include: date and time of detonation, location of test site, total yield, fission yield, type of burst and placement, height of burst, cloud-top and -bottom heights, crater data, and wind information up to nuclear cloud-top height.

No fallout patterns are available for any of the Soviet detonations. The list of Soviet detonations, which is as comprehensive as possible, contains the chronological order of the detonations, date, yield, type of burst and location of test site.

[redacted]

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SUPPLEMENT TO VOLUME II

FOREIGN NUCLEAR TESTS (U)

I. INTRODUCTION

A. Objective.

The objective of NDL-TR-34, Parts I and II, was to provide a convenient reference of United States nuclear detonations, fallout patterns, and related test data for scientific and technical personnel engaged in the measurement, analyses, and use of nuclear weapon-effects data. This supplement extends the scope of NDL-TR-34 to include weapon tests conducted by other nations, namely the United Kingdom, the Republic of France, and the Union of Soviet Socialist Republics (USSR).

B. Scope and Organization of Supplement.

This supplement presents a compilation of data from published and unpublished reports, but does not attempt to completely evaluate all the information on which the results are based. Although local (early) fallout is emphasized, the data presented will also be useful to those studying world-wide fallout. For the purposes of this report, local fallout is defined as all fallout consisting principally of the larger particles that are deposited within 24 hours after the detonation. World-wide or delayed fallout is defined as fallout consisting of very small particles that descend very slowly over large areas of the earth.

The information presented includes residual radiation patterns, wind and cloud measurements, and conditions of detonation, when known. Data resulting from each British, French, and USSR detonation are presented chronologically. For each British detonation, the basic information useful for an interpretation of fallout data is presented first. This is followed by on-site and off-site fallout patterns, where available. Wind speed and direction are then tabulated as a function of altitude, and hodographs are presented as an aid to visualizing these data.

The presentation of French detonations is analogous to that of the British, with the exception of wind and cloud data. No wind or cloud data are available for the French tests.

The section of USSR detonations presents a partial list of the shots with the date, yield, type of burst, and location of test site listed. These are the only available data relative to USSR nuclear detonations.

[redacted]

C. Background.

The United Kingdom tested twenty-one devices in the 6-year period, October 1952 to September 1958. [redacted] The detonations included a surface burst on soil, a surface burst in a ship on water, eight detonations on 100-foot towers, three air bursts from balloons at 1,000 feet to 1,500 feet, and eight air drops that burst at altitudes ranging from 500 to 9,500 feet.

Since February 1960 the Republic of France has detonated [redacted] nuclear devices. [redacted]

The USSR tested [redacted] from August 1949 to November 1958, when the moratorium became effective. When the moratorium was violated in 1961, an additional [redacted] were detonated through November 1961. [redacted]

D. Abbreviations Used in Supplement.

DASA - Defense Atomic Support Agency
GMT - Greenwich Mean Time
GZ - Ground Zero
keV - kilo-electron Volt
km - kilometers
kt - kiloton
MeV - Million electron Volt
MPG - Maralinga Proving Ground
mph - miles per hour
MSL - Mean Sea Level
Mt - megaton
nm - nautical miles
t - time

II. PRESENTATION OF DATA

A. United Kingdom Detonations

[redacted]

[redacted]

OPERATION HURRICANE

GMT

DATE: 2 Oct 1952
TIME: 2359

TOTAL YIELD: [redacted]
FISSION YIELD [redacted]

CLOUD DATA: [redacted]

SITE: Monte Bello Islands off northwest coast of Australia 20°S 115°E

TYPE OF BURST AND PLACEMENT: Shallow underwater - Device in hold of ship moored in 40 ft of water about 400 yds off Trimouille Island.

REMARKS:

The dose-rate levels over the Monte Bello Islands were determined by re-entry parties using portable radiac dose-rate meters. Actual decay measurements were used to extrapolate to H+1 hour. The decay exponent was -1.2 between 12 and 100 hours, -1.0 between 100 and 200 hours, and -1.6 after 200 hours.

TABLE 1 WIND DATA FOR OPERATION HURRICANE

Altitude (MSL) feet	Direction degrees	Speed mph	Altitude (MSL) feet	Direction degrees	Speed mph
Surface	---	---			
1,000	158.5	17.2	11,000	147.0	8.6
2,000	141.5	16.7	12,000	154.0	8.4
3,000	133.0	17.1	13,000	163.0	8.0
4,000	129.0	14.0	14,000	176.0	8.0
5,000	123.0	12.9	15,000	194.0	8.3
6,000	117.5	12.2	16,000	212.5	9.4
7,000	117.5	11.6	17,000	228.0	11.5
8,000	122.0	10.6	18,000	239.0	13.6
9,000	129.5	9.7	19,000	246.5	16.0
10,000	138.0	9.1	20,000	251.0	18.4

[redacted]

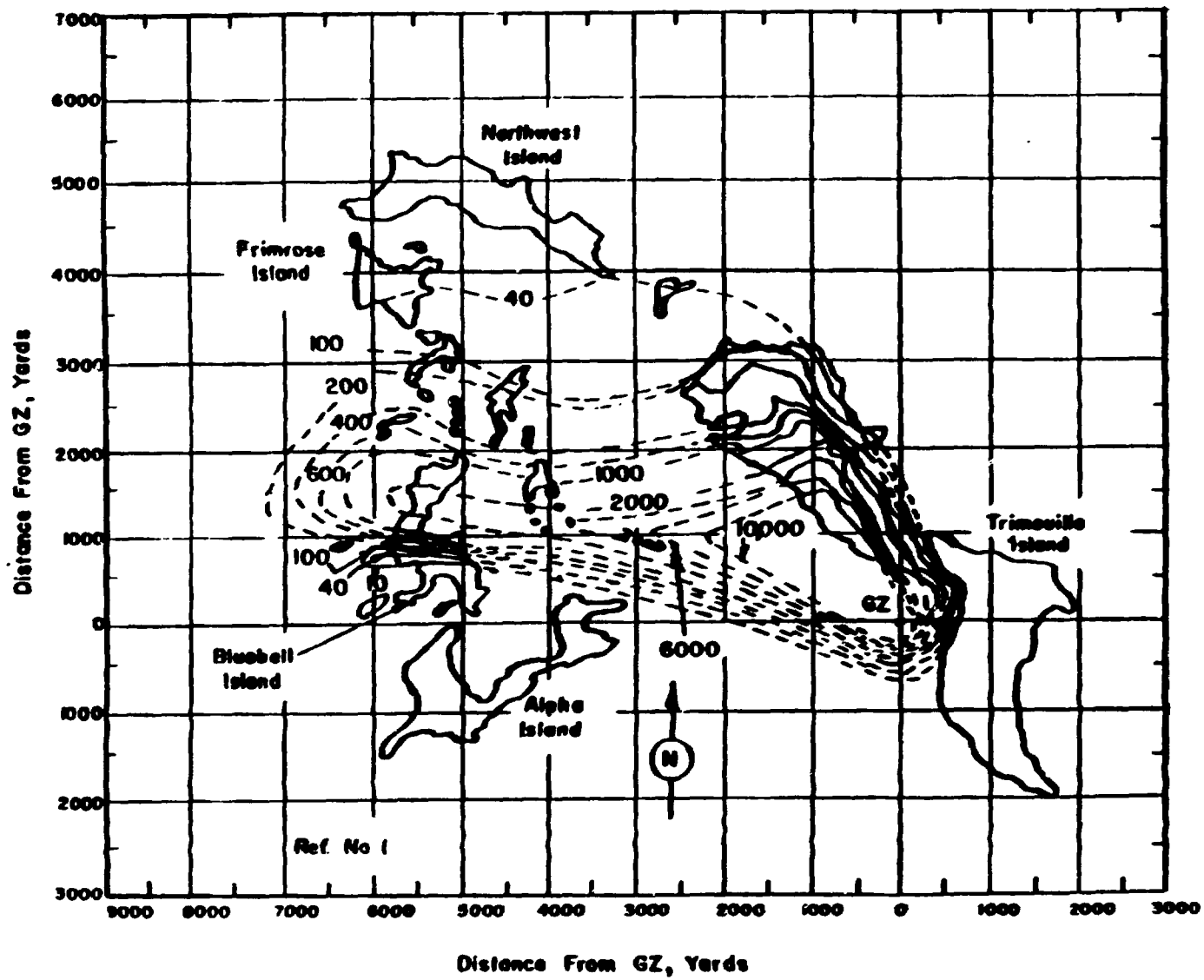

Figure 1. Operation HURRICANE, Monte Bello Islands
Off-site dose-rate contours in r/hr at H+1 hour.

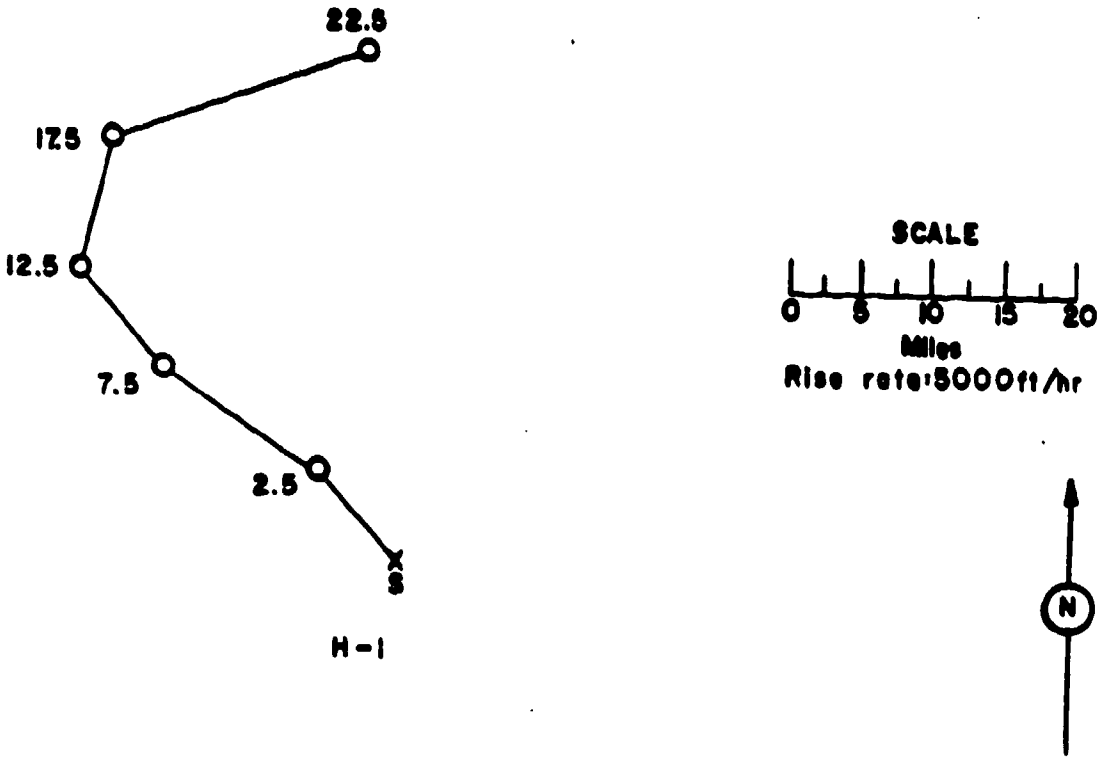

Figure 2. Hodograph for Operation HURRICANE

OPERATION TOTEM - Round 1

GMT
DATE: 14 Oct 1953
TIME: 2130

TOTAL YIELD: [redacted]
FISSION YIELD: [redacted]

CLOUD TOP HEIGHT: [redacted]
CLOUD BOTTOM HEIGHT: [redacted]

SITE: Test held at EMU Flats, South Australia, 300 miles NW of Woomera 31°S 137°E

HEIGHT OF BURST: 100 ft

TYPE OF BURST AND PLACEMENT: Tower burst over Australian soil

REMARKS:

The ground contamination contours were obtained by both ground and aerial surveys. The dashed line shows the estimated center line of the contamination pattern. The $t^{-1.2}$ decay approximation was used to extrapolate the readings to H+1 hour.

TABLE 2 WIND DATA FOR OPERATION TOTEM - ROUND 1

Altitude (MSL) feet	Direction degrees	Speed mph
Surface	---	---
1,000	250	3
2,000	225	8
3,000	220	14
6,000	225	21
9,000	225	24
11,000	225	37
13,000	230	39

RESTRICTED DATA
ATOMIC ENERGY ACT - 1954

[redacted]

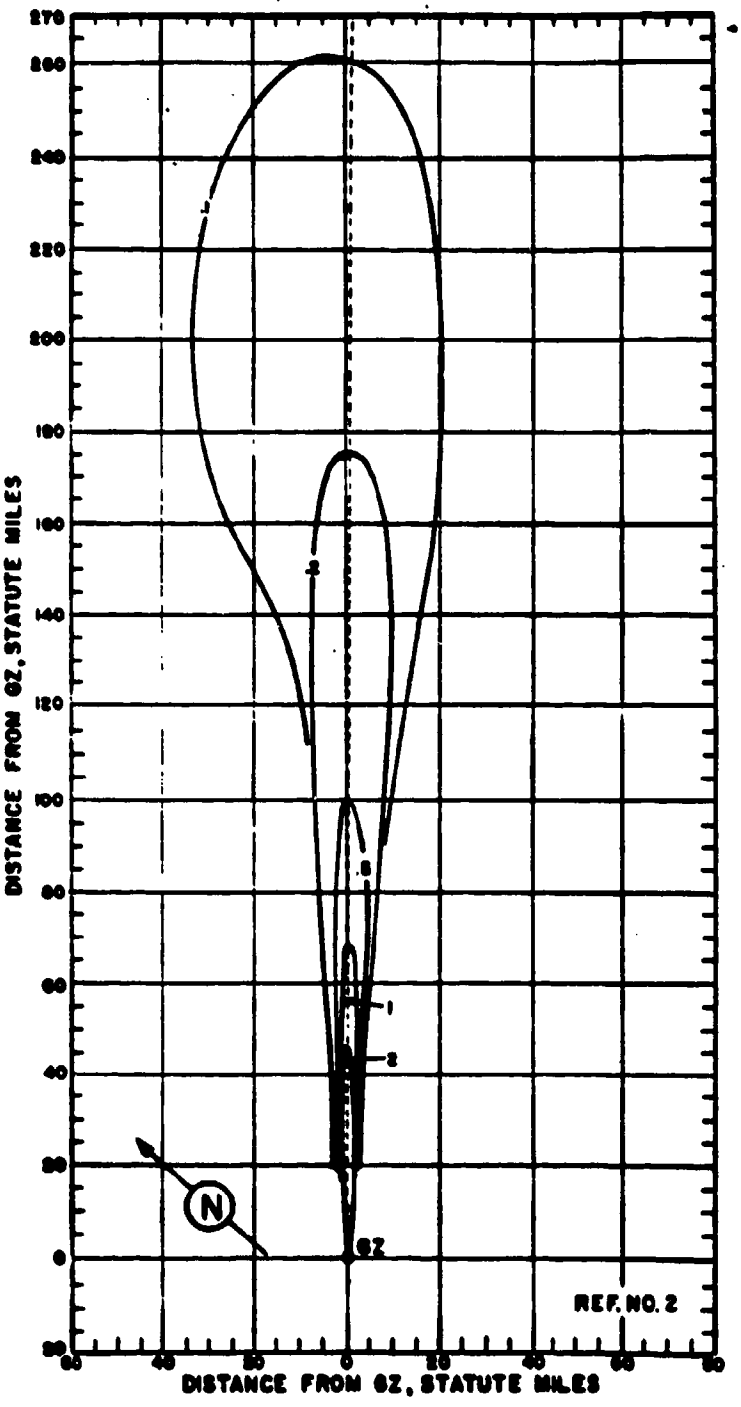

Figure 3. Operation TOTEM - Round 1
Off-site dose-rate contours in r/hr at H+1 hour.

[redacted]

OPERATION TOTEM - Round 2

DATE: 25 Oct 1953 GMT
TIME: 2130

TOTAL YIELD: [redacted]
FISSION YIELD: [redacted]

CLOUD TOP HEIGHT: [redacted]
CLOUD BOTTOM HEIGHT: [redacted]

SITE: Test held at EMU Flats, South Australia, 300 miles NW of Woomera 31°S 137°E

HEIGHT OF BURST: 100 ft

TYPE OF BURST AND PLACEMENT: Tower burst over Australian soil

REMARKS:

The ground contamination contours were obtained by both ground and aerial surveys. The dashed line shows the estimated center line of the contamination pattern. The $t^{-1.2}$ decay approximation was used to extrapolate the readings to H+1 hour.

TABLE 3 WIND DATA FOR OPERATION TOTEM - ROUND 2

Altitude (MSL) feet	Direction degrees	Speed mph
Surface	---	---
1,000	30	29
2,000	25	36
3,000	20	37
5,000	05	33
6,000	350	28
10,000	340	26
15,000	325	23
20,000	315	22
25,000	300	26
30,000	295	32

RESTRICTED DATA
ATOMIC ENERGY ACT 1954

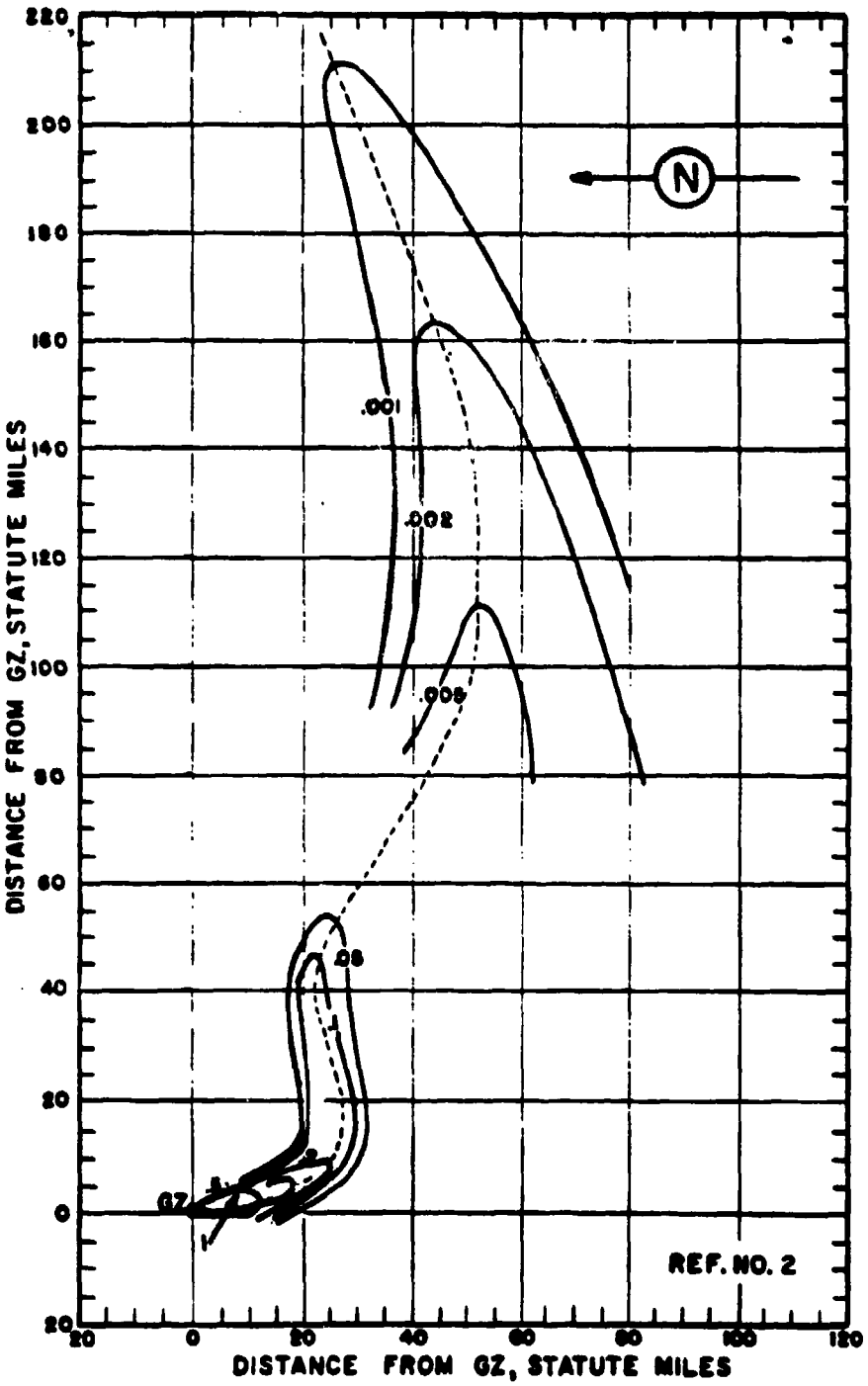

Figure 4. Operation TOTEM - Round 2
Off-site dose-rate contours in r/hr at H+1 hour.

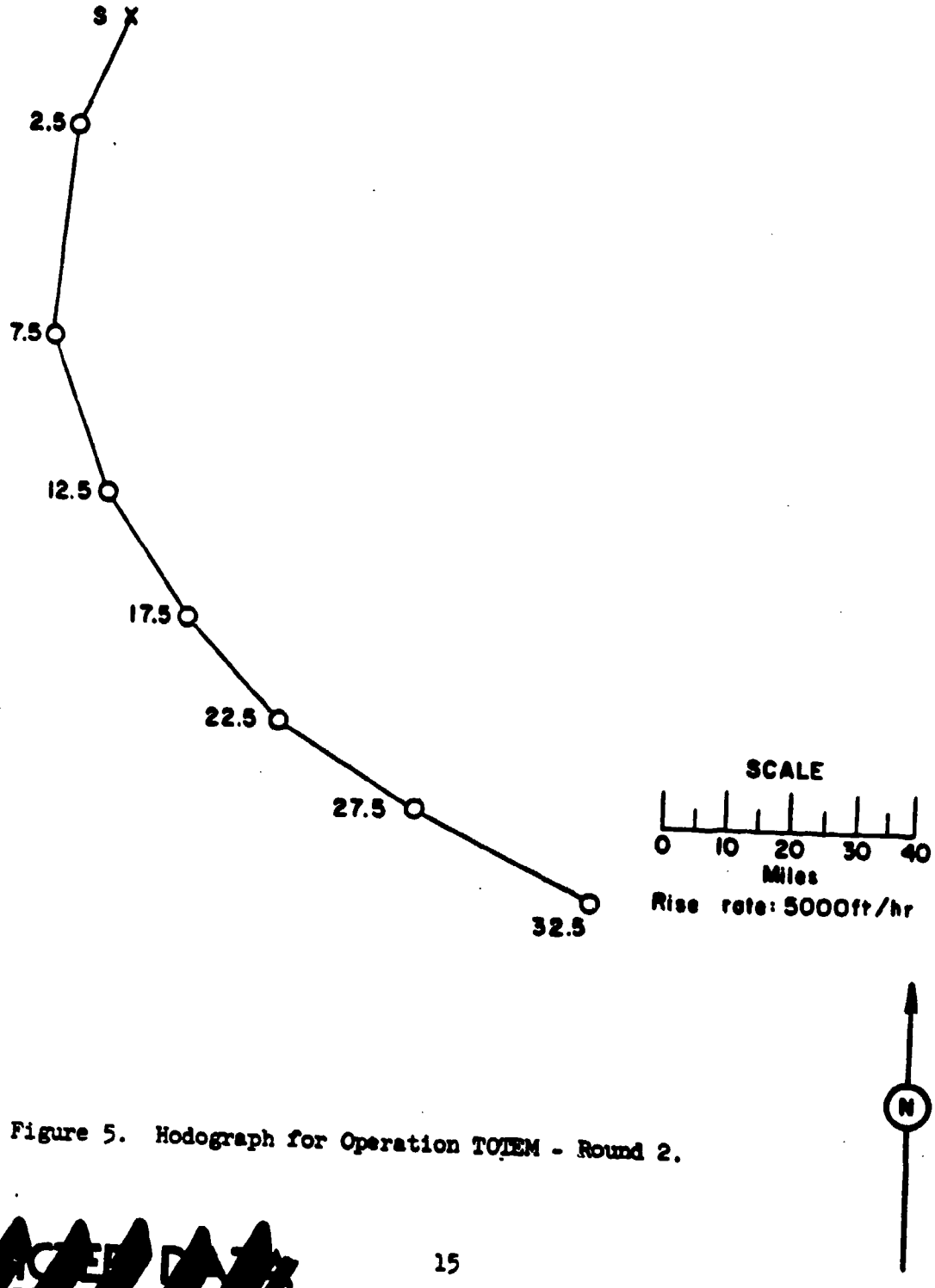

Figure 5. Hodograph for Operation TOTEM - Round 2.

[redacted]

OPERATION MOSAIC - Round 1

GMT

DATE: 16 May 1956
TIME: 1130

TOTAL YIELD: [redacted]
FISSION YIELD: [redacted]

CLOUD TOP HEIGHT: [redacted]
CLOUD BOTTOM HEIGHT: [redacted]

SITE: Monte Bello Islands

HEIGHT OF BURST: 100 ft

TYPE OF BURST AND PLACEMENT:
Tower burst over soil

OPERATION MOSAIC - Round 2

GMT

DATE: 19 June 1956
TIME: 1014

TOTAL YIELD: [redacted]
FISSION YIELD: [redacted]

CLOUD TOP HEIGHT: [redacted]
CLOUD BOTTOM HEIGHT: [redacted]

SITE: Monte Bello Islands

HEIGHT OF BURST: 100 ft

TYPE OF BURST AND PLACEMENT:
Tower burst over soil

[redacted]

[redacted]

OPERATION BUFFALO - Round 1

DATE: 27 Sept 1956 GMT
TIME: 0730

TOTAL YIELD: [redacted]
FISSION YIELD: [redacted]

CLOUD TOP HEIGHT: [redacted]
CLOUD BOTTOM HEIGHT: [redacted]

SITE: Maralinga Proving Ground, South Australia 30°S 131°E

HEIGHT OF BURST: 100 ft

TYPE OF BURST AND PLACEMENT: Tower burst over Australian soil

REMARKS:

The off-site dose-rate readings were taken between D+1 day and D+5 days by ground-survey teams with gamma-survey instruments, types 1390A and 1391A. Readings were taken at one-tenth mile intervals. Actual decay measurements were used to extrapolate the dose-rate readings to H+24 hours. The $t^{-1.2}$ decay approximation was used to extrapolate the H+24-hour dose-rate readings to H+1 hour. Type 1390A survey meter is a battery-operated ionization chamber instrument designed to measure gamma dose rates more accurately than standard radiac survey instruments. The field of view is a solid angle of nearly 4π and response is uniform, to within 8 percent, over an energy range from 65 keV to 2 MeV. The type 1391A survey meter is a beta-plus-gamma survey instrument. It is similar to the 1390A instrument and was used as the standard beta measuring instrument.

The crater region dose-rate readings were taken at D+10 days. The $t^{-1.2}$ decay approximation was used to extrapolate the readings to H+1 hour. Dust storms and heavy rain occurred during the week after the burst and the pattern is not considered to be reliable.

RESTRICTED DATA
ATOMIC ENERGY ACT - 1954

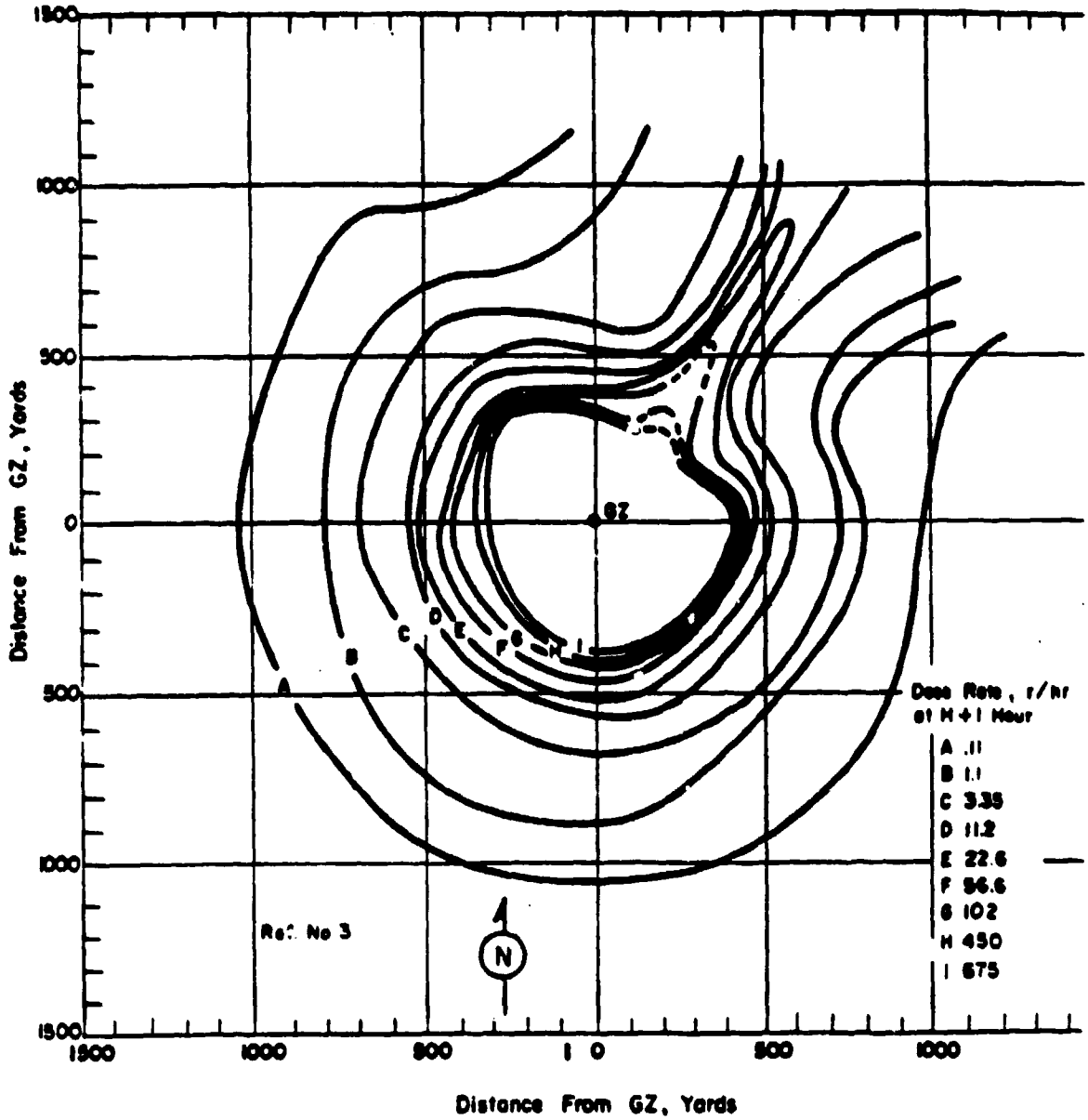

Figure 6. Operation BUFFALO - Round 1.
Crater region dose-rate contours in r/hr at H+1 hour.

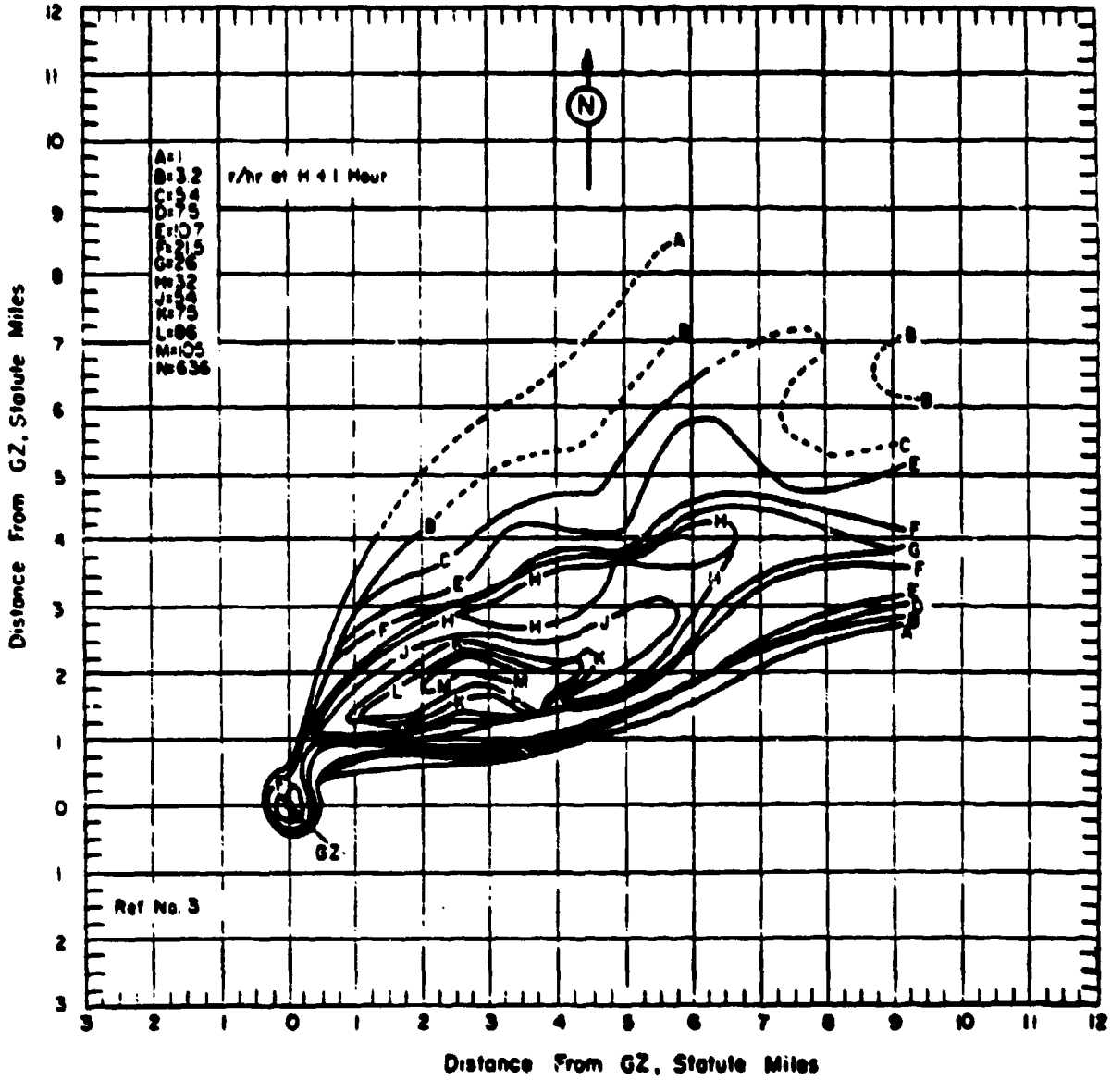

Figure 7. Operation BUFFALO - Round 1.
Off-site dose-rate contours in r/hr at H+1 hour.

TABLE 4 WIND DATA FOR OPERATION BUFFALO - ROUND 1

Altitude (MSL) feet	Direction degrees	Speed mph
Surface	190	14
5,000	200	15
10,000	230	15
15,000	250	20
20,000	255	24
25,000	255	29
30,000	255	36
35,000	255	40
40,000	260	44

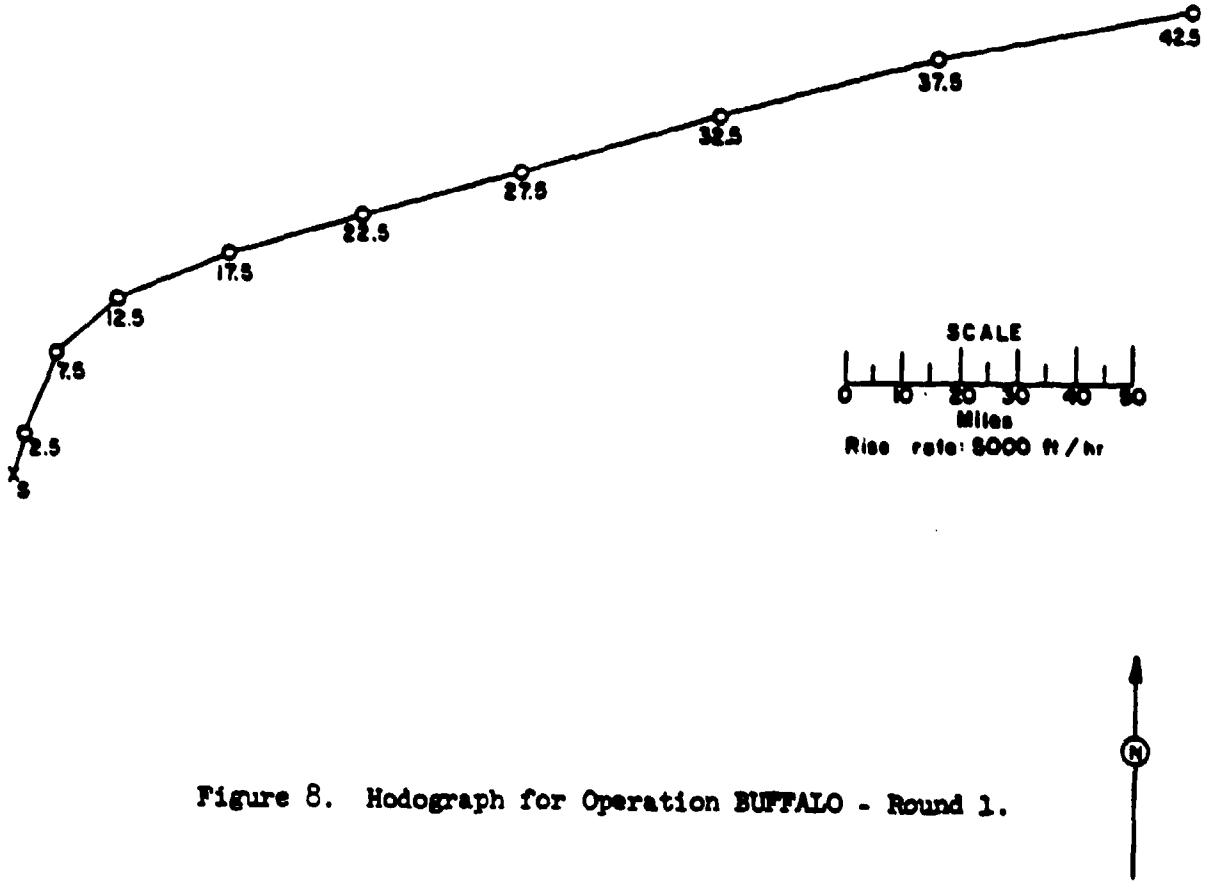

Figure 8. Hodograph for Operation BUFFALO - Round 1.

[redacted]

OPERATION BUFFALO - Round 2

DATE: 4 Oct 1956 GMT
TIME: 0700

TOTAL YIELD: [redacted]
FISSION YIELD: [redacted]

CLOUD TOP HEIGHT:
Upper portion: [redacted]
CLOUD BOTTOM HEIGHT:
Lower portion: [redacted]

SITE: Maralinga Proving Ground, South Australia 30°S 131°E

HEIGHT OF BURST: Surface

TYPE OF BURST AND PLACEMENT: Surface burst on Australian soil

REMARKS:

The dose-rate readings were taken between D+1 day and D+4 days by ground-survey teams with gamma-survey instruments, types 1390A and 1391A, at one-tenth mile intervals. The type 1390A survey meter is a battery operated ionization chamber instrument. The field of view is a solid angle of nearly 4π and response is uniform, to within 8 percent, over an energy range from 65 keV to 2 MeV. The type 1391 survey meter is a beta-plus-gamma survey instrument. It is similar to the 1390A instrument and was used as the standard beta measuring instrument. Laboratory decay measurements were used to extrapolate the dose-rate readings to H+24 hours; the $t^{-1.2}$ decay approximation was used to extrapolate the H+24-hour dose-rate readings to H-1 hour. The northeasterly part of the pattern was obtained by subtracting the contribution of the contamination from Round 1.

[redacted]

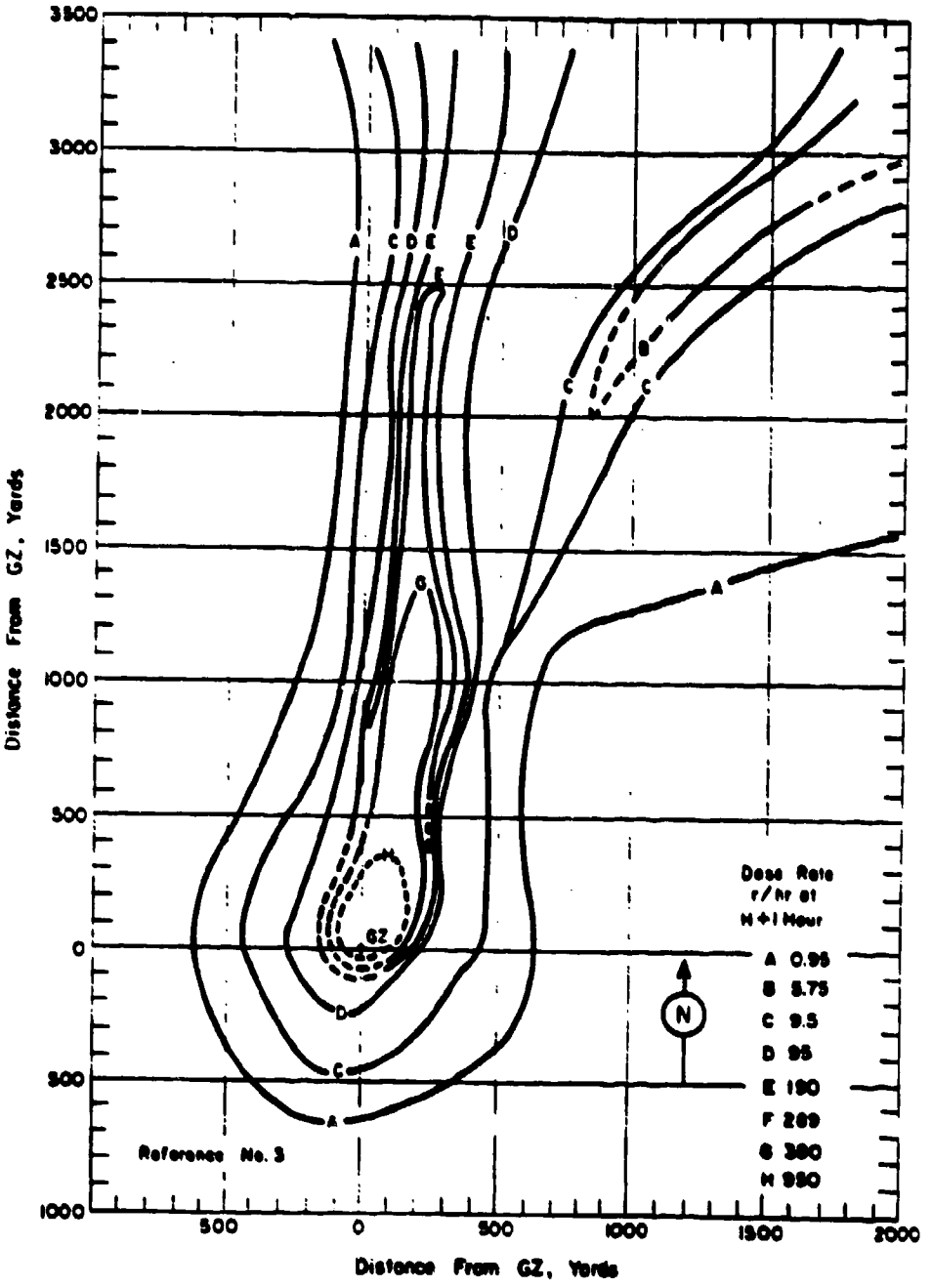

Figure 9. Operation BUFFALO - Round 2.
On-site dose-rate contours in r/hr at H+1 hour.

RESTRICTED DATA
ATOMIC ENERGY ACT 1954

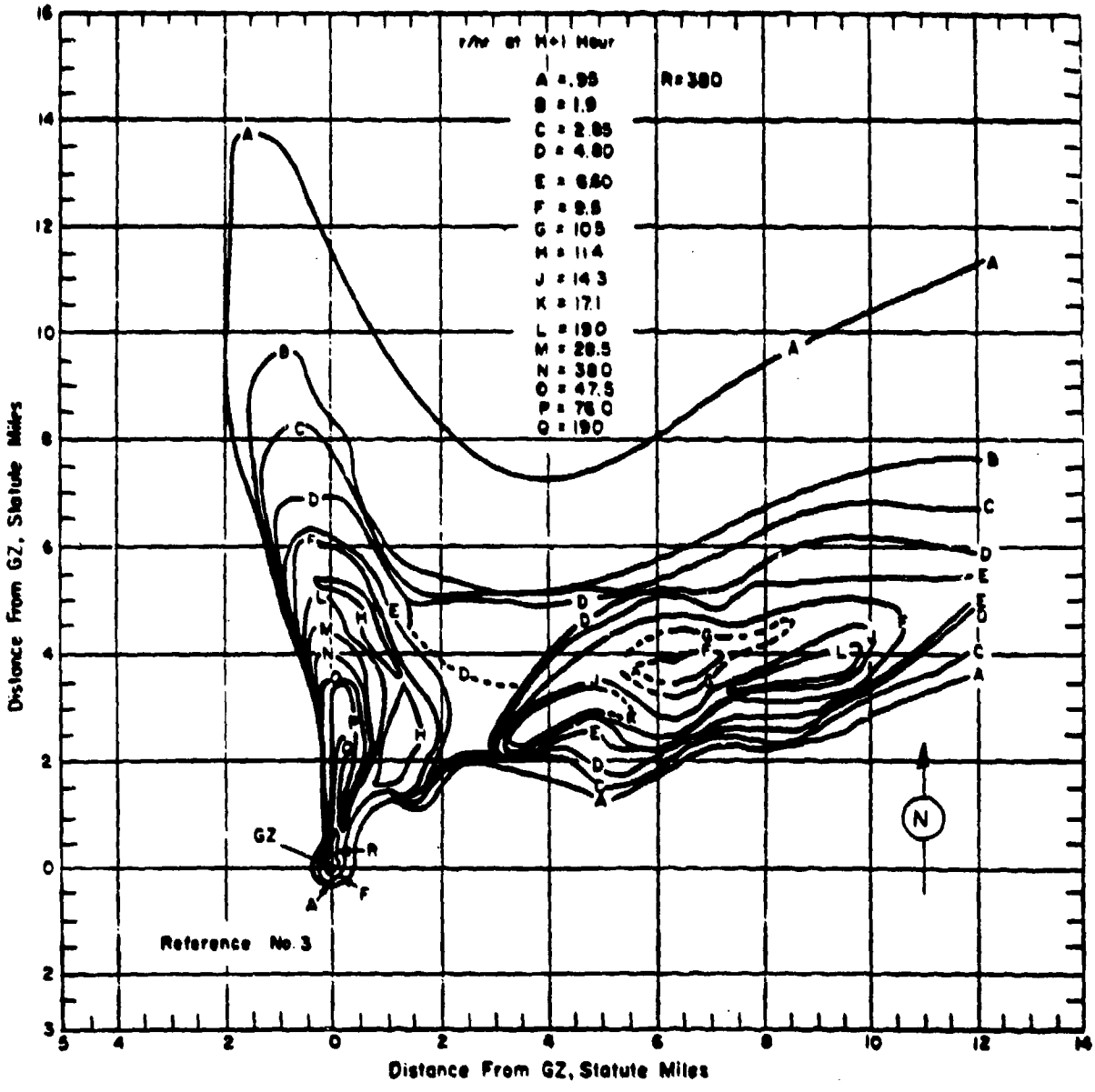

Figure 10. Operation BUFFALO - Round 2.
Off-site dose-rate contours in r/hr at H+1 hour.

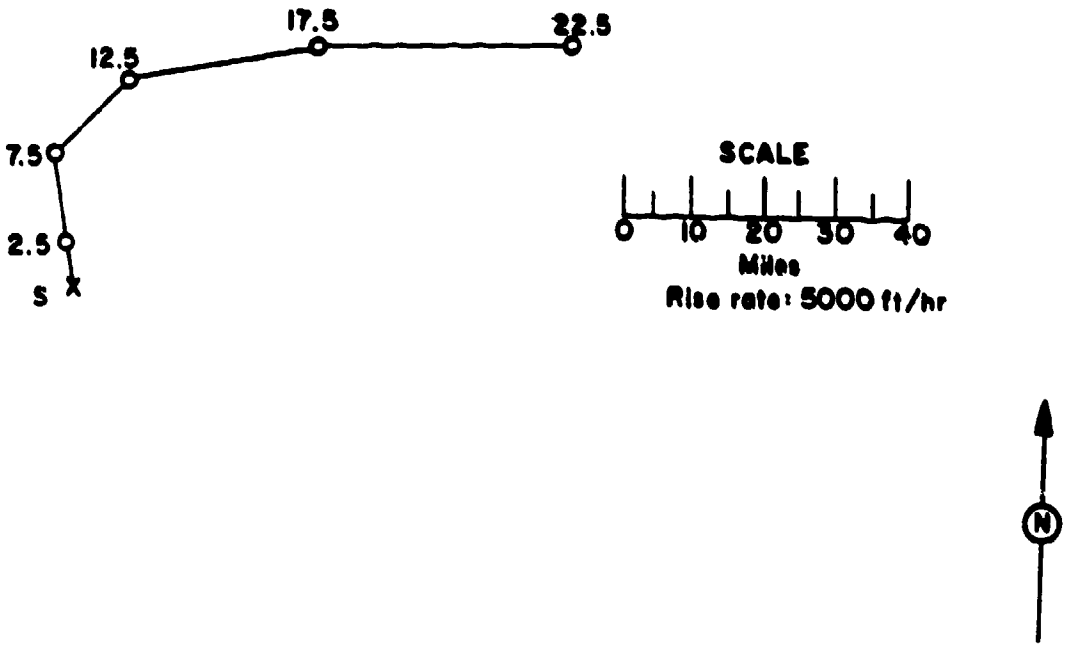

Figure 11. Hodograph for Operation BUFFALO - Round 2.

OPERATION BUFFALO - Round 3

GMT
DATE: 11 Oct 1956
TIME: 0600

TOTAL YIELD: [redacted]
FISSION YIELD: [redacted]

SITE: Maralinga Proving Ground, South Australia 30°S 131°E

HEIGHT OF BURST: 500 ft

TYPE OF BURST AND PLACEMENT: Air burst

REMARKS:

No detailed survey was made on the shot. Measurements were made at ground zero at H+1 hour, and the maximum dose rate recorded was 17 r/hr.

OPERATION BUFFALO - Round 4

GMT
DATE: 21 Oct 1956
TIME: 1435

TOTAL YIELD: [redacted]
FISSION YIELD: [redacted]

CLOUD TOP HEIGHT: [redacted]
CLOUD BOTTOM HEIGHT: [redacted]
(estimates from aircraft of shot fired in darkness)

SITE: Maralinga Proving Ground, South Australia 30°S 131°E

HEIGHT OF BURST: 100 ft

TYPE OF BURST AND PLACEMENT: Tower burst over Australian soil

REMARKS:

The survey on this shot was performed as a military operation. An operational headquarters was set up and as the dose-rate readings were observed they were radioed to the military commander, converted to the H+1 hour reading, and plotted on a map. The instruments used were Victoreen No. 592 gamma survey meters. The $t^{-1.2}$ decay approximation was used to convert the dose rates to H+1 hour.

The crater region survey was made on D+10 days by a military unit. The $t^{-1.2}$ decay approximation was used to convert the dose rates to H+1 hour.

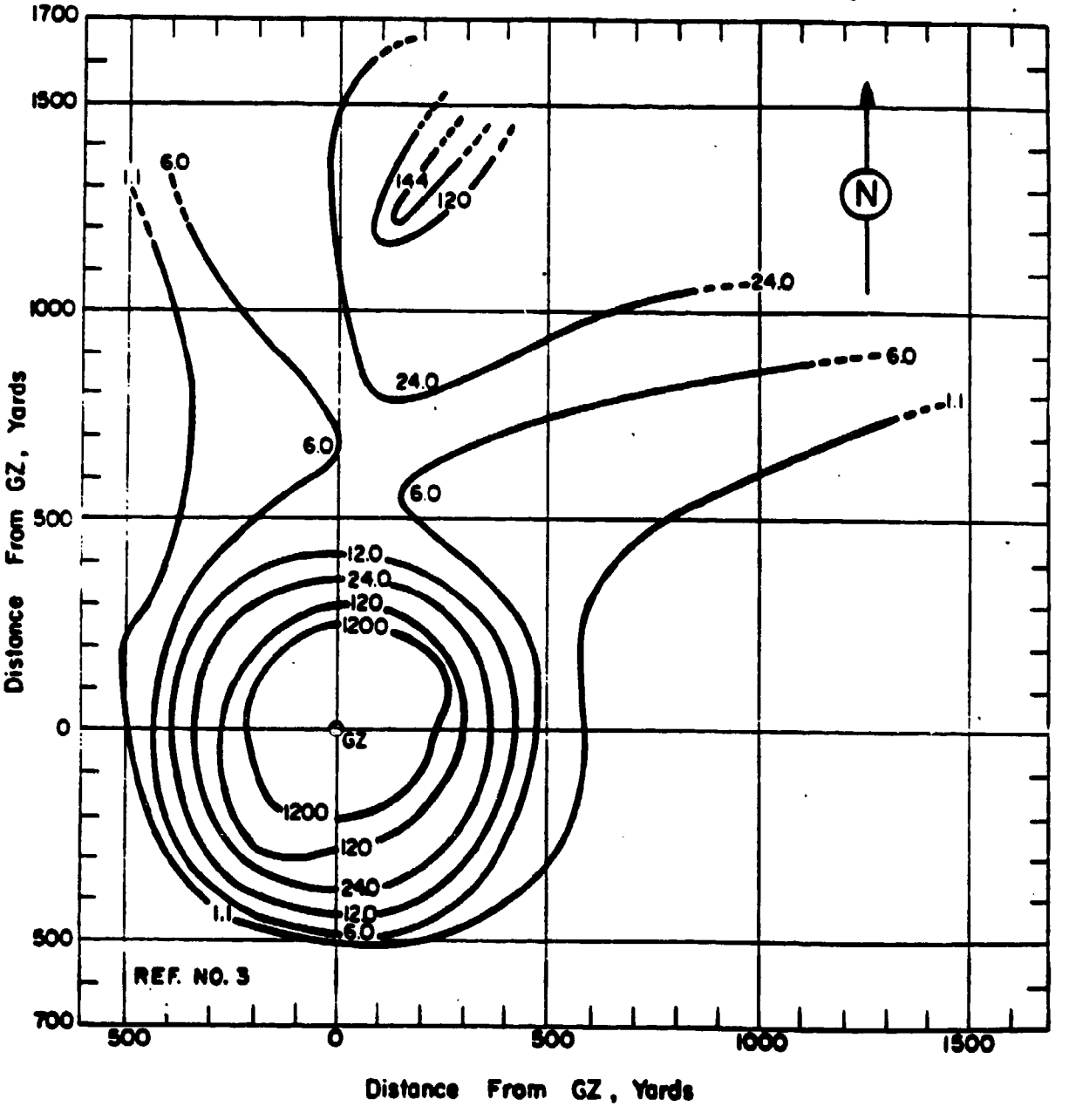

Figure 12. Operation BUFFALO - Round 4.
Crater region dose-rate contours in r/hr at H+1 hour.

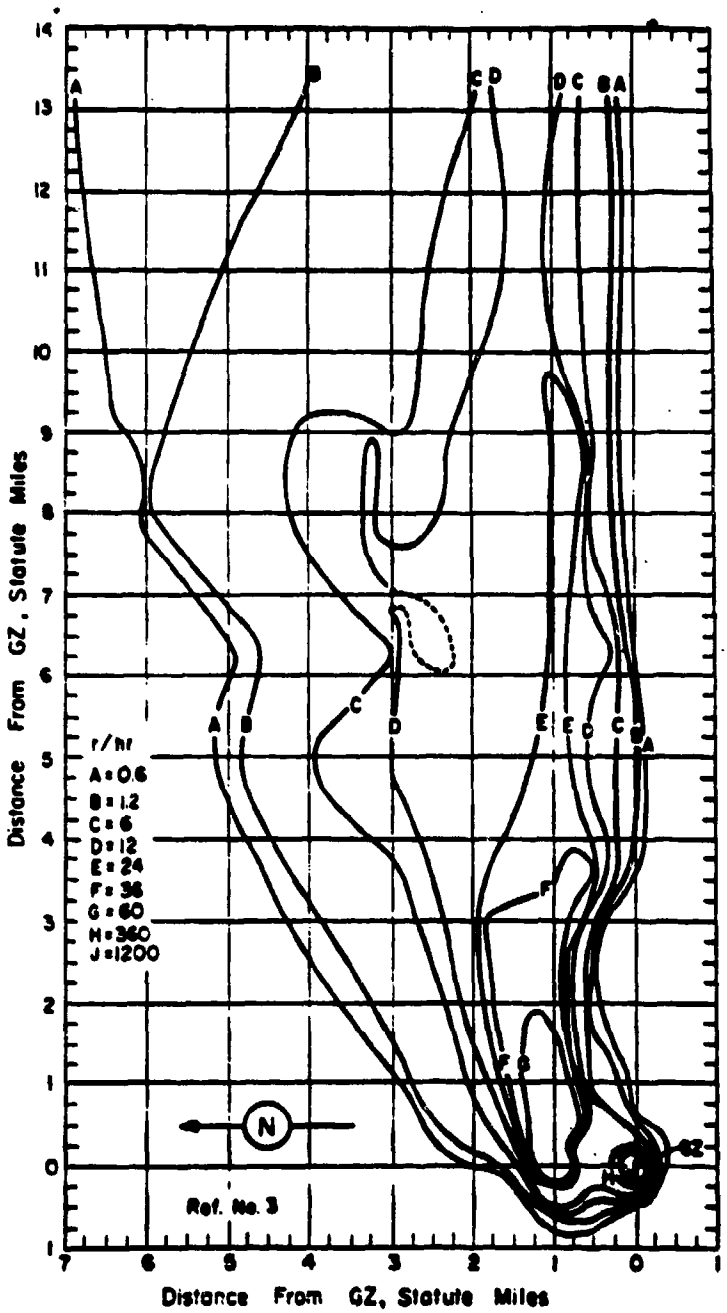

Figure 13. Operation BUFFALO - Round 4.
Off-site dose-rate contours in r/hr at H+1 hour.

TABLE 6 WIND DATA FOR OPERATION BUFFALO - ROUND 4

Altitude (MSL) feet	Direction degrees	Speed mph
Surface	180	12
5,000	210	12
10,000	260	16
15,000	270	21
20,000	270	26
25,000	260	33
30,000	255	38
35,000	245	47
40,000	240	55

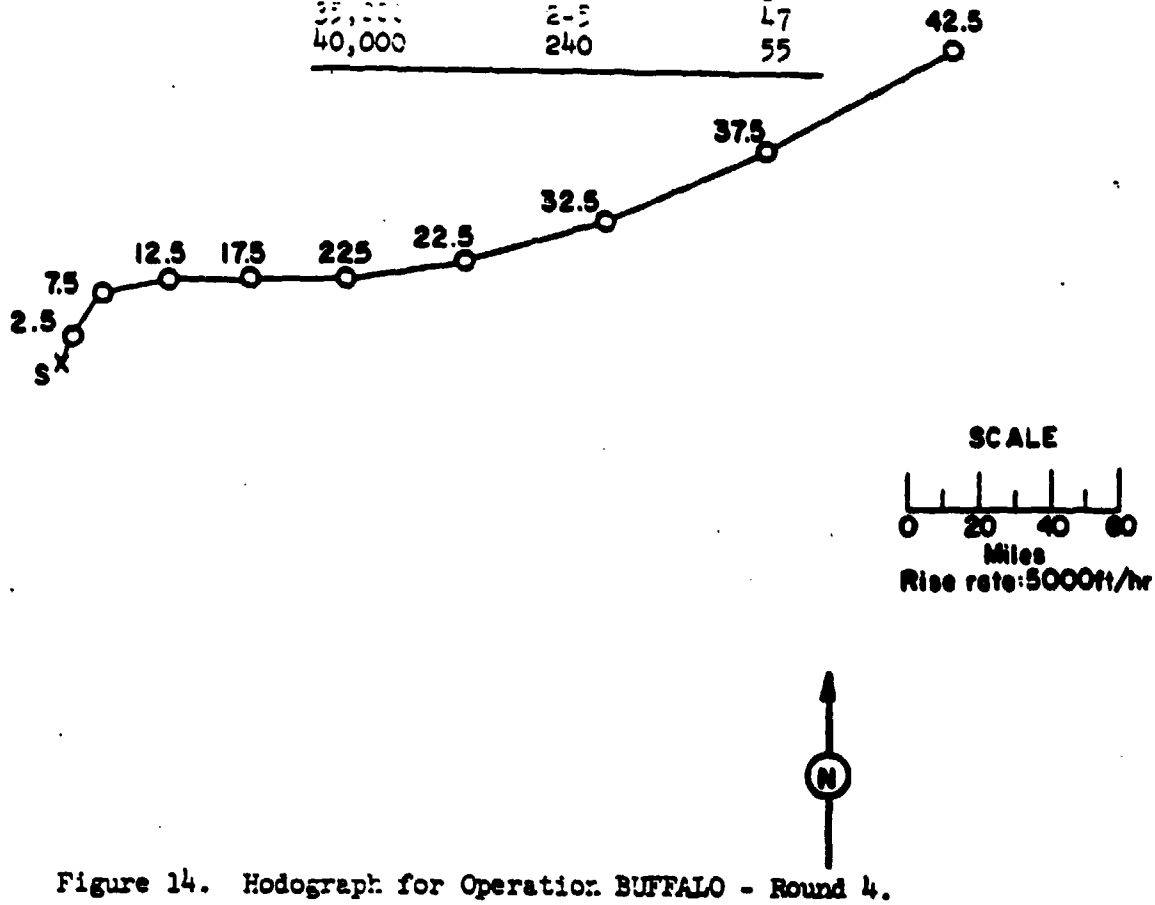

Figure 14. Hodograph for Operation BUFFALO - Round 4.

OPERATION GRAPPLE 1957 - Round 1

GMT
DATE: 15 May 1957
TIME: 1938

TOTAL YIELD: [redacted]
FISSION YIELD: [redacted]

SITE: Christmas Island Area

HEIGHT OF BURST: [redacted]

TYPE OF BURST AND PLACEMENT:
Air burst

OPERATION GRAPPLE 1957 - Round 2

GMT
DATE: 31 May 1957
TIME: 1942

TOTAL YIELD: [redacted]
FISSION YIELD: [redacted]

SITE: Christmas Island Area

HEIGHT OF BURST: [redacted]

TYPE OF BURST AND PLACEMENT:
Air burst

OPERATION GRAPPLE 1957 - Round 3

GMT
DATE: 19 June 1957
TIME: 1940

TOTAL YIELD: [redacted]
FISSION YIELD: [redacted]

SITE: Christmas Island Area

HEIGHT OF BURST: [redacted]

TYPE OF BURST AND PLACEMENT:
Air burst

OPERATION GRAPPLE 1957 - Round 4

GMT
DATE: 8 Nov 1957
TIME: 1748

TOTAL YIELD: [redacted]
FISSION YIELD: [redacted]

SITE: Christmas Island Area

HEIGHT OF BURST: [redacted]

TYPE OF BURST AND PLACEMENT:
Air burst

[redacted]

OPERATION ANTLER - Round 1

GMT
DATE: 14 Sept 1957
TIME: 0505

TOTAL YIELD: [redacted]
FISSION YIELD:

CLOUD TOP HEIGHT:
CLOUD BOTTOM HEIGHT:

SITE: Maralinga Proving Ground South Australia

HEIGHT OF BURST: 100 ft

TYPE OF BURST AND PLACEMENT: Tower burst over Australian soil

---

OPERATION ANTLER - Round 2

GMT
DATE: 25 Sept 1957
TIME: 0030

TOTAL YIELD: [redacted]
FISSION YIELD:

CLOUD TOP HEIGHT:
CLOUD BOTTOM HEIGHT:

SITE: Maralinga Proving Ground South Australia

HEIGHT OF BURST: 100 ft

TYPE OF BURST AND PLACEMENT: Tower burst over Australian soil

---

OPERATION ANTLER - Round 3

GMT
DATE: 9 Oct 1957
TIME: 0645

TOTAL YIELD: [redacted]
FISSION YIELD:

CLOUD TOP HEIGHT:
CLOUD BOTTOM HEIGHT:

SITE: Maralinga Proving Ground South Australia

HEIGHT OF BURST: 1,000 ft

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

RESTRICTED DATA
ATOMIC ENERGY ACT - 1954

[redacted]

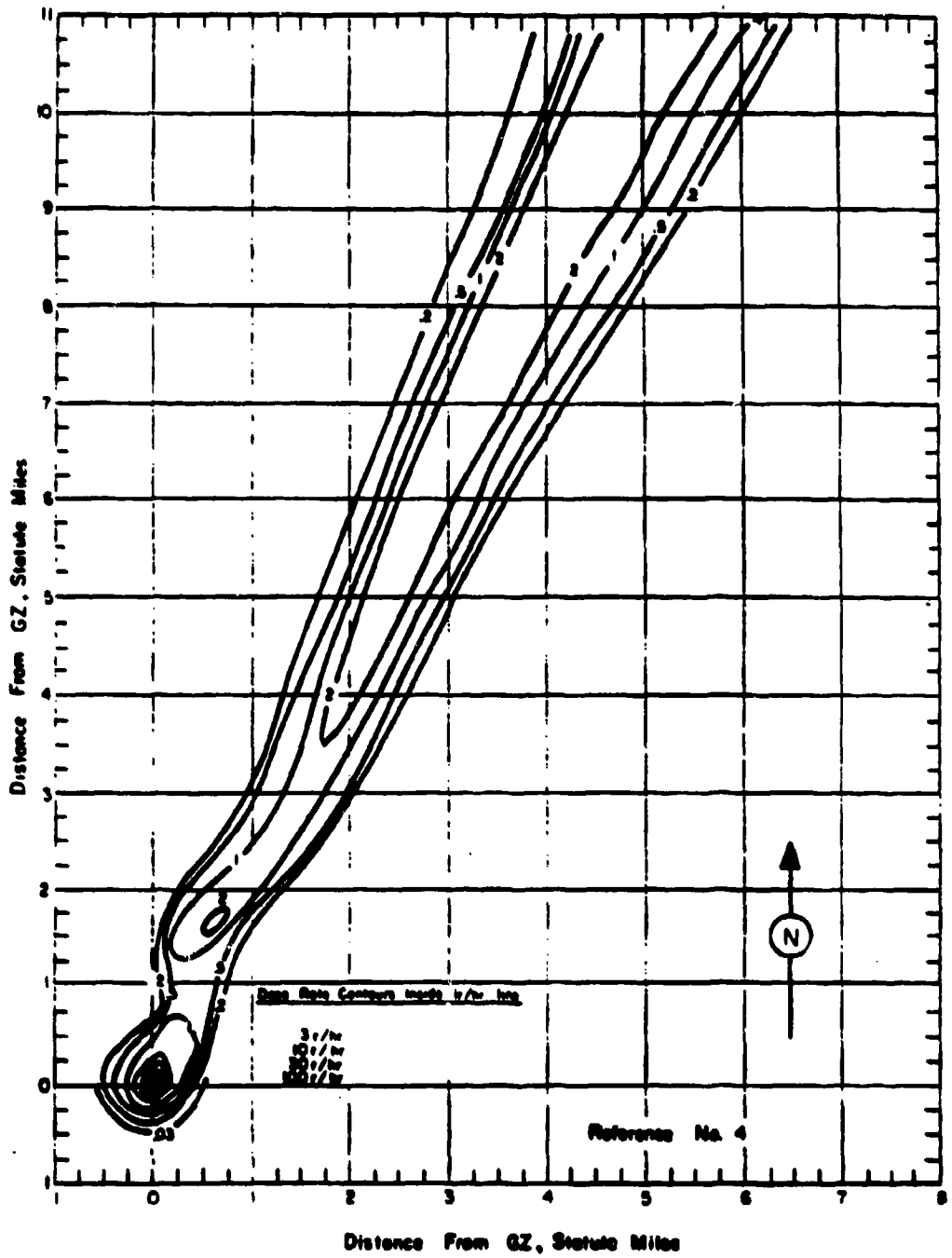

Figure 15. Operation ANTLER - Round 1.
On-site dose-rate contours in r/hr at H+1 hour.

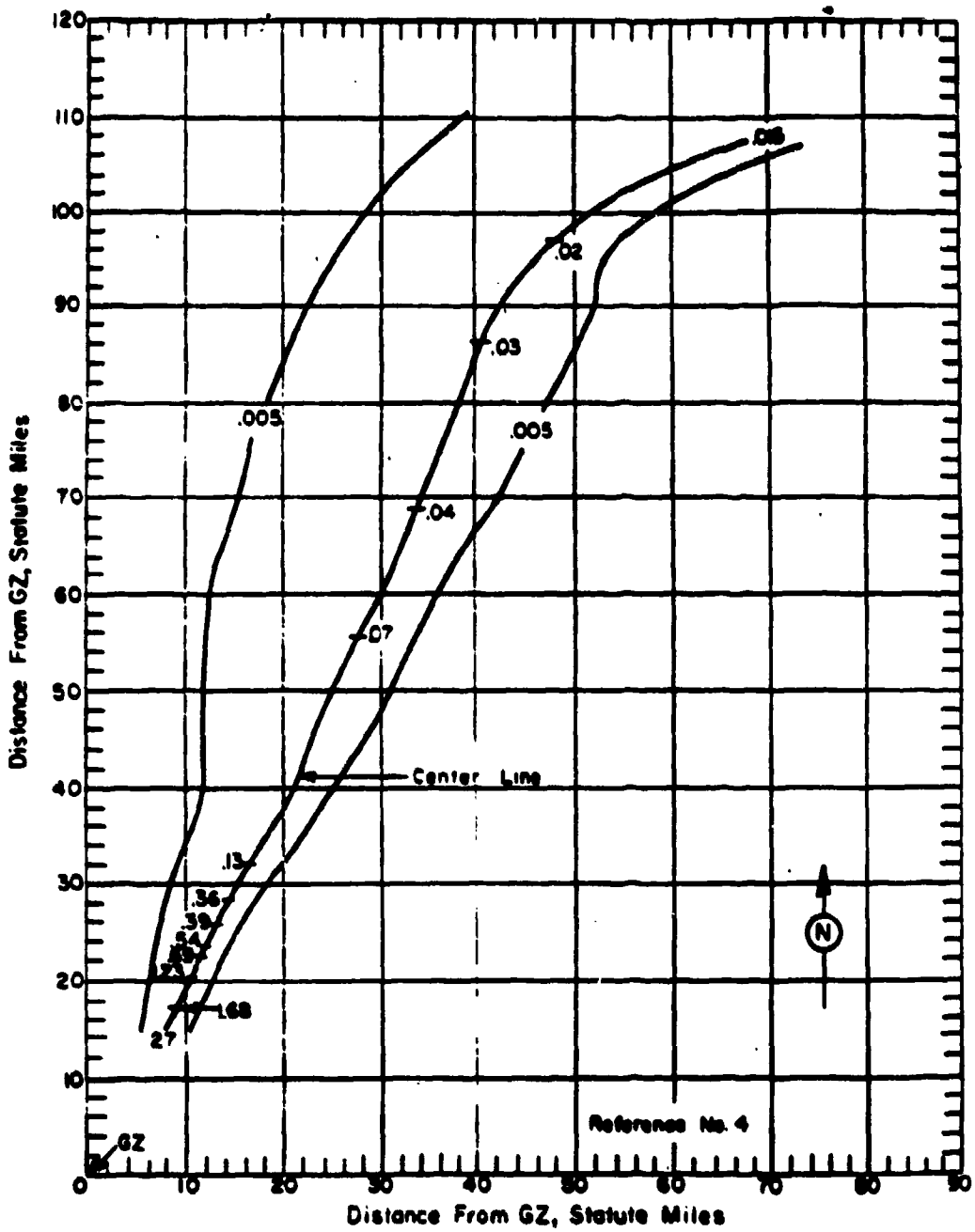

Figure 16. Operation ANTLER - Round 1
Off-site dose-rate contours in r/hr at H+1 hour.

TABLE 7 WIND DATA FOR OPERATION ANTLER - ROUND 1

Altitude (MSL) feet	Direction degrees	Speed mph
Surface	---	--
2,500	209	24
5,000	218	28
7,500	214	26
10,000	211	30
12,500	216	33
15,000	224	37
17,500	229	39
20,000	232	42

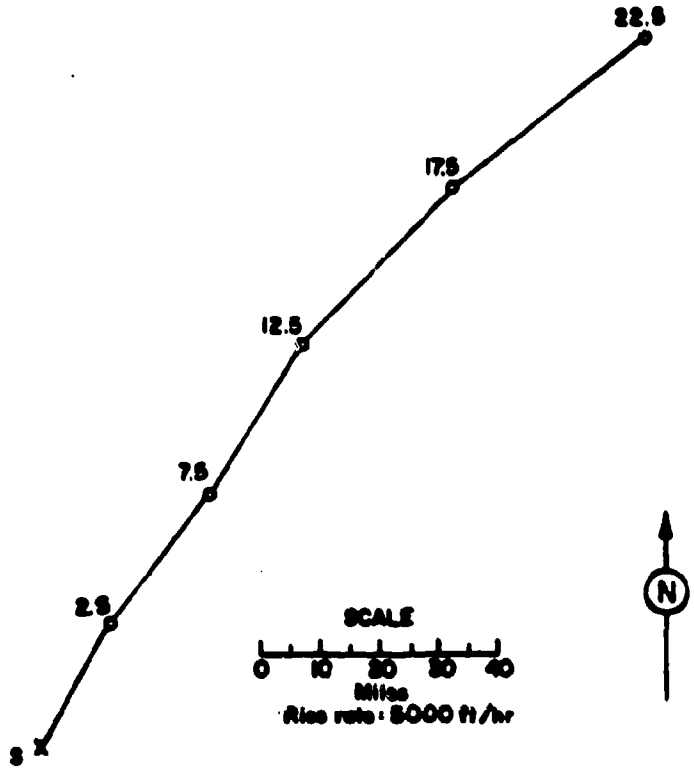

Figure 17. Hodograph for Operation ANTLER - Round 1.

[redacted]

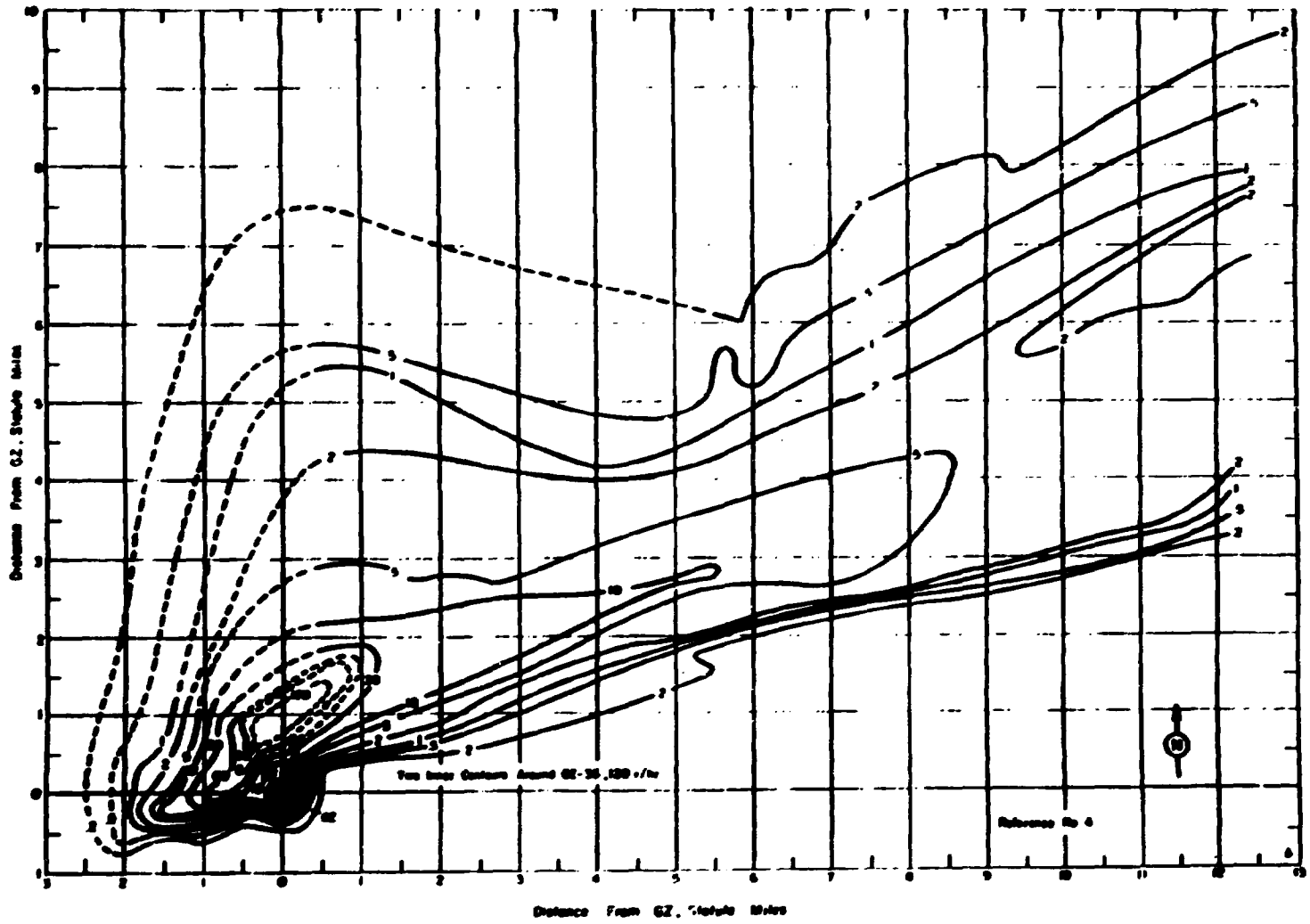

Figure 18. Operation ANTLER - Round 2.
On-site dose-rate contours in r/hr at H+1 hour.

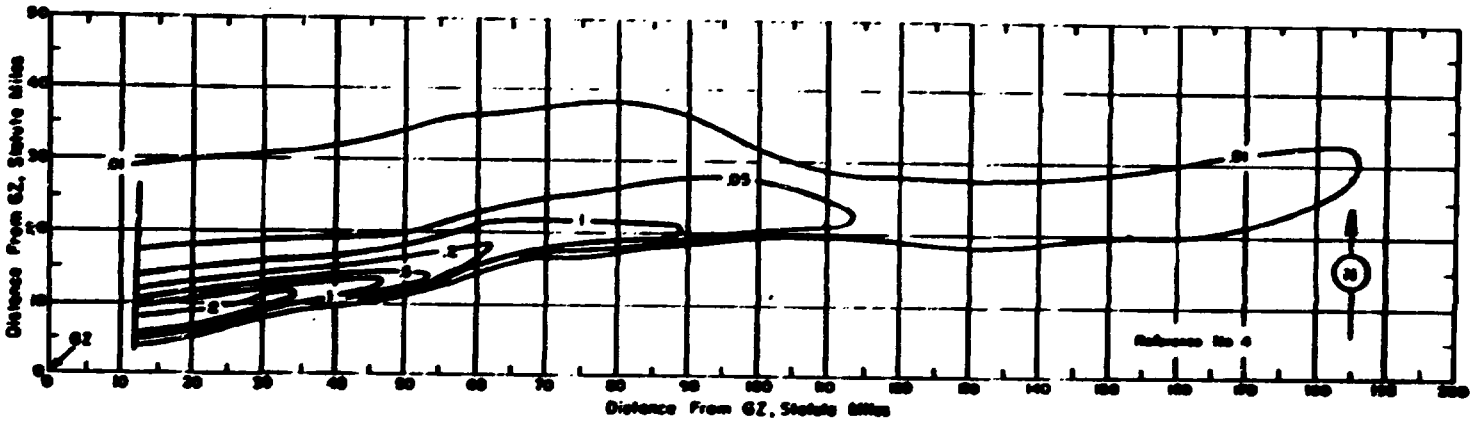

Figure 19. Operation ANTLER - Round 2.
Off-site dose-rate contours in r/hr at H+1 hour.

TABLE [illegible] WIND DATA FOR OPERATION ANTLER - ROUND 2

Altitude (MSL) feet	Direction degrees	Speed mph
Surface	---	---
5,000	73	1
7,500	204	6
10,000	233	9
12,500	241	15
15,000	245	18
17,500	250	22
20,000	253	25
25,000	252	31

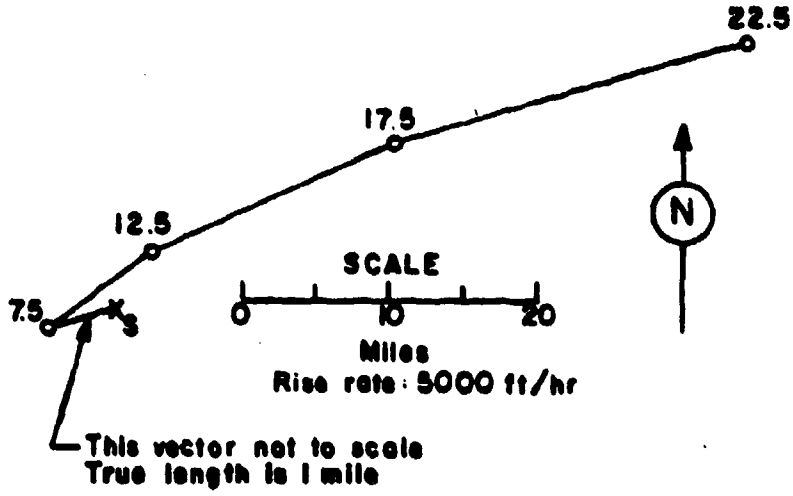

Figure 20. Hodograph for Operation ANTLER - Round 2.

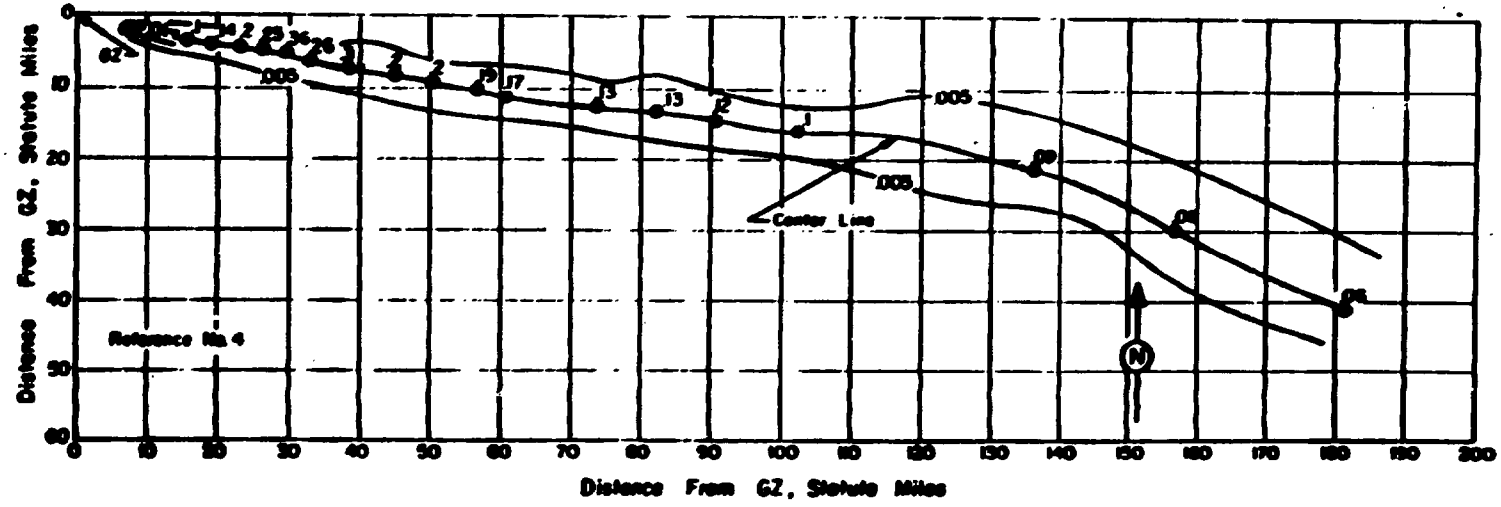

Figure 21. Operation ANTLER - Round 3.
Off-site dose-rate contours in r/hr at H+1 hour.

TABLE 9 WIND DATA FOR OPERATION ANTLER - ROUND 3

Altitude (MSL) feet	Direction degrees	Speed mph
Surface	---	--
2,500	241	13
5,000	247	10
7,500	270	22
10,000	280	26
12,500	285	31
15,000	282	36
17,500	284	39
20,000	285	42
22,500	282	51
25,000	277	63
30,000	280	56
39,000	275	68

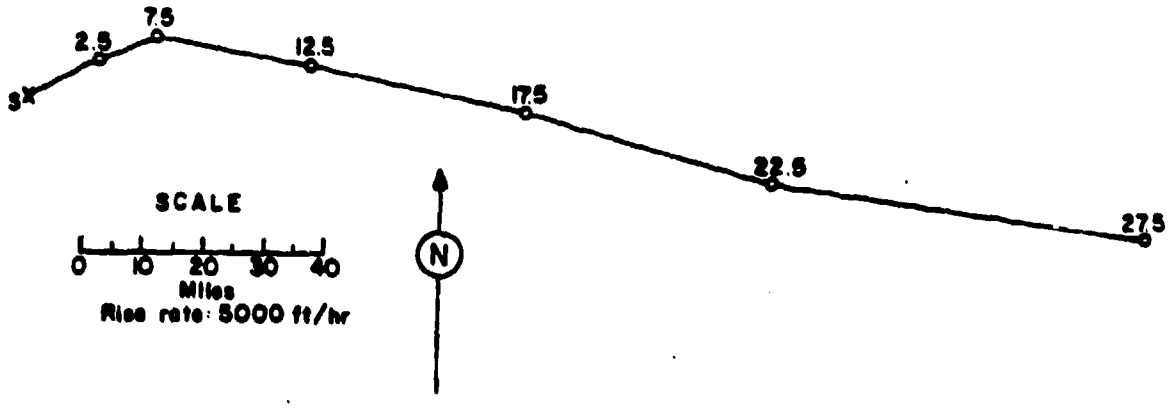

Figure 22. Hodograph for Operation ANTLER - Round 3.

OPERATION GRAPPLE 1958 - Round 1

GMT
DATE: 28 Apr 1958
TIME: 1905

TOTAL YIELD: [redacted]
FISSION YIELD: [redacted]

SITE: Christmas Island Area

HEIGHT OF BURST: [redacted]

TYPE OF BURST AND PLACEMENT:
Air Drop

OPERATION GRAPPLE 1958 - Round 2

GMT
DATE: 22 Aug 1958
TIME: 1800

TOTAL YIELD: [redacted]
FISSION YIELD: [redacted]

SITE: Christmas Island Area

HEIGHT OF BURST: [redacted]

TYPE OF BURST AND PLACEMENT:
Air burst from balloon

OPERATION GRAPPLE 1958 - Round 3

GMT
DATE: 2 Sept 1958
TIME: 1724

TOTAL YIELD: [redacted]
FISSION YIELD: [redacted]

SITE: Christmas Island Area

HEIGHT OF BURST: [redacted]

TYPE OF BURST AND PLACEMENT:
Air drop

[redacted]

OPERATION GRAPPLE 1958 - Round 4

GMT
DATE: 11 Sept 1958
TIME: 1748

TOTAL YIELD: [redacted]
FISSION YIELD: [redacted]

SITE: Christmas Island Area

HEIGHT OF BURST: [redacted]

TYPE OF BURST AND PLACEMENT:
Air drop

OPERATION GRAPPLE 1958 - Round 5

GMT
DATE: 23 Sept 1958
TIME: 1600

TOTAL YIELD: [redacted]
FISSION YIELD: [redacted]

SITE: Christmas Island Area

HEIGHT OF BURST: [redacted]

TYPE OF BURST AND PLACEMENT:
Air burst from balloon

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B. Republic of France Detonations

OPERATION GERBOISE BLEUE

Local Time
DATE: 13 Feb 1960
TIME: 0700

TOTAL YIELD: [redacted]

SITE: Reggane, Central Algeria

HEIGHT OF BURST: 350 ft

PLACEMENT: Tower

OPERATION GERBOISE BLANCHE

Local Time
DATE: 1 Apr 1960
TIME: 0615

TOTAL YIELD: [redacted]

SITE: Reggane, Central Algeria

PLACEMENT: Surface

OPERATION GERBOISE ROUGE

Local Time
DATE: 27 Dec 1960
TIME: 0730

TOTAL YIELD: [redacted]

SITE: Reggane, Central Algeria

HEIGHT OF BURST: 350 ft

PLACEMENT: Tower

OPERATION GERBOISE VERTE

Local Time
DATE: 25 Apr 1961
TIME: 0500

TOTAL YIELD: [redacted]

SITE: Reggane, Central Algeria

HEIGHT OF BURST: Not available

PLACEMENT: Tower

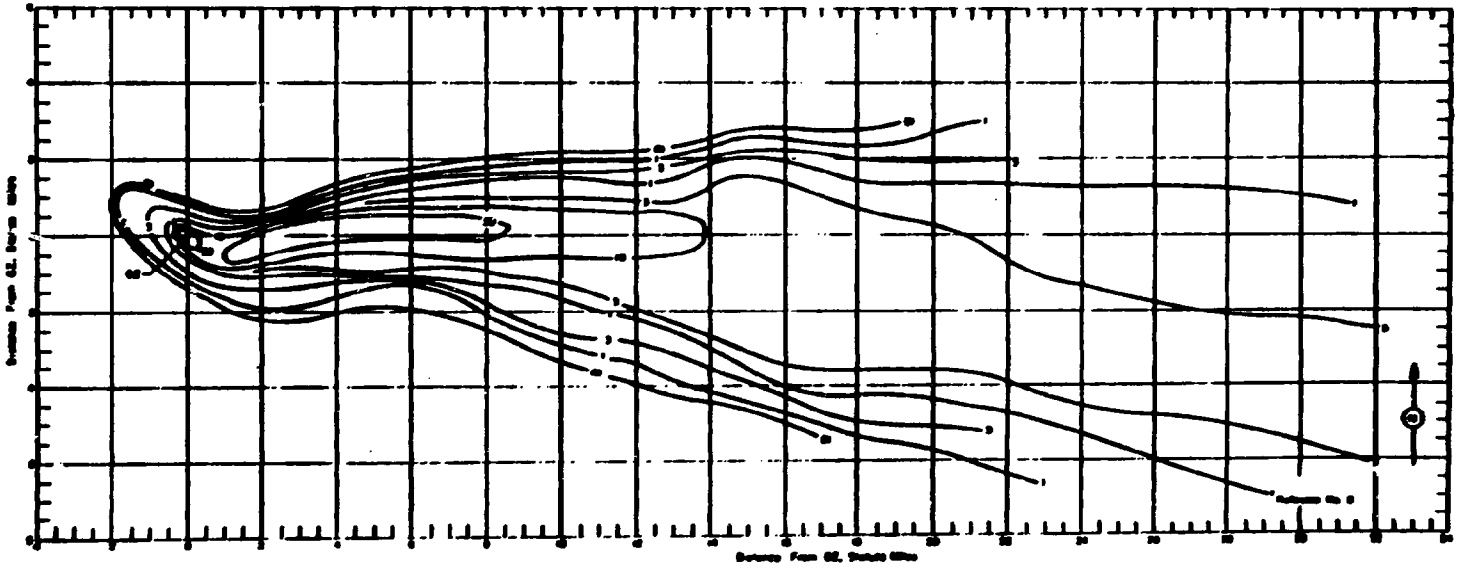

Figure 23. Operation GERBOISE BLEUE.
On-site dose-rate contours in r/hr at H+1 hour.

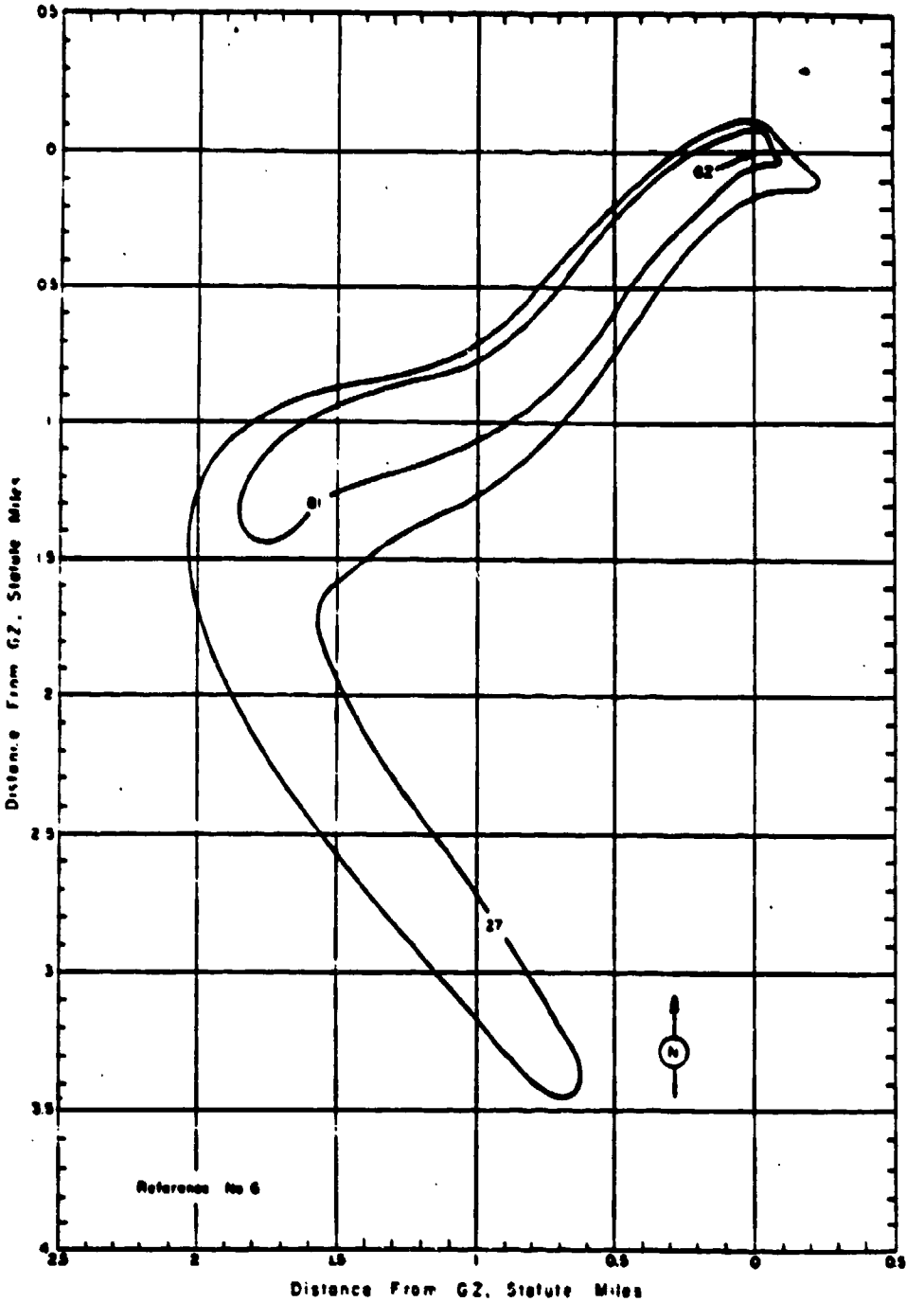

Figure 24. Operation GERBOISE BLANCHE.
On-site dose-rate contours in r/hr at H+1 hour.

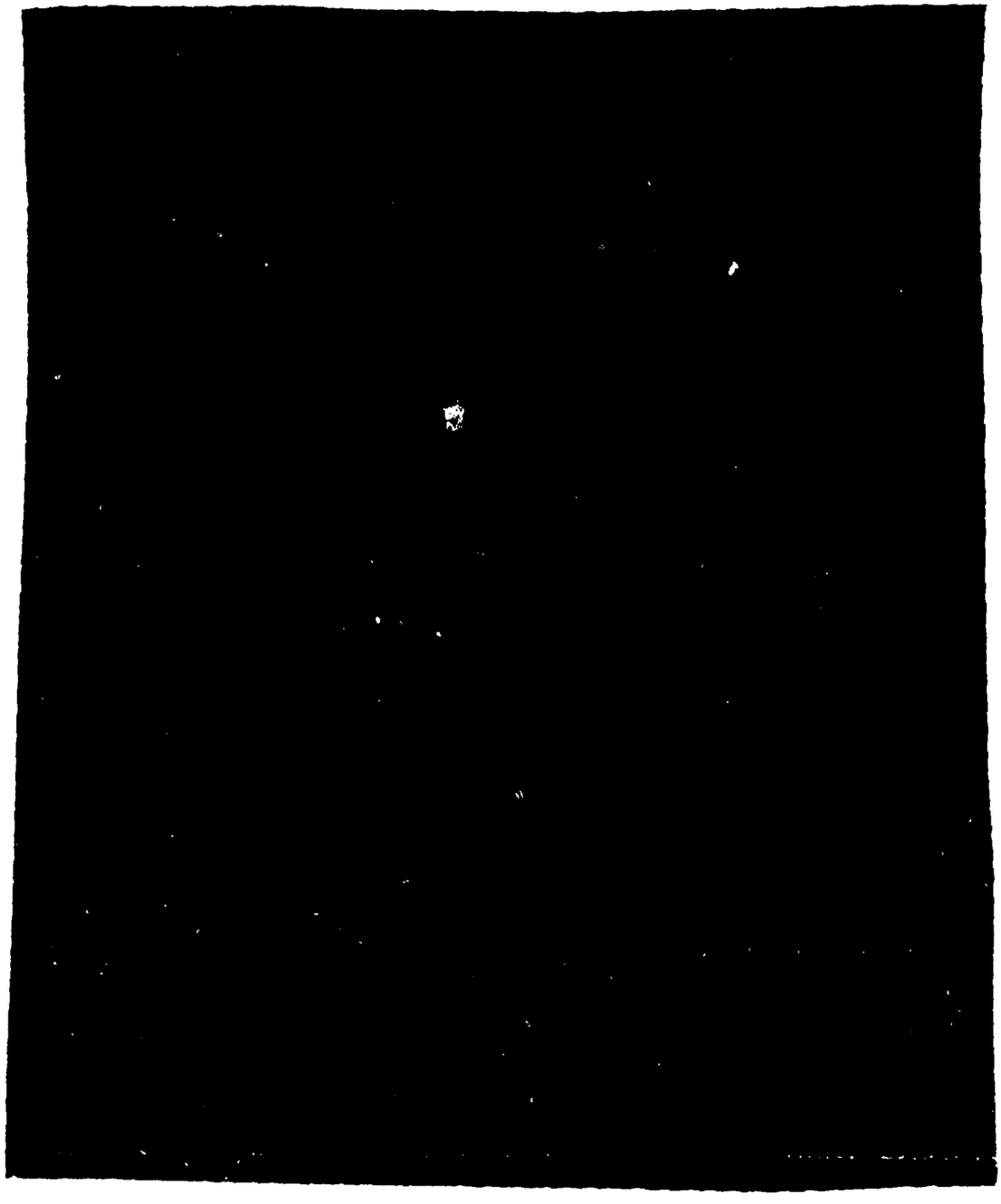

Figure 25. Operation GERBOISE BLANCHE.
Off-site dose-rate contours in r/hr at H+1 hour.

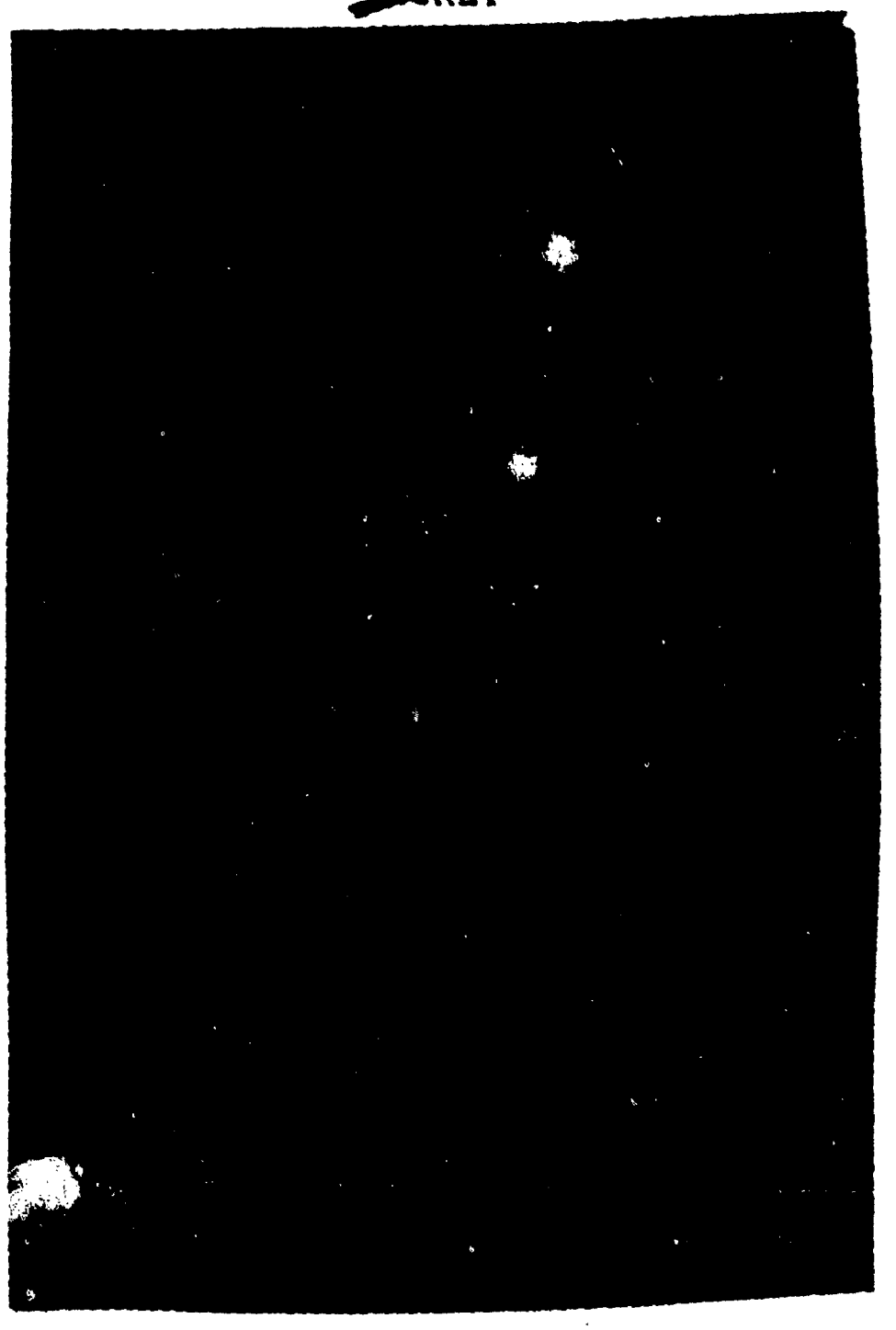

Figure 26. Operation GERBOISE ROUGE.
On-site dose-rate contours in r/hr at H+1 hour.

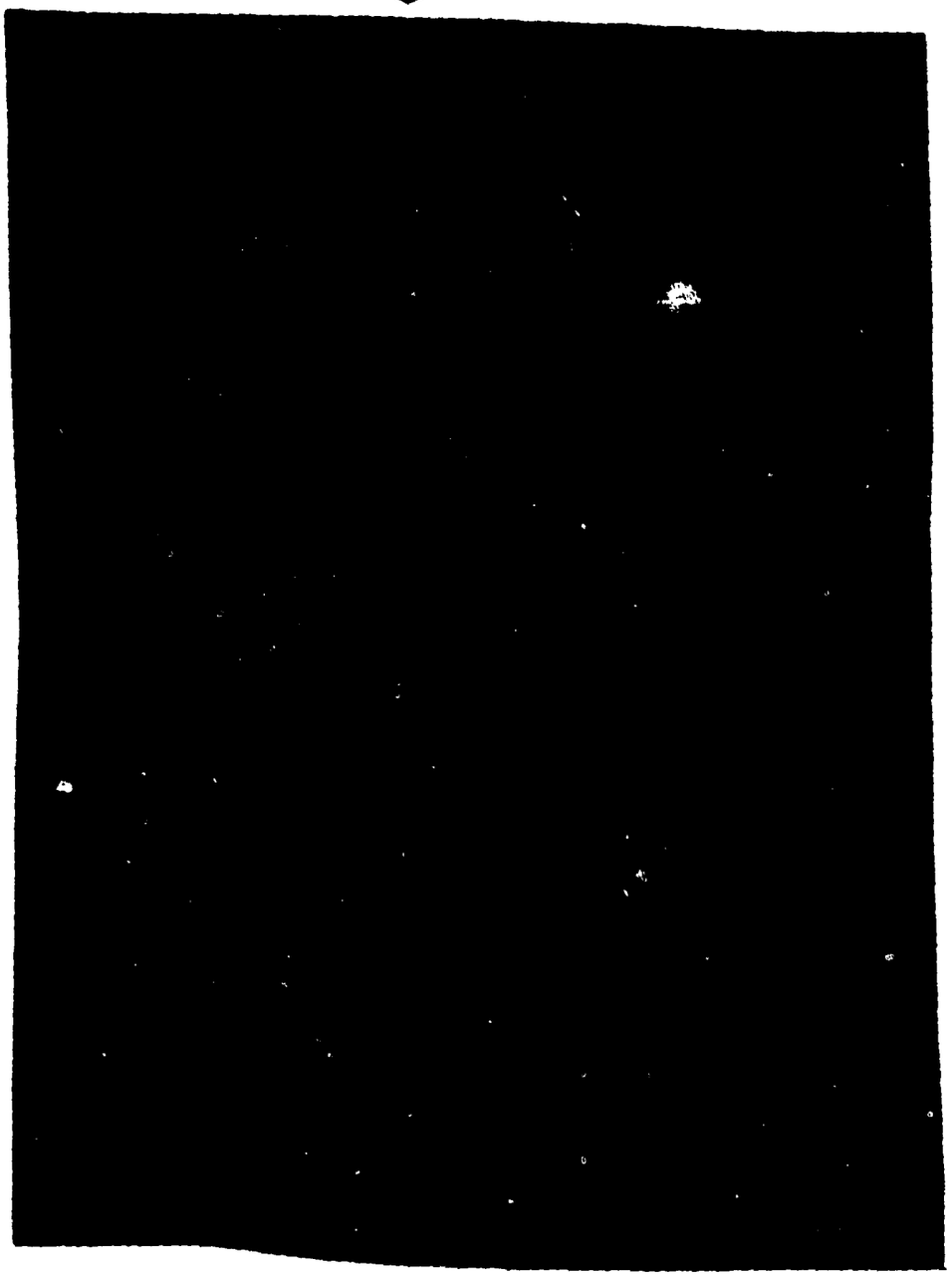

Figure 27. Operation GERBOISE ROUGE.
Off-site dose-rate contours in r/hr at H+1 hour.

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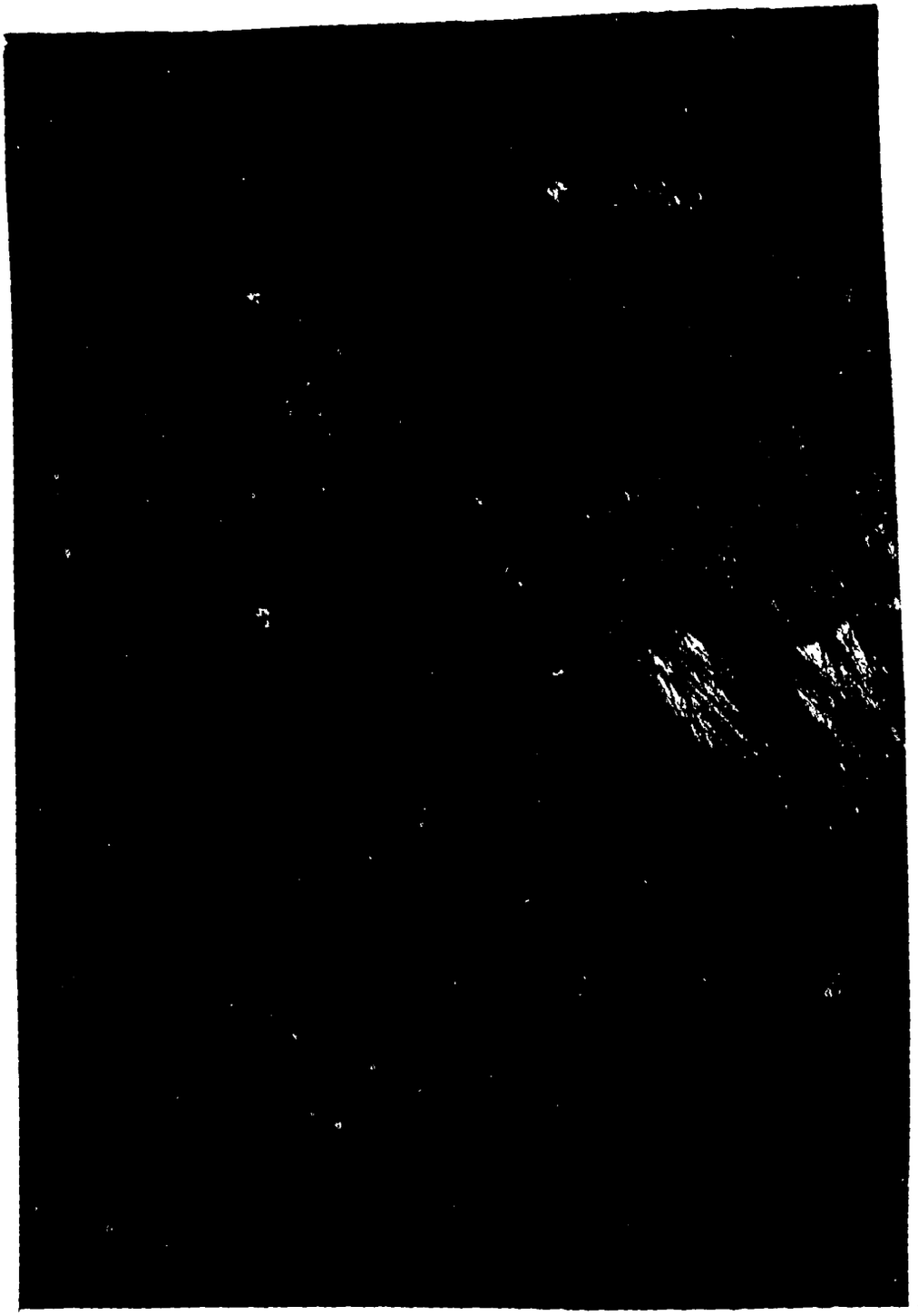

Figure [illegible]. Operation GEPHOTE VELTE.
On-site dose-rate contours in r/hr at [illegible] hour.

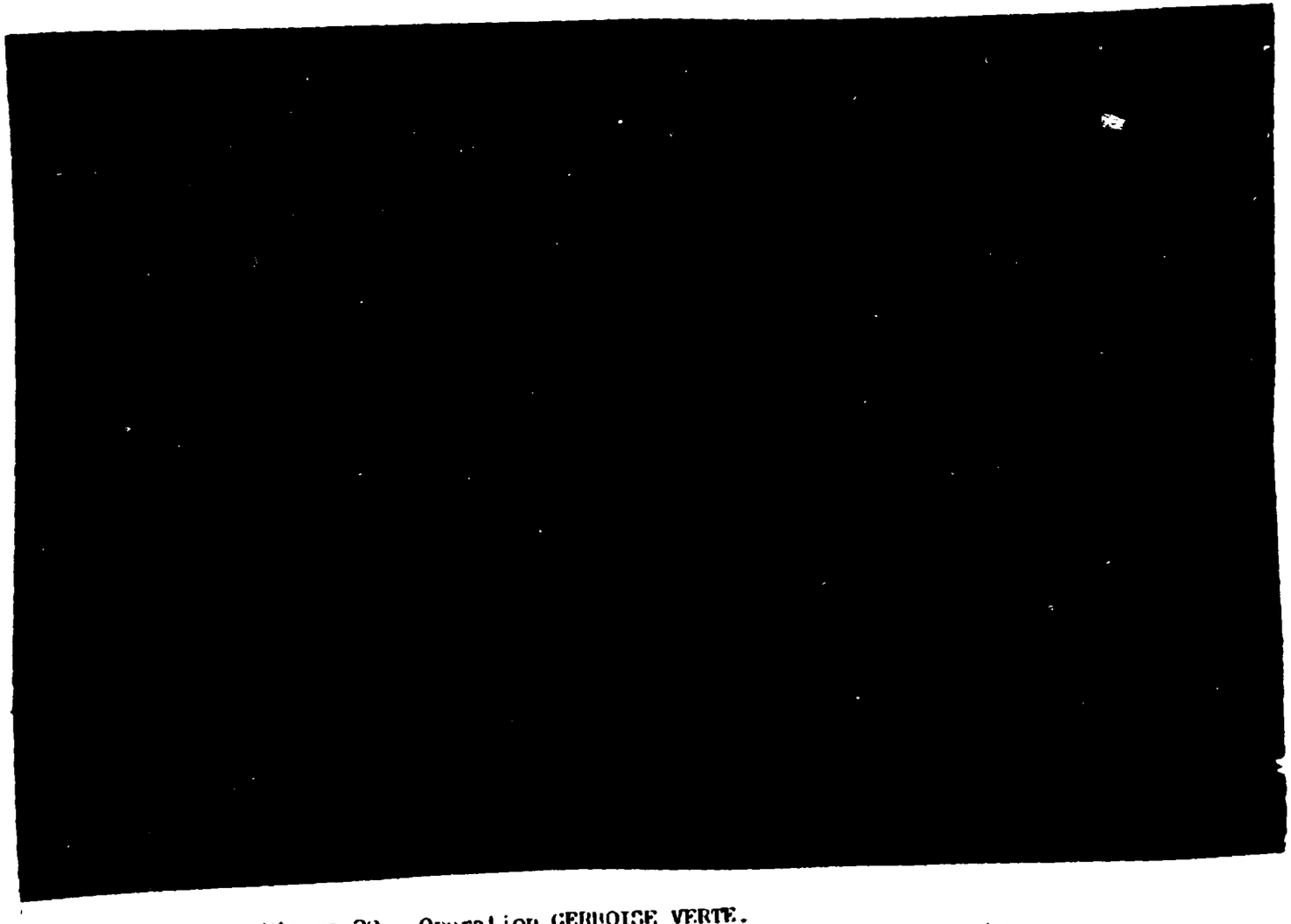

Figure 29. Operation GERBOISE VERTE.
Off-site dose-rate contours in r/hr at H+1 hour.

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~~CONTROLLED BY AEC~~

C. Union of Soviet Socialist Republics

~~RESTRICTED DATA~~
~~CONFIDENTIAL~~ ~~SECRET~~

Information Tabulated for Union of Soviet Socialist Republics Detonations

USSR Tests

[redacted]

Tabulated USSR Information (Continued)

USSR Tests (Continued)

[redacted]

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ATOMIC ENERGY ACT - 1954

Partial List of USSR Tests for 1962

[redacted]

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APPENDIXES

A. Chronological Summaries of Nuclear Tests.

~~RESTRICTED DATA~~
~~ATOMIC ENERGY ACT 1954~~

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1. CHRONOLOGICAL SUMMARY OF UNITED KINGDOM TESTS

Shot No.	Date	Time (GMT)	Operation	Round No.	Total Yield	Type	Site
1	2 Oct 1952	2359	Hurricane	Round 1	[redacted]	Shallow Underwater	Monte Bello Islands
2	14 Oct 1953	2130	Totem	Round 1	[redacted]	Tower-100 ft.	Emu Flats, S. Australia
3	26 Oct 1953	2130	Totem	Round 2	[redacted]	Tower-100 ft.	Emu Flats, S. Australia
4	16 May 1956	1130	Mosaic	Round 1	[redacted]	Tower-100 ft.	Monte Bello Islands
5	19 Jun 1956	1014	Mosaic	Round 2	[redacted]	Tower-100 ft.	Monte Bello Islands
6	27 Sep 1956	0730	Buffalo	Round 1	[redacted]	Tower-100 ft.	MPG, South Australia
7	4 Oct 1956	0700	Buffalo	Round 2	[redacted]	Surface	MPG, South Australia
8	11 Oct 1956	0600	Buffalo	Round 3	[redacted]	Air - 500 ft.	MPG, South Australia
9	21 Oct 1956	1435	Buffalo	Round 4	[redacted]	Tower-100 ft.	MPG, South Australia
10	15 May 1957	1938	Grapple 1957	Round 1	[redacted]	Air-8,000 ft.	Christmas Island Area
11	31 May 1957	1942	Grapple 1957	Round 2	[redacted]	Air-8,000 ft.	Christmas Island Area
12	19 Jun 1957	1940	Grapple 1957	Round 3	[redacted]	Air-8,000 ft.	Christmas Island Area
13	14 Sep 1957	0505	Antler	Round 1	[redacted]	Tower-100 ft.	MPG, South Australia
14	25 Sep 1957	0030	Antler	Round 2	[redacted]	Tower-100 ft.	MPG, South Australia
15	9 Oct 1957	0645	Antler	Round 3	[redacted]	Air-1,000 ft.	MPG, South Australia
16	8 Nov 1957	1748	Grapple 1957	Round 4	[redacted]	Air-8,000 ft.	Christmas Island Area
17	28 Apr 1958	1905	Grapple 1958	Round 1	[redacted]	Air-8,500 ft.	Christmas Island Area
18	22 Aug 1958	1800	Grapple 1958	Round 2	[redacted]	Air-1,500 ft.	Christmas Island Area
19	2 Sep 1958	1724	Grapple 1958	Round 3	[redacted]	Air-9,500 ft.	Christmas Island Area
20	11 Sep 1958	1748	Grapple 1958	Round 4	[redacted]	Air-8,500 ft.	Christmas Island Area
21	23 Sep 1958	1800	Grapple 1958	Round 5	[redacted]	Air-1,500 ft.	Christmas Island Area

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2. CHRONOLOGICAL SUMMARY OF REPUBLIC OF FRANCE TESTS

Shot No.	Date	Local Time	Shot Code Name	Yield kt	Type	Site
1	13 Feb 1960	0700	Gerboise Bleue	60 to 70	350 ft Tower	Reggane, Central Algeria
2	1 Apr 1960	0615	Gerboise Blanche	[redacted]	Surface	Reggane, Central Algeria
3	27 Dec 1960	0730	Gerboise Rouge	[redacted]	350 ft Tower	Reggane, Central Algeria
4	25 Apr 1961	0500	Gerboise Verte	[redacted]	Tower	Reggane, Central Algeria

B. Location Maps of Test Sites.

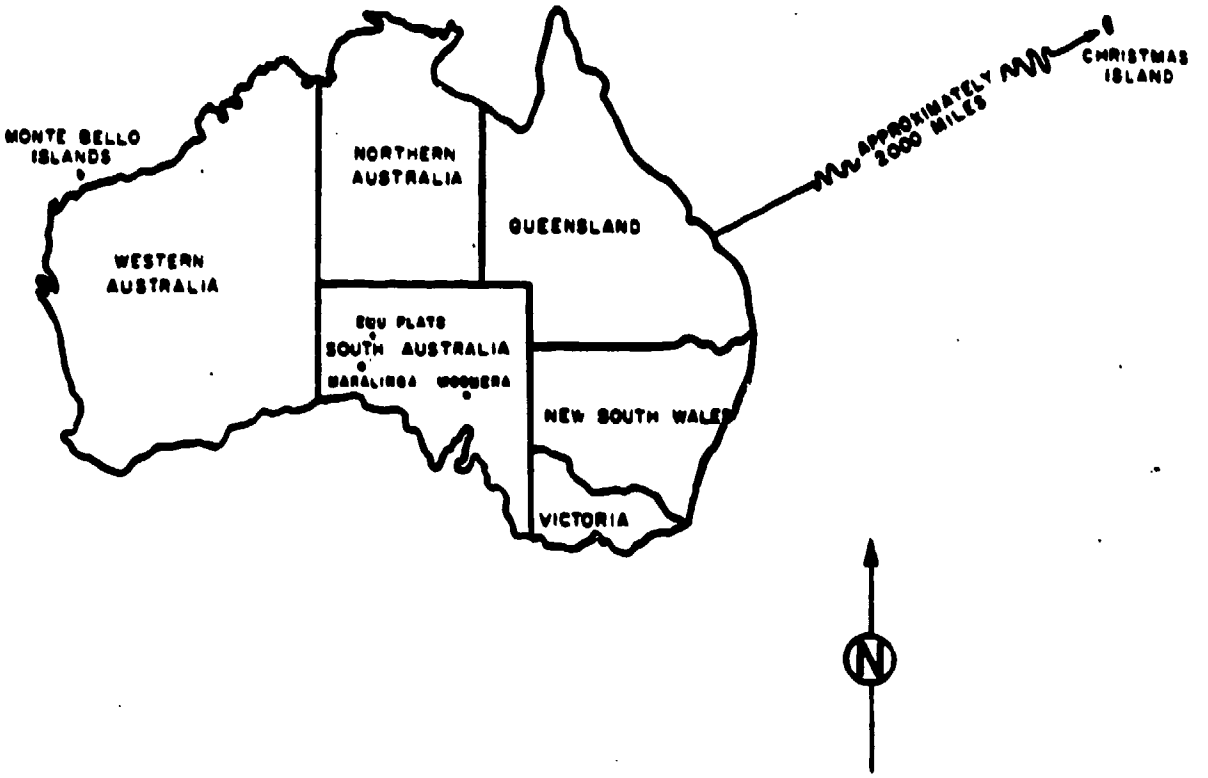

Figure 30. Location Map of United Kingdom Test Sites.

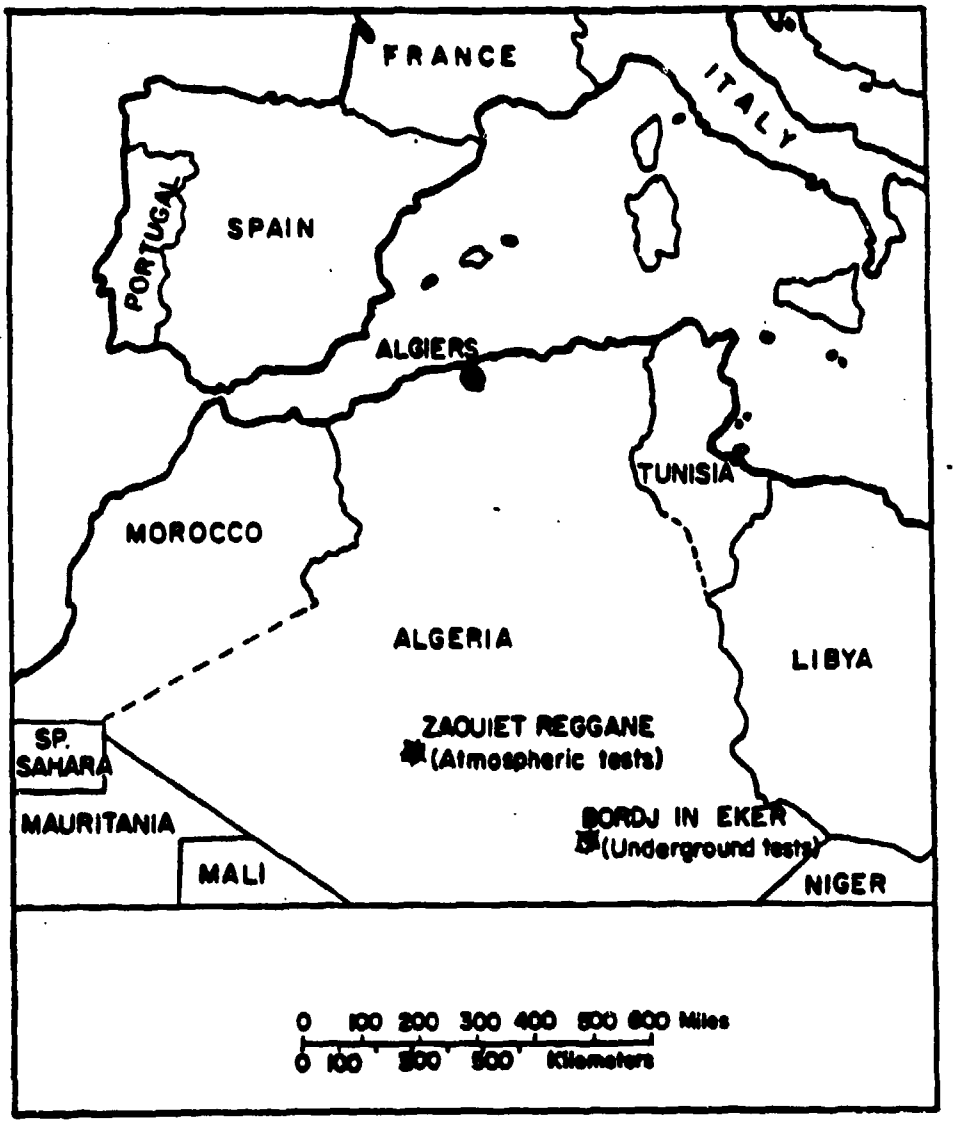

Figure 31. Location map of test sites for Republic of France

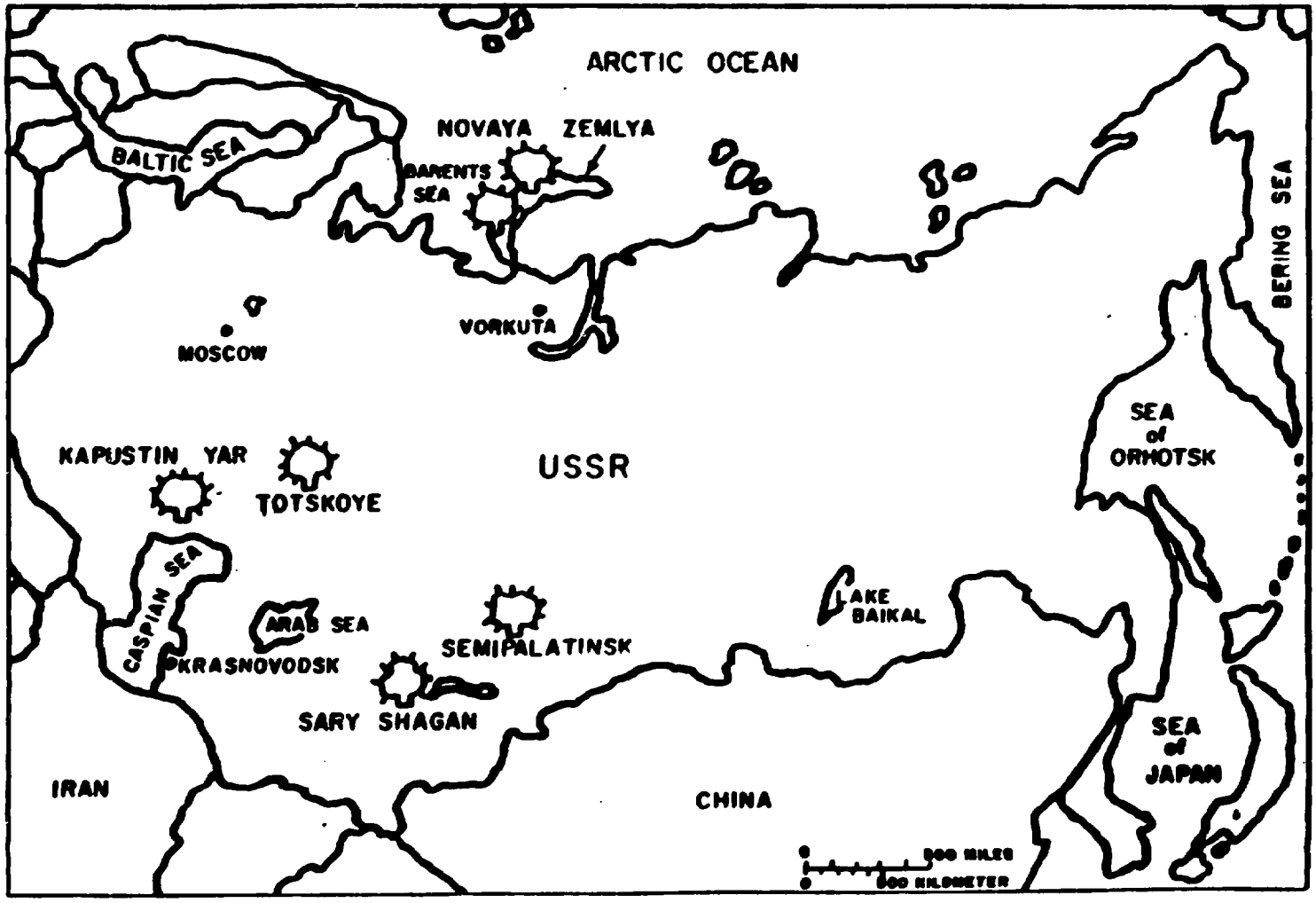

Figure 32. Location Map of Union of Soviet Socialist Republics Test Sites.

REFERENCES

A. Reference Numbers for Specific Types of Data.

1. UNITED KINGDOM DETONATIONS

Operation	Round No.	Date	Time	Yield	Site and Placement	Height of Burst	Fall-out Data	Wind Data	Cloud Data
Hurricane	1	4	4	[redacted]	4,1	4,1	1	1	1,-
Totem	1	4	4		4,2	4,2	2	2	2,-
	2	4	4		4,2	4,2	2	2	2,1
Mosaic	1	4	4		4	4	-	-	-
	2	4	4		4	4	-	-	4
Buffalo	1	4	4		4,3	4	3	3	3,-
	2	4	4		4,3	4	3	3	3,-
	3	4	4		4,3	4	3	-	3,-
	4	4	4		4,3	4	3	3	3,-
1957									
Grapple-1	1	4	4		4	4	-	-	-
	2	4	4		4	4	-	-	-
	3	4	4		4	4	-	-	-
	4	4	4		4	4	-	-	-
Antler	1	4	4		4	4	4	4	4
	2	4	4		4	4	4	4	-
	3	4	4		4	4	4	4	4
1958									
Grapple-II	1	4	4		4	4	-	-	-
	2	4	4		4	4	-	-	-
	3	4	4		4	4	-	-	-
	4	4	4		4	4	-	-	-
	5	4	4		4	4	-	-	-

2. REPUBLIC OF FRANCE DETONATIONS

Operation	Shot No.	Date	Yield	Site	Placement	Fallout Data
Gerboise	1	10	[redacted]	10	.10,9	5
	2	10		10	10,9	6
	3	10		10	9	7
	4	10		10	10	8

3. UNION OF SOVIET SOCIALIST REPUBLICS DETONATIONS

All data except site location from Reference Number 13. All site location data from Reference Number 12.

RESTRICTED DATA
ATOMIC ENERGY ACT 1954

E. List of References.

REFERENCES

1. Soole, B. W. (Department of Physical Research, Admiralty, Great Britain), "Surface Phenomenon at Operation Hurricane, Proceedings of Tripartite Symposium on Technical Status of Radiological Defense in the Fleets," May 16-20; Vol III. U.S. Naval Radiological Defense Laboratory, San Francisco, California. A SECRET Report.

2. [redacted]

3. [redacted]

4. [redacted]

5. [redacted]

6. [redacted]

7. [redacted]

8. [redacted]

9. Gerboise Rouge, La Troisieme Bombe Nucleaire Francaise, Protection Civile, No. 60, February 1961. An UNCLASSIFIED Journal.

10. Stebbins, Albert K., III, "Special Report on High Altitude Sampling Program (HASP)," DASA 539 B, Hqs, Defense Atomic Support Agency, Washington, D. C., 1 August 1961, An UNCLASSIFIED Report.

11. [redacted] A SECRET - FORMERLY RESTRICTED DATA Report.

12. Scientific and Technical Abstracts and Reports, ONI-ST-2-60, Office of Naval Intelligence, Washington 25, D. C., 21 April 1960, A SECRET RESTRICTED DATA Report.

13. Scientific and Technical Abstracts and Reports, ONI-ST---63, Office of Naval Intelligence, Washington 25, D. C., 15 July 1963. A SECRET Report.