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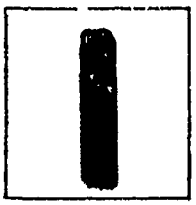

INVENTORY

Fallout Patterns From Operation HARDTACK, Phase II

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UNITED STATES DEPARTMEN

WEATHER BUREA

FALLOUT PATTERNS FROM OPERATI

by

Kosta Telegadas and Kenneth

U. S. Weather Bureau, Washin

May 1960

Prepared for

ALBUQUERQUE OPERATIONS OFFICE, U. S. AT

TATES DEPARTMENT OF COMMERCE

WEATHER BUREAU

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FROM OPERATION HARDTACK, PHASE II

H90

by

Telegadas and Kenneth M. Nagler

Weather Bureau, Washington, D. C.

May 1960

Prepared for

ONS OFFICE, U. S. ATOMIC ENERGY COMMISSION.

SUMMARY OF BURST INFORMATION

BURST NUMBER	BURST NAME	YIELD	TIME	DATE	TYPE	BURST SITE
1	Otero	Some Nuclear Reaction	1300 PDT	12 SEP.	480' Deep Well	U-3q
2	Bernalillo	Minor Nuclear Reaction	1230	17	456' Deep Well	U-3n
3	Eddy	83 T	0700	19	500' Balloon	B-7b
4	Luna	Slight Nuclear Reaction	1200	21	484' Deep Well	U-3m
5	Mercury	Explosion Contained	1500	23	Tunnel	U-12f.(
6	Valencia	Slight Nuclear Reaction	1300	26	484' Deep Well	U-3r
7	Mars	13 ± 3 T	1700	27	Tunnel	U-12f.(
8	Mora	2 KT	0605 PST	29	1500' Balloon	B-7b
9	Hidalgo	Low-level Nuclear Reaction	0610	5 OCT.	377' Balloon	B-7b
10	Colfax	Slight Nuclear Reaction	0815	5	350' Deep Well	U-3k
11	Tamalpais	72 ± 10 T	1400	8	Tunnel	U-12b.(
12	Quay	84 T	0630	10	100' Steel Tower	T-7c
13	Lea	1.5 KT	0520	13	1500' Balloon	B-7b
14	Neptune	90 ± 20 T	1000	14	Tunnel	U-12c.(
15	Hamilton	1.0 T	0800	15	50' Wooden Tower	T-F1
16	Logan	5.0 ± 0.2/0.4 KT	2200	15	Tunnel	U-12e.(
17	Dona Ana	36 T	0620	16	450' Balloon	B-7b
18	Vesta	Slight Nuclear Reaction	1500	17	Gravel Gertie	S-9e
19	Rio Arriba	92 T	0625	18	72 1/2' Wooden Tower	T-3s
20	San Juan	Non-nuclear Explosion	0630	20	234' Deep Well	U-3p
21	Socorro	6 KT	0530	22	1450' Balloon	B-7b
22	Wrangell	100 T	0850	22	1500' Balloon	B-Fa
23	Oberon	Non-nuclear Explosion	1230	22	25' Wooden Tower	T-8a
24	Rushmore	180 T	1540	22	500' Balloon	B-9a
25	Catron	Slight Nuclear Reaction	0700	24	72 1/2' Wooden Tower	T-3t
26	Juno	Slight Nuclear Reaction	0801	24	Gravel Gertie	S-9f
27	Ceres	Slight Nuclear Reaction	2000	25	25' Wooden Tower	T-8b
28	Sanford	4.5 KT	0220	26	1500' Balloon	B-Fa
29	De Baca	2.5 KT	0800	26	1500' Balloon	B-7b
30	Chaves	Slight Nuclear Reaction	0630	27	52 1/2' Wooden Tower	T-3u
31	Evans	55 ± 30 T	1600	28	Tunnel	U-12b.(
32	Mazama	0	0320	29	50' Steel Tower	T-9d
33	Humboldt	6 T	0645	29	25' Wooden Tower	T-3v
34	Santa Fe	1.25 KT	1900	29	1500' Balloon	B-7b
35	Canymede	Non-nuclear Explosion	0300	30	Gravel Gertie	S-9g
36	Blanca	19 ± 1.5 KT	0700	30	Tunnel	U-12e.(
37	Titania	Slight Nuclear Reaction	1234	30	25' Wooden Tower	T-8c

URST INFORMATION

TYPE	BURST SITE	ELEVATION OF SITE	CLOUD TOP (MSL-FEET)	CLOUD BASE (MSL-FEET)	PAGE
p Well	U-3q	4035	9,000	-	12, 13
p Well	U-3n	4030	7,500	5,500	15
loon	B-7b	4186	11,000	7,500	16, 17
p Well	U-3m	4031	Low Diffuse Cloud	-	18
	U-12f.01	6720	None	-	5
p Well	U-3r	4033	5,500	-	19
	U-12f.02	6720	Low Diffuse Cloud	-	21
lloon	B-7b	4186	18,500	10,000	22, 23
loon	B-7b	4186	12,000	8,000	24, 25
p Well	U-3k	4033	5,500	4,500	26
	U-12b.02	6650	Low Diffuse Cloud	-	27
el Tower	T-7c	4249	10,000	7,500	29, 30, 31
lloon	B-7b	4186	17,000	12,000	32, 33
	U-12c.03	6800	11,000	-	35
den Tower	T-F1	3080	6,000	4,500	36, 37
	U-12e.02	6140	None	-	5
loon	B-7b	4186	11,000	6,500	38, 39
ertie	S-9e	4226	10,000	-	40, 41
Wooden Tower	T-3s	4010	13,500	11,000	42, 43
ep Well	U-3p	4033	None	-	6
lloon	B-7b	4186	26,000	20,000	45, 47
lloon	B-Fa	3077	10,000	7,000	46, 47
den Tower	T-8a	4446	Very Low	-	6
loon	B-9a	4214	11,500	-	45
Wooden Tower	T-3t	4018	8,500	5,000	48, 49
ertie	S-9f	4210	5,500	-	50
den Tower	T-8b	4428	6,000	-	51
lloon	B-Fa	3077	26,000	12,500	53, 55
lloon	B-7b	4186	17,500	10,000	54, 55
Wooden Tower	T-3u	4025	6,500	-	56, 57
	U-12b.04	6650	No Organized Cloud	-	59
l Tower	T-9d	4202	6,500	-	6
den Tower	T-3v	4029	7,500	6,000	60, 61
lloon	B-7b	4186	18,000	13,000	62, 63
ertie	S-9g	4193	Very Low	-	6
	U-12e.05	7120	7,700	-	64, 65, 66
den Tower	T-8c	4403	6,000	-	67

EXPLANATION OF TABLE

Column 3, Yield:

a. T indicates ton equivalent of TNT.
b. KT indicates kiloton equivalent of TNT.
c. The yields for tunnel detonations are from the unclassified memorandum, "Total Yields of Underground Events-Hardtack II", Lawrence Radiation Laboratory, Livermore, California, June 23, 1959, and from
d. Johnson, G.W. et al., "Underground Nuclear Detonations". Journal of Geophysical Research, Vol. 64, No. 10, October 1959, pp. 1457-1470.
e. Other yields are from "AEC Releases Data on Hardtack Bomb Tests". U.S.A.E.C., Washington, D.C., March 10, 1959.
f. The Office of Test Information, Nevada Test Site Organization, Las Vegas, Nevada, issued news reports on the yield or containment of explosions. The original language from these reports was included wherever a yield was not given.

Column 4, Time: PST - Pacific Standard Time; PDT - Pacific Daylight Time.

Column 6, Type:

a. For deep-well shots all devices were placed at various depths in 500-foot wells, with the exception of the San Juan event which was in a 250-foot well.
b. Gravel Gertie denotes a surface shot detonated in a small wooden building covered with about 20 feet of gravel.

Column 7, Burst Site: Each burst site is denoted by (1), a capital letter designating the type of shot (i.e., B for balloon, S for surface, T for tower, and U for underground); (2), a number indicating the area in which the burst occurred; and (3), a small letter identifying the location in the area.

Column 8, Elevation of Site: For balloon or tower bursts-the height above sea level of the earth's surface below the device; for underground bursts-the elevation at which venting occurred or, when there was no venting, the elevation of the device.

Column 9, Cloud Top: Height of the cloud top above mean sea level, in feet. There is some uncertainty as to the values presented here since they were primarily visual aircraft reports and since the reports were not always made at the time of cloud stabilizat on.

Column 10, Cloud Base: Height of the top of the stem (or base of the mushroom head) above mean sea level, in feet. There is considerable more uncertainty as to these numbers than for the cloud tops. Besides the uncertainty in the visual aircraft reports and cloud stabilization time, there is also the uncertainty as to the height of the base since in many cases the base was not too well defined. For some events the height of the cloud base was not reported.

Column 11, Page: Pages on which maps or discussions of the bursts appear.

UNITED STATES DEPARTMENT OF COMMERCE WEATHER BUREAU

FALLOUT PATTERNS FROM OPERATION HARDTACK, PHASE II

by

Kosta Telegadas and Kenneth M. Nagler
U. S. Weather Bureau, Washington, D. C.
MAY [redacted] 1960

Prepared For
THE ALBUQUERQUE OPERATIONS OFFICE, U.S. ATOMIC ENERGY COMMISSION

INTRODUCTION

The Hardtack, Phase II, nuclear test operation differed from previous series in the great number of nuclear and safety devices detonated within a fairly brief period, in the very low yields of many of the detonations, and in the variety of burst conditions. Basic information on the various bursts is summarized on the inside of the front cover. Orientation maps of the Nevada Test Site region, and of the Nevada Test Site itself are shown on the inside of the back cover.

As far as public safety is concerned, radiation from Hardtack, Phase II, was even less important than that from most previous Nevada test operations. However, since low levels of activity are fairly difficult to detect, the documentation of such fallout that did occur was comparatively difficult. The radiation from passing airborne radioactive clouds was relatively more important than in previous test series because of the many low nuclear cloud heights. There were also problems concerning decay rates and the arrival times of the fallout.

The purpose of this report is to present and discuss the fallout patterns from Operation Hardtack, Phase II. Although there are many uncertainties in the analysis of the fallout data, careful consideration has been given to all available monitoring and wind information in an attempt to depict as well as possible the actual fallout patterns.

Similar patterns from past Nevada operations are given in References 1 and 2.

SOURCES OF DATA

Off Site

The fallout documentation for purposes of public safety outside the test site was performed by the Off-Site Radiation Safety Organization (staffed by the U.S. Public Health Service). Their monitoring information is for the most part contained in the "Off-Site Radiological Safety Report for Operation Hardtack, Phase II", (3), which contains dose-rate and dose information for selected points, ground monitors' survey summaries, and measurements of the concentration of radioactivity in the air at a number of communities. Measurements of airborne alpha activity appear in the "Alpha Air Sampling Report" (4). The monitors' original logs were also of use, as they often contain useful information as to background radiation or as to very low activities observed but not reported in the summaries.

On Site

The fallout documentation for purposes of personnel safety within the test site was performed by the On-Site Radiological Safety Organization (staffed by the Reynolds Electrical and Engineering Company). Their monitoring information appears in several sources: 1, the monitors' original logs; 2, reports of special surveys performed for the Fallout Prediction Unit; and 3, maps of the dose-rate field based on the results of each survey. These maps appear in the "On-Site Radiological Safety Report for Operation Hardtack, Phase II", (5).

On many occasions talks with the monitors proved helpful in the analysis of the data. Also, the special surveys made for the Fallout Prediction Unit by both of the Off-Site and On-Site groups were useful in delineating the fallout from some of the bursts.

DECAY RATES

Since the monitor readings of dose rate were made at various times after the detonation, these measurements had to be adjusted to a common reference time to permit analysis of the data. The available information from which decay rates could be derived was examined for each of the various different types of detonations, that is, for balloon, tower, surface, deep well, and tunnel shots. However, the only available information as to decay rates was

that derivable from the routine monitoring data. As would be expected in the absence of a specific program to study decay rates, the pertinent data are limited and the determination of decay rates can only be approximate.

A major source of error is the uncertainty as to whether the measurements taken along a particular route at different times were taken at precisely the same location. To minimize this error, only the measurements at specifically-designated locations were considered, and even for such locations this position error cannot be eliminated altogether. It normally is greatest where the gradient of activity is strongest.

The available data are shown in graphical form in figures 1-3. Figure 1 shows the decay curves for radiation from balloon detonations close to ground zero, where neutron-induced radioactivity is logically significant. As has previously been observed by the On-Site Rad-Safety group, the dominant constituent of this induced activity, except at early times when manganese-56 is important, appears to be sodium-24, which has a half life of about 15 hours. This decay rate and the $t^{-1.2}$ approximation of gross fission-product decay are shown. From figure 1 it can be seen that the sodium decay better approximates the observed decay of the close-in radiation from balloon bursts than does the gross fission-product decay. For simplicity, the sodium-24 decay rate was used to adjust the close-in radiation measurements from balloon shots to a common reference time.

Figures 2 and 3 show the data available for assessing decay rates for the deep-well, tower, and surface detonations. The sodium-24 and $t^{-1.2}$ decay curves are included for reference. The $t^{-1.2}$ approximation seems reasonable for these shots, and, for lack of better information, was also used for the tunnel bursts and for all off-site fallout. Again, it should be pointed out that the decay rates used are only approximate.

RADIATION FROM PASSING NUCLEAR CLOUDS

Some of the early dose-rate measurements show the effect of radiation from passing nuclear clouds. This radiation, sometimes called shine or sky shine, may come from a nuclear cloud many thousands of feet or perhaps a few hundred feet above ground, or it may come from nuclear debris in the air right at the ground level. Because of the nearness of the radiation source, the shine from a low-level cloud is normally more apparent than that from a high cloud even though the radiation in the higher cloud may be several orders of magnitude greater than that in the cloud near the ground.

Figures 4 and 5 show the early dose-rate measurements at several locations from several of the bursts. Typically, the dose rate shows a rapid rise and then a rapid decline, but there may be subsequent fluctuations as other parts of the nuclear cloud pass by. Later there is a gradual decrease of dose rate, which results from the decay of the true fallout.

It is of interest to compare the contribution from the shine to that from the true fallout. The total dose accumulated during any period is indicated by the area under the dose-rate curve for that period. To obtain the infinite dose an extrapolation was made beyond the last measurement by means of the $t^{-1.2}$ decay law. In order to get a rough estimate of the fallout part it was assumed that the true fallout began to arrive when radiation above background was first detected and that the dose rate increased linearly up to the time when fallout had ceased and there appeared to be no further effect of shine, that is, up to the time when the decrease in the dose rate seemed to be governed by the typical gross fission-product decay.

From the estimates of the total infinite dose and the infinite dose from true fallout only, an estimate of the contribution to the dose from shine can be made.

In the case of radiation at Mercury from the Hamilton burst it was estimated that the dose from the transient debris was about the same as the infinite dose from the true fallout, namely about 8 mr from each source. For the other cases depicted in figures 4 and 5, the dose from shine was also about as large as or greater than that from true fallout.

It might be pointed out here that if the high reading (at Mercury from Hamilton) of 11 mr/hr at H+1.8 hours was assumed to be exclusively from fallout and was extrapolated from H+1.8 hours to infinity by means of the $t^{-1.2}$ law, a fictitious infinite dose of nearly 100 mr would result.

ALPHA CONTAMINATION

Monitoring reports from a few of the bursts indicated that there was no gamma fallout but that there was some alpha contamination on the ground close to the burst sites. Also, there were a few cases in which some alpha fallout was reported in addition to gamma fallout. No analysis of the alpha radiation has been included in this report; but the general areas of alpha contamination are shown in the On-Site Radiological Safety Report (5).

The off-site alpha activities (Reference 4) as well as the beta activities (Reference 3) frequently detected at the fixed air-sampling stations were used

as an indication of the general movement of fallout.

DISCUSSION OF FALLOUT MAPS

One or more fallout maps are given for each burst in the series, except for those from which there was no gamma radiation observed or from which there were too few reports of radiation to suggest any sort of pattern. The bursts for which no patterns are drawn are discussed on pages 5 and 6.

For most bursts maps of two scales are given: a large-scale map showing the very close-in fallout (termed Map A), and a smaller-scale map showing the more remote spread (Map B). For bursts from which only close-in fallout was reported only a large-scale map is given. For Quay and Blanca maps of three scales are included, identified as Maps A, B, and C. It should be noted that maps for different bursts are sometimes of different scales, even though they are indicated as being in the same category; e.g., Map A or Map B.

When there are two or three maps for one burst, they have been arranged so that two of them appear on facing pages - which accounts for the blank pages.

There is some variety in the format of the maps. For example, the terrain is indicated only on the small-scale maps. Also, on the small-scale maps only, those roads along which monitoring runs were made are shown as heavy lines. To avoid confusion not all of the monitored roads are shown on the large scale maps.

The coordinates shown on the large-scale maps are from the Nevada State Grid, which is a rectangular grid system based on a transverse Mercator projection. The coordinates are designated in feet.

The various items contained on the maps are discussed in the following sections.

Dose-rate contours. Dose-rate contours for the large-scale fallout patterns have been drawn for the gamma dose rate one hour after burst time. A few of the small-scale patterns were drawn for 12 hours after burst time, consistent with the procedure used in References 1 and 2; but because of the very low levels of radiation, most of the small-scale patterns are for H+1 hour.

As noted earlier, the $t^{-1.2}$ approximation was used to adjust radiation measurements to the appropriate reference times for all types of bursts, except for the close-in patterns from balloon bursts, for which the sodium-24 decay curve was used.

Each of the close-in patterns from the balloon bursts shows a closed 10 mr/hr contour, and on each small-scale pattern a secondary maximum appears. Between the two fallout areas it is not known whether there is very light fallout or no fallout at all. From Plumbbob data there is a suggestion that the pattern is continuous, but that the dose rates in the intermediate region were too low to be recorded by the on-site monitors, who normally were concerned only with dose-rates of 10 mr/hr or greater.

Where the patterns are based on nearby monitoring information, they are shown as solid lines; where there was a considerable interpolation or extrapolation, dashed lines are used.

The maximum dose rate. As a guide to the highest dose rates associated with the various types of detonations, an estimate has been given whenever possible of the highest dose rate observed, adjusted to the H+1 value by the appropriate decay scheme as discussed above. These estimates appear on the large-scale fallout maps. Often the maximum dose rate at H+1 was estimated from a dose-rate reading made in a survey a day or two after the burst, particularly when the readings were too high to permit routine monitoring near ground zero during the early surveys. In such a case errors in the assumed decay rate may lead to a fairly large error in the estimate of the H+1 dose rate. Also, there is sometimes the possibility of there having been a small area of greater activity than was detected. The maximum dose rate given can only be considered a rough guide to the approximate highest radiation level from each burst.

Time of arrival. Normally when fallout first arrives at any location, the dose-rate is rather small, but it increases as more fallout descends. While the fallout is accumulating (and possibly even before any true fallout arrives), there may temporarily be high dose rates due to passing airborne debris. In a few minutes or a few hours, depending on the nature of the explosion, the wind field, and the distance from the burst site, the fallout is essentially complete and the dose rate starts its steady decrease due to the decay of the fission products. Thus there is no precise time of arrival of the fallout. The time lines shown on the fallout maps are intended to give only rough average arrival times as estimated from the wind reports and the available monitoring information.

Trajectories. Meteorological trajectories for selected levels are included on the off-site fallout maps. Such a trajectory depicts the

path of gaseous or small-particle debris which has a negligible fall rate. The trajectories are all for constant heights above sea level except those marked, in a meteorological jargon, "trajectory at gradient wind level". The gradient wind, simply, is the wind at some level high enough above the general terrain so that the effects of friction of air with the earth are trivial. The gradient level trajectories in this report represent a height of about 1,500 feet above the ground and hence vary in height above sea level. As a rough average, however, this level is about 6,500 feet above sea level in the region of the test site.

The meteorological trajectories are based on the wind analyses for the various levels at three- or six-hour intervals, as provided by the Weather Bureau Research Station, Las Vegas, Nevada. They take into account the temporal and spatial changes in the wind. Meteorological trajectories are, of course, subject to error, particularly over regions of sparse data, in areas of rapidly changing or complex flow patterns, and in regions where the wind speeds are very light. Even though there was a fairly dense network of stations reporting upper winds during the test period, significant uncertainties were sometimes present.

In general, however, the fallout patterns and the meteorological trajectories were in fairly good agreement. Such differences as do appear between the location of a trajectory and the location of the contaminated area may be due to errors in computing the trajectory; but normally they are due primarily to the fact that the deposition is a function of the winds at all levels below the nuclear cloud. Also, a great many of the Hardtack, Phase II, bursts resulted in low nuclear clouds. Such clouds may be subject to channelling or other effects of the terrain; or particularly during the daytime, they may be diffused upward and downward by turbulent mixing. A nuclear cloud from an early morning detonation, for example, may be such that most of the radioactivity is between 5,000 and 10,000 feet above the ground. The part of the material which does not have a significant fall rate would be moved by winds in this layer until daytime heating of the ground is sufficient to produce an unstable layer from the ground up to the radioactive levels. Then, there may be a mixing of the nuclear debris throughout the layer from the ground to the initial cloud height or even higher. Some small particles may then be brought close enough to the ground so that their otherwise trivial fall

rates may bring them to earth. Even particles with completely negligible fall rates may impinge upon and remain on the ground or on vegetation.

In addition to their use as a rough check on the locations of the fallout patterns, the trajectories were used as a guide in estimating times of arrival of the fallout.

Meteorological data. The most important pertinent meteorological information has been included on the fallout maps in order that it may be viewed along with the fallout estimates.

Curves of temperature and dew point versus height, as measured at the Yucca Lake Weather Station, are given. The temperature-height structure is useful in assessing the vertical stability of the atmosphere and plays a dominant role (along with weapon yield) in determining the height of a nuclear cloud.

The dew point distribution with height probably also plays a role in determining cloud height and is related to the amount of water in the nuclear cloud and hence to the appearance of the nuclear cloud. Levels for which the dew-point curve is missing are normally very dry.

The adiabatic lapse rate indicated on each sounding is that rate of temperature decrease with height which indicates neutral stability. When that lapse rate exists in the atmosphere, a parcel of air given some impetus upward or downward meets no opposition, other than friction, to its motion. Such a lapse rate is often accompanied by vertical mixing. When the temperature decreases more slowly with height than the adiabatic rate and, particularly when there is no decrease or even an increase with height, then the atmosphere is in a stable condition, since work must be done on any parcel of air to move it upward or downward. When the temperature decreases more rapidly than the adiabatic rate, which is an infrequent and temporary condition except near the ground on days with strong solar heating, the atmosphere is subject to rapid overturning and hence mixing throughout the unstable layer.

The most important meteorological factor in determining the distribution of the fallout is the wind field. For most bursts the upper-air shot-time winds are given for heights up to at least the top of the nuclear cloud. Directions are in degrees from which the wind is blowing; speeds are in knots. These winds were measured at the Yucca Lake Weather Station. In some cases, however, these winds may not be representative

of the winds at the place of detonation. This is especially true for the Area 12 tunnel shots, since the Yucca station is about 20 miles to the southeast and has an elevation of about 4,000 feet whereas the tunnels were above the 6,000-foot level on the slopes of a 7,500-foot mesa. When a nuclear cloud from this area extended higher than the mesa top, the part that extended above the mesa top was probably influenced by winds not very different from those measured at Yucca Lake, since the Weather Bureau Research Station at Las Vegas has found a high correlation between the wind direction on a meteorological tower on the mesa and the wind direction at the same elevation (about 7,500 feet above sea level) over Yucca Lake. For the majority of tunnel bursts from which venting occurred, however, the nuclear clouds were confined to very low heights where the winds were greatly influenced by local factors. The heating (or cooling) of the air near the slopes relative to that at similar elevations in the free air over the valleys leads to flow upslope in the daytime (or downslope during the night). Typically, the upslope winds start at about a half hour after sunrise and reverse their direction shortly before sunset. While the reversal is taking place the winds usually remain very light and variable for five or ten minutes.

When available, pertinent wind information from meteorological towers in Area 12 and Area 8 is included in the remarks accompanying the fallout maps.

Remarks. For each of the fallout maps comments are given on the analysis, and the uncertainties are discussed in order that the reliability of various parts of the pattern can be judged.

BURSTS FOR WHICH NO MAPS ARE GIVEN

No fallout maps are given for several of the bursts because there was a negligible yield or, in the case of underground bursts, because there was a trivial or no release of fission products into the atmosphere. These bursts are discussed individually below.

Mercury (Burst No. 5). Since there was essentially no nuclear yield from Mercury, no venting into the atmosphere was observed. There was, however, some alpha contamination in the main tunnel.

Logan (Burst No. 16). The Logan burst was completely contained and therefore no radiation from this explosion was released into the air.

San Juan (Burst No. 20). 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.

Oberon (Burst No. 23). There was essentially no nuclear yield from Oberon and only a very low cloud was observed. No gamma activity was reported, but there was some alpha contamination around ground zero and a short distance down wind (toward the northwest).

Mazama (Burst No. 32). There was essentially no nuclear yield from Mazama and only alpha contamination was reported around ground zero. A visible cloud resulted from the Mazama explosion which was estimated from aircraft to reach somewhere between 5,000 and 6,500 feet above sea level (800 to 2,300 feet above ground). With the stable night-time atmosphere, no nuclear yield, and only a small amount of high explosive, it seems doubtful that the cloud could have reached higher than the lowest of the estimates. Perhaps the higher estimates resulted from the difficulty in estimating the height of a low, small cloud at night.

Ganymede (Burst No. 35). There was no nuclear yield for Ganymede. The cloud was very low, but the height could not be determined due to darkness. There was some alpha contamination in the immediate vicinity of ground zero.

ACKNOWLEDGMENTS

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5. Reynolds Electrical and Engineering Company, Radiological Safety Division, On-Site Radiological Safety Report, Operation Hardtack, Phase II (OTO-58-5), 1959.

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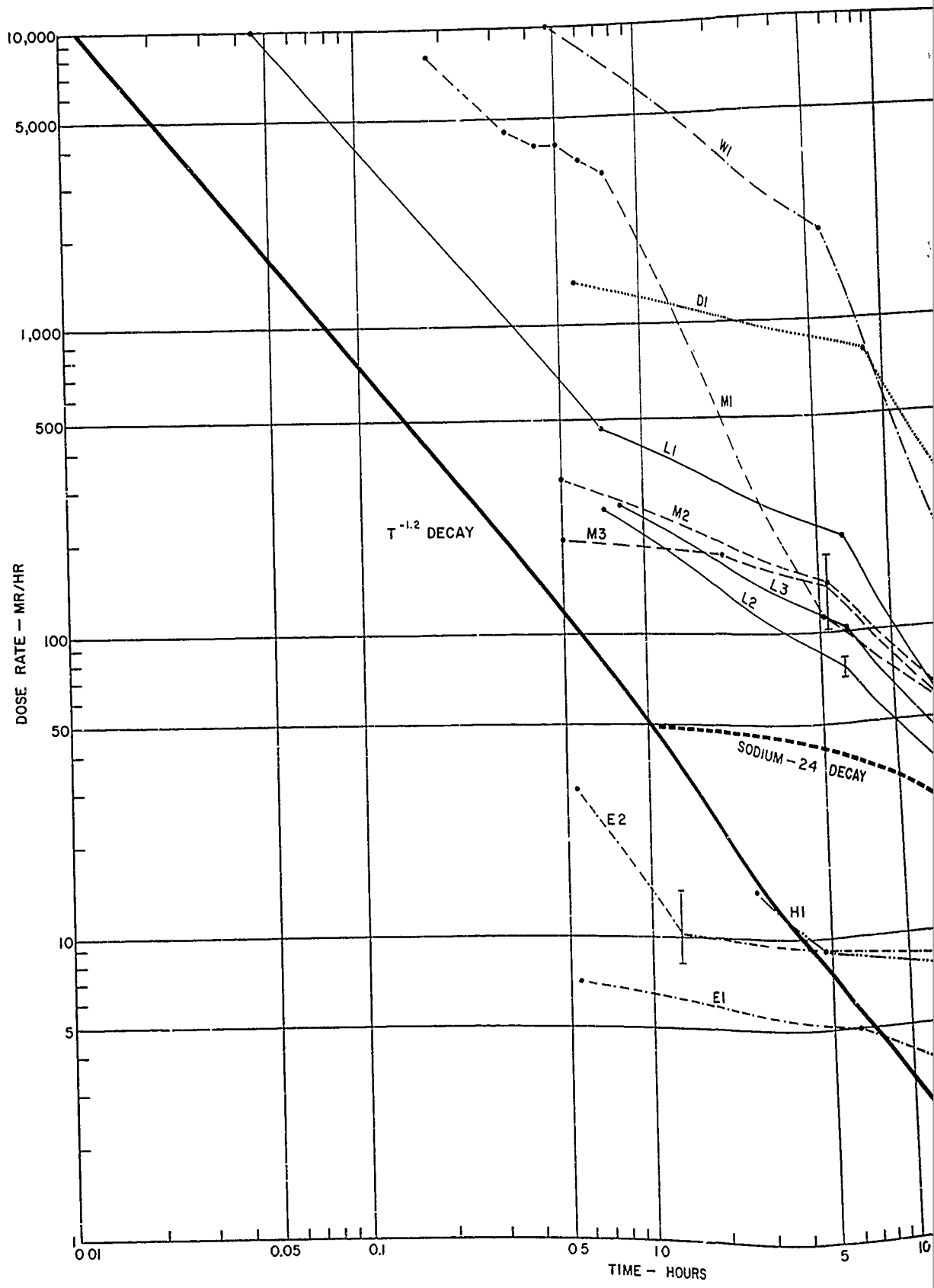
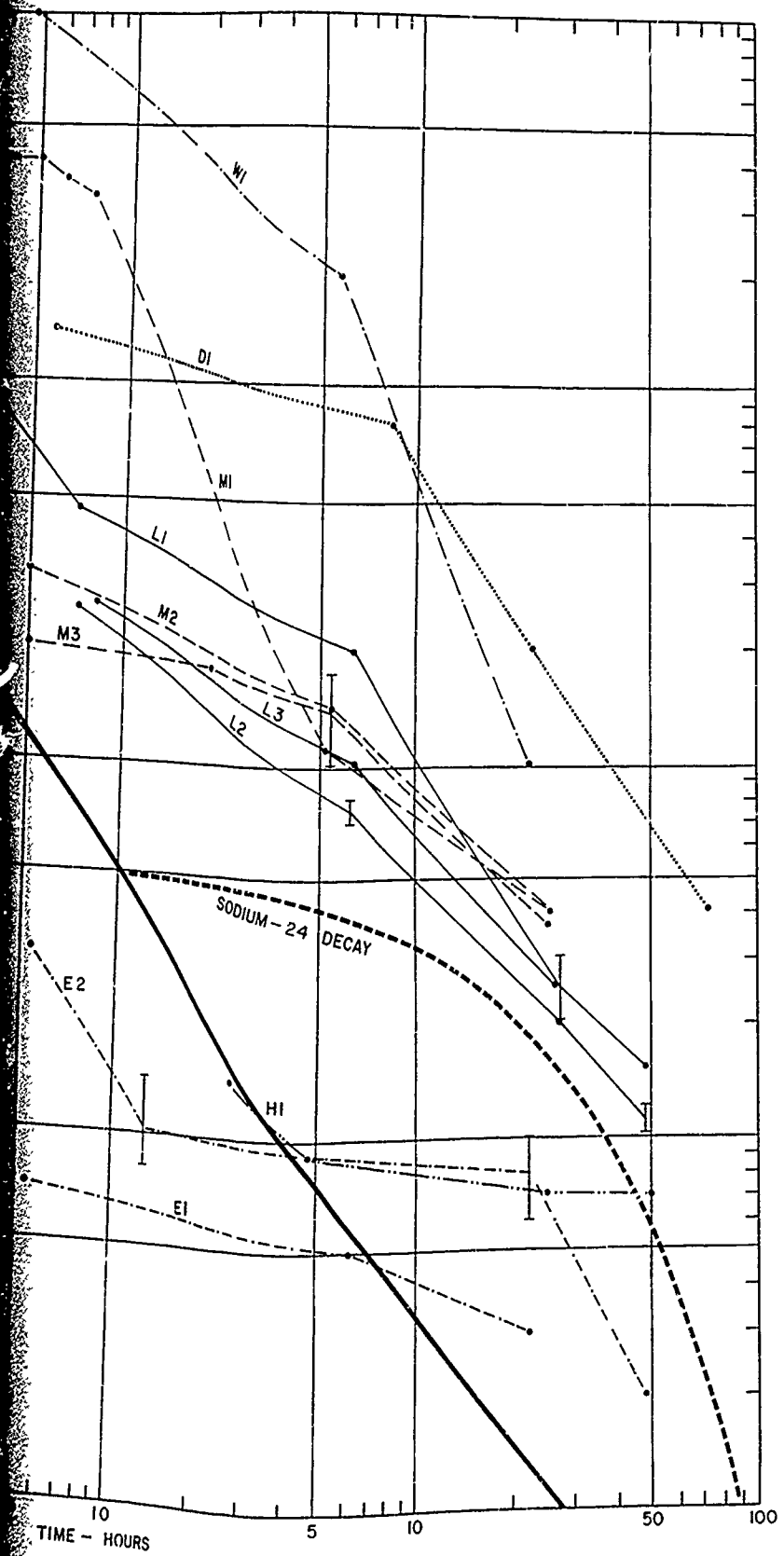


FIGURE 1 — DECAY CURVES FOR HARDTACK PHASE 2 BALLOON SHOTS FO

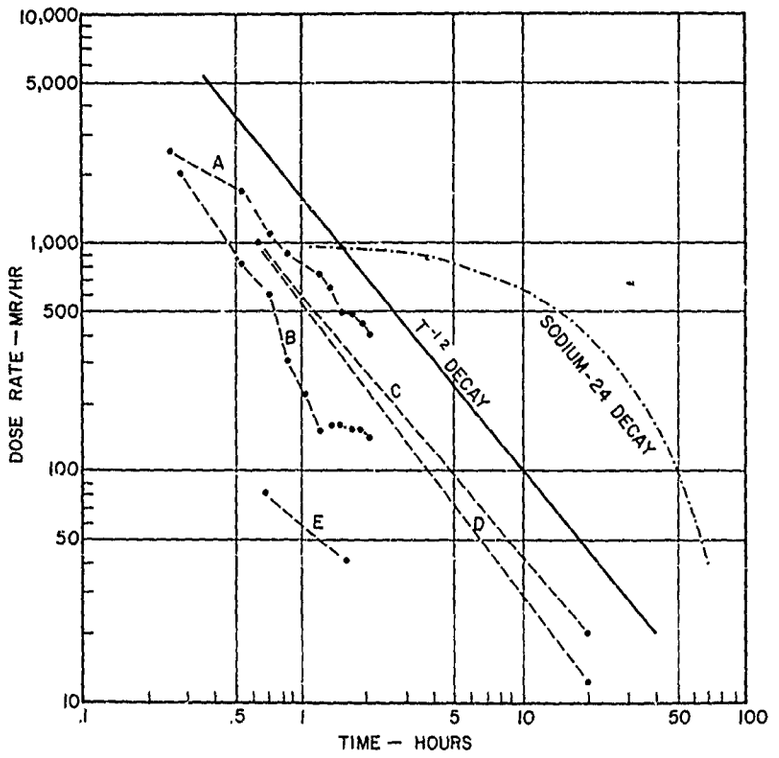


PHASE 2 BALLOON SHOTS FOR THE ON-SITE AREA.

BURSTS AND MONITORING LOCATIONS

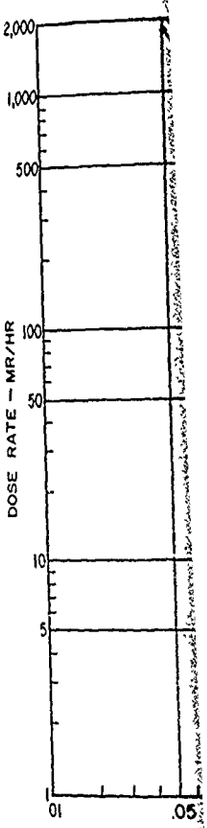
WRANGELL		
	W1	Ground zero
EDDY		
	E1	South winch site ~ 3000 ft from G.Z
	E2	T-7c station ~ 3000 ft. from G.Z
MORA		
	M1	7-800 station ~ 3000 ft. from G.Z.
	M2	Japanese houses ~ 3500 ft. from G.Z
	M3	T-7c station ~ 3000 ft from G.Z.
LEA		
	L1	7-800 station ~ 3000 ft. from G.Z.
	L2	West winch site ~ 3000 ft. from G Z.
	L3	East winch site ~ 3000 ft from G.Z.
DOÑA ANA		
	D1	7-300 station ~ G.Z.
HIDALGO		
	H1	T-7c station ~ 3000 ft. from G Z.

| Indicates the range of dose rates given



---- OTERO – 480 FT WELL

A RAM station ~ 1000 ft. from G.Z.
B Station NBS ~ 1000 ft from G.Z
C Station 3-300 ~ 1000 ft. from G Z.
D Station 3-330 ~ 1300 ft. from G Z
E Station 7-300 ~ 2.5 miles from G Z.



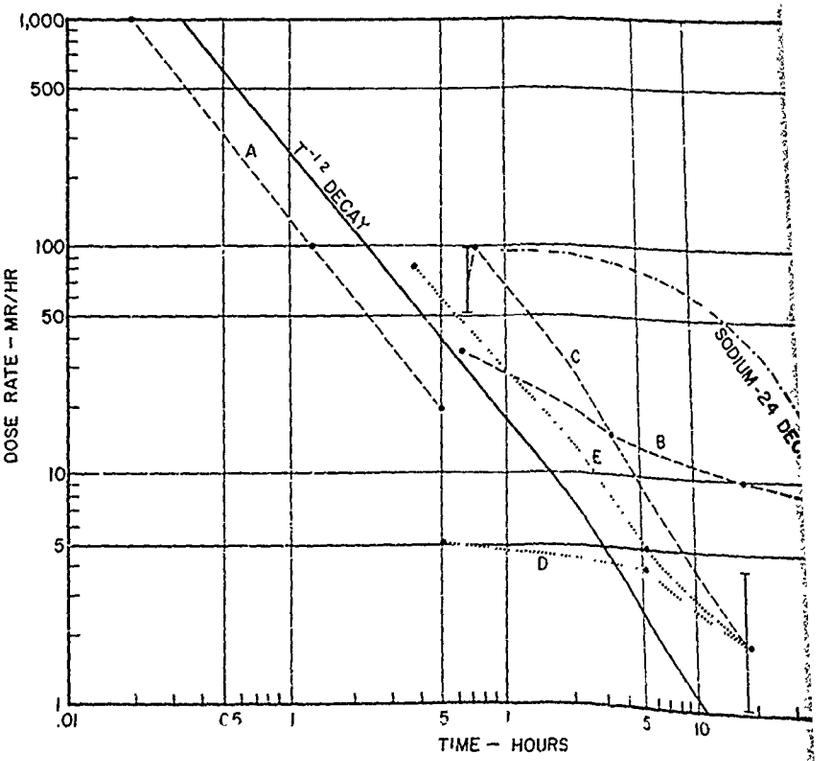
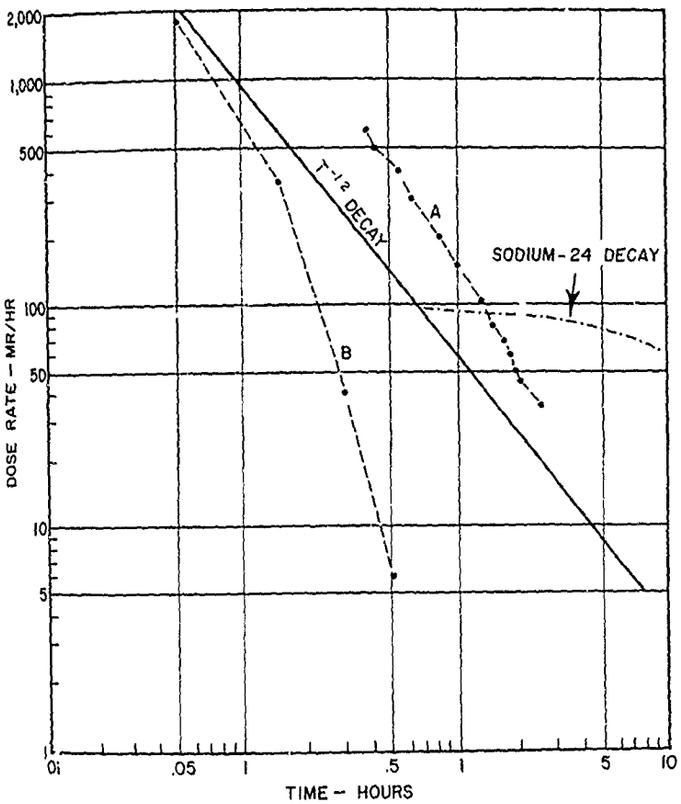


FIGURE 2 – DECAY CURVES FOR HARDTACK PHASE 2 WELL SHOTS FOR T

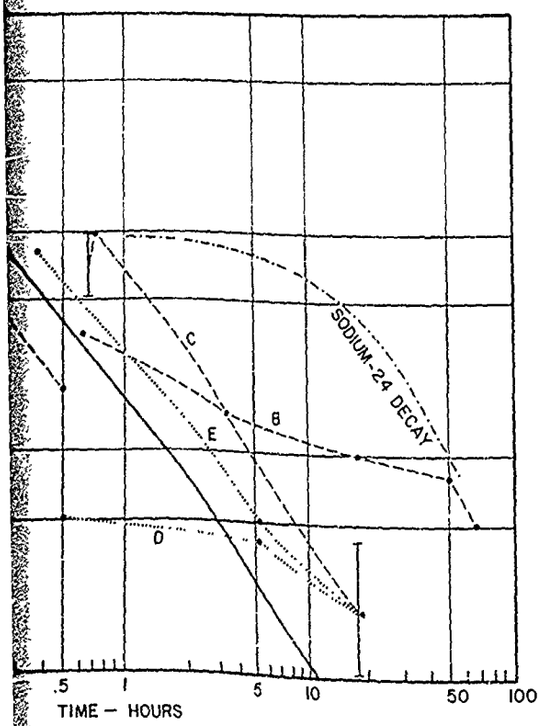
2.

WELL
ft. from G Z
ft. from G Z.
00 ft. from G Z.
00 ft. from G Z.
5 miles from G.Z.



---- COLFAX – 350 FT. WELL

A RAM station ~ 300 ft. from G.Z.
B Station 3-300 ~ 1000 ft. from G.Z.



– – – BERNALILLO – 456 FT. WELL

A RAM station ~ 800 ft. from G Z.
B Station U3r ~ 800 ft. from G.Z
C Station U3k ~ 500 ft. from G.Z.

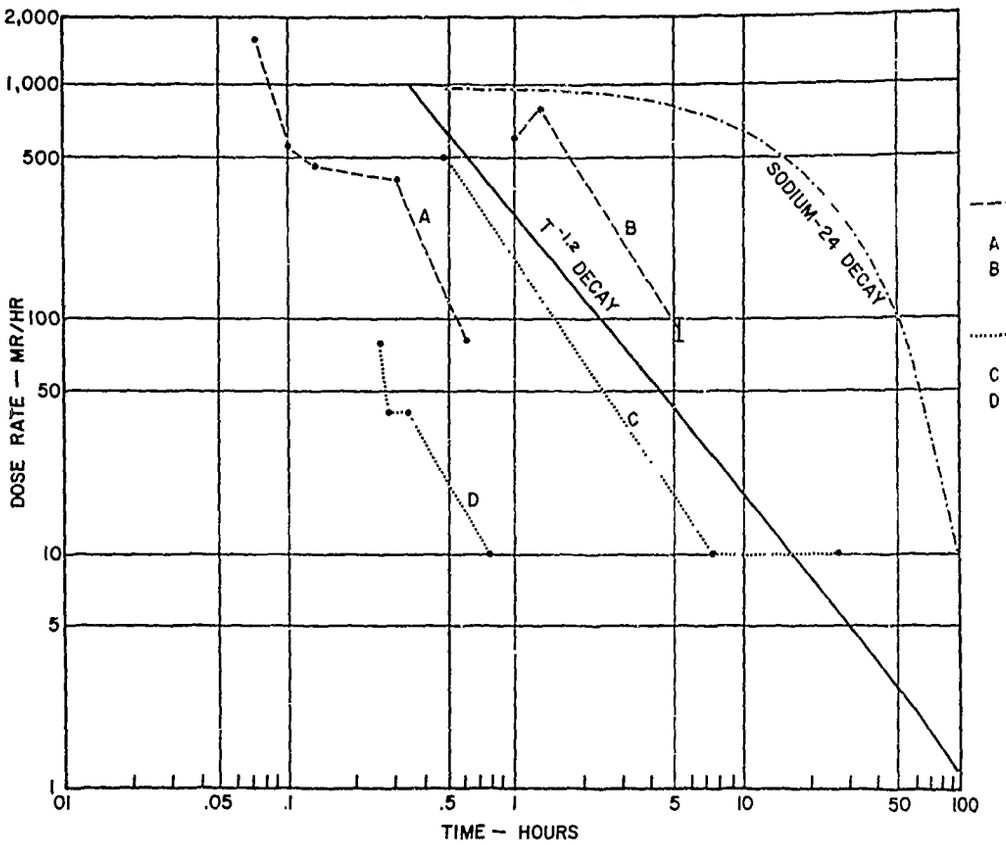
..... LUNA – 500 FT. WELL

D Station U3r ~ 1000 ft. from G.Z.
E Station U3k ~ 200 ft. from G Z.

I indicates the *range* of dose rates given

PHASE 2 WELL SHOTS FOR THE ON-SITE AREA.

2.



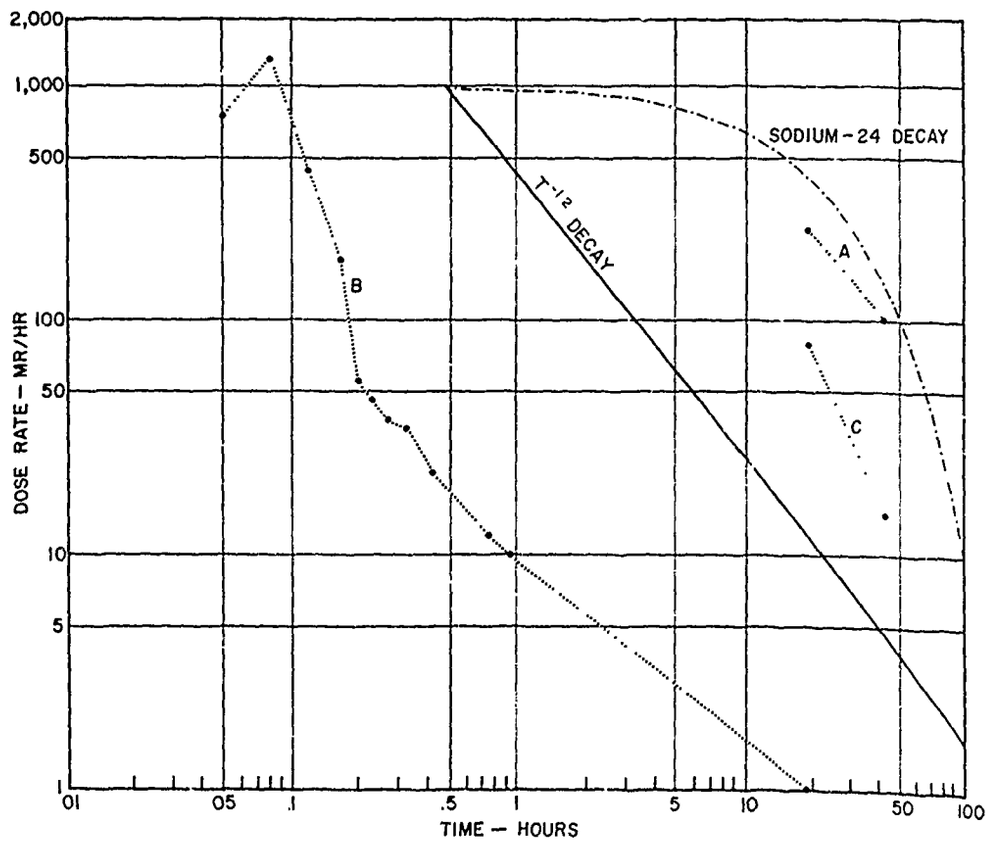


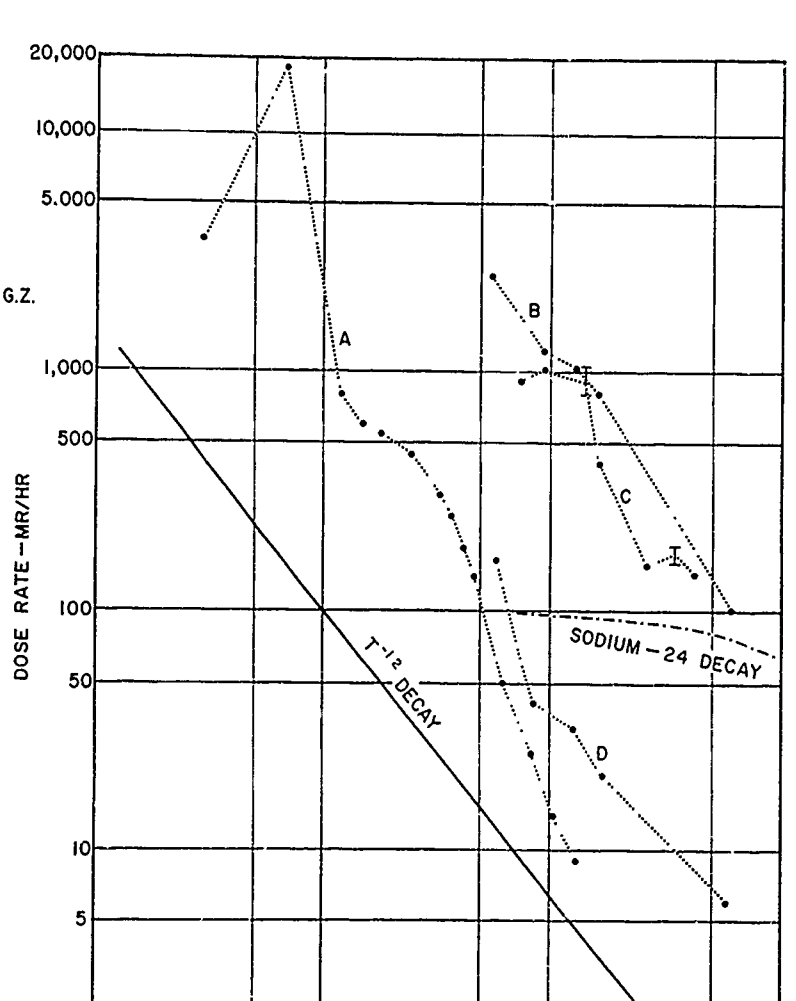
FIGURE — 3 DECAY CURVES FOR HARDTACK PHASE 2 TOWER AND GRAVEL G

---- RIO ARRIBA — 72 1/2 FT. TOWER

A Station 3-300 ~ 3000 ft. from G.Z
B East winch site ~ 3 5 miles from G Z

..... HUMBOLDT — 25 FT. TOWER

C Station 3-330 ~ 1200 ft. from G Z.
D Control point building 2 ~ 8 miles from G.Z.



..... VESTA — GRAVEL GERTIE

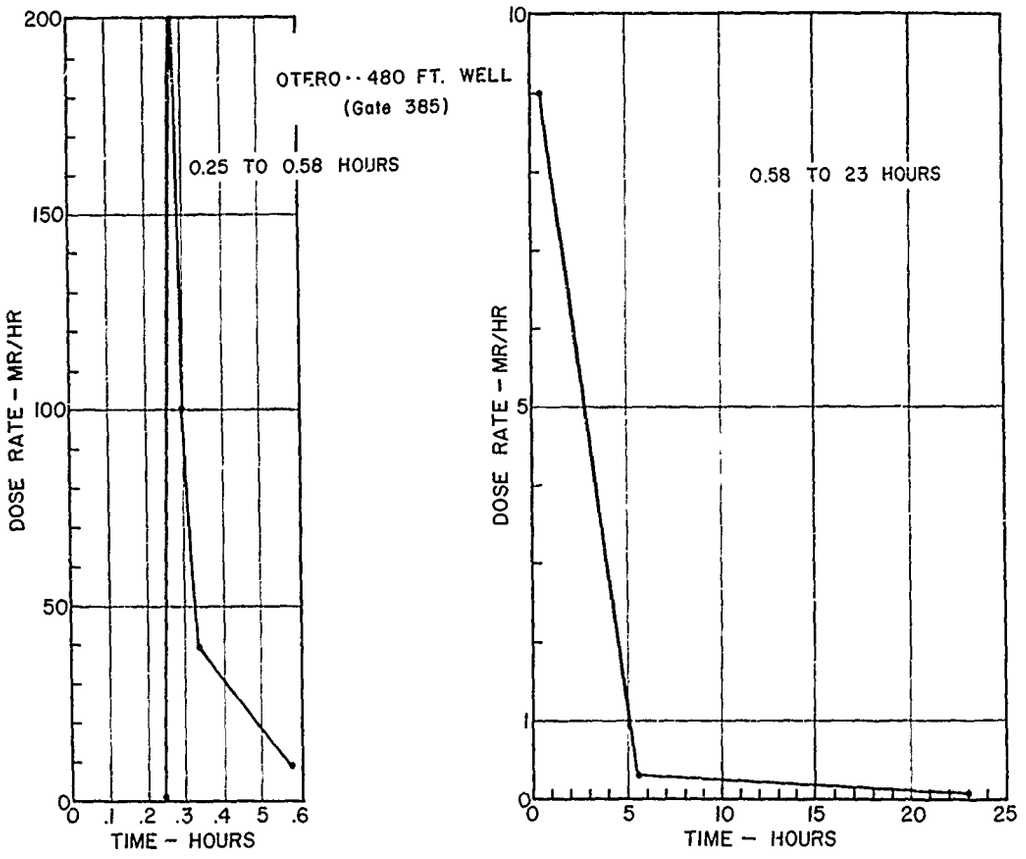
A East winch site ~ 0.5 miles from G Z.
B West winch site ~ 1 1 miles from G Z
C North winch site ~ 1 5 miles from G Z.

..... QUAY — 100 FT. TOWER

A Station 7-800 ~ 6000 ft from G.Z.
B Intersection of area 3 Main Access Road and Mercury Highway ~ 19,000 ft from G.Z.
C BJY ~ 14,000 ft. from G Z.
D Intersection of Road "G" and Mercury Highway ~ 30,000 ft from G Z.

I Indicates the range of dose rates given

SE 2 TOWER AND GRAVEL GERTIE SHOTS FOR THE ON-SITE AREA.



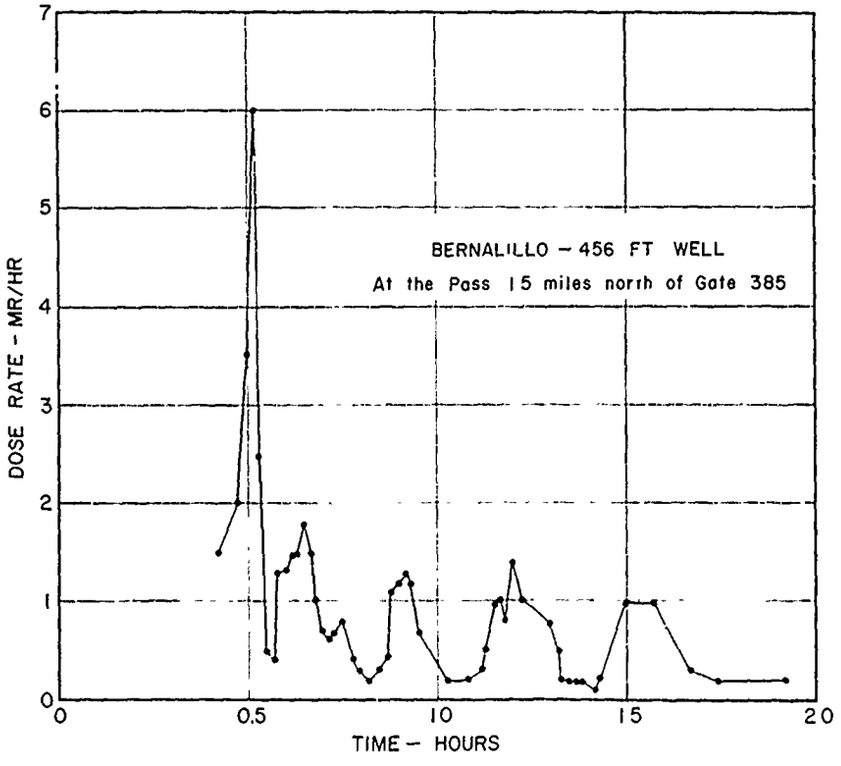
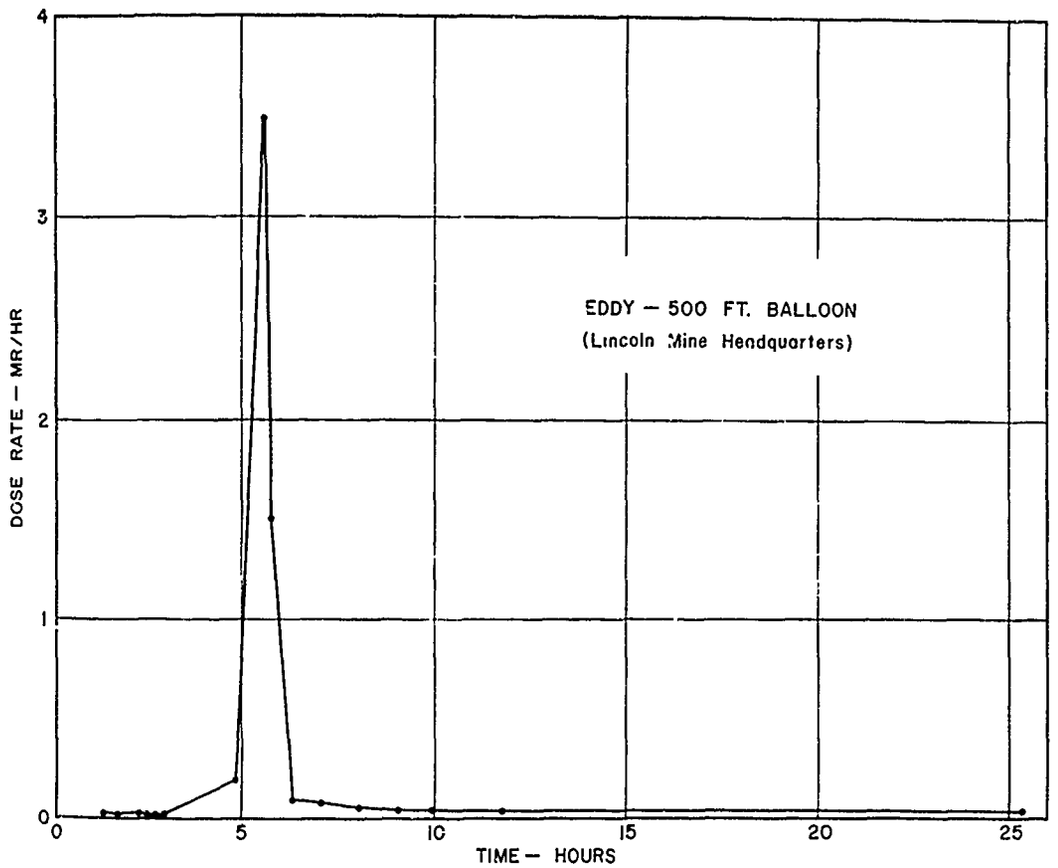
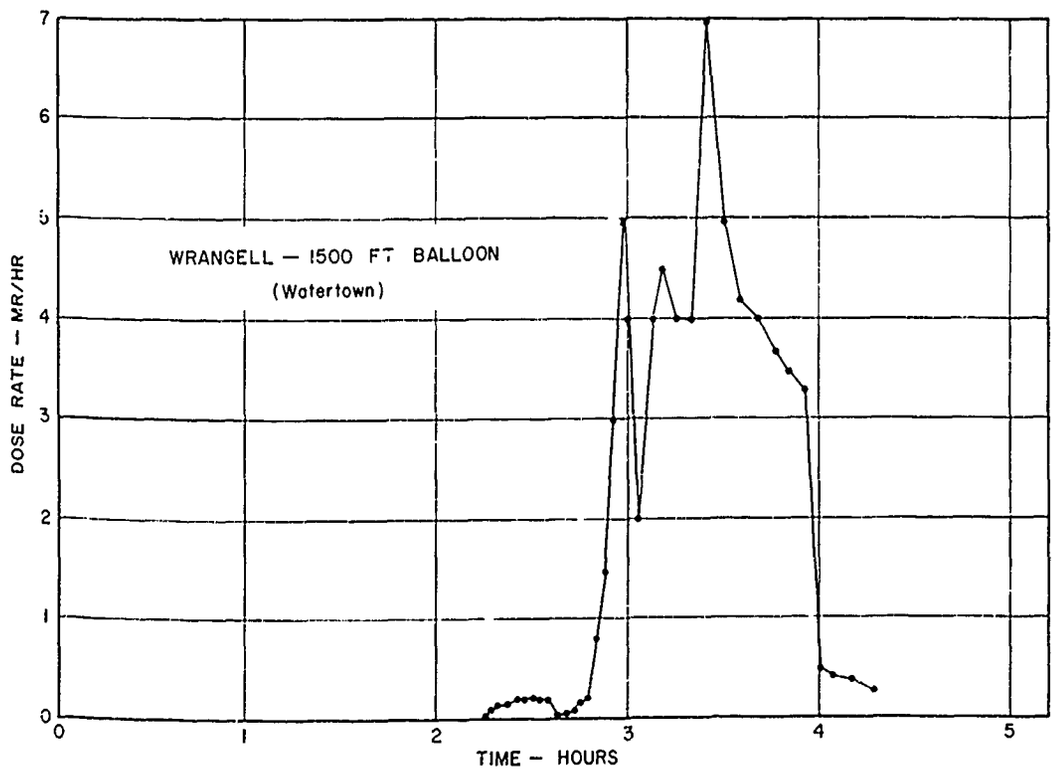


FIGURE 4 - EARLY DOSE-RATE MEASUREMENTS, SHOWING EFFECTS OF PASSING





ECTS OF PASSING RADIOACTIVE CLOUDS (WELL AND BALLOON BURSTS).

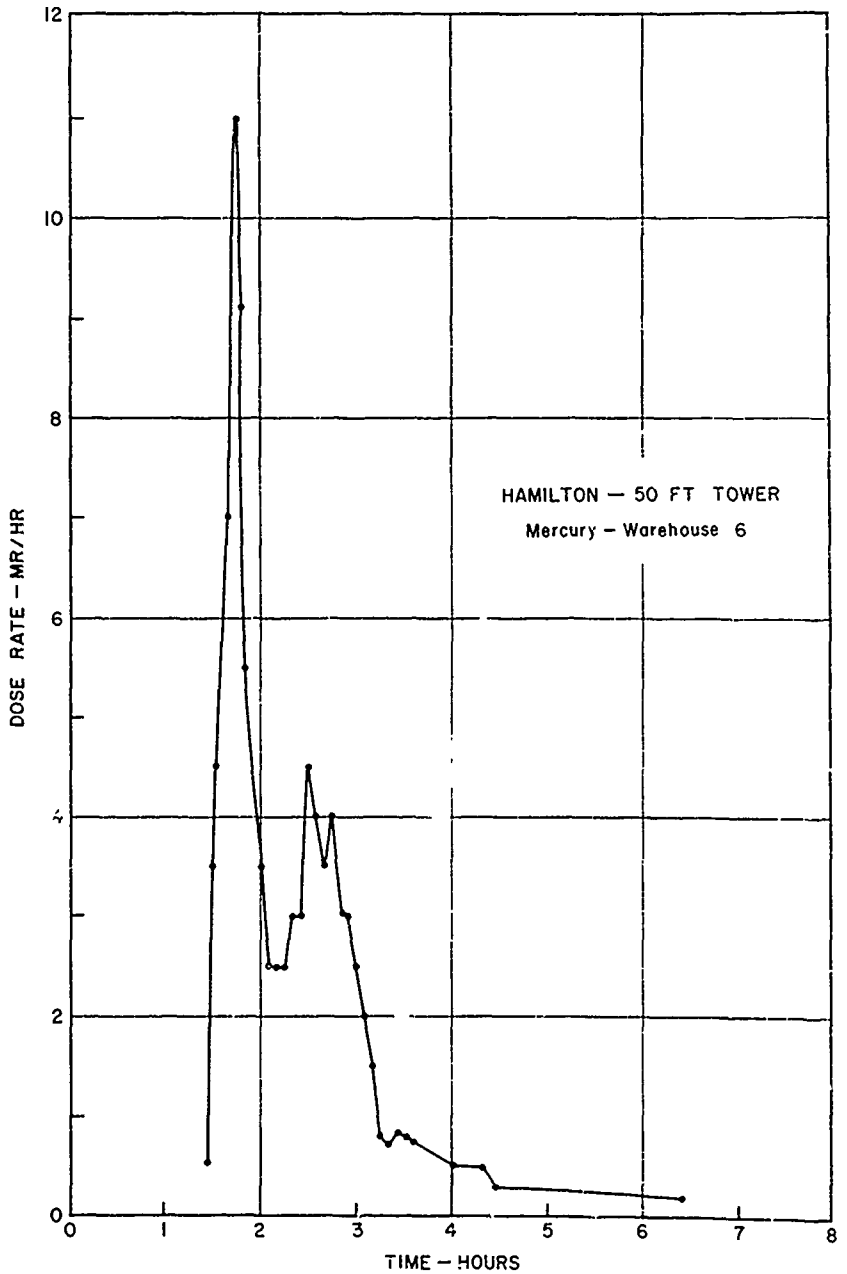
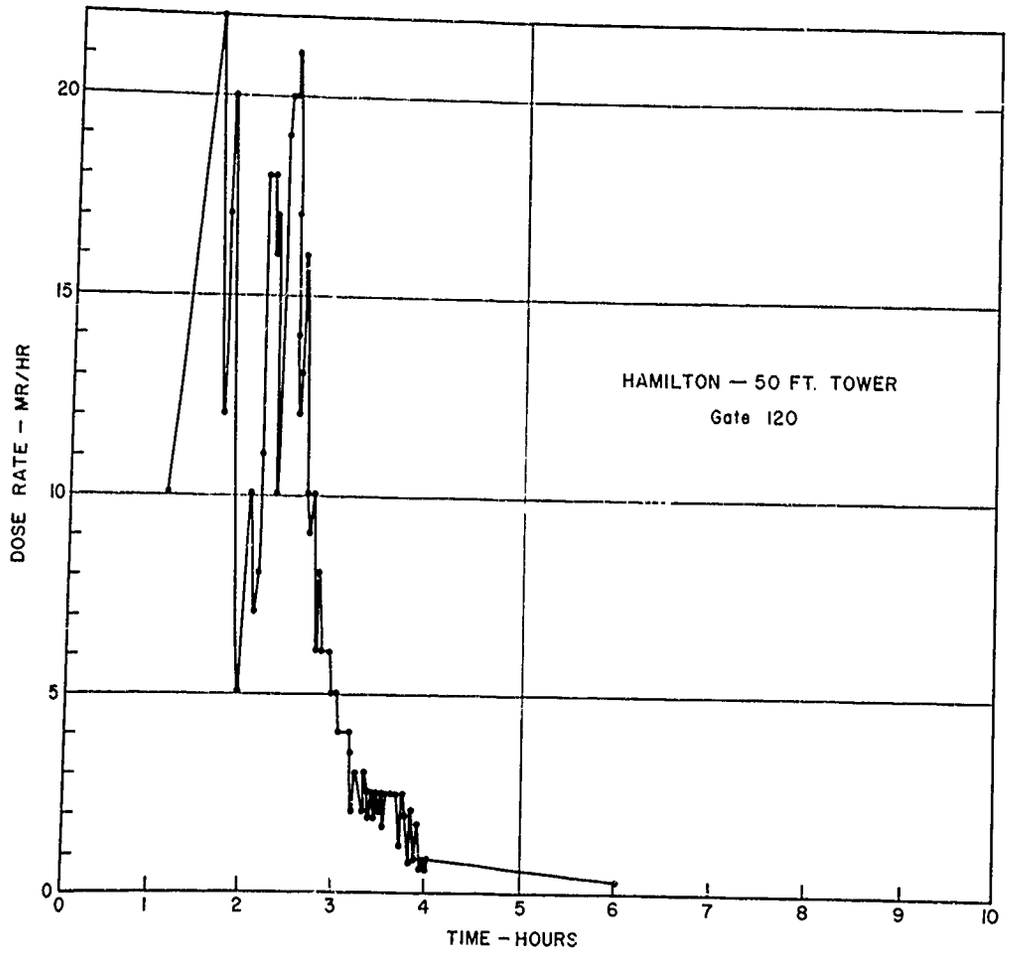
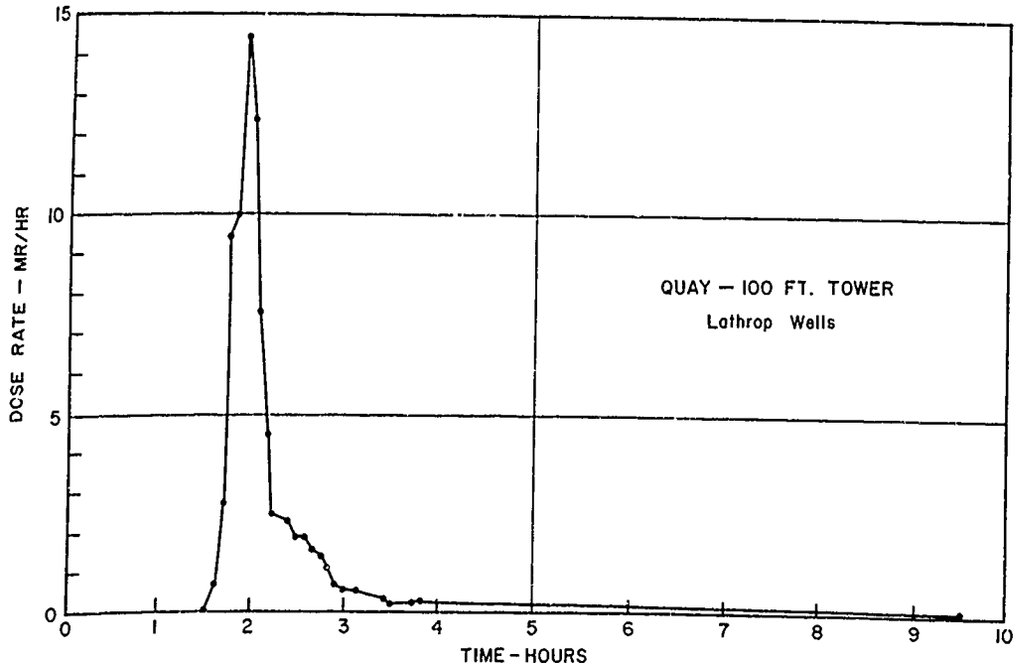


FIGURE 5 — EARLY DOSE-RATE MEASUREMENTS, SHOWING EFFE



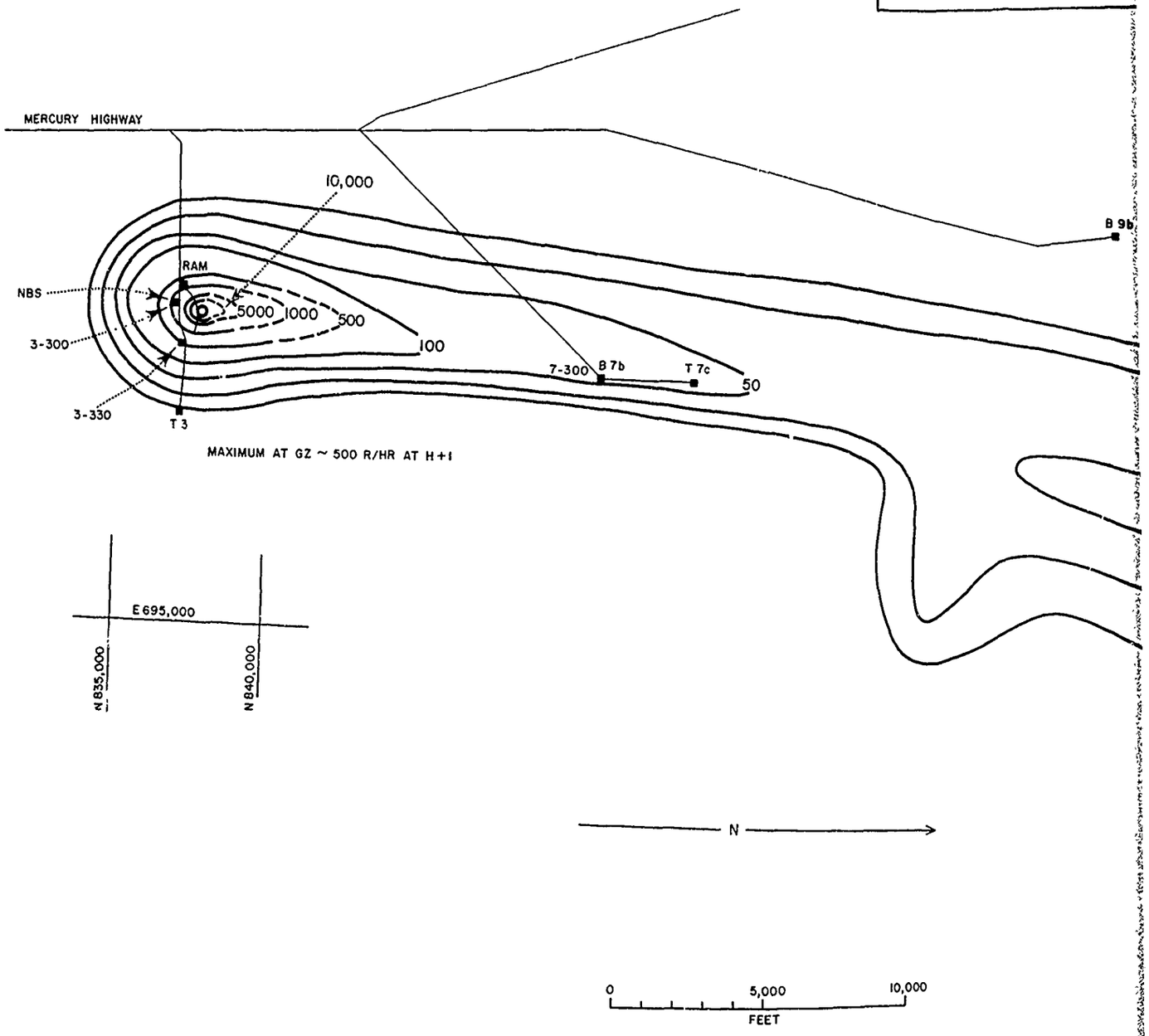


SHOWING EFFECTS OF PASSING RADIOACTIVE CLOUDS (TOWER BURSTS).

2,

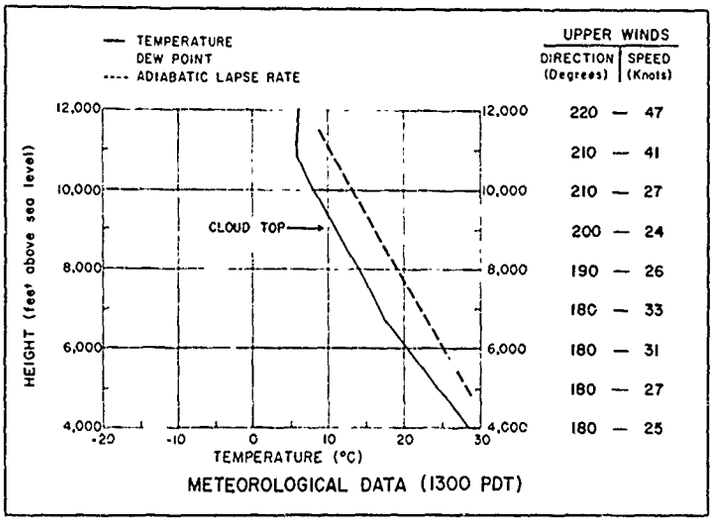
REMARKS

The pattern was interpolated east of Gate 388
proximation for this area in the absence of
of the on-site pattern was well documented, and

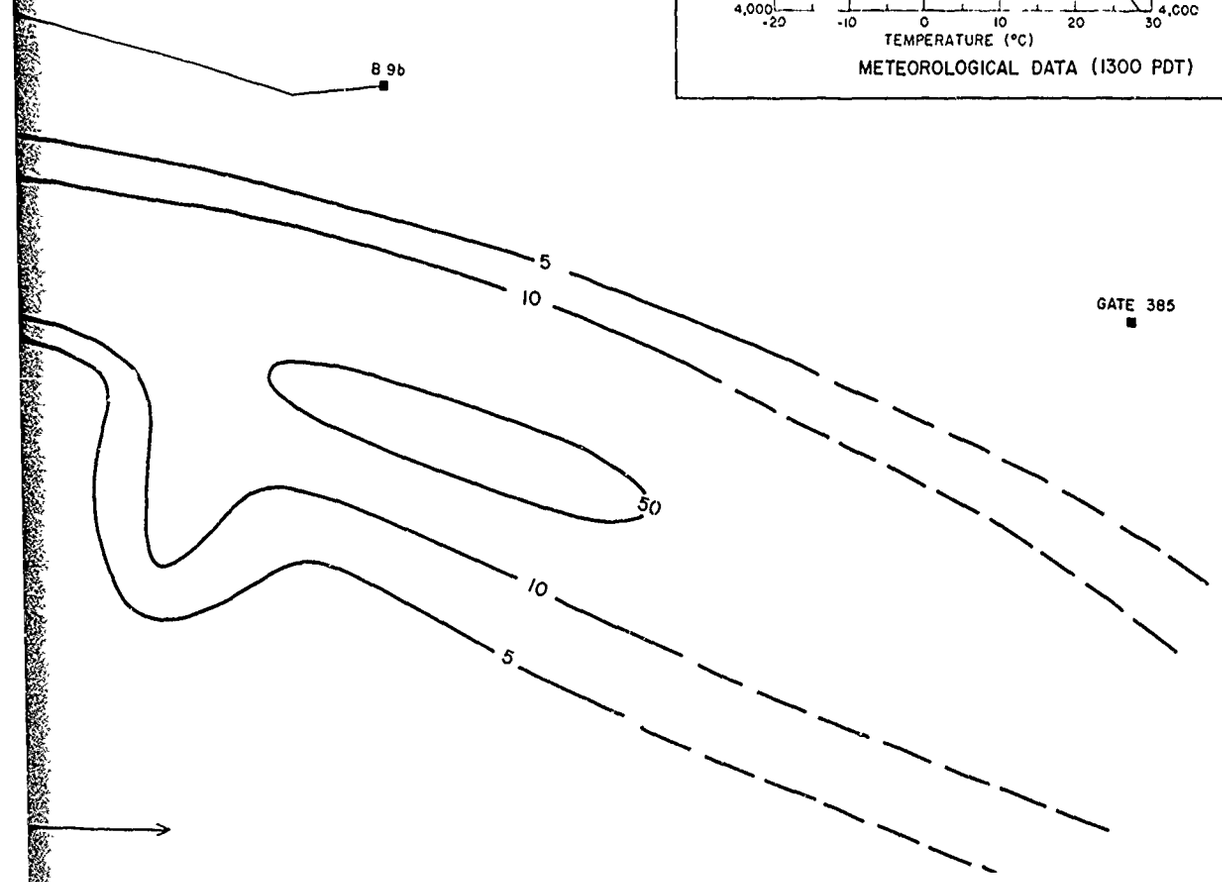


REMARKS

The pattern was interpolated east of Gate 385 and can only be an approximation for this area in the absence of measurements. The rest of the on-site pattern was well documented, and should be fairly reliable.



METEOROLOGICAL DATA (1300 PDT)



OTERO (480 FT WELL) MAP A
H-HR = 1300 PDT 12 SEPT. 1958
CLOUD TOP - 9000 FT. M S L

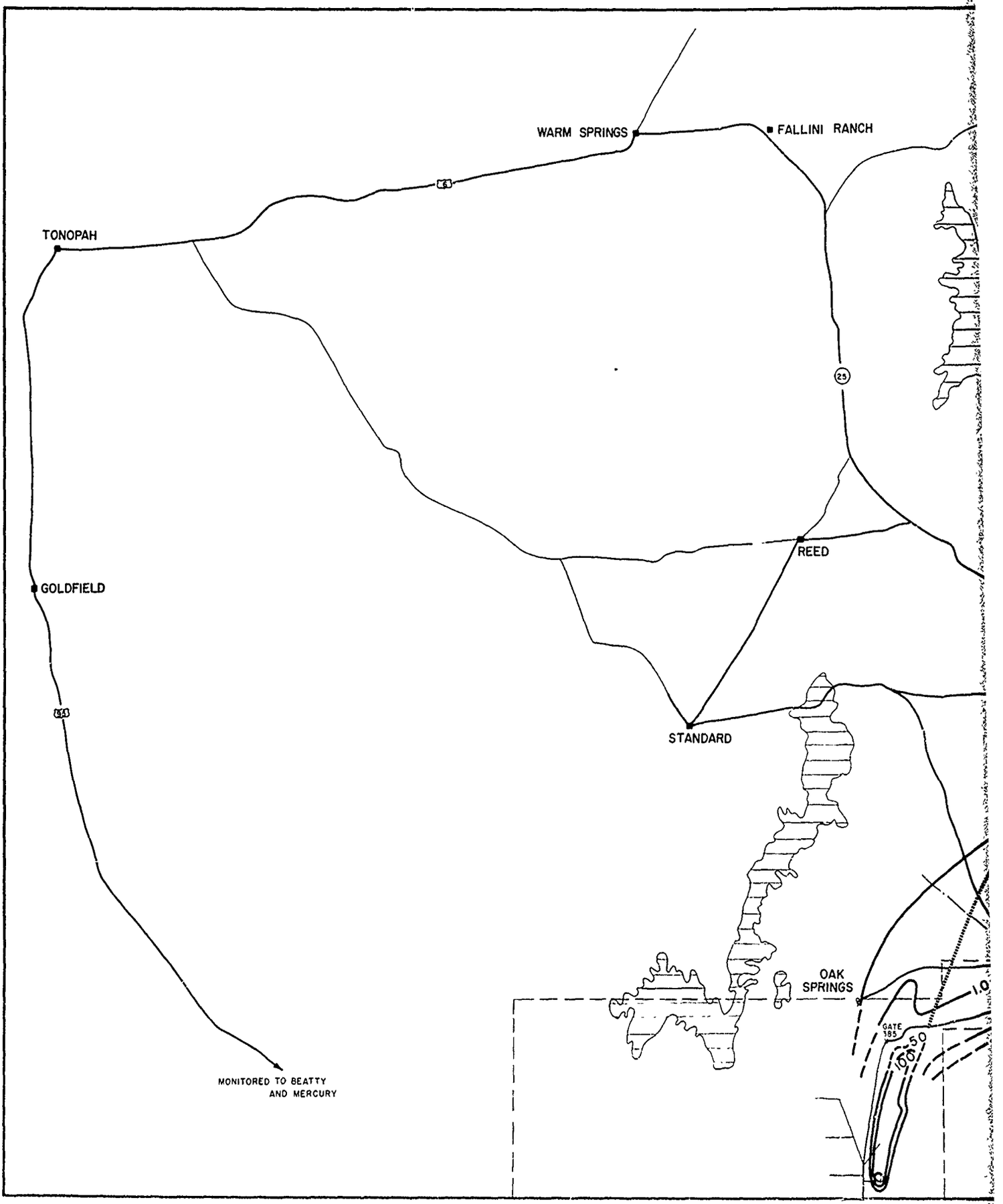
RESIDUAL GAMMA RADIATION
MR/HR AT H + 1 HOUR

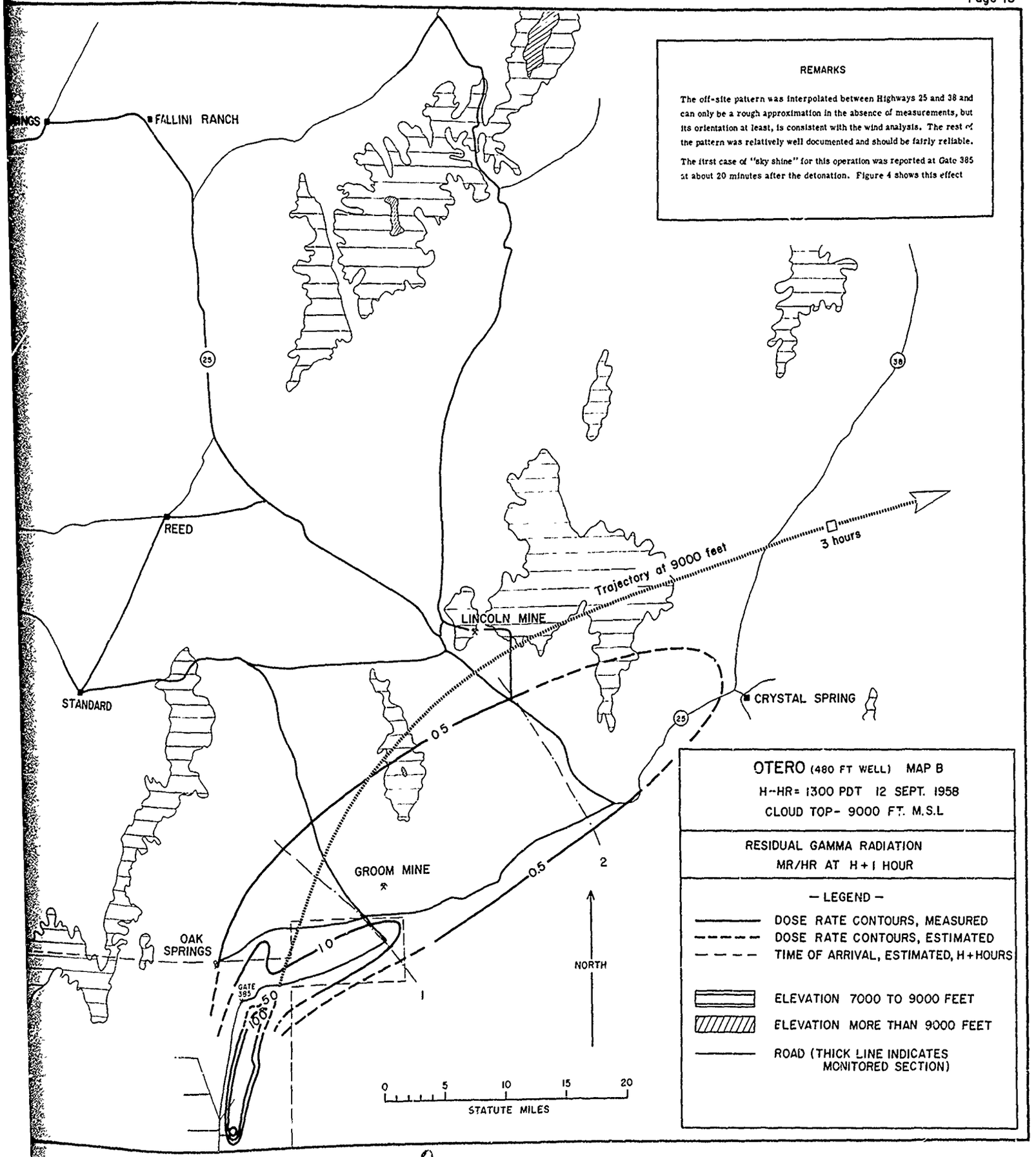
— LEGEND —

——— DOSE RATE CONTOURS, MEASURED

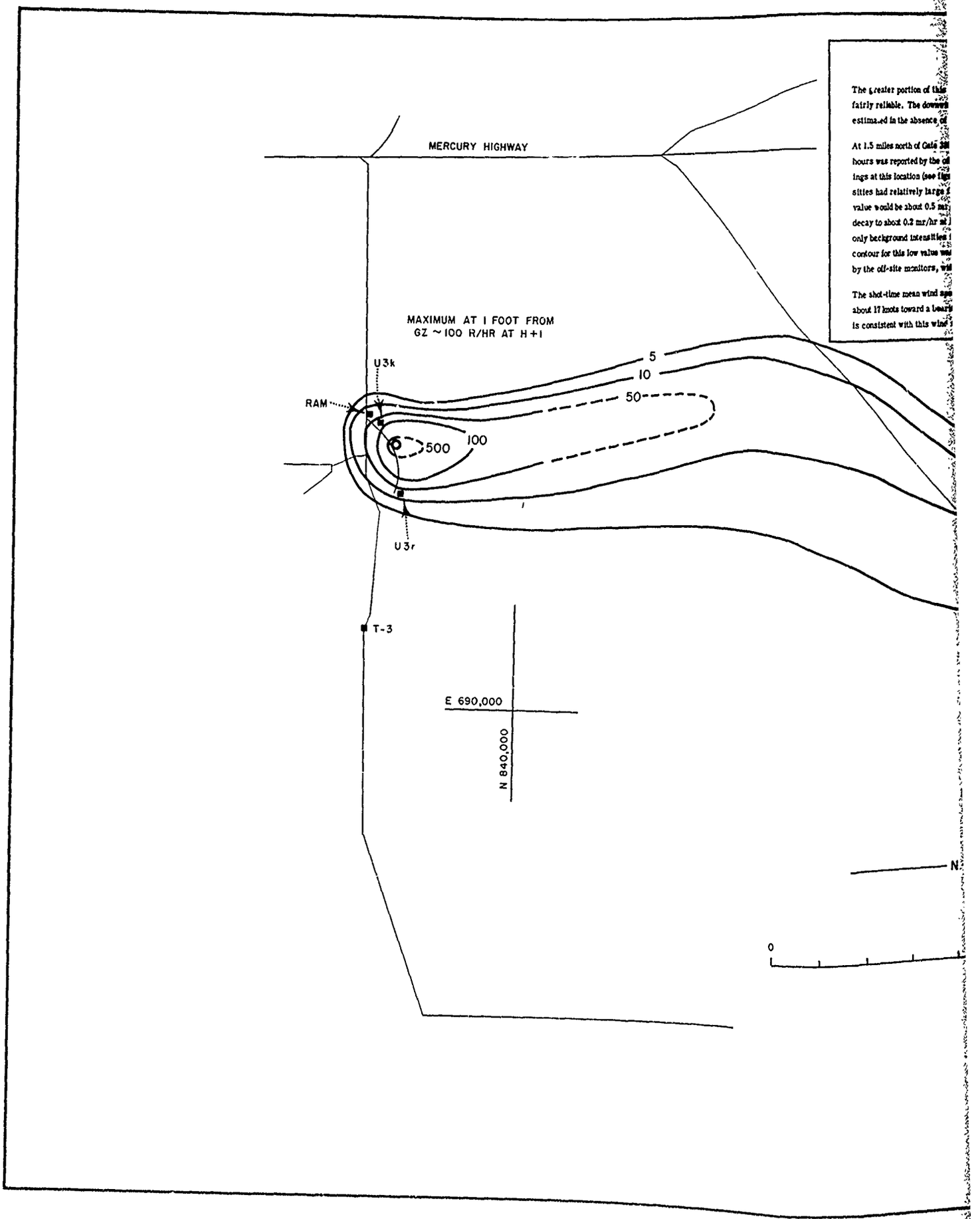
– – – – DOSE RATE CONTOURS, ESTIMATED

2.


WARM SPRINGS
FALLINI RANCH
TONOPAH
95
25
REED
GOLDFIELD
95
STANDARD
OAK
SPRINGS
1.0
GATE
185
MONITORED TO BEATTY
AND MERCURY


REMARKS
The off-site pattern was interpolated between Highways 25 and 38 and can only be a rough approximation in the absence of measurements, but its orientation at least, is consistent with the wind analysis. The rest of the pattern was relatively well documented and should be fairly reliable.
The first case of "sky shine" for this operation was reported at Gate 385 at about 20 minutes after the detonation. Figure 4 shows this effect
FALLINI RANCH
REED
STANDARD
LINCOLN MINE
GROOM MINE
OAK SPRINGS
CRYSTAL SPRING
Trajectory at 9000 feet
3 hours
0.5
2
1
10
50
GATE 385
NORTH
0 5 10 15 20
STATUTE MILES
OTERO (480 FT WELL) MAP B
H-HR= 1300 PDT 12 SEPT. 1958
CLOUD TOP- 9000 FT. M.S.L
RESIDUAL GAMMA RADIATION
MR/HR AT H+1 HOUR
— LEGEND —
DOSE RATE CONTOURS, MEASURED
DOSE RATE CONTOURS, ESTIMATED
TIME OF ARRIVAL, ESTIMATED, H+HOURS
ELEVATION 7000 TO 9000 FEET
ELEVATION MORE THAN 9000 FEET
ROAD (THICK LINE INDICATES MONITORED SECTION)

2.



The greater portion of this
fairly reliable. The downwa
estimated in the absence of

At 1.5 miles north of Gate 30
hours was reported by the of
ings at this location (see fig
sities had relatively large f
value would be about 0.5 mr
decay to about 0.2 mr/hr at
only background intensities
contour for this low value wo
by the off-site monitors, wh

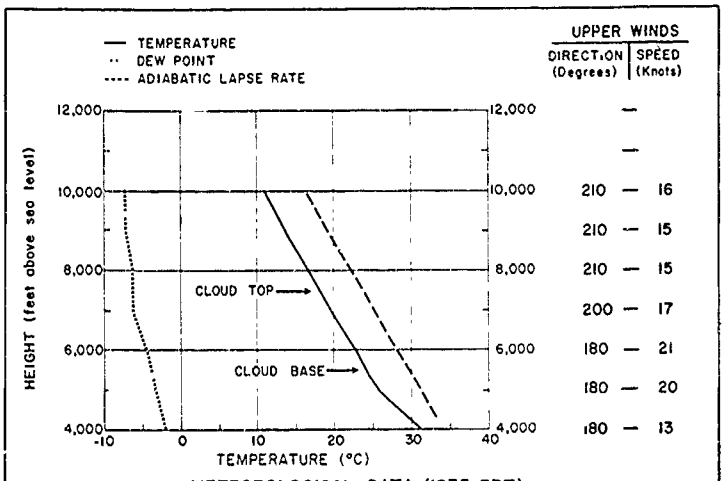
The shot-time mean wind spe
about 17 knots toward a bearin
is consistent with this wind

REMARKS

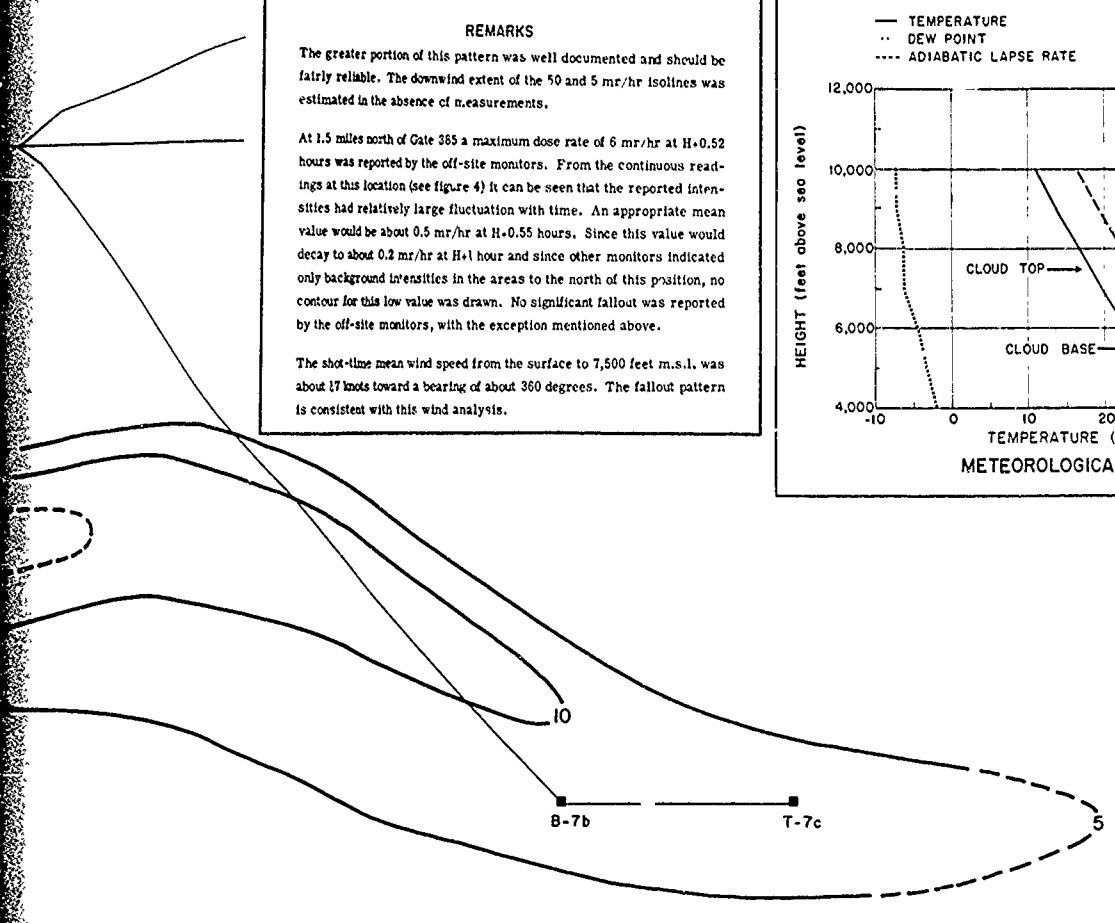
The greater portion of this pattern was well documented and should be fairly reliable. The downwind extent of the 50 and 5 mr/hr isolines was estimated in the absence of measurements.

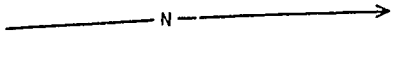
At 1.5 miles north of Gate 385 a maximum dose rate of 6 mr/hr at H+0.52 hours was reported by the off-site monitors. From the continuous readings at this location (see figure 4) it can be seen that the reported intensities had relatively large fluctuation with time. An appropriate mean value would be about 0.5 mr/hr at H+0.55 hours. Since this value would decay to about 0.2 mr/hr at H+1 hour and since other monitors indicated only background intensities in the areas to the north of this position, no contour for this low value was drawn. No significant fallout was reported by the off-site monitors, with the exception mentioned above.

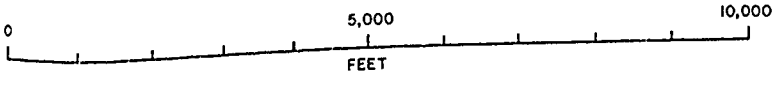
The shot-time mean wind speed from the surface to 7,500 feet m.s.l. was about 17 knots toward a bearing of about 360 degrees. The fallout pattern is consistent with this wind analysis.



METEOROLOGICAL DATA (1235 PDT)







BERNALILLO (456 FT WELL) MAP A

H-HR = 1230 PDT 17 SEPT 1958

CLOUD TOP - 7500 FT M S L

RESIDUAL GAMMA RADIATION
MR/HR AT H + 1 HOUR

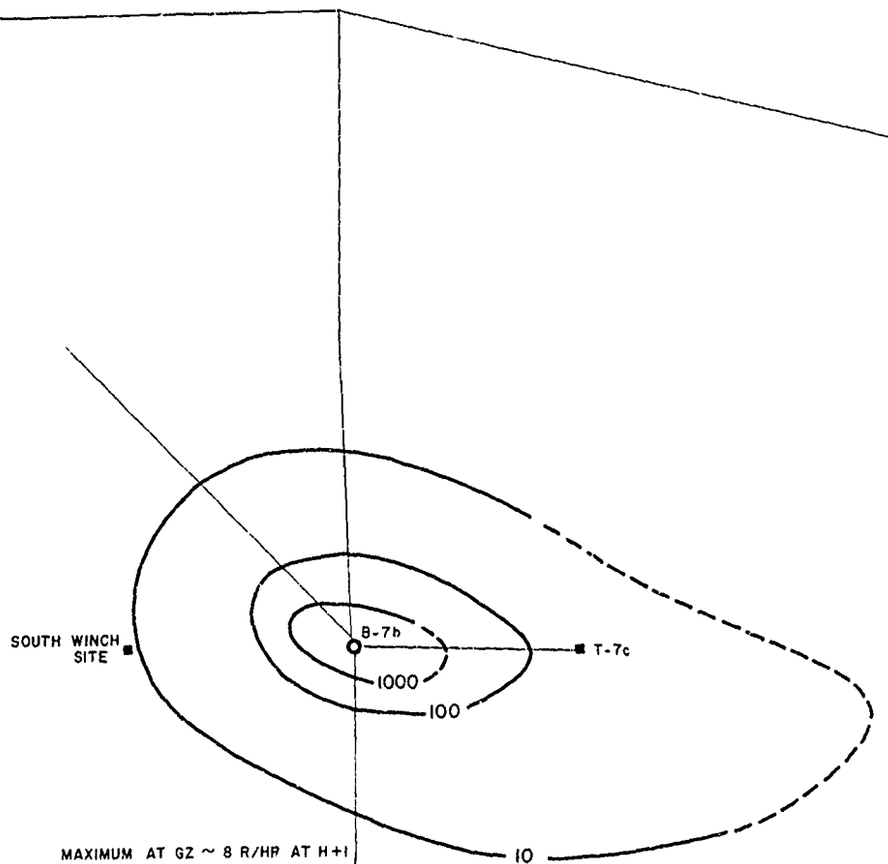
- LEGEND -

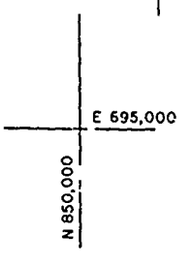
——— DOSE RATE CONTOURS, MEASURED

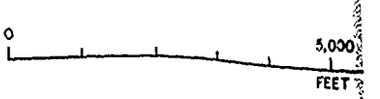
– – – – DOSE RATE CONTOURS, ESTIMATED

REMARKS

The on-site monitoring for this event was adequate. [illegible]
surveys, the on-site group made a special survey north
and the surrounding areas. It is difficult to say with ac
was being monitored during this special survey was f
sidual gamma activity, or a combination of both since o
taken at each position. Therefore, the decay rate co
for this area. To add to this confusion, residual acti
detonations was known to exist in this general area a
percent of what was observed. Since the observed re
average about 0.4 mr hr at H + 10 hours, this would
to the total close-in fallout fraction. No pattern was
on either the on-site or off site map

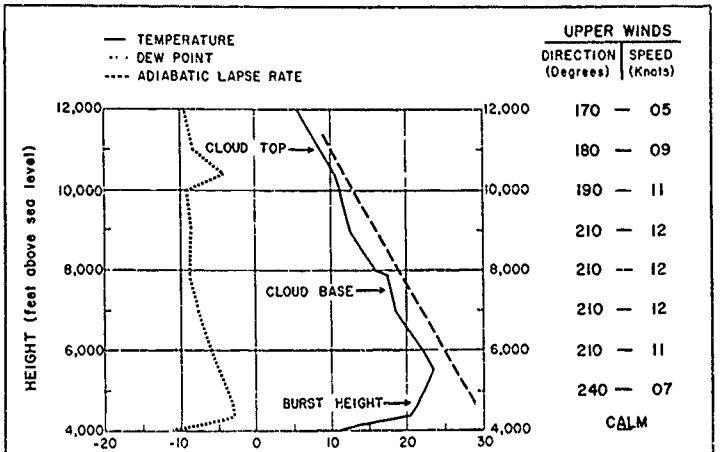






REMARKS

The on-site monitoring for this event was adequate. Besides their regular surveys, the on-site group made a special survey north of T-7c to Gate 385 and the surrounding areas. It is difficult to say with any confidence if what was being monitored during this special survey was induced activity, residual gamma activity, or a combination of both since only one reading was taken at each position. Therefore, the decay rate could not be estimated for this area. To add to this confusion, residual activity from Plumbbob detonations was known to exist in this general area and to be at least 30 percent of what was observed. Since the observed readings were on the average about 0.4 mr/hr at H + 10 hours, this would not add significantly to the total close-in fallout fraction. No pattern was drawn for this area on either the on-site or off-site map.



METEOROLOGICAL DATA (0700 PDT)

B-9b

N

0 5,000 10,000

FEET

EDDY (500 FT BALLOON) MAP A

H-HR = 0700 PDT 19 SEPT 1958

CLOUD TOP - 11,000 FT MSL

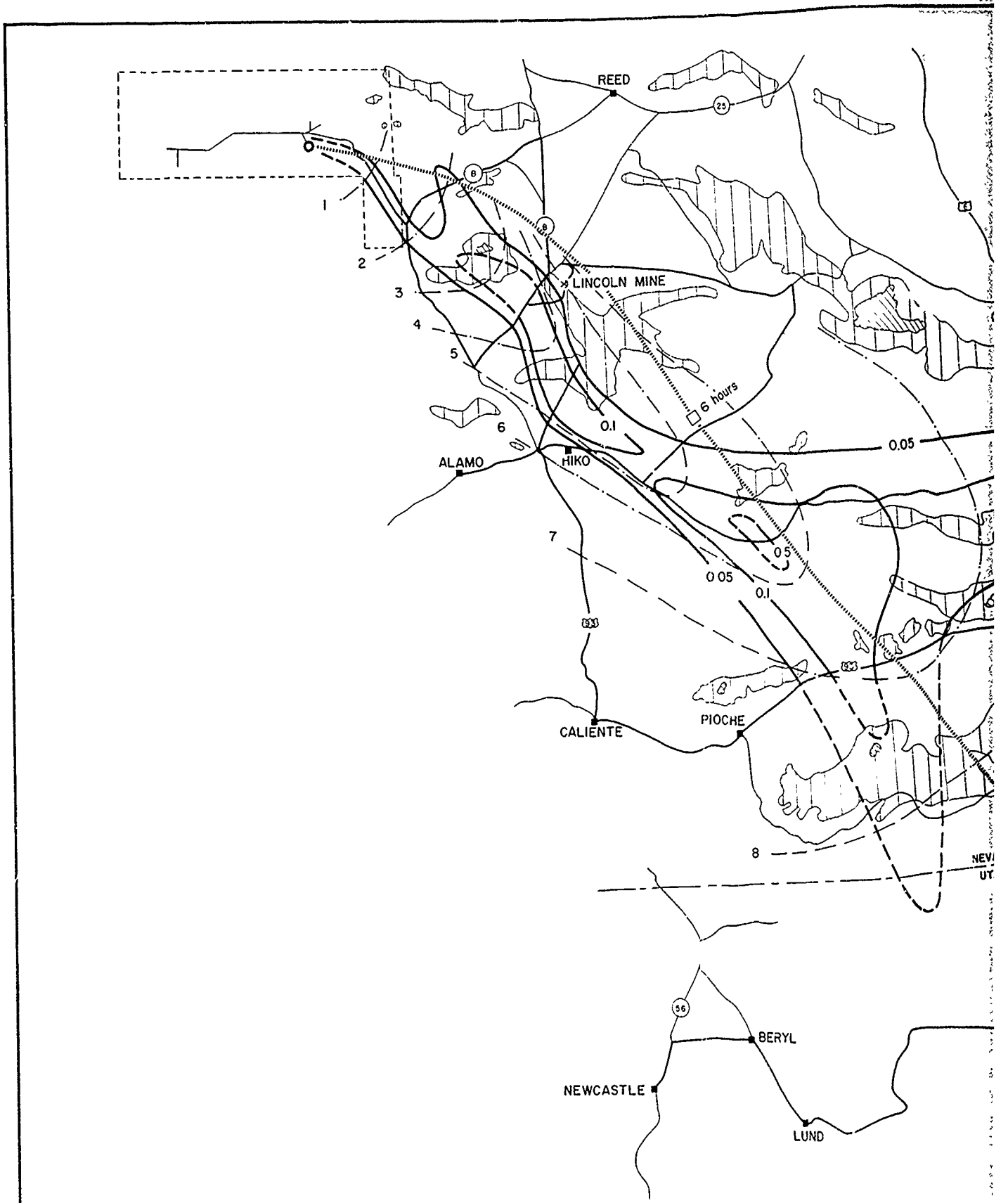
RESIDUAL GAMMA RADIATION

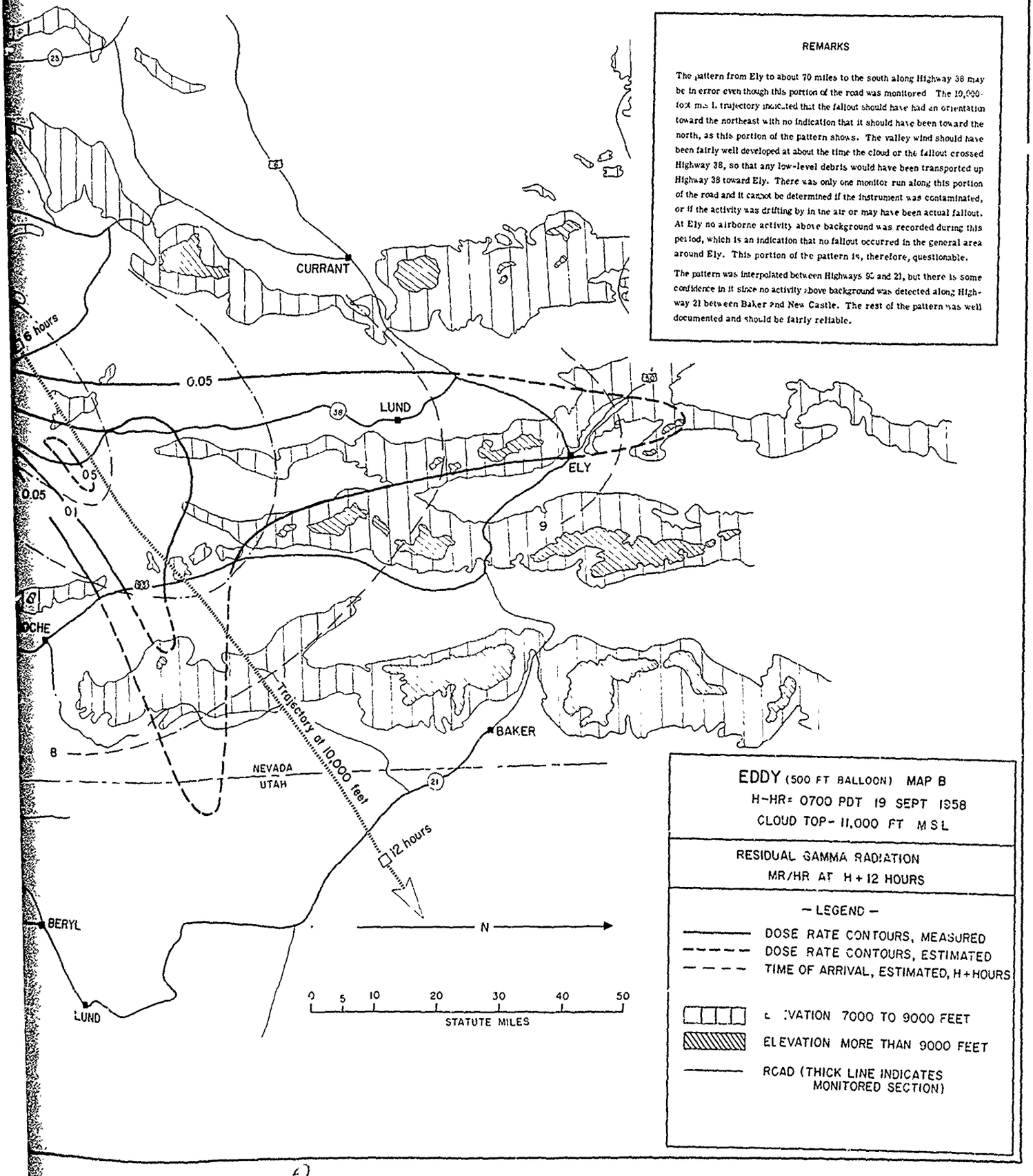
MR/HR AT H+1 HOUR

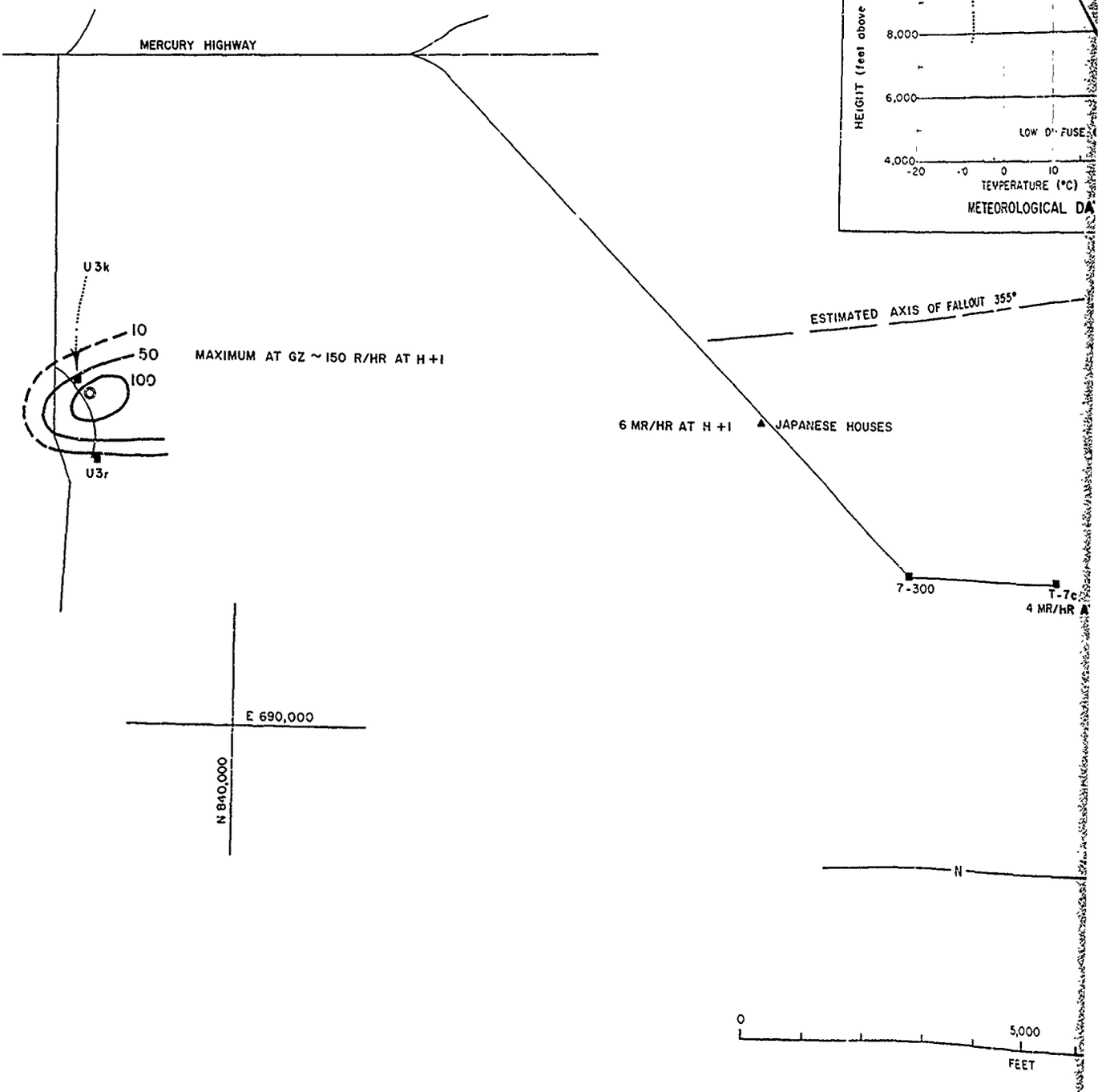
- LEGEND -

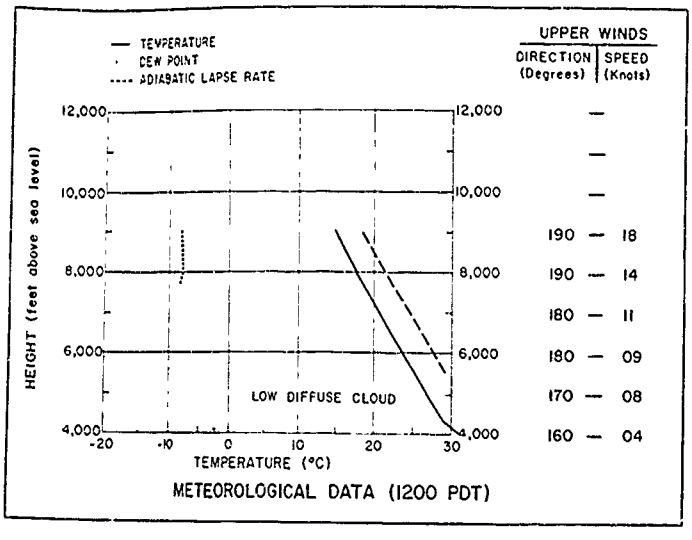
——— DOSE RATE CONTOURS, MEASURED

– – – – DOSE RATE CONTOURS, ESTIMATED


REED
25
8
95
1
2
3
4
5
6
7
8
LINCOLN MINE
6 hours
0.1
0.05
ALAMO
HIKO
0.5
0.05
0.1
93
CALIENTE
PIOCHE
NEV
UT
56
BERYL
NEWCASTLE
LUND


REMARKS
The pattern from Ely to about 70 miles to the south along Highway 38 may be in error even though this portion of the road was monitored. The 10,000-foot mean trajectory indicated that the fallout should have had an orientation toward the northeast with no indication that it should have been toward the north, as this portion of the pattern shows. The valley wind should have been fairly well developed at about the time the cloud or the fallout crossed Highway 38, so that any low-level debris would have been transported up Highway 38 toward Ely. There was only one monitor run along this portion of the road and it cannot be determined if the instrument was contaminated, or if the activity was drifting by in the air or may have been actual fallout. At Ely no airborne activity above background was recorded during this period, which is an indication that no fallout occurred in the general area around Ely. This portion of the pattern is, therefore, questionable.
The pattern was interpolated between Highways 93 and 21, but there is some confidence in it since no activity above background was detected along Highway 21 between Baker and New Castle. The rest of the pattern was well documented and should be fairly reliable.
CURRANT
LUND
ELY
BAKER
BERYL
LUND
NEVADA
UTAH
6 hours
12 hours
Trajectory at 10,000 feet
0.05
0.1
0.5
1
9
N
0 5 10 20 30 40 50
STATUTE MILES
EDDY (500 FT BALLOON) MAP B
H-HR= 0700 PDT 19 SEPT 1958
CLOUD TOP- 11,000 FT MSL
RESIDUAL GAMMA RADIATION
MR/HR AT H+12 HOURS
— LEGEND —
DOSE RATE CONTOURS, MEASURED
DOSE RATE CONTOURS, ESTIMATED
TIME OF ARRIVAL, ESTIMATED, H+HOURS
ELEVATION 7000 TO 9000 FEET
ELEVATION MORE THAN 9000 FEET
ROAD (THICK LINE INDICATES MONITORED SECTION)


TEMPERATURE
DEW POINT
ADIABATIC LAPSE RATE
12,000
10,000
8,000
6,000
4,000
HEIGHT (feet above sea level)
LOW D
FUSE
-20
-10
0
10
TEMPERATURE (°C)
METEOROLOGICAL DA
MERCURY HIGHWAY
U3k
10
50
100
MAXIMUM AT GZ ~ 150 R/HR AT H+1
U3r
ESTIMATED AXIS OF FALLOUT 355°
6 MR/HR AT H +1
JAPANESE HOUSES
7-300
T-7c
4 MR/HR A
E 690,000
N 840,000
N
0
5,000
FEET



METEOROLOGICAL DATA (1200 PDT)

REMARKS

Based on the shot time wind run the Luna fallout should have had a hot line bearing of about 355 degrees. Since there were few monitor runs across this bearing it is difficult to draw a pattern with any confidence.

There appeared to have been some fallout at the Japanese Houses Site T-7c and the Area 9 ground zero. At the Japanese Houses a reading of 6 mr/hr, converted to H+1, was reported. There did not appear to be any residual contamination from previous events in this area.

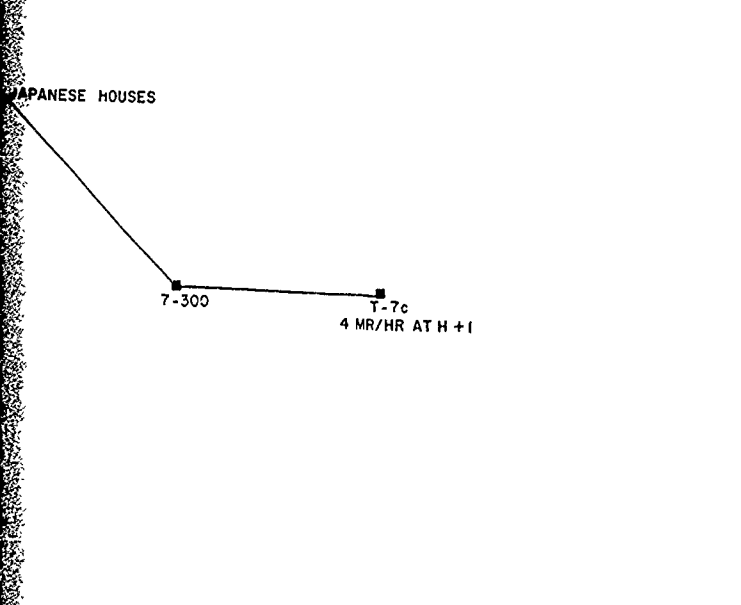
At Site T-7c there was a background contamination of about 2 mr/hr from the Eddy burst at the time of the Luna detonation. Subtracting this from the Luna monitor reading would leave a dose rate of about 4 mr/hr at H+1.

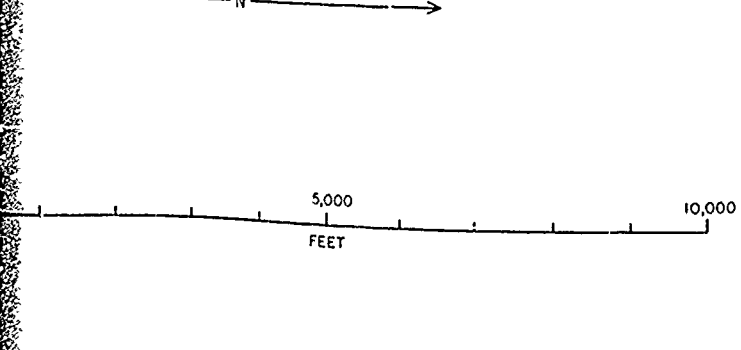
The Area 9 ground zero, which is about 6 miles from the Luna position on a bearing of about 357 degrees, was reported to have only background radiation at 16 minutes after shot time. At 20 and 29 minutes the readings there were 5 and 10 mr/hr, respectively. From the shot time m[illegible] wind speed (about 10 knots from the surface to 9,000 feet, m.s.l.) the cloud passage and the fallout should have occurred at about 30 minutes after shot time. It is thus difficult to estimate the H+1 value since the activity was apparently still arriving at the time of the last observation.

For Site 7-300 the background contamination from the Eddy event was of the order of 200 to 300 mr/hr 5 hours before the Luna detonation or 48 hours after the Eddy burst. Taking a value of 250 mr/hr at 48 hours and decaying it (sodium-24 decay) to 54 and 72 hours (which are equivalent to the H+1 and the H+19 Luna surveys) we would arrive at values of 200 and 100 mr/hr respectively. Since the readings on the Luna surveys at these times were of this order or less, we can assume that it was primarily residual Eddy contamination that was being monitored.

Again, since there were so few significant readings downwind from the Luna ground zero, no attempt was made to draw a complete pattern.

There were no readings above background reported off-site.





LUNA (484 FT WELL) MAP A

H-HR = 1200 PDT 21 SEPT 1958

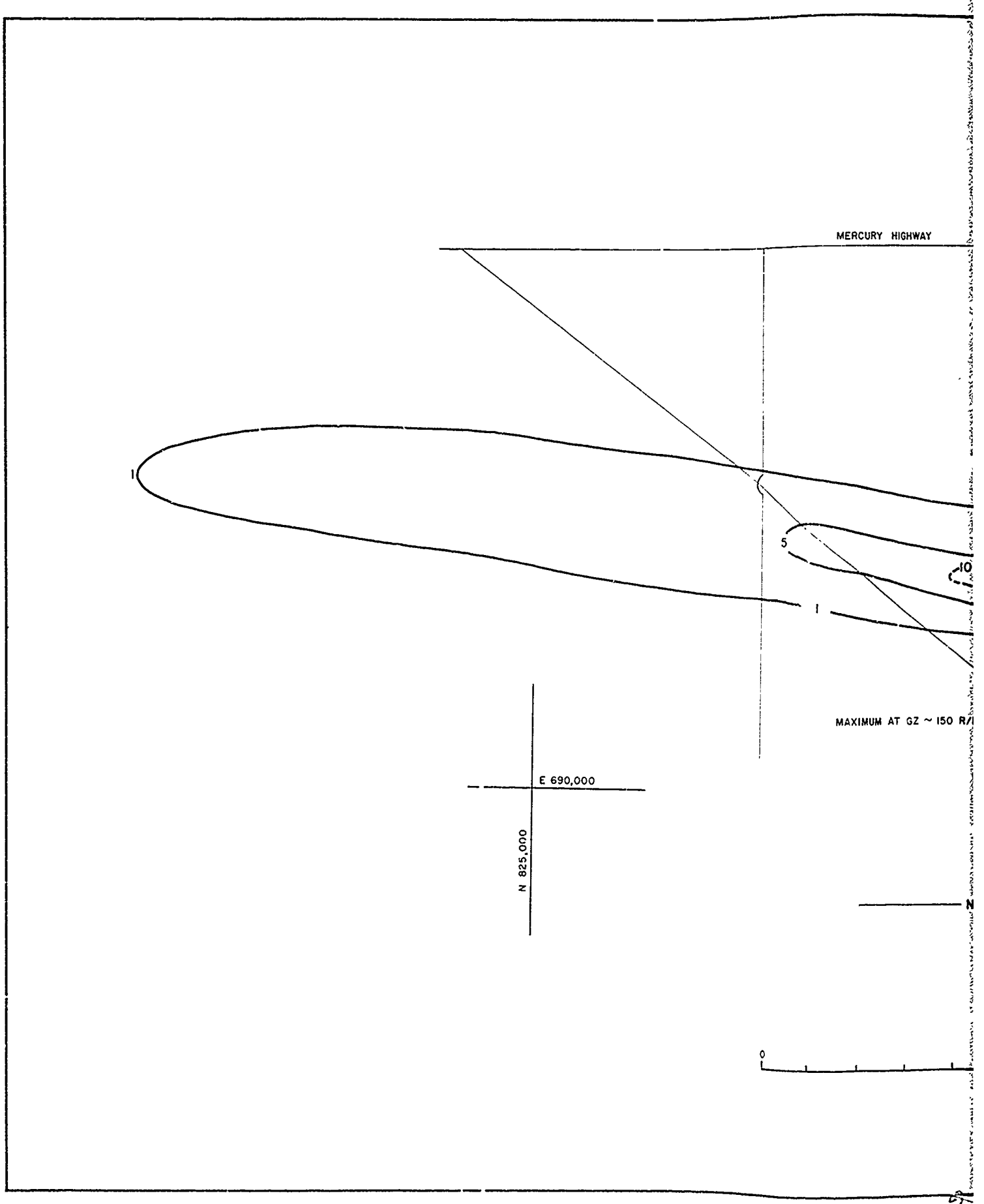
CLOUD TOP - LOW DIFFUSE CLOUD

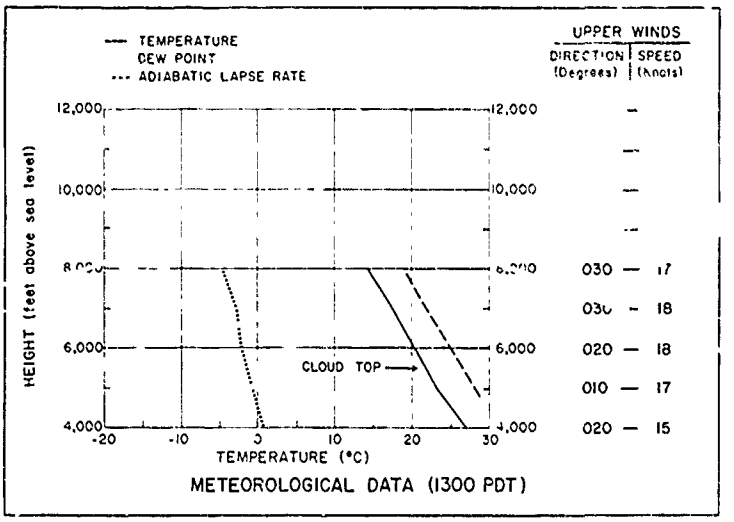
RESIDUAL GAMMA RADIATION
MR/HR AT H + 1 HOUR

— LEGEND —

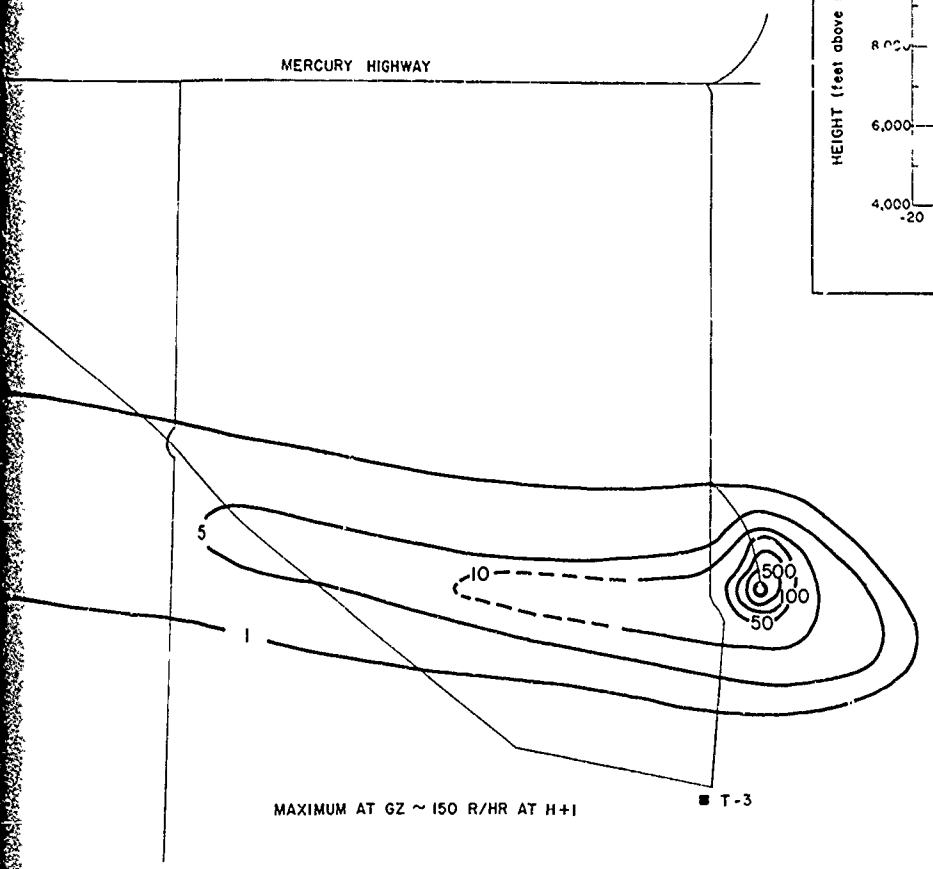
——— DOSE RATE CONTOURS, MEASURED

- - - - - DOSE RATE CONTOURS, ESTIMATED


MERCURY HIGHWAY
1
5
1
MAXIMUM AT GZ ~ 150 R/
E 690,000
N 825,000
0



METEOROLOGICAL DATA (1300 PDT)



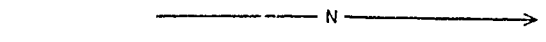
MAXIMUM AT GZ ~ 150 R/HR AT H+1

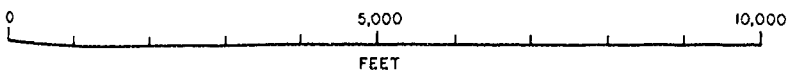
REMARKS

The Valencia cloud moved at a speed of about 16 knots along a bearing of about 195 degrees from ground zero At about 1 2 hour after shot time, although the cloud was not visible, readings at Control Point Building 2 (approximately 8 miles from ground zero on a bearing of about 185°) rose rapidly to 9 mr hr and then dropped rapidly to 0 35 mi hr. The mean wind speed and direction show that the cloud should have been in this general area at about the time of this maximum reading, indicating that what was being recorded was sky shine.

Special surveys across Yucca Lake to Area 11, west of the Mercury Highway, and along the Cane Spring road to Jackass Flats showed that there was no activity above background or above the levels of residual contamination from previous events. It, therefore, seems doubtful that there could have been additional areas of fallout on-site In general, the documentation was such as to yield a high degree of confidence in the analysis

No intensities significantly above background were found by the off-site monitors





VALENCIA (484 FT WELL) MAP A

H-HF = 1300 PDT 26 SEPT 1958

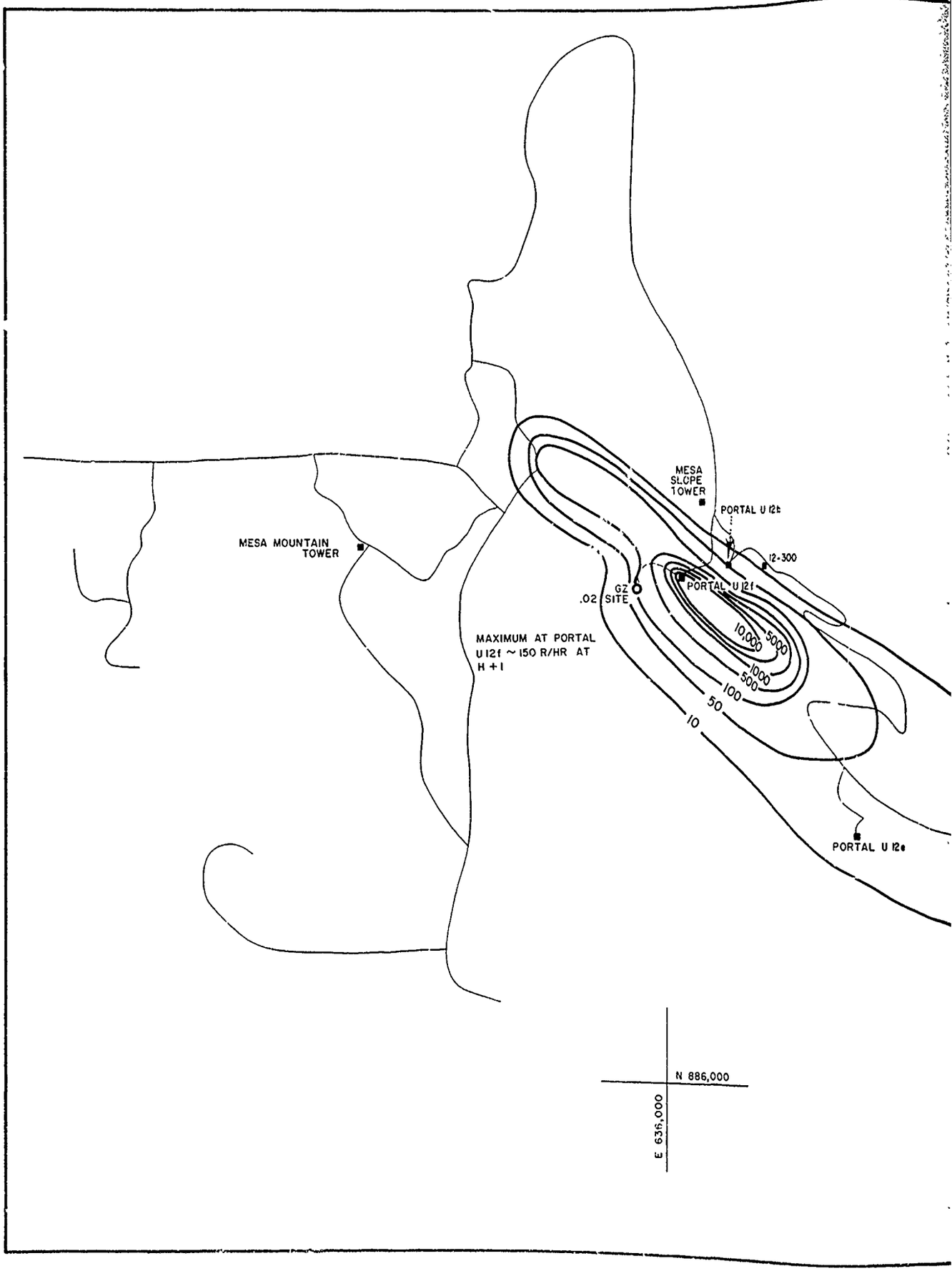
CLOUD TOP- 5500 FT M S L

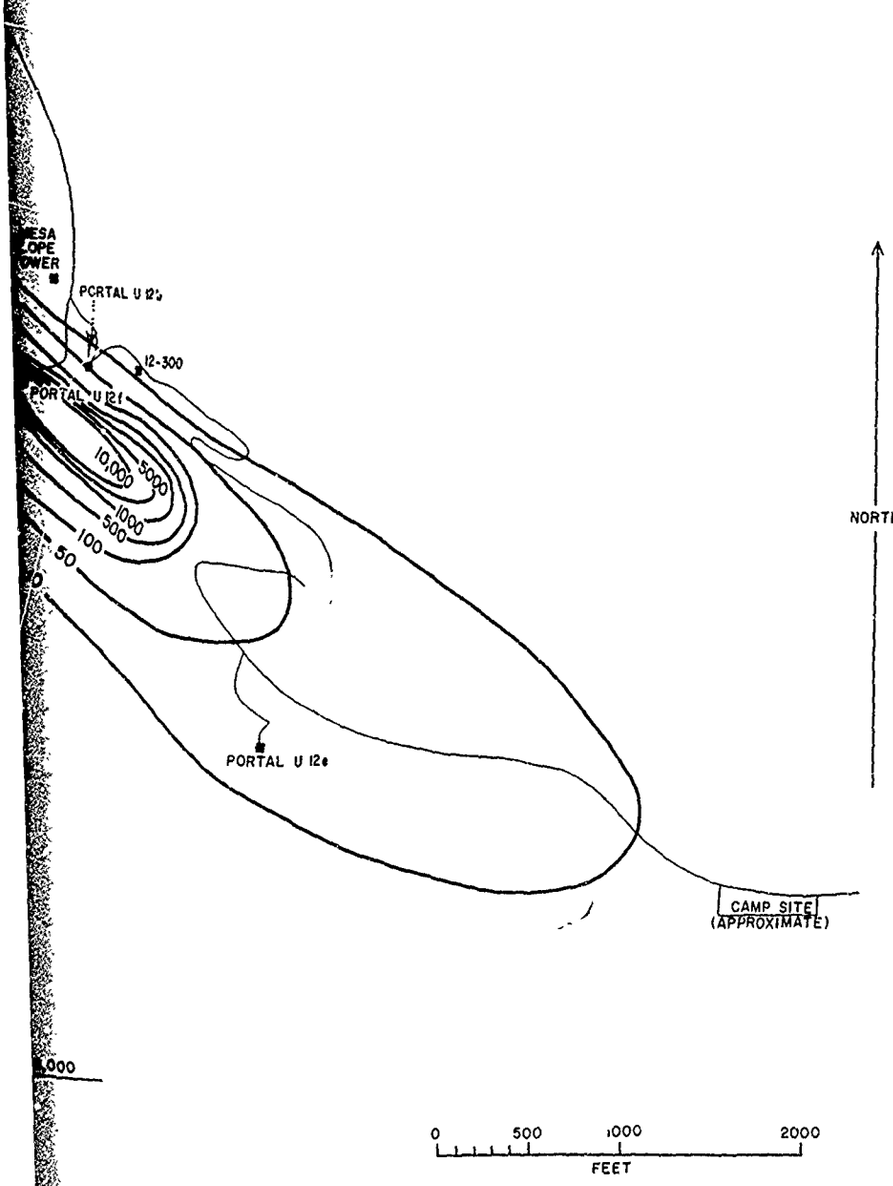
RESIDUAL GAMMA RADIATION
MR/HR AT H + 1 HOUR

— LEGEND —

——— DOSE RATE CONTOURS, MEASURED

– – – – DOSE RATE CONTOURS, ESTIMATED


MESA SLOPE TOWER
PORTAL U 12b
MESA MOUNTAIN TOWER
12-300
GZ
.02 SITE
PORTAL U 12f
MAXIMUM AT PORTAL U 12f ~ 150 R/HR AT H + 1
10,000
5000
1000
500
100
50
10
PORTAL U 12e
N 886,000
E 636,000



REMARKS

Mars vented through the tunnel mouth (situated on the mesa slope at an elevation of 6,725 feet m.s.l.), and a cloud rose to only a few hundred feet above the surface. Before shot time the winds along the mesa slope (see table below) were approximately from the northeast with the winds over the mesa top also from about northeast. Two minutes before shot time the winds at the slope station shifted and blew from approximately northwest (drainage winds), while the winds over the mesa slope were still from about northeast. Since the cloud rose to only a few hundred feet, it was under the influence of the drainage winds and travelled toward the southeast.

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.

No activity above background was detected off-site.

10-Minute Average Winds

9-foot Mesa Slope Tower (Surface Elevation-6,725 feet m.s.l.)			100-foot Mesa Mountain Tower (Surface Elevation-7,475 feet m.s.l.)		
Time (PDT)	Direction (degrees)	Speed m.p.h.	Time (PDT)	Direction (degrees)	Speed m.p.h.
1545-1600	040	08	1545-1600	060	14
1645-1657	040	02	1645-1700	060	07
1658	Reversal				
1745-1800	320	08	1745-1800	025	21
1845-1900	330	06	1845-1900	035	21
1945-2000	320	05	1945-2000	045	20

MARS (TUNNEL) MAP A

H-HR = 1700 PDT 27 SEPT 1958

CLOUD TOP - LOW DIFFUSE CLOUD

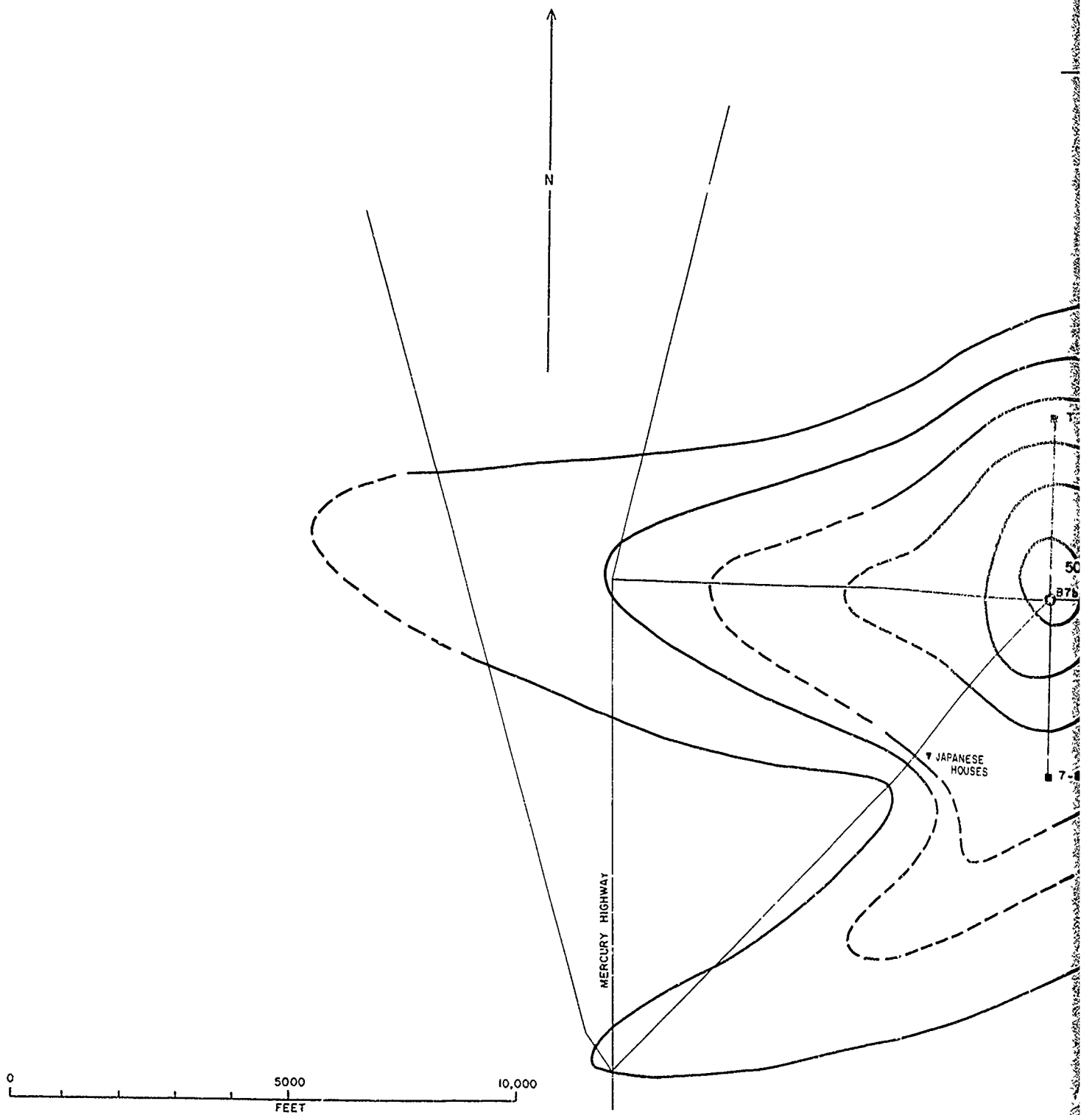
RESIDUAL GAMMA RADIATION
MR/HR AT H + 1 HOUR

- LEGEND -

——— DOSE RATE CONTOURS, MEASURED

– – – – DOSE RATE CONTOURS, ESTIMATED

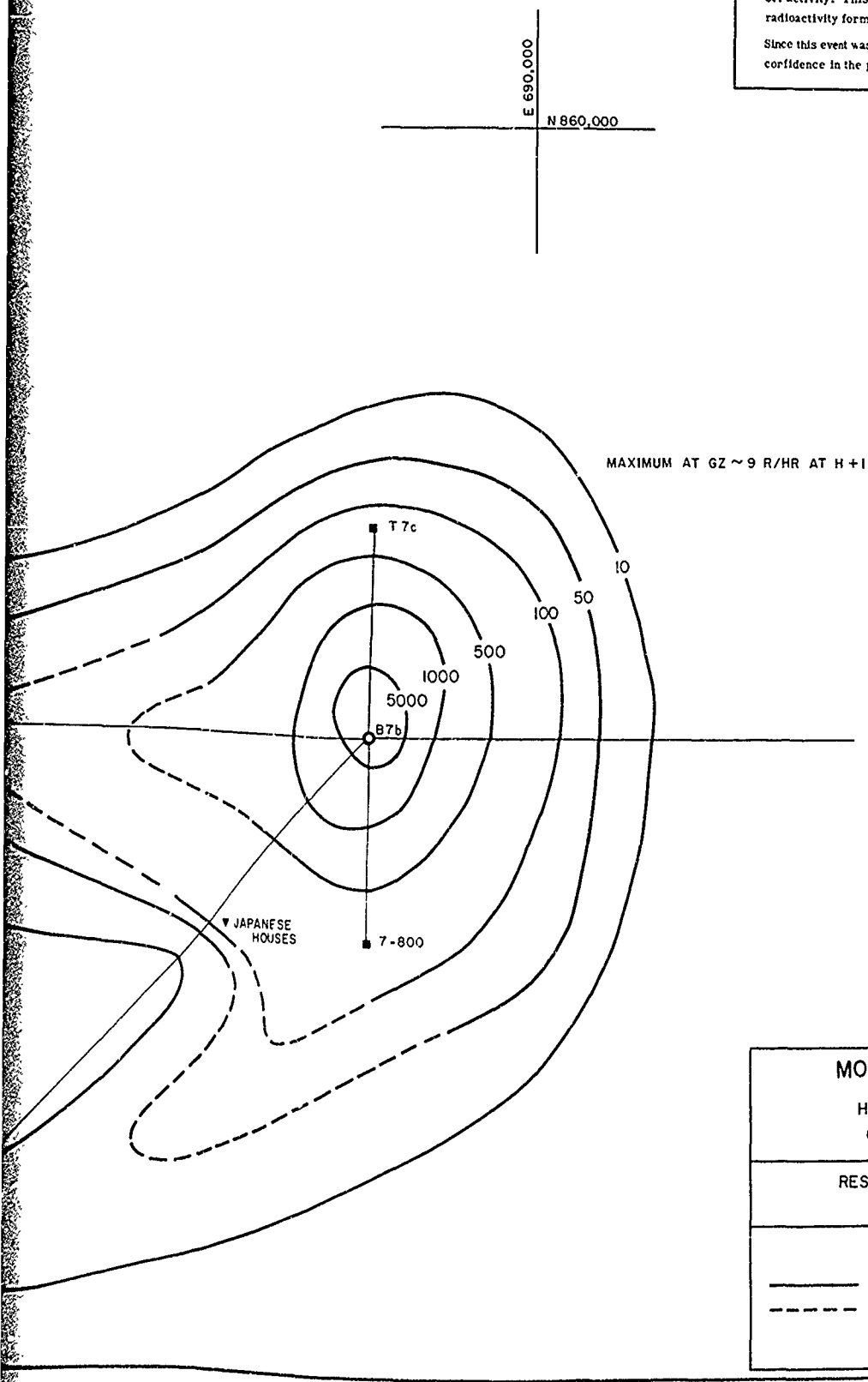
21


N
JAPANESE HOUSES
MERCURY HIGHWAY
0
5000
10,000
FEET

REMARKS

At shot time a dust cloud was formed (most likely by the shock wave kicking up the surface dirt) in the lower levels and was observed to move toward the west over the Mercury Highway producing relativel, high fallout activity. This dust cloud most likely contained primarily induced radioactivity formed by the neutron capture by the sodium in the soil.

Since this event was fairly well documented on site, there is considerable confidence in the pattern presented.



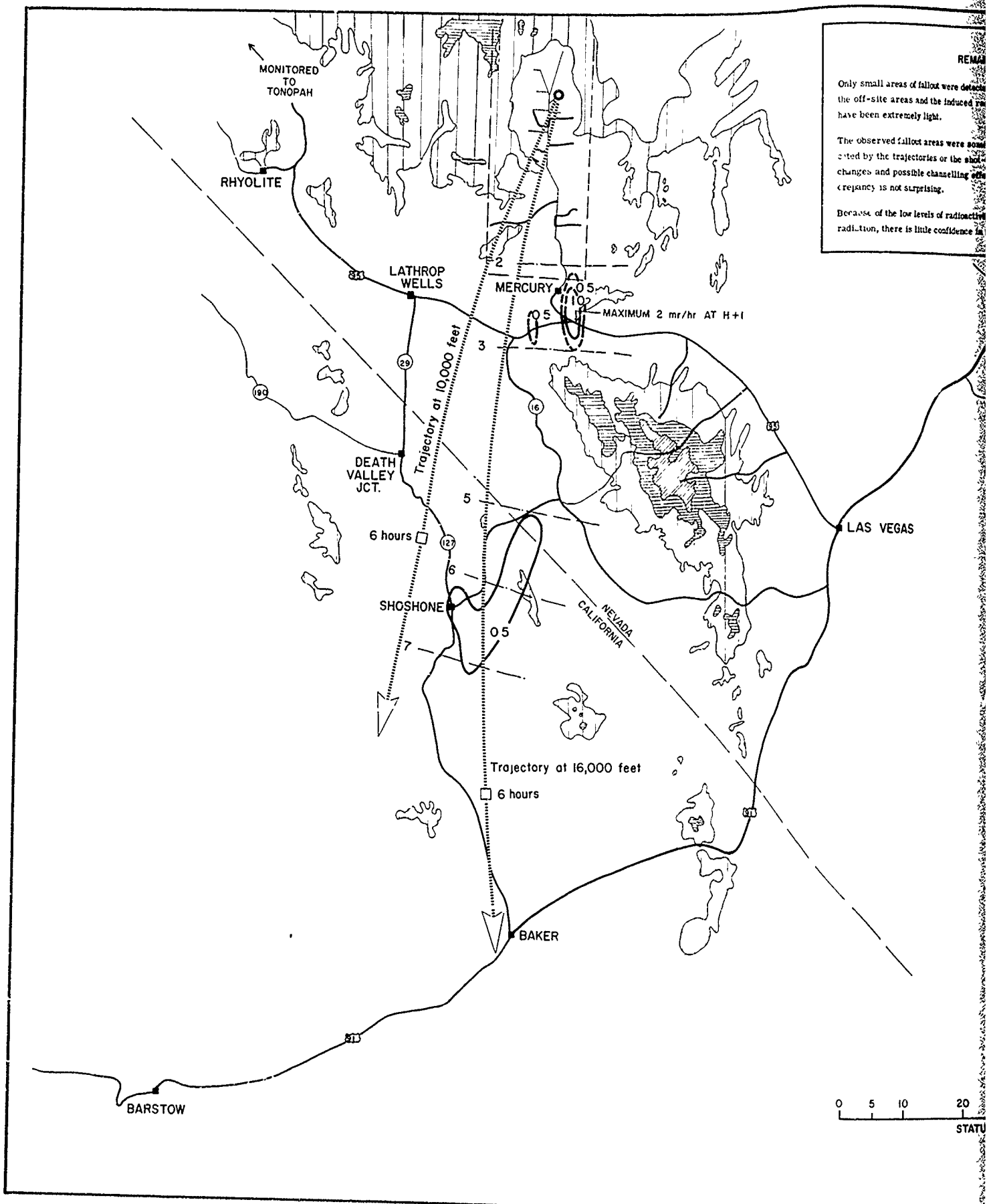
MORA (1500 FT BALLOON) MAP A

H-HR = 0605 PST 29 SEPT 1958
CLOUD TOP - 18,500 FT. M.S.L.

RESIDUAL GAMMA RADIATION
MR/HR AT H + 1 HOUR

— LEGEND —

——— DOSE RATE CONTOURS, MEASURED
– – – – – DOSE RATE CONTOURS, ESTIMATED

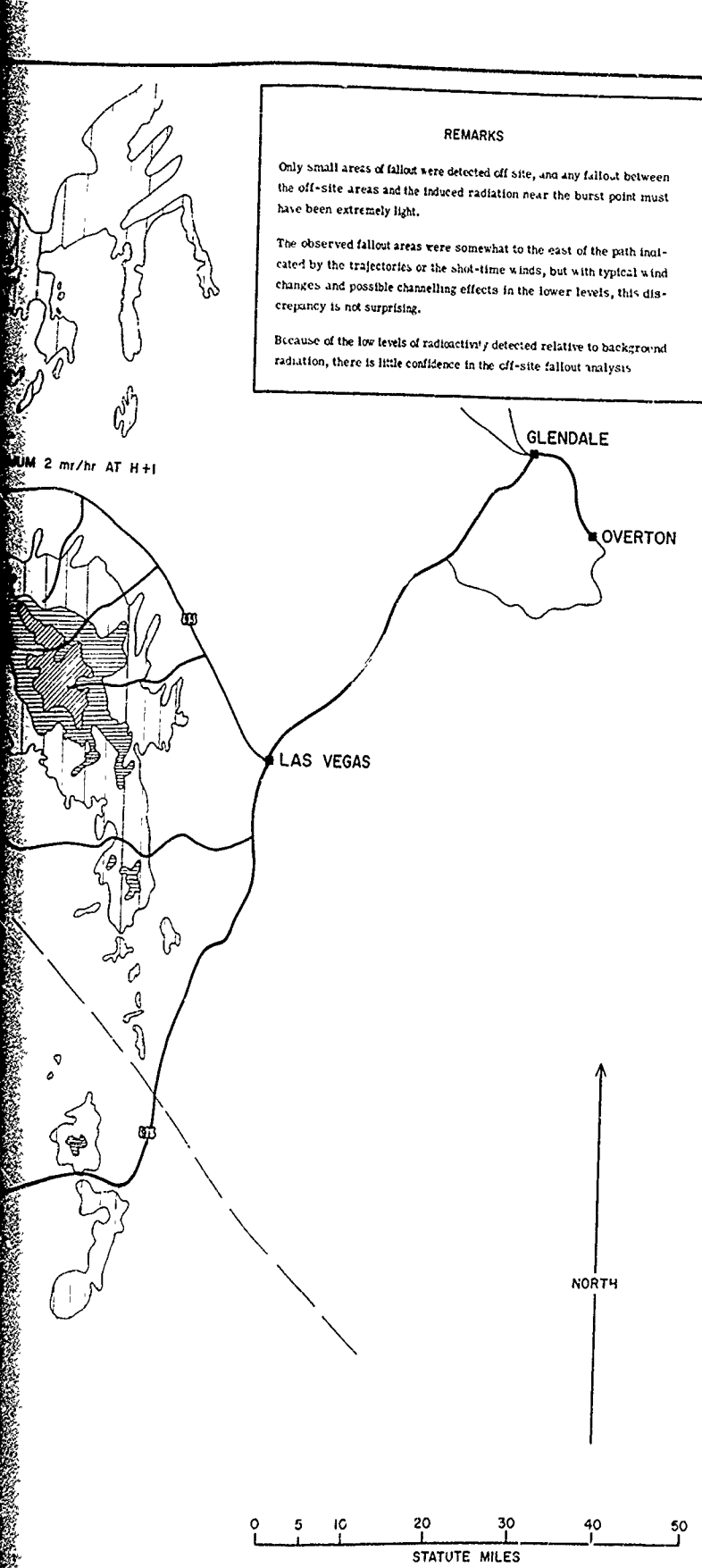

MONITORED TO TONOPAH
RHYOLITE
LATHROP WELLS
MERCURY
MAXIMUM 2 mr/hr AT H+1
Trajectory at 10,000 feet
DEATH VALLEY JCT.
6 hours
SHOSHONE
NEVADA
CALIFORNIA
LAS VEGAS
Trajectory at 16,000 feet
6 hours
BAKER
BARSTOW
0 5 10 20
STATU

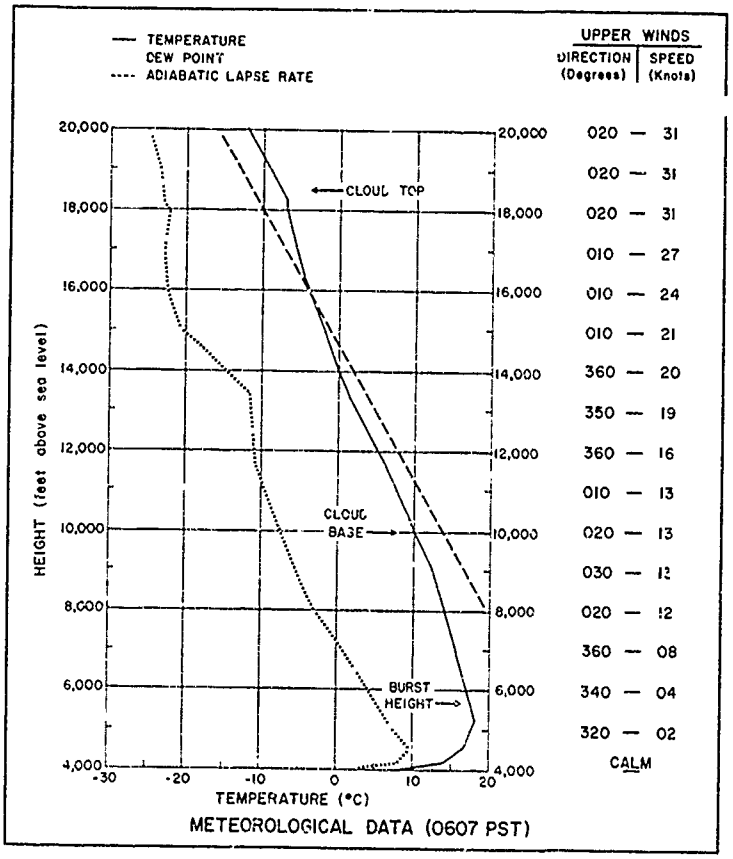
REMARKS

Only small areas of fallout were detected off site, and any fallout between the off-site areas and the induced radiation near the burst point must have been extremely light.

The observed fallout areas were somewhat to the east of the path indicated by the trajectories or the shot-time winds, but with typical wind changes and possible channelling effects in the lower levels, this discrepancy is not surprising.

Because of the low levels of radioactivity detected relative to background radiation, there is little confidence in the off-site fallout analysis





METEOROLOGICAL DATA (0607 PST)

MORA (1500 FT BALLOON) MAP B

H-HR = 0605 PST 29 SEPT 1958

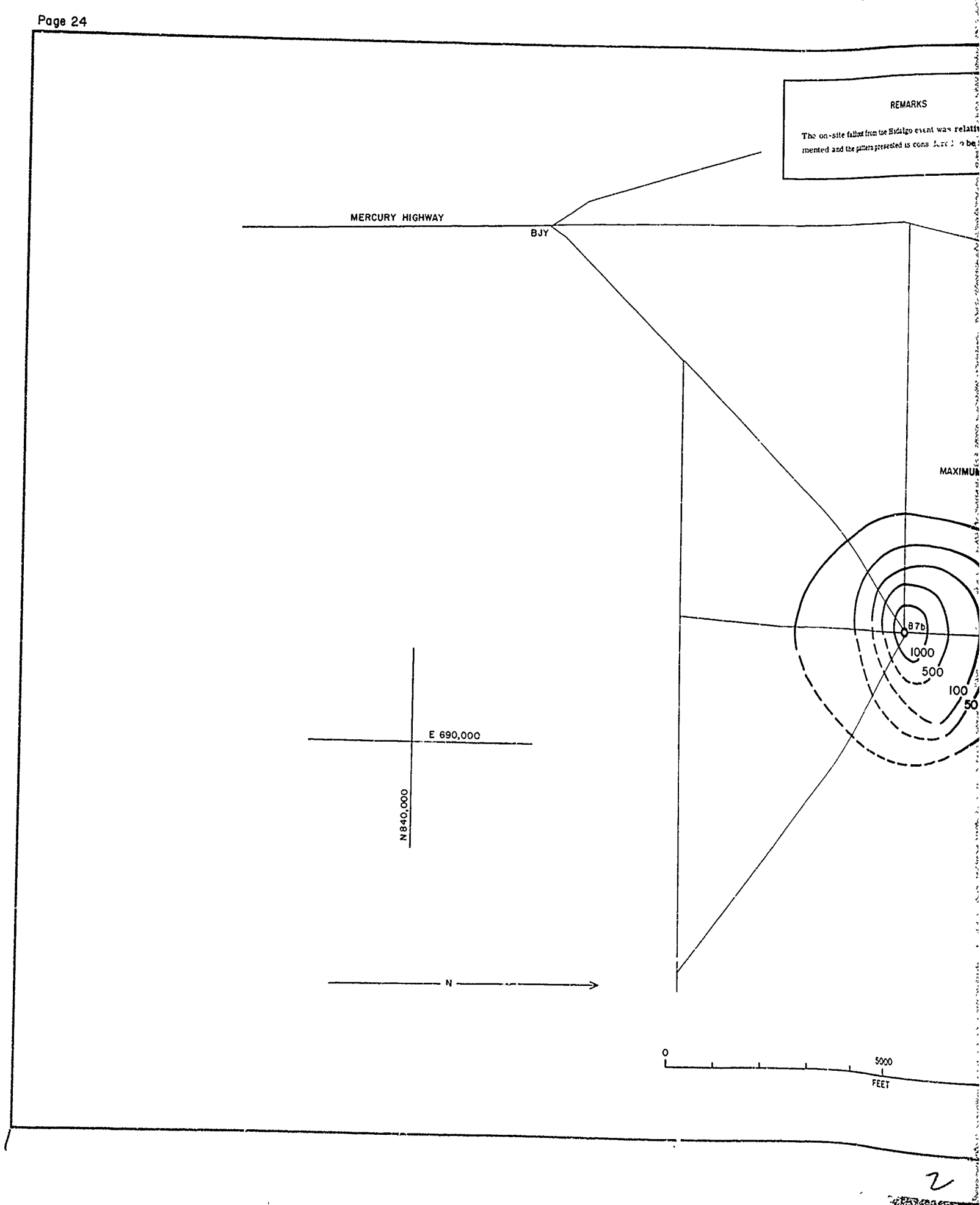
CLOUD TOP - 18,500 FT. M.S.L

RESIDUAL GAMMA RADIATION
MR/HR AT H + 1 HOUR

— LEGEND —

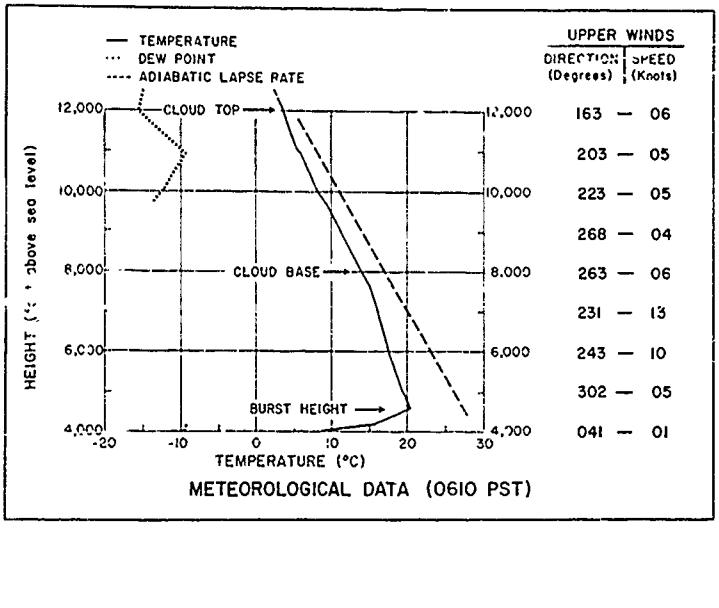
- DOSE RATE CONTOURS, MEASURED
- DOSE RATE CONTOURS, ESTIMATED
- TIME OF ARRIVAL, ESTIMATED, H+HOURS
- ELEVATION 5000 TO 7000 FEET
- ELEVATION 7000 TO 9000 FEET
- ELEVATION MORE THAN 9000 FEET
- ROAD (THICK LINE INDICATES MONITORED SECTION)

2.


REMARKS
The on-site fallout from the Hidalgo event was relati
mented and the pattern presented is cons
MERCURY HIGHWAY
BJY
MAXIMU
87b
1000
500
100
50
E 690,000
N 840,000
N
0
5000
FEET

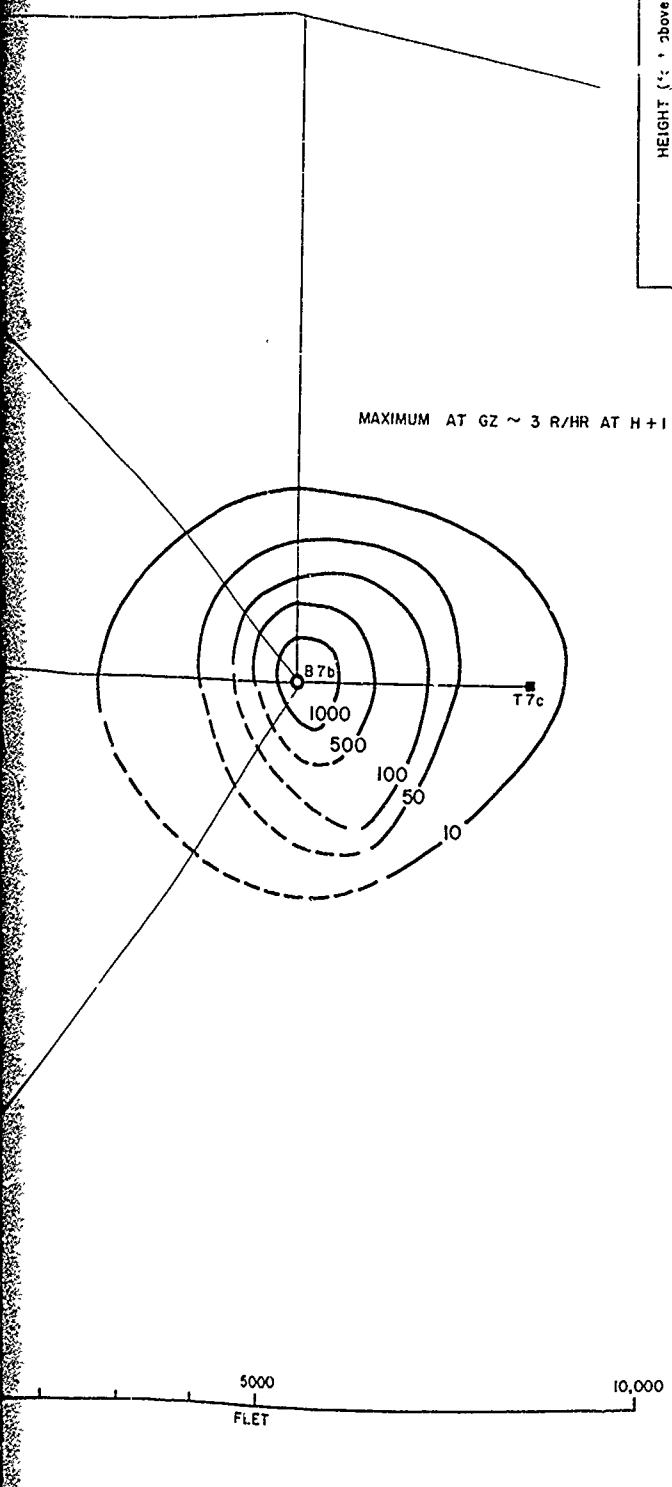
REMARKS

The on-site fallout from the Hidalgo event was relatively well documented and the pattern presented is considered to be fairly reliable



METEOROLOGICAL DATA (0610 PST)

MAXIMUM AT GZ ~ 3 R/HR AT H+1



HIDALGO (377 FT BALLOON) MAP A

H-HR = 0610 PST 5 OCT 1958

CLOUD TOP - 12,000 FT MSL

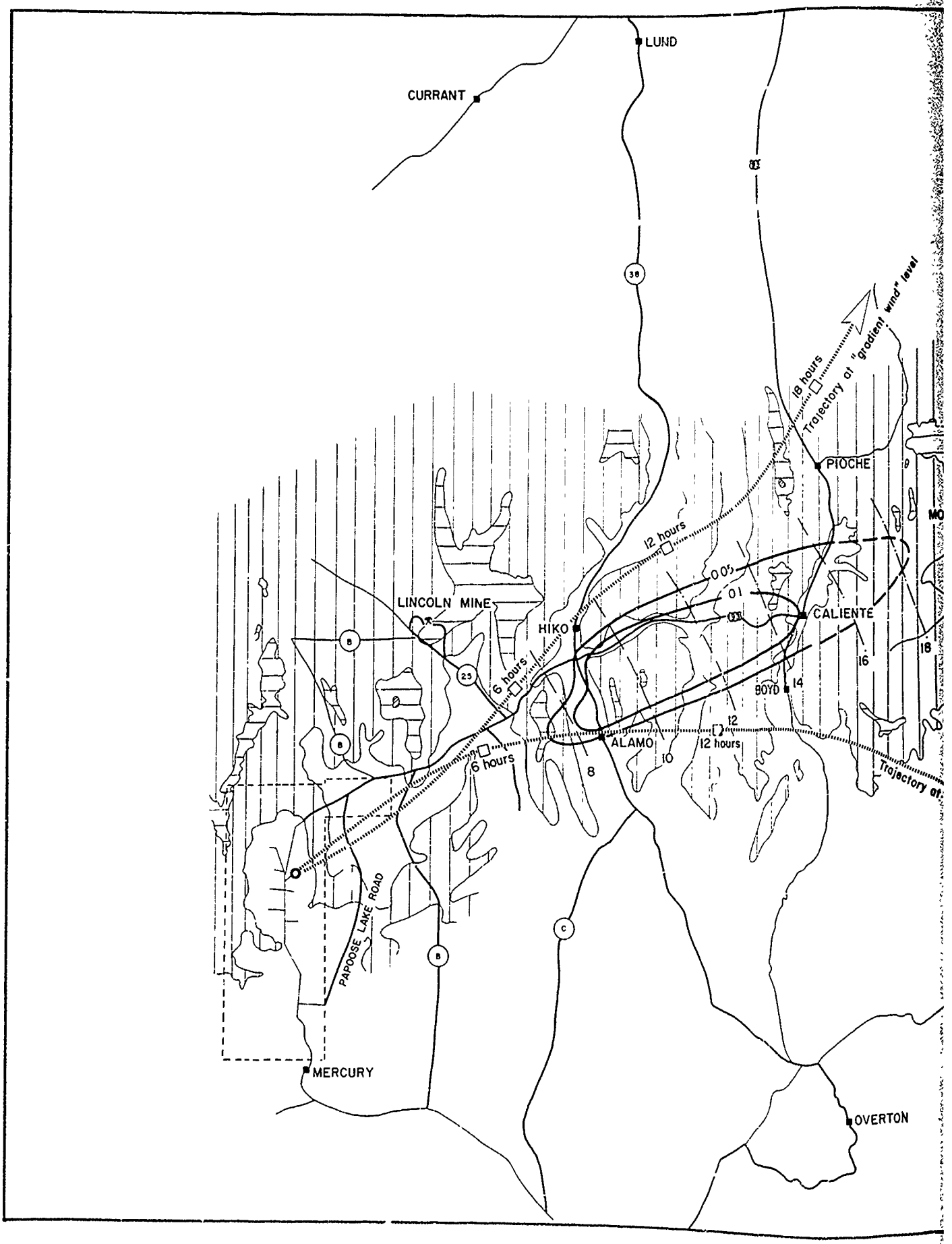
RESIDUAL GAMMA RADIATION
MR/HR AT H+1 HOUR

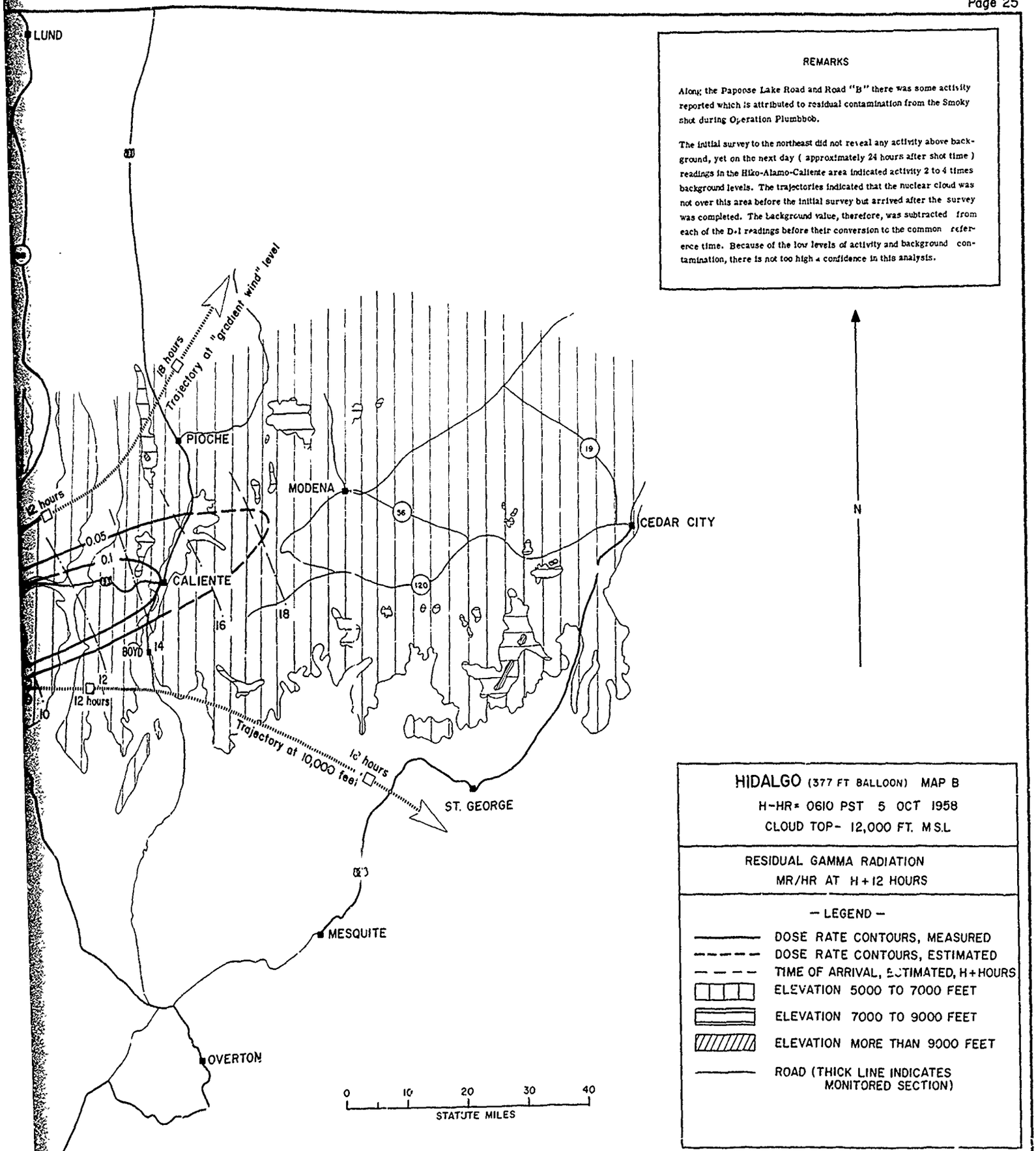
— LEGEND —

——— DOSE RATE CONTOURS, MEASURED

– – – – DOSE RATE CONTOURS, ESTIMATED

2


LUND
CURRANT
18 hours
Trajectory at "gradient wind" level
PIOCHE
12 hours
005
01
LINCOLN MINE
HIKO
CALIENTE
6 hours
BOYD
14
16
18
12
12 hours
ALAMO
10
6 hours
8
Trajectory at
PAPOOSE LAKE ROAD
MERCURY
OVERTON



REMARKS

Along the Paposse Lake Road and Road "B" there was some activity reported which is attributed to residual contamination from the Smoky shot during Operation Plumbbob.

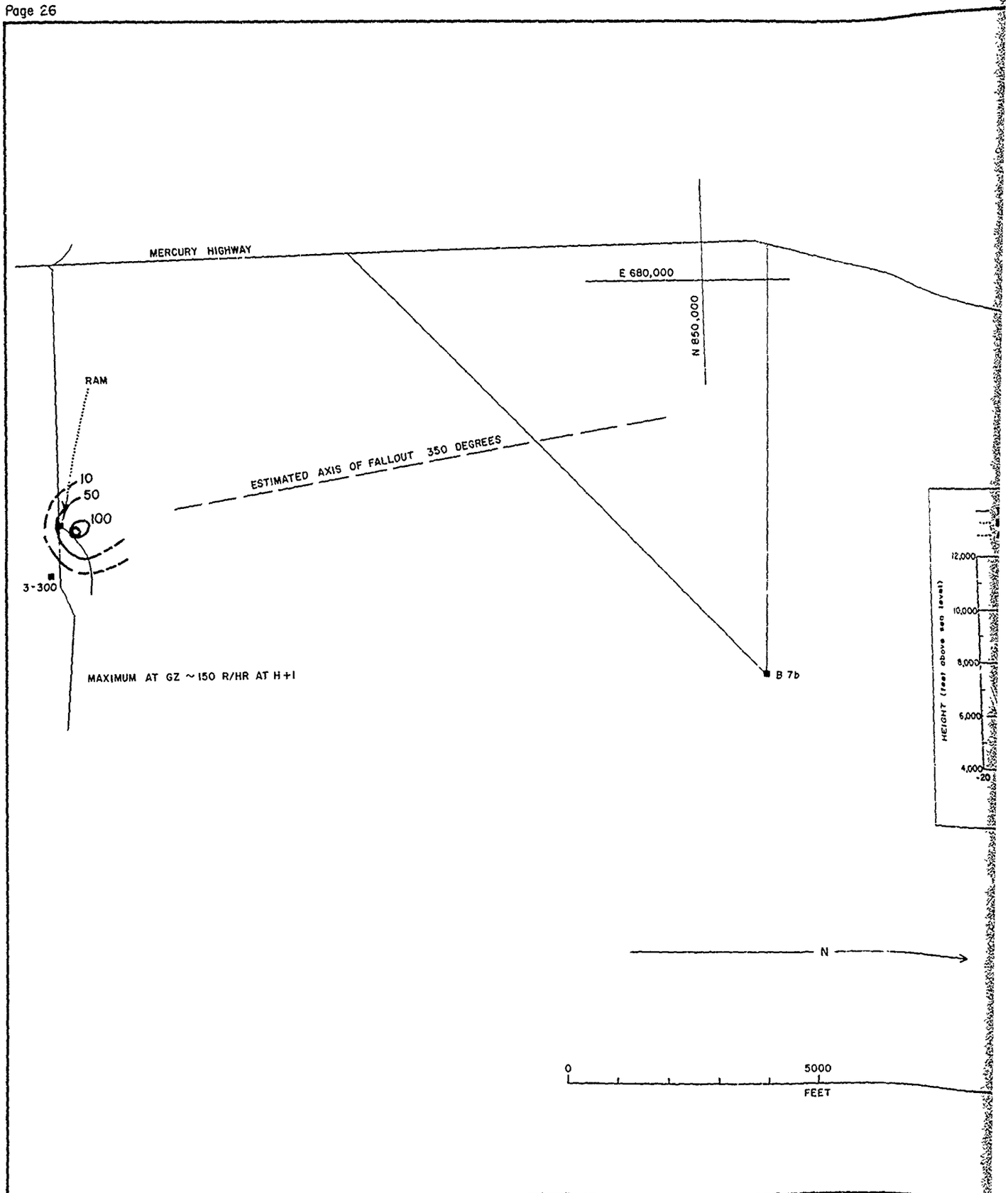
The initial survey to the northeast did not reveal any activity above background, yet on the next day (approximately 24 hours after shot time) readings in the Hiko-Alamo-Caliente area indicated activity 2 to 4 times background levels. The trajectories indicated that the nuclear cloud was not over this area before the initial survey but arrived after the survey was completed. The background value, therefore, was subtracted from each of the D+1 readings before their conversion to the common reference time. Because of the low levels of activity and background contamination, there is not too high a confidence in this analysis.

HIDALGO (377 FT BALLOON) MAP B
H-HR= 0610 PST 5 OCT 1958
CLOUD TOP- 12,000 FT. M.S.L.

RESIDUAL GAMMA RADIATION
MR/HR AT H+12 HOURS

— LEGEND —

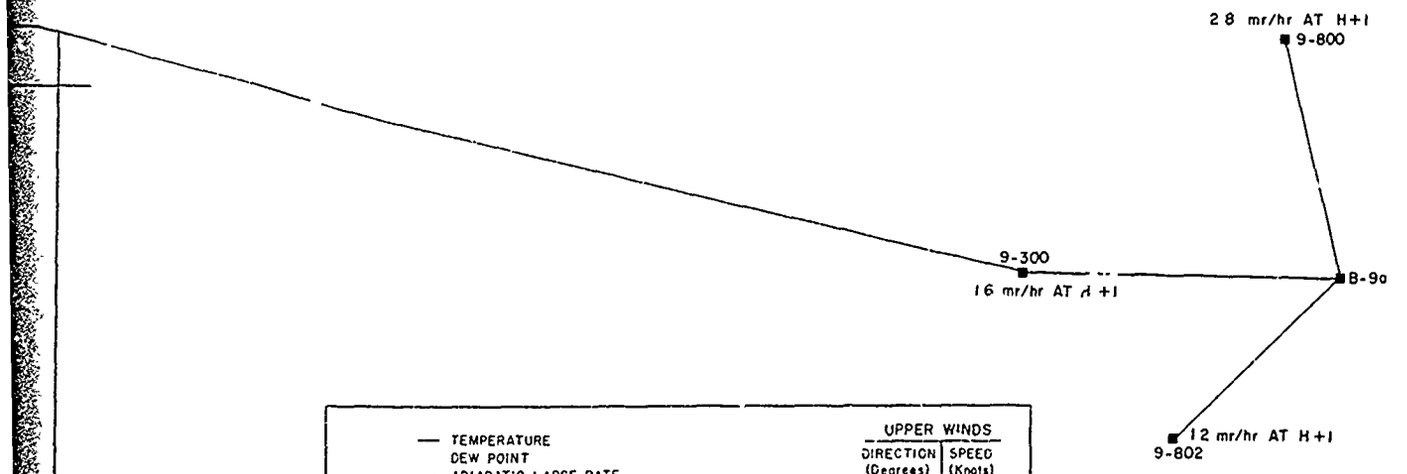
- DOSE RATE CONTOURS, MEASURED
- DOSE RATE CONTOURS, ESTIMATED
- TIME OF ARRIVAL, ESTIMATED, H+HOURS
- ELEVATION 5000 TO 7000 FEET
- ELEVATION 7000 TO 9000 FEET
- ELEVATION MORE THAN 9000 FEET
- ROAD (THICK LINE INDICATES MONITORED SECTION)

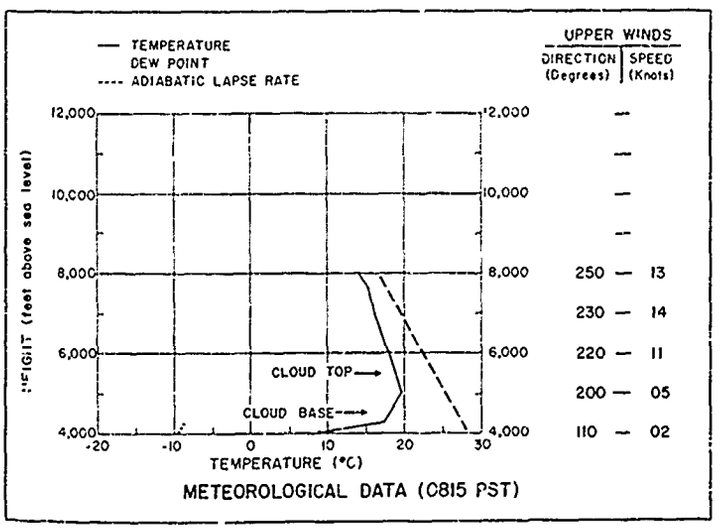

MERCURY HIGHWAY
E 680,000
N 850,000
RAM
ESTIMATED AXIS OF FALLOUT 350 DEGREES
10
50
100
3-300
B 7b
MAXIMUM AT GZ ~ 150 R/HR AT H+1
HEIGHT (feet above sea level)
12,000
10,000
8,000
6,000
4,000
-20
N
0
5000
FEET

REMARKS

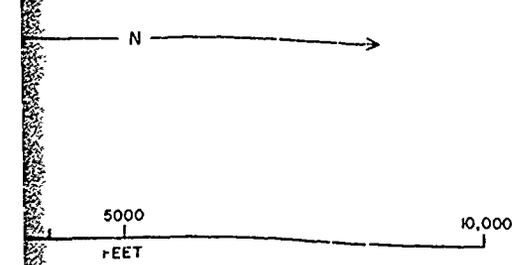
Based on the shot time wind run the Colfax fallout should have had a hot-line bearing of about 350 degrees. There was some activity reported around Area 9, as indicated on the map. Elsewhere there was insufficient monitoring information from which to draw a complete pattern.

The only activity above background reported by the off-site monitor was at about 1/2 mile north of Gate 585 on the Groom Lake Road. This was about 0.3 mr/hr when converted to H+1.





METEOROLOGICAL DATA (0815 PST)



COLFAX (350 WELL) MAP A

H-HR= 0815 PST 5 OCT. 1958

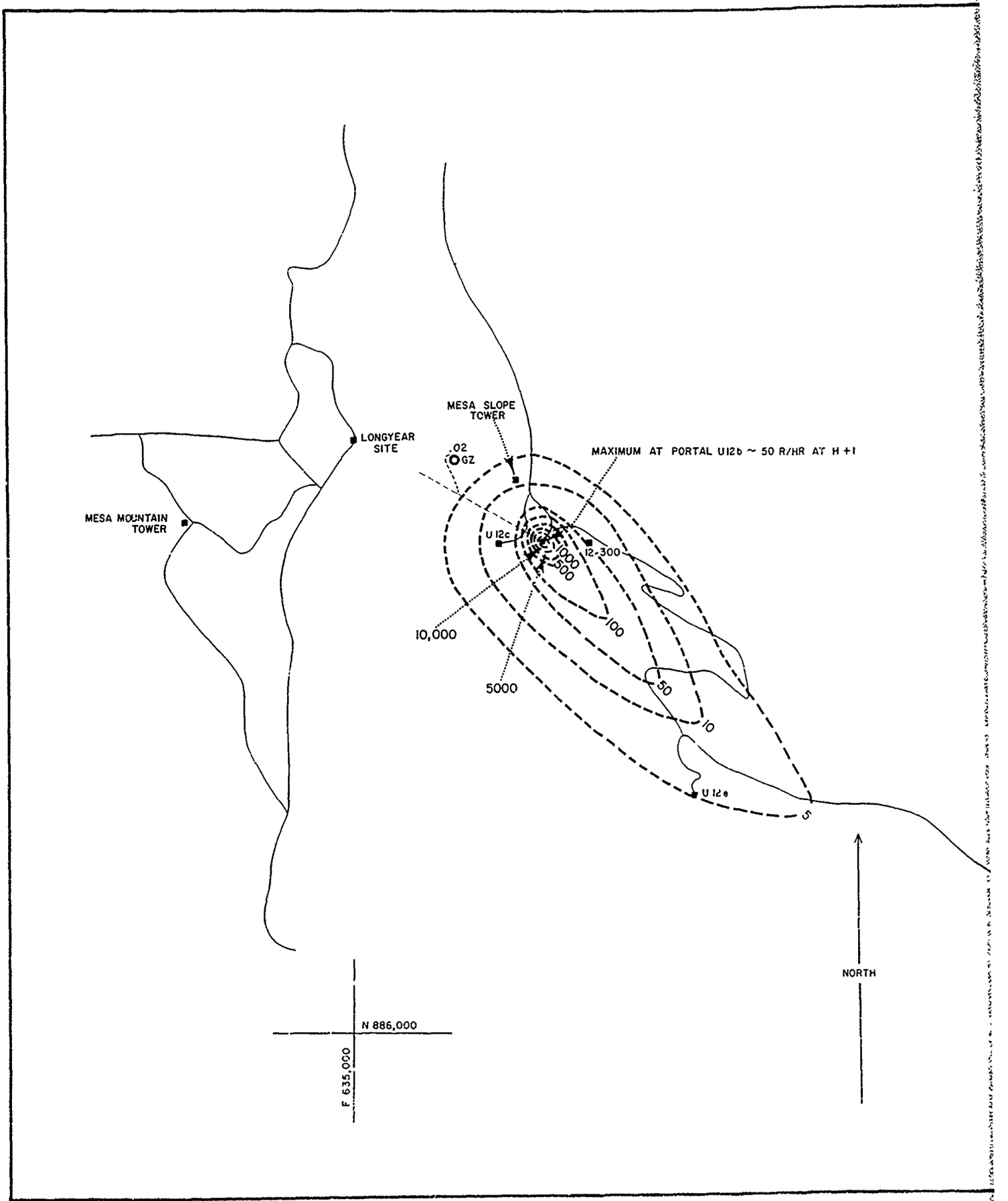
CLOUD TOP- 5500 FT M.S.L.

RESIDUAL GAMMA RADIATION
MR/HR AT H+1 HOUR

— LEGEND —

——— DOSE RATE CONTOURS, MEASURED

– – – – – DOSE RATE CONTOURS, ESTIMATED


MESA SLOPE TOWER
LONGYEAR SITE
.02
GZ
MAXIMUM AT PORTAL U12b ~ 50 R/HR AT H+1
MESA MOUNTAIN TOWER
U 12c
12-300
1,000
500
100
10,000
50
5000
10
U 12e
5
NORTH
N 886,000
F 635,000

REMARKS

There was only a minor amount of venting through the tunnel mouth (located at the side of the mesa slope at an elevation of 6,650 feet m.s.l.) and no organized cloud was formed. Strong west winds above the mesa slope (see table below) prevented the formation of the normal afternoon upslope (northeast) winds

The shot-time winds at the Mesa Mountain tower were from the west while the winds at the slope station were from the north. The slope winds indicated that the activity, which was confined to the lower layers, should have been transported toward the south A channeling effect due to the canyon, oriented northwest-southeast, between Portals B and E transported the debris toward the southeast.

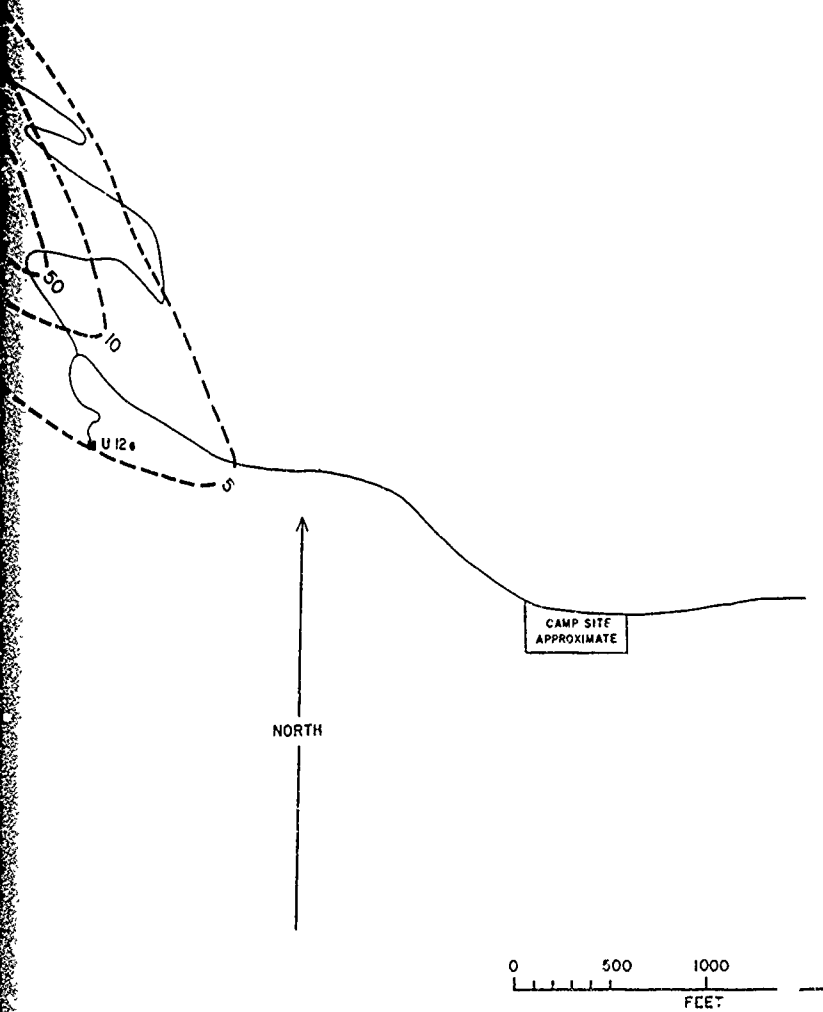
The activity isolines shown are very uncertain. It is believed that there was some true fallout downwind from the portal, but that the radiation reported was primarily airborne activity in gaseous or very small particulate form. At several places, such as the B, C, and E portals, and at the Longyear Site, a rapid drop in intensity in a very short time period was recorded, indicating that the activity was most likely drifting by in the air An attempt was made to normalize the activity to a common reference time, but because of the uncertainty as to what fraction of the activity was airborne and what was true fallout, the isolines were dashed and there is no degree of confidence in this pattern. For this reason no attempt should be made to integrate this pattern to estimate the fraction of the total activity which came down as close-in fallout.

No activity above background was detected off-site.

15 Minute Average Winds

	9-foot Mesa Slope Tower (Surface Elevation-6725 feet m.s.l.)		100-foot Mesa Mountain Tower (Surface Elevation-7465 feet m.s.l.)	
Time (PST)	Direction (degrees)	Speed (m.p.h.)	Direction (degrees)	Speed (m.p.h.)
1145-1200	360	11	300	11
1245-1300	360	08	290	15
1345-1400	360	09	270	17
1445-1500	360	09	285	17
1545-1600	360	06	270	18

AT PORTAL U12b ~ 50 R/HR AT H + 1



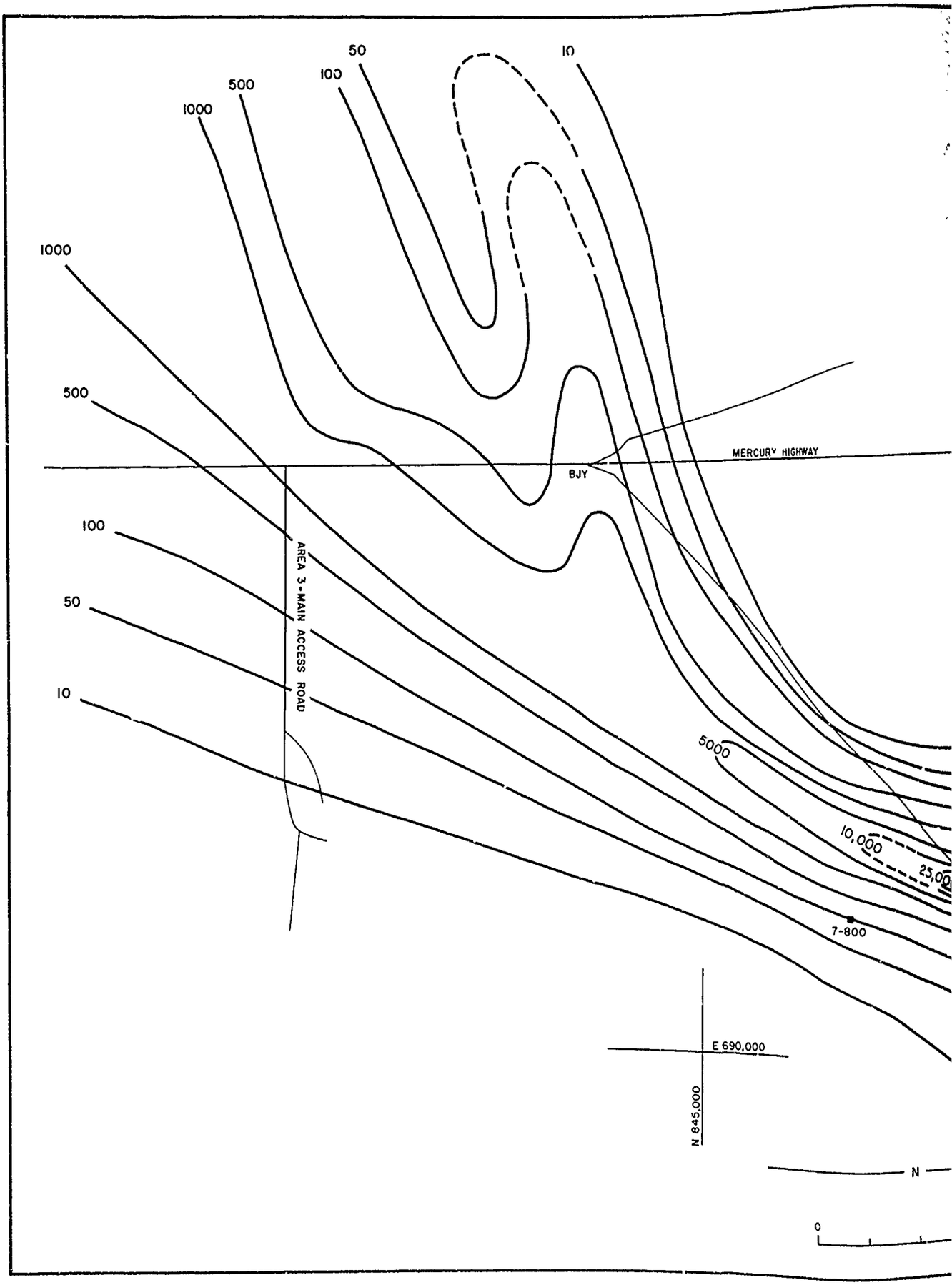
TAMALPAIS (TUNNEL) MAP A
H-HR- 1400 PST 8 OCT 1958
CLOUD TOP- LOW DIFFUSE CLOUD

RESIDUAL GAMMA RADIATION
MR/HR AT H + 1 HOUR

— LEGEND —

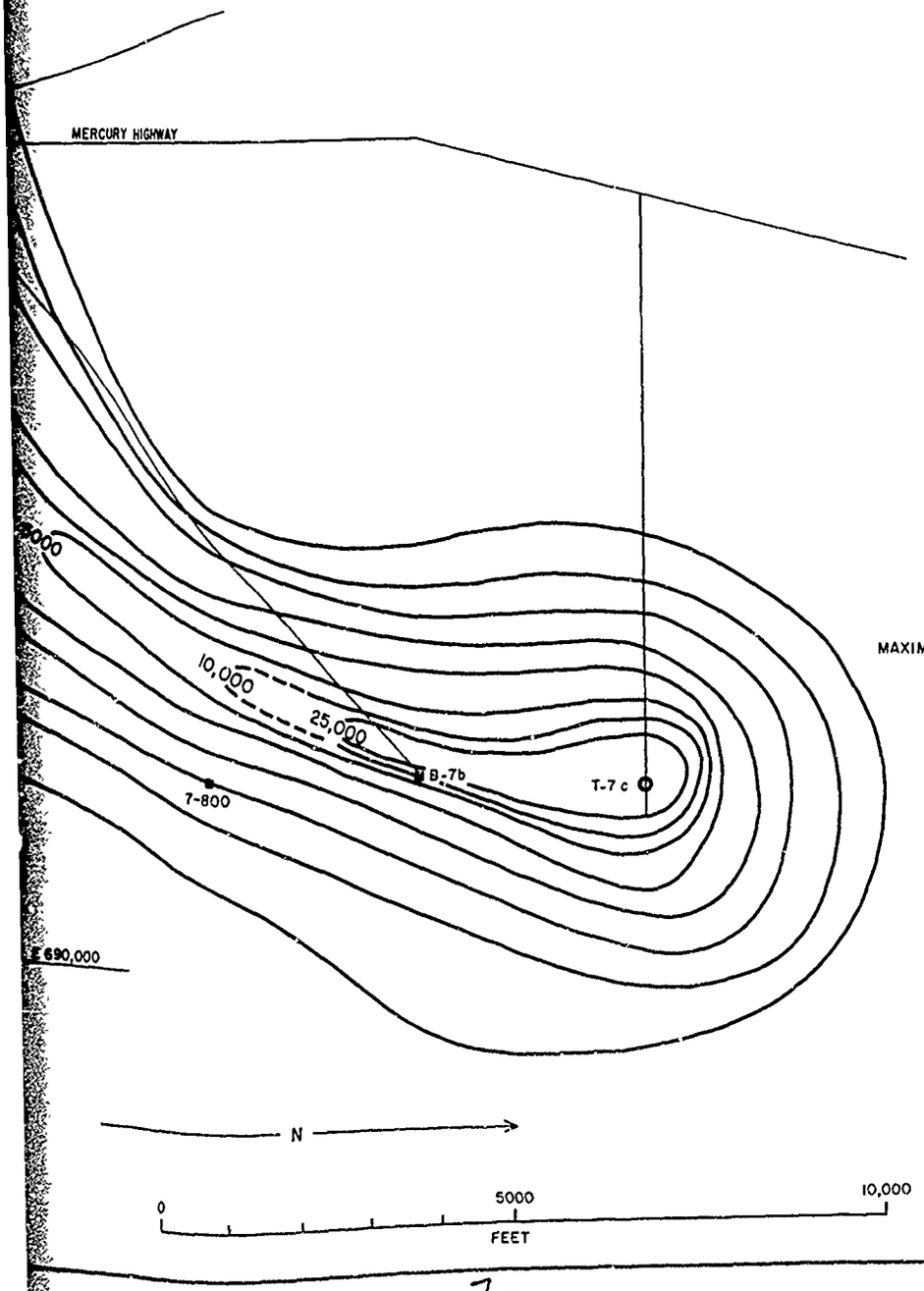
——— DOSE RATE CONTOURS, MEASURED
– – – – – DOSE RATE CONTOURS, ESTIMATED

2


50
10
100
500
1000
1000
500
MERCURY HIGHWAY
BJY
100
AREA 3-MAIN ACCESS ROAD
50
10
5000
10,000
25,00
7-800
E 690,000
N 845,000
N
0

REMARKS

The on-site fallout from the Quay event was well documented and the pattern is considered to be fairly reliable. The portion of the pattern which was interpolated (indicated by the dashed isolines) can only be an approximation in the absence of measurements.



MAXIMUM AT G Z ~ 2,000 R/HR AT H +1

QUAY (100 FT STEEL TOWER) MAP A

H-HR= 0630 PST 10 OCT. 1958

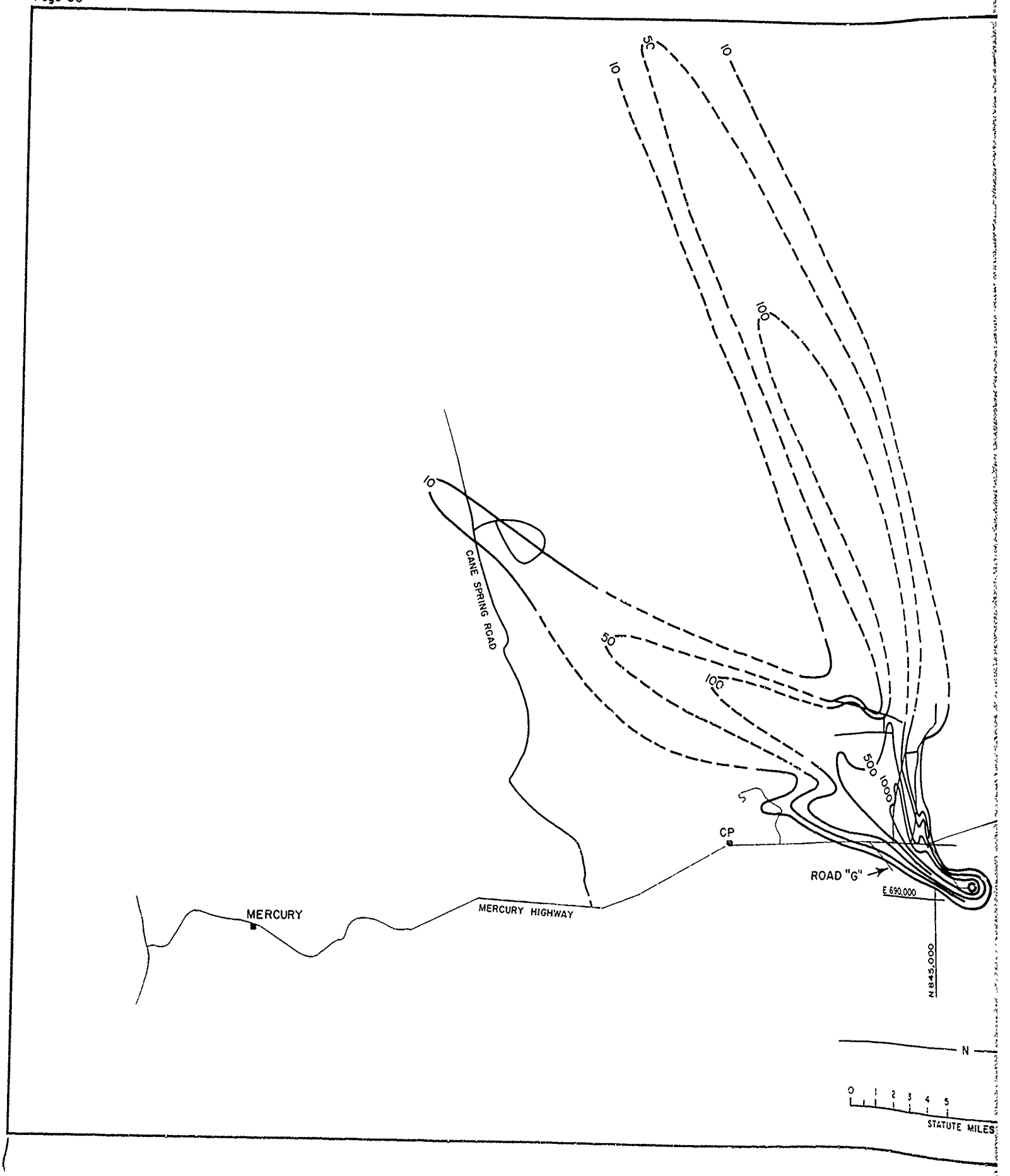
CLOUD TOP- 10,000 FT. M.S.L.

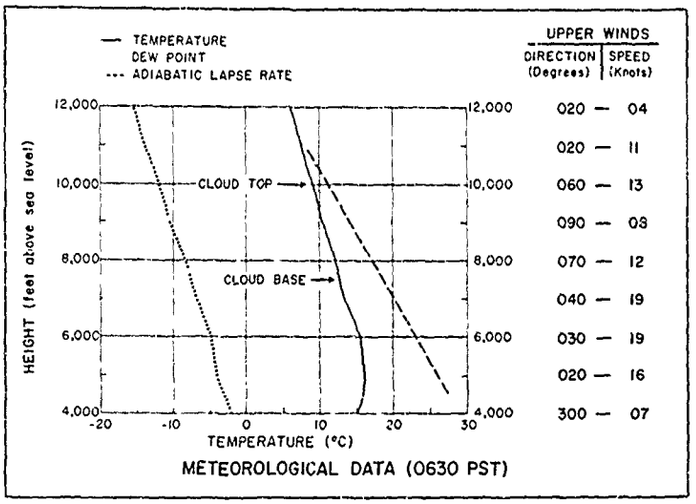
RESIDUAL GAMMA RADIATION
MR/HR AT H + 1 HOUR

- LEGEND -

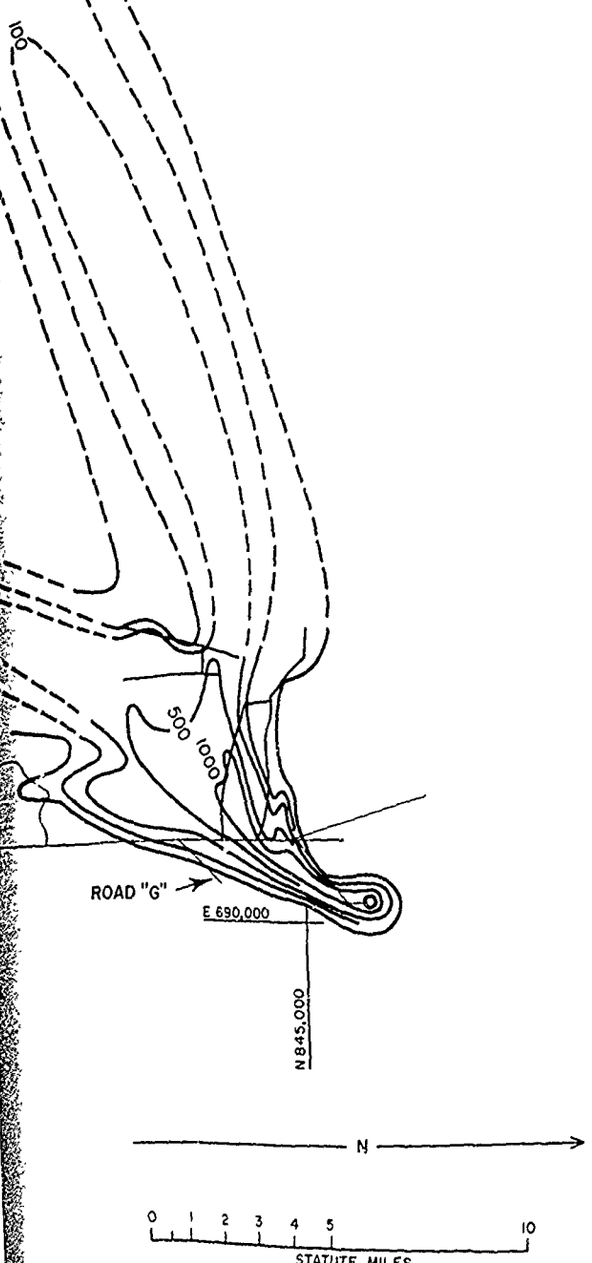
——— DOSE RATE CONTOURS, MEASURED

– – – – – DOSE RATE CONTOURS, ESTIMATED


50
10
10
100
10
CANE SPRING ROAD
50
100
500
1000
5
CP
ROAD "G"
E 690,000
N 845,000
MERCURY
MERCURY HIGHWAY
N
0 1 2 3 4 5
STATUTE MILES



METEOROLOGICAL DATA (0630 PST)



N

0 1 2 3 4 5 10
STATUTE MILES

QUAY (100 FT. STEEL TOWER) MAP B

H-HR = 0630 PST 10 OCT 1958

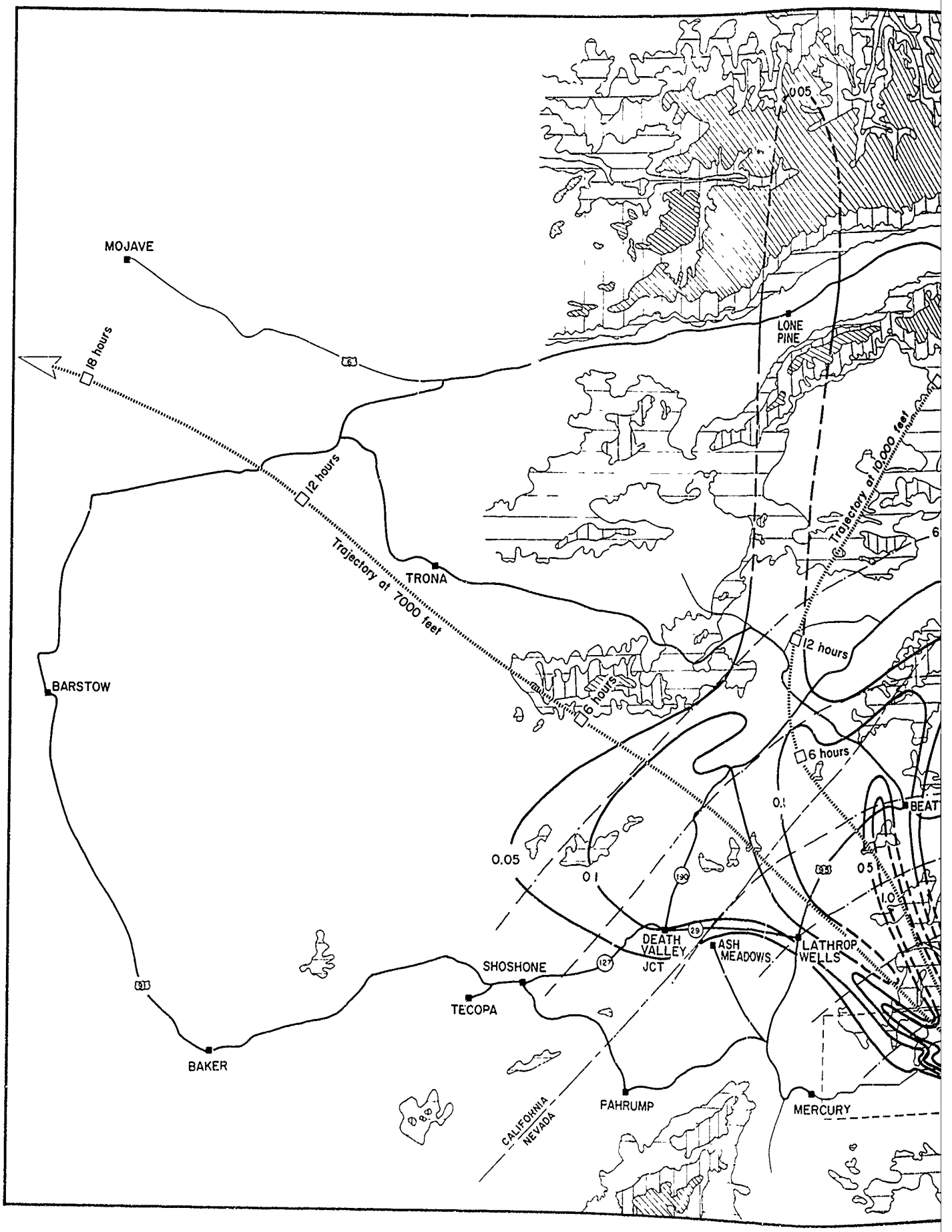
CLOUD TOP - 10,000 FT M.S.L.

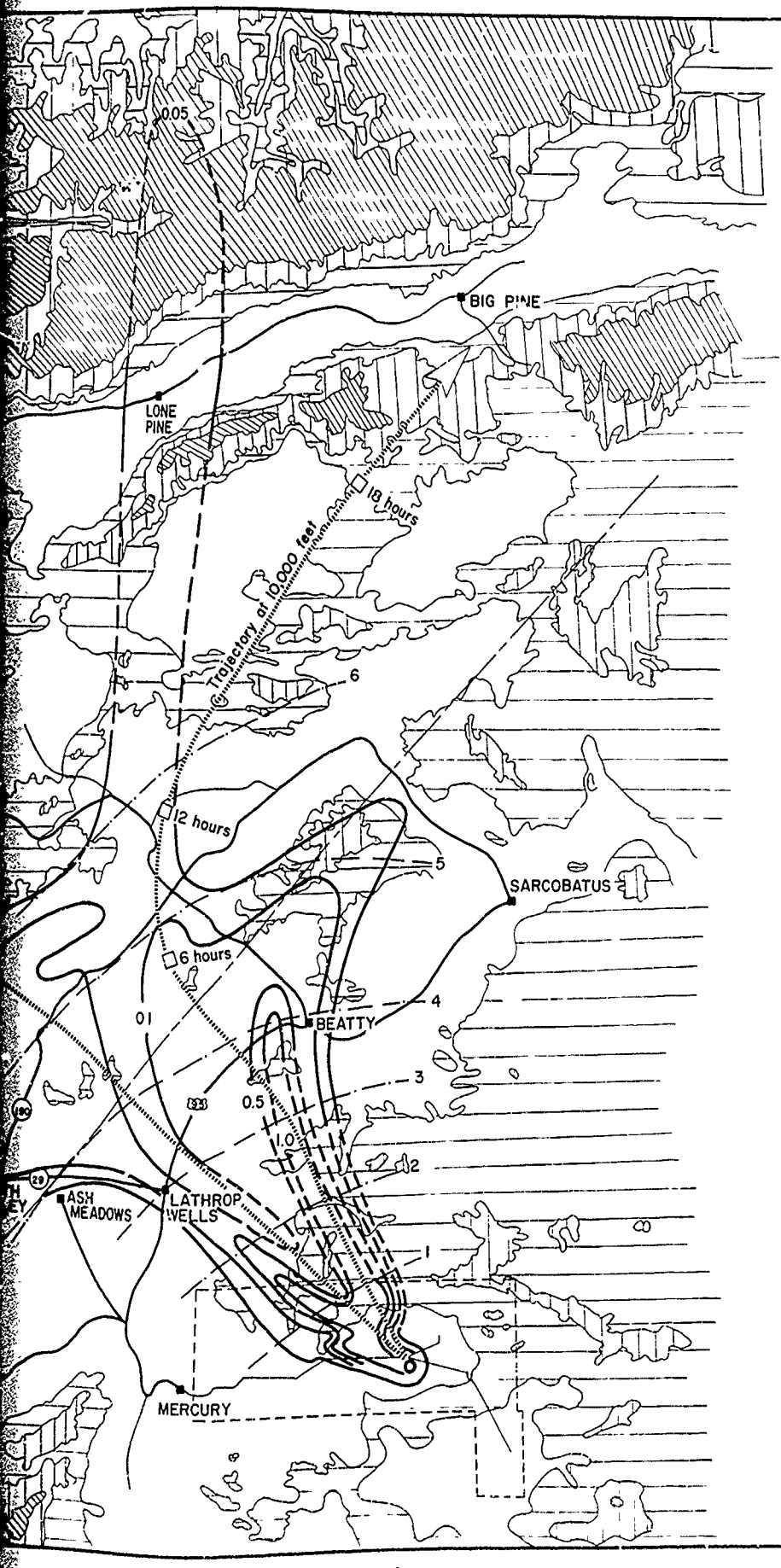
RESIDUAL GAMMA RADIATION
MR/HR AT H + 1 HOUR

— LEGEND —

——— DOSE RATE CONTOURS, MEASURED

– – – – DOSE RATE CONTOURS, ESTIMATED


MOJAVE
LONE PINE
18 hours
12 hours
Trajectory at 7000 feet
Trajectory at 10,000 feet
TRONA
BARSTOW
6 hours
12 hours
6 hours
0.05
0.1
0.5
1.0
DEATH VALLEY JCT
ASH MEADOWS
LATHROP WELLS
SHOSHONE
TECOPA
BAKER
PAHRUMP
MERCURY
CALIFORNIA
NEVADA



REMARKS

Since the winds were light, with several small cyclonic and anticyclonic cells in the area, there is considerable doubt as to the true path of the trajectories.

The air sampling of beta activity indicated above-background readings at Beatty, Goldfield, Tonopah and Warm Springs These results indicated that at least a portion of the cloud had a northward trajectory from Beatty towards Tonopah and then probably veered toward Warm Springs.

There were no monitor runs north of Sarcobatus, but it is believed that the fallout north of this point was light since the activity would have been spread over a relatively large area. Therefore, the pattern was not extended toward the north, even though the beta readings indicated this to be the path of the activity.

Since this event was well documented off-site, the pattern is considered to be reliable.

N

0 5 10 20 30 40
STATUTE MILES

QUAY (100 FT STEEL TOWER) MAP C
H-HR= 0630 PST 10 OCT 1958
CLOUD TOP- 10,000 FT M S L.

RESIDUAL GAMMA RADIATION
MR/HR AT H + 12 HOURS

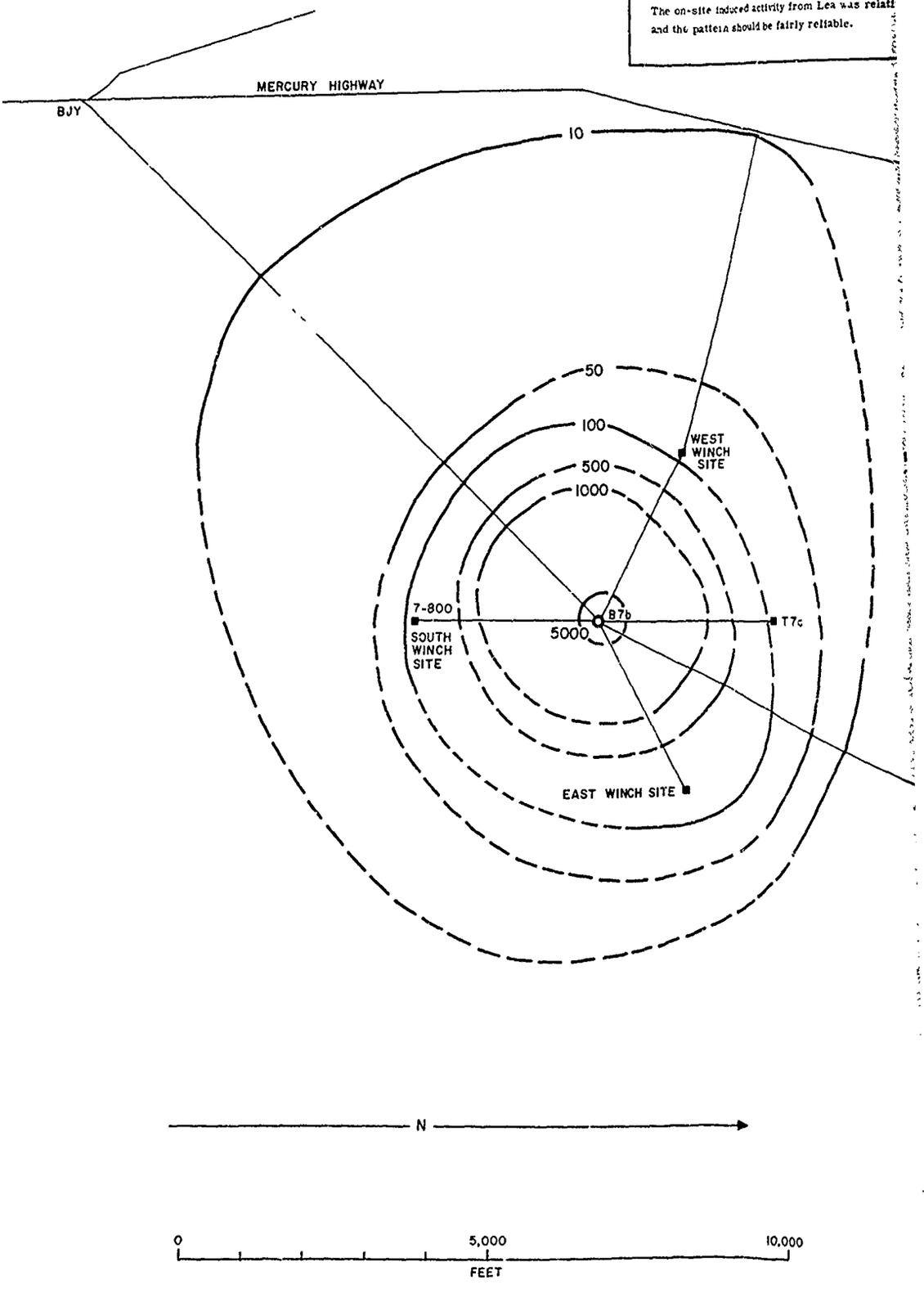
— LEGEND —

- DOSE RATE CONTOURS, MEASURED
- DOSE RATE CONTOURS, ESTIMATED
- TIME OF ARRIVAL, ESTIMATED, H+HOURS
- ELEVATION 5000 TO 7000 FEET
- ELEVATION 7000 TO 9000 FEET
- ELEVATION MORE THAN 9000 FEET
- ROAD (THICK LINE INDICATES MONITORED SECTION)

2

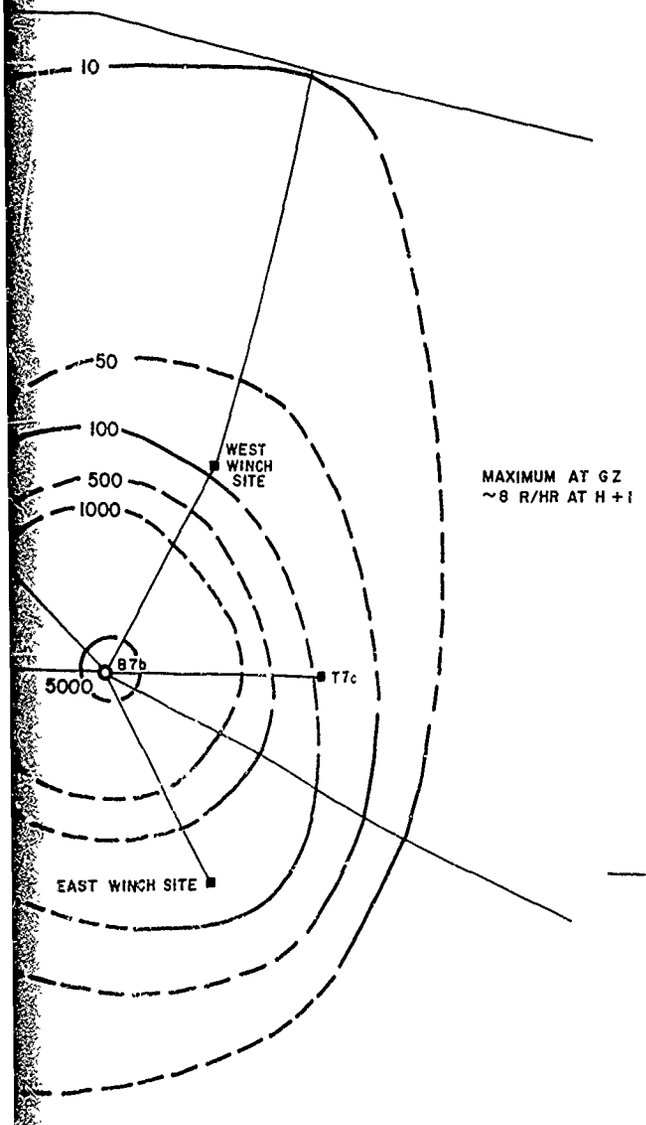
REMARKS

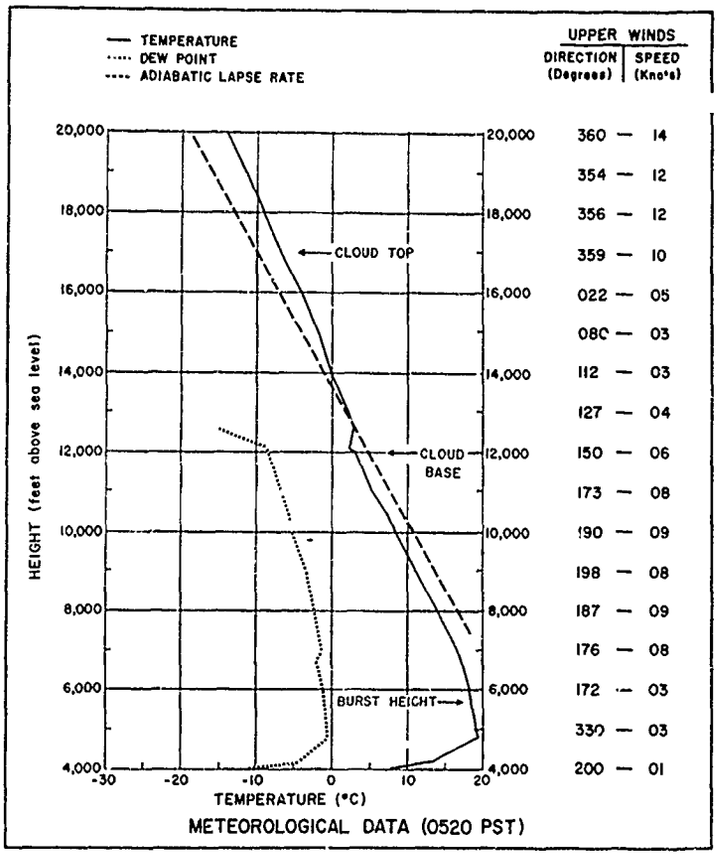
The on-site induced activity from Lea was relati
and the pattern should be fairly reliable.



REMARKS

The on-site induced activity from Lea was relatively well documented and the pattern should be fairly reliable.





METEOROLOGICAL DATA (0520 PST)

LEA (1500 FT BALLOON) MAP A

H-HR= 0520 PST 13 OCT. 1958

CLOUD TOP- 17,000 FT. M.S.L.

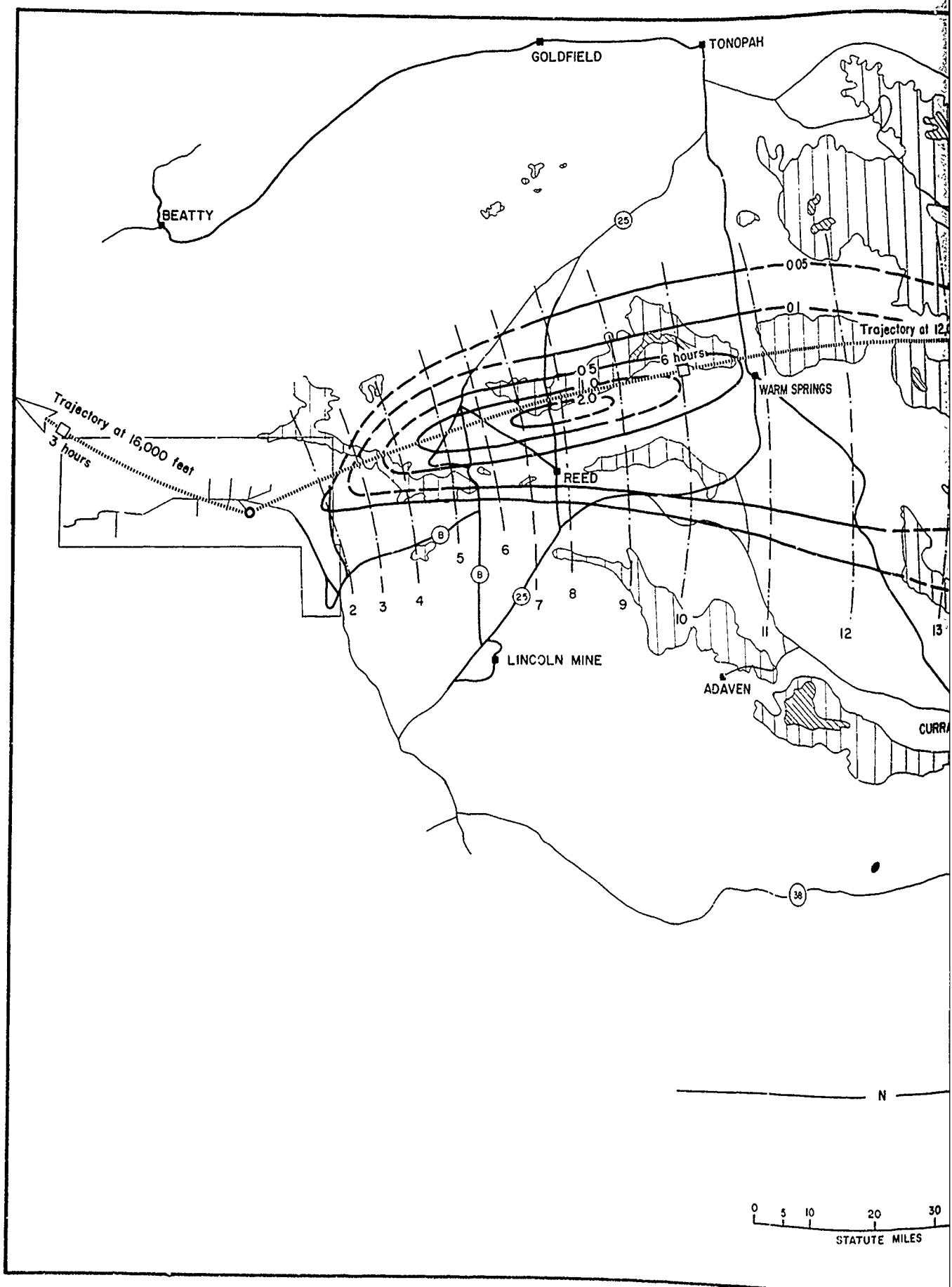
RESIDUAL GAMMA RADIATION
MR/HR AT H + 1 HOUR

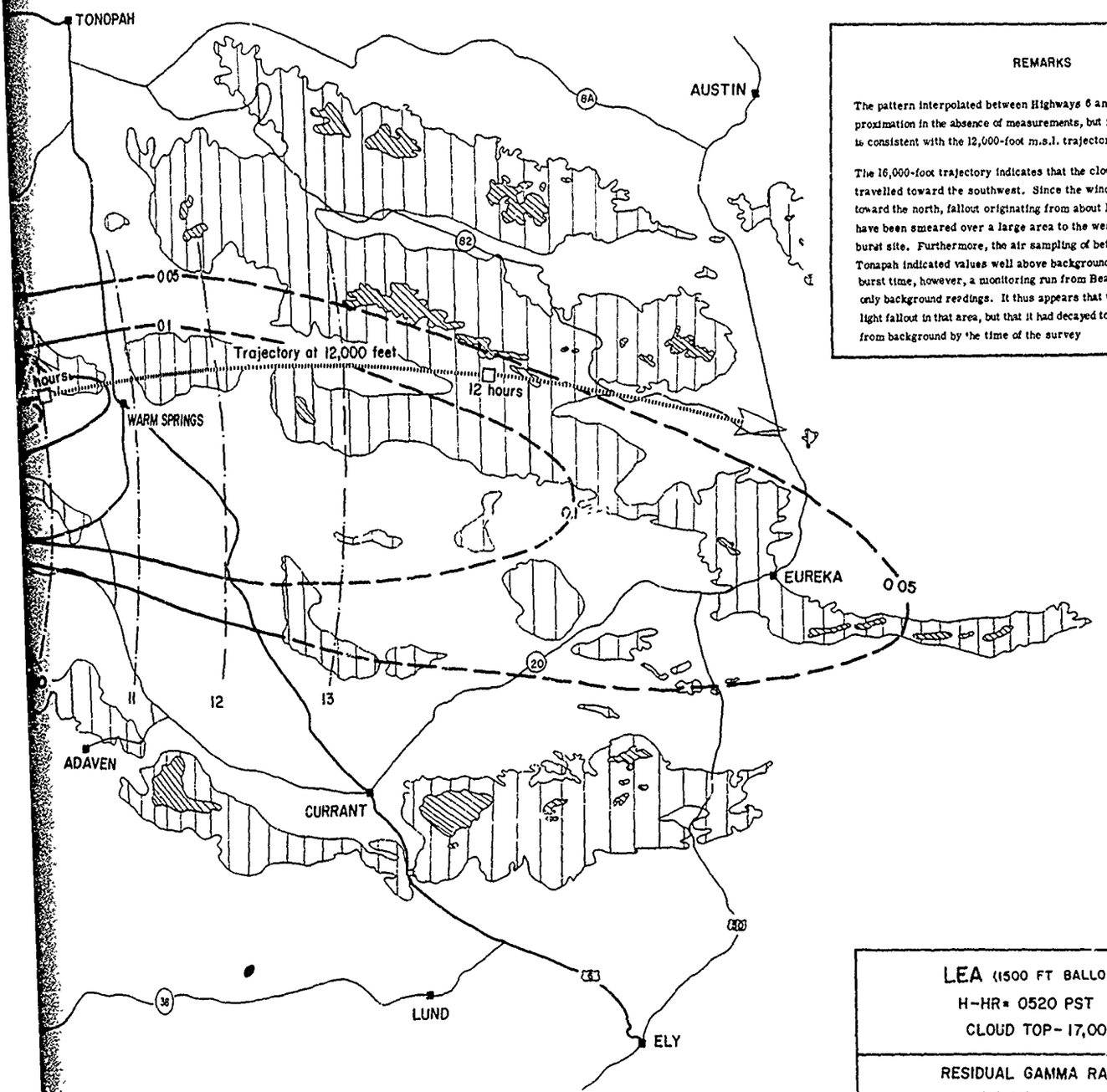
— LEGEND —

——— DOSE RATE CONTOURS, MEASURED

– – – – – DOSE RATE CONTOURS, ESTIMATED

2


GOLDFIELD
TONOPAH
BEATTY
25
0.05
0.1
Trajectory at 12,
6 hours
0.5
1.0
2.0
WARM SPRINGS
Trajectory at 16,000 feet
3 hours
REED
8
5
6
8
25
2
3
4
7
8
9
10
11
12
13
LINCOLN MINE
ADAVEN
CURRA
38
N
0
5
10
20
30
STATUTE MILES



REMARKS

The pattern interpolated between Highways 6 and 50 can only be an approximation in the absence of measurements, but its orientation, at least, is consistent with the 12,000-foot m.s.l. trajectory.

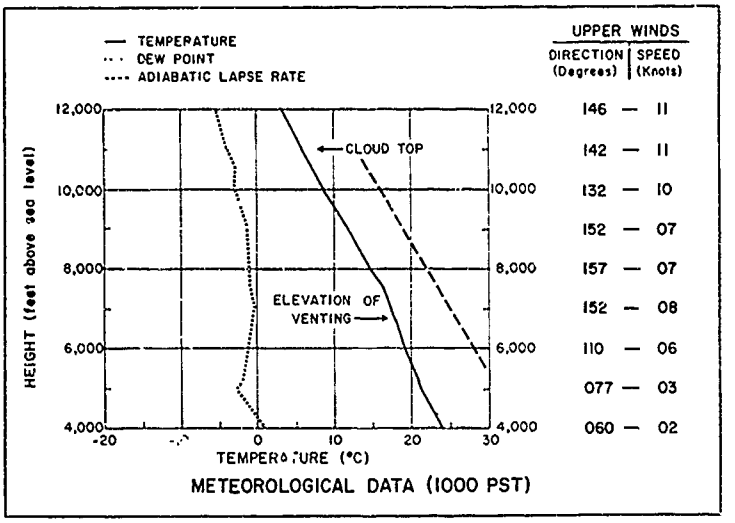
The 16,000-foot trajectory indicates that the cloud at that level initially travelled toward the southwest. Since the winds at lower levels were toward the north, fallout originating from about 16,000 feet m.s.l. would have been smeared over a large area to the west and northwest of the burst site. Furthermore, the air sampling of beta activity at Beatty and Tonapah indicated values well above background. About 30 hours after burst time, however, a monitoring run from Beatty to Tonopah reported only background readings. It thus appears that there probably was very light fallout in that area, but that it had decayed to levels indistinguishable from background by the time of the survey

LEA (1500 FT BALLOON) MAP B
H-HR= 0520 PST 13 OCT. 1958
CLOUD TOP- 17,000 FT. M.S.L.

RESIDUAL GAMMA RADIATION
MR/HR AT H+12 HOURS

— LEGEND —

- DOSE RATE CONTOURS, MEASURED
- DOSE RATE CONTOURS, ESTIMATED
- TIME OF ARRIVAL, ESTIMATED. H+HOURS
- ELEVATION 7000 TO 9000 FEET
- ELEVATION MORE THAN 9000 FEET
- ROAD (THICK LINE INDICATES MONITORED SECTION)



METEOROLOGICAL DATA (1000 PST)

REMARKS

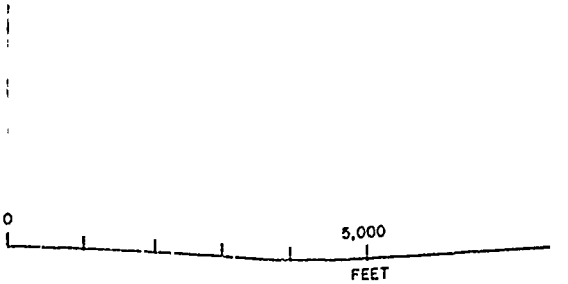
The Neptune explosion vented through the mesa slope at an elevation of about 6,800 feet. The cloud rose to about 11,000 feet m.s.l. The winds at the mesa mountain tower indicated that the lower layers of the cloud would be transported on a bearing of 310 degrees. The actual fallout was centered on a bearing of about 300 degrees. This would imply that the direction was fairly constant between the level of the top of the cloud and that part which passed just above the mesa.

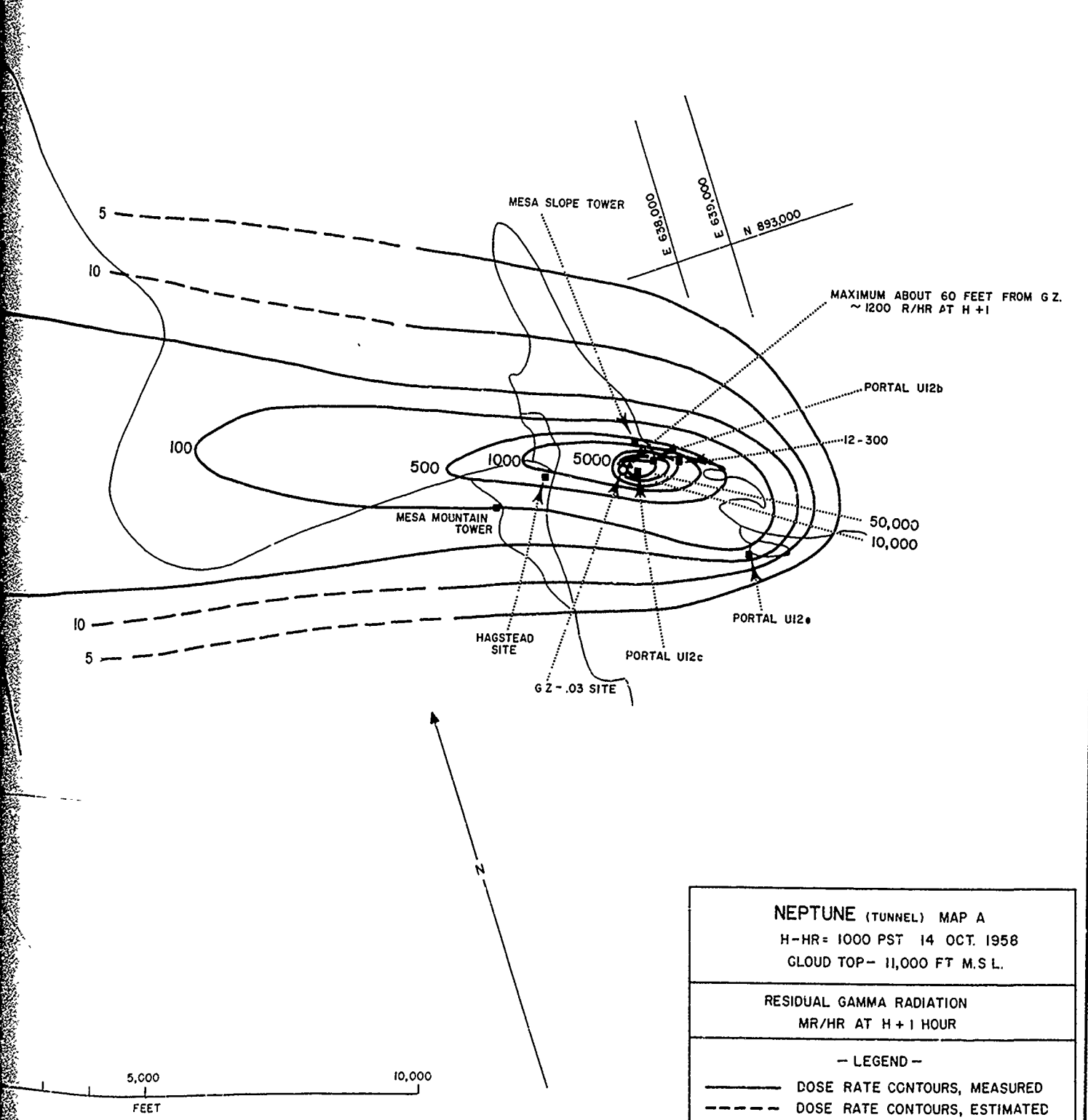
The pattern for that part of the mesa which was monitored, as indicated by the solid lines, is considered fairly reliable.

No activity above background levels was reported off site.

15 Minute Average Winds

	9-foot Mesa Slope Tower (Surface Elevation-6725 feet m.s.l.)		100-foot Mesa Mountain Tower (Surface Elevation-7465 feet m.s.l.)	
Time (PST)	Direction (degrees)	Speed (m.p.h.)	Direction (degrees)	Speed (m.p.h.)
0745-0800	040	05	180	09
0845-0900	040	07	110	02
0945-1000	045	08	130	06
1045-1100	050	10	Missing	Missing
1145-1200	060	10	Missing	Missing



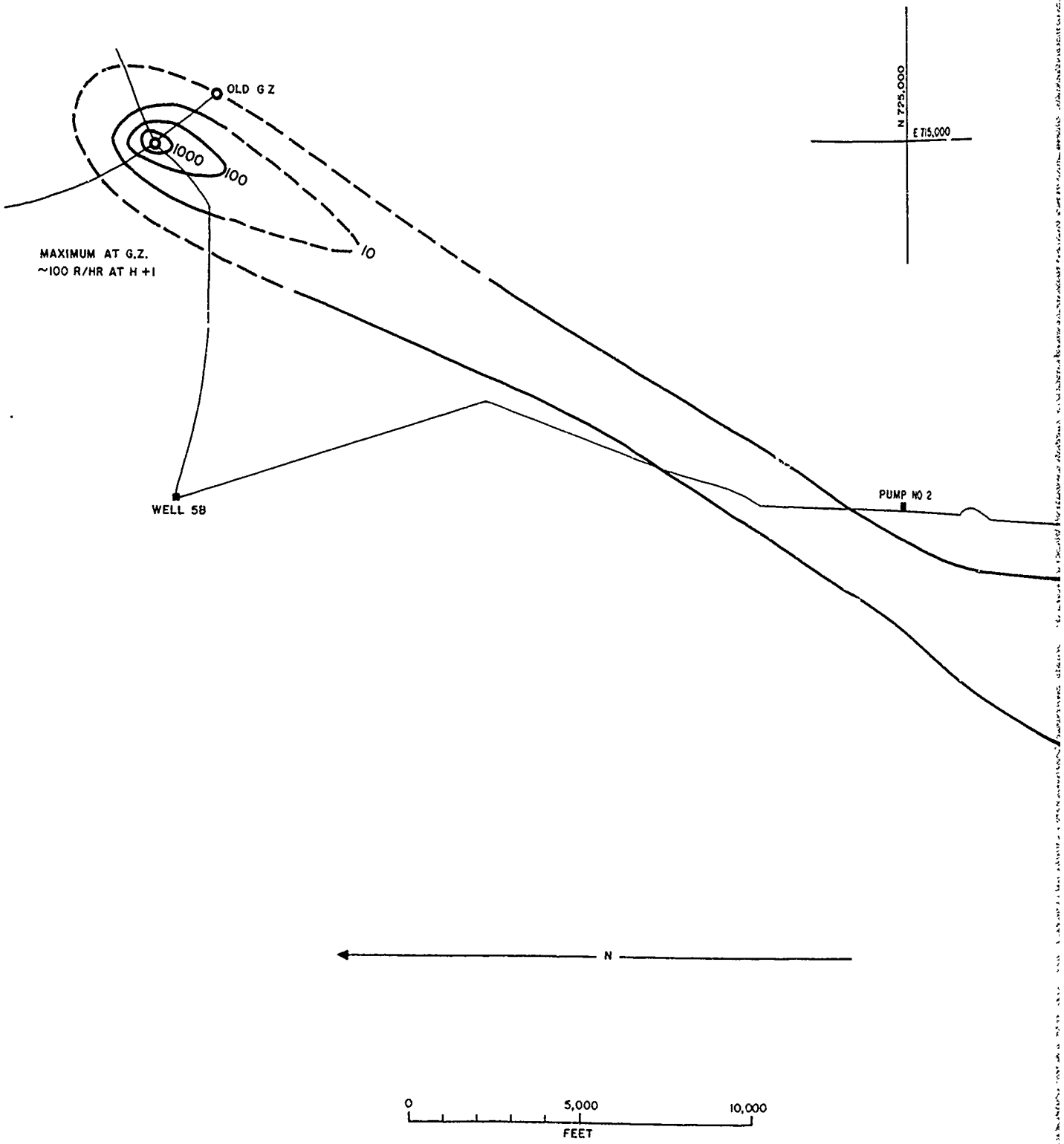


NEPTUNE (TUNNEL) MAP A
H-HR= 1000 PST 14 OCT. 1958
CLOUD TOP- 11,000 FT M.S.L.

RESIDUAL GAMMA RADIATION
MR/HR AT H + 1 HOUR

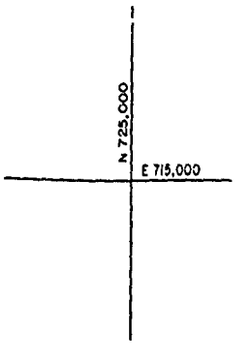
— LEGEND —
——— DOSE RATE CONTOURS, MEASURED
- - - - - DOSE RATE CONTOURS, ESTIMATED

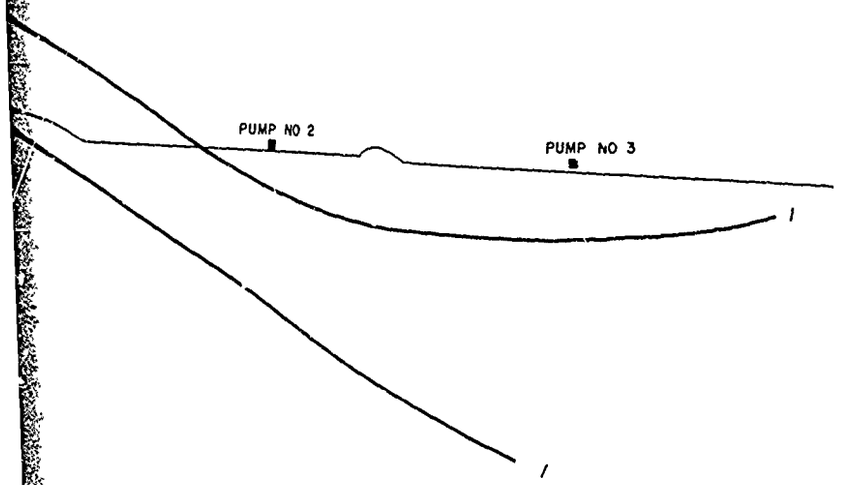
2


OLD G Z
1000
100
10
MAXIMUM AT G.Z.
~100 R/HR AT H +1
WELL 58
N 725,000
E 715,000
PUMP NO 2
N
0
5,000
10,000
FEET

REMARKS

The downwind extent of the 10 mr/hr line is uncertain but the rest of the pattern is considered to be reliable.





HAMILTON (50 FT WOOD TOWER) MAP A

H-HR= 0800 PST 15 OCT 1958

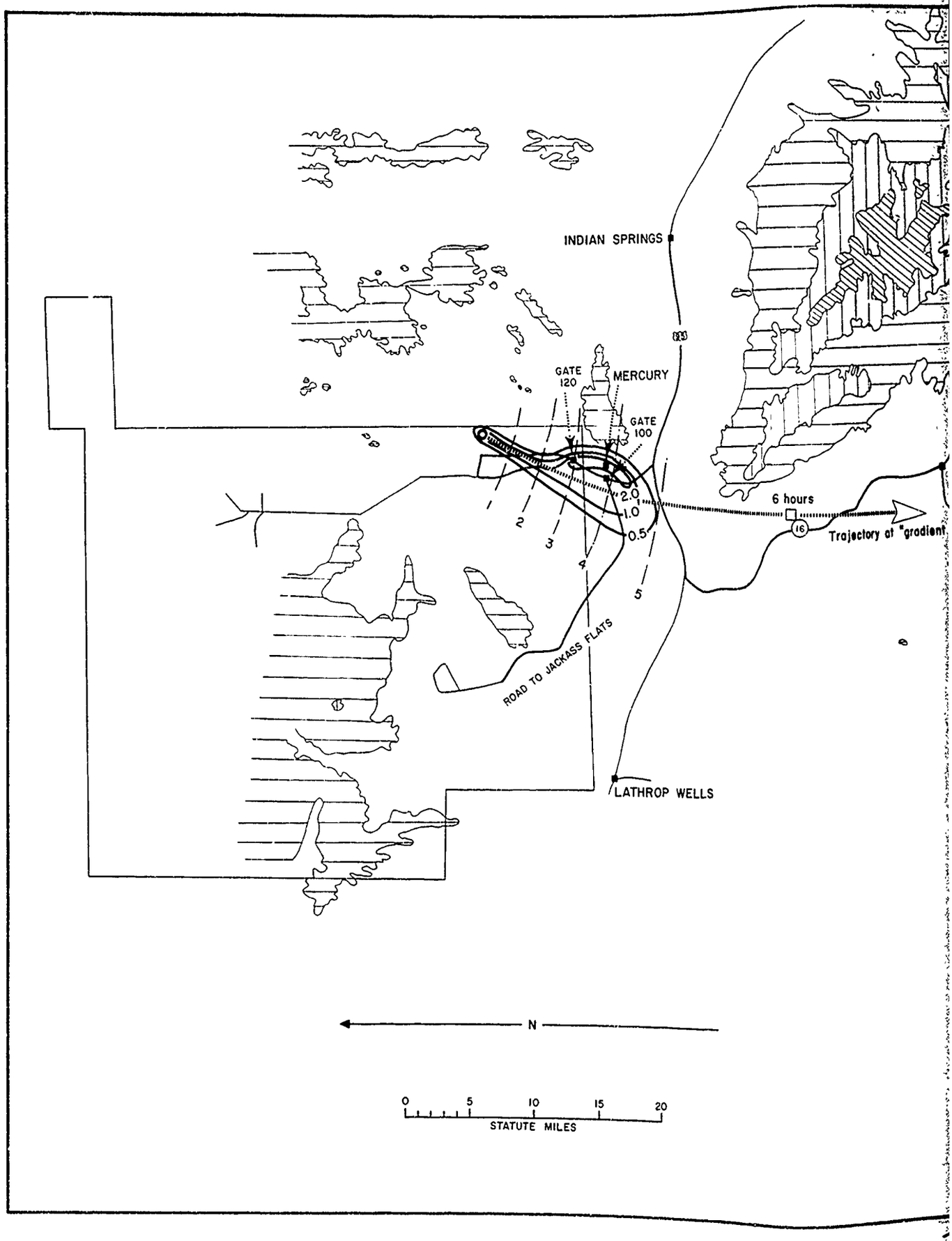
CLOUD TOP-- 6,000 FT M.S.L.

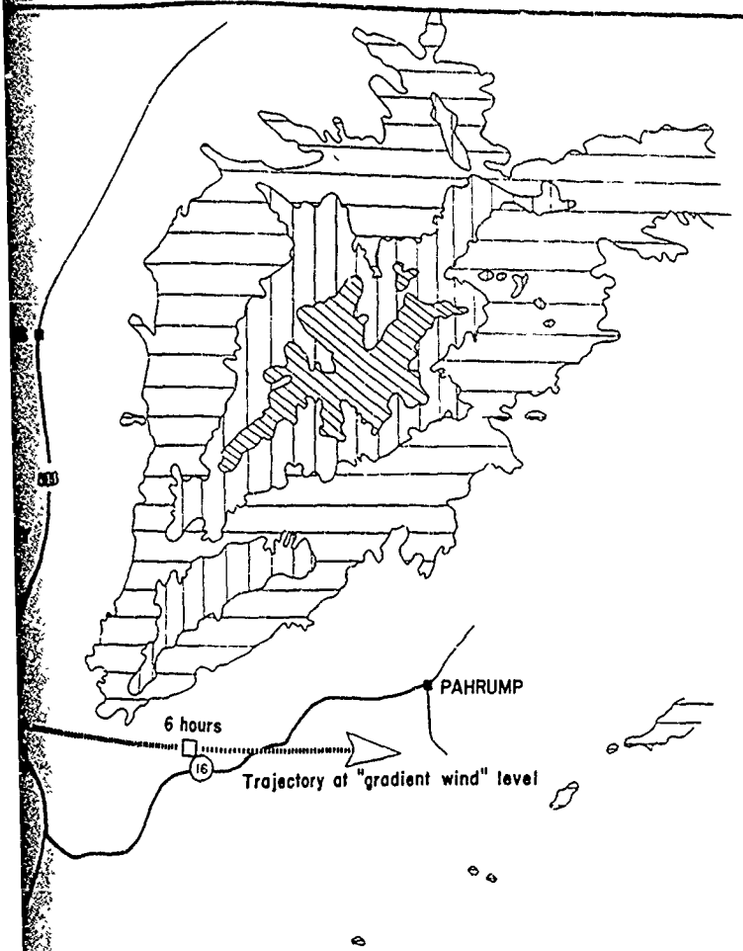
RESIDUAL GAMMA RADIATION
MR/HR AT H + 1 HOUR

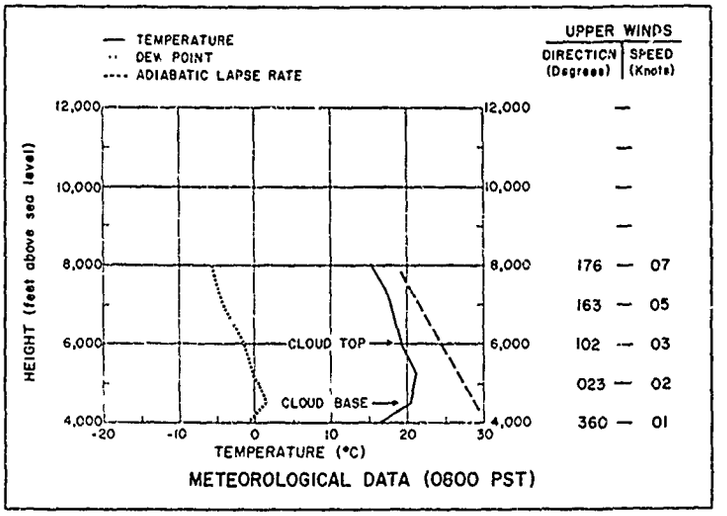
— LEGEND —

——— DOSE RATE CONTOURS, MEASURED

– – – – – DOSE RATE CONTOURS, ESTIMATED


INDIAN SPRINGS
95
GATE 120
MERCURY
GATE 100
2.0
1.0
0.5
1
2
3
4
5
6 hours
16
Trajectory at "gradient
ROAD TO JACKASS FLATS
LATHROP WELLS
N
0
5
10
15
20
STATUTE MILES





METEOROLOGICAL DATA (0800 PST)

REMARKS

The representativeness of the temperature height curve shown with the meteorological data is questionable, since the elevation of the Hamilton site in Frenchman's Flat is 3,080 feet, about 800 feet below that of the Yucca Lake weather station where the temperature soundings were made. Also, because of the very low speeds and the influence of terrain, the winds reported may not be representative of those in Frenchman's Flat.

The gradient wind trajectory had a speed of about 4 knots while the mean wind speed from the surface to 6,000 feet m.s.l. was about 2 knots. As the cloud moved southward rather slowly, it gave moderate peaks of activity at Mercury as indicated in figure 5.

This pattern was relatively well documented and is consistent with the wind analysis.

HAMILTON (50 FT WOOD TOWER) MAP B

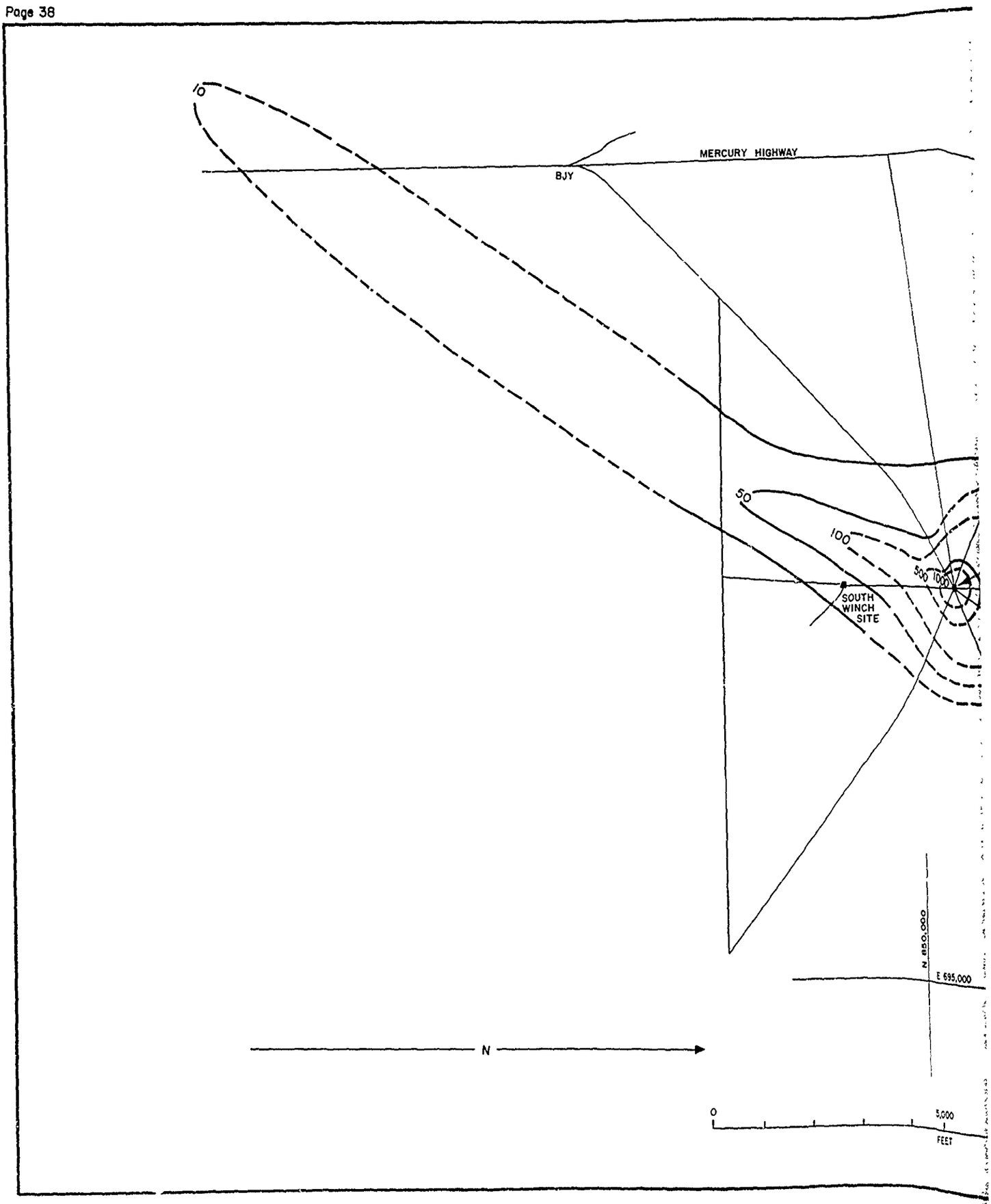
H-HR= 0800 PST 15 OCT. 1958

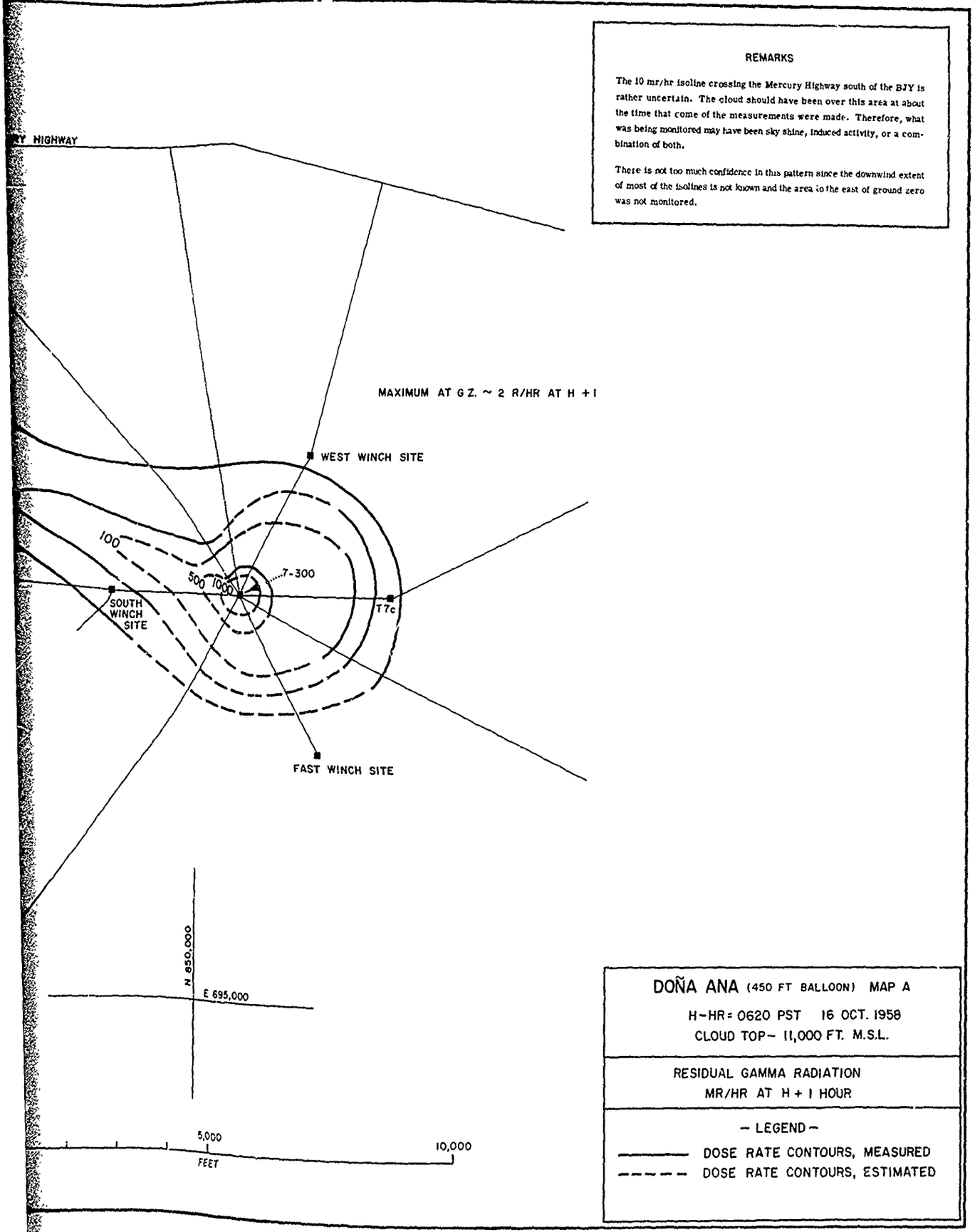
CLOUD TOP- 6,000 FT. M.S.L.

RESIDUAL GAMMA RADIATION
MR/HR AT H + 1 HOUR

— LEGEND —

- DOSE RATE CONTOURS, MEASURED
- DOSE RATE CONTOURS, ESTIMATED
- TIME OF ARRIVAL, ESTIMATED, IN HOURS
- ELEVATION 5000 TO 7000 FEET
- ELEVATION 7000 TO 9000 FEET
- ELEVATION MORE THAN 9000 FEET
- ROAD (THICK LINE INDICATES MONITORED SECTION)


10
MERCURY HIGHWAY
BJY
50
100
500
1000
SOUTH
WINCH
SITE
N 850,000
E 695,000
N
0
5,000
FEET



REMARKS

The 10 mr/hr isoline crossing the Mercury Highway south of the BJY is rather uncertain. The cloud should have been over this area at about the time that come of the measurements were made. Therefore, what was being monitored may have been sky shine, induced activity, or a combination of both.

There is not too much confidence in this pattern since the downwind extent of most of the isolines is not known and the area to the east of ground zero was not monitored.

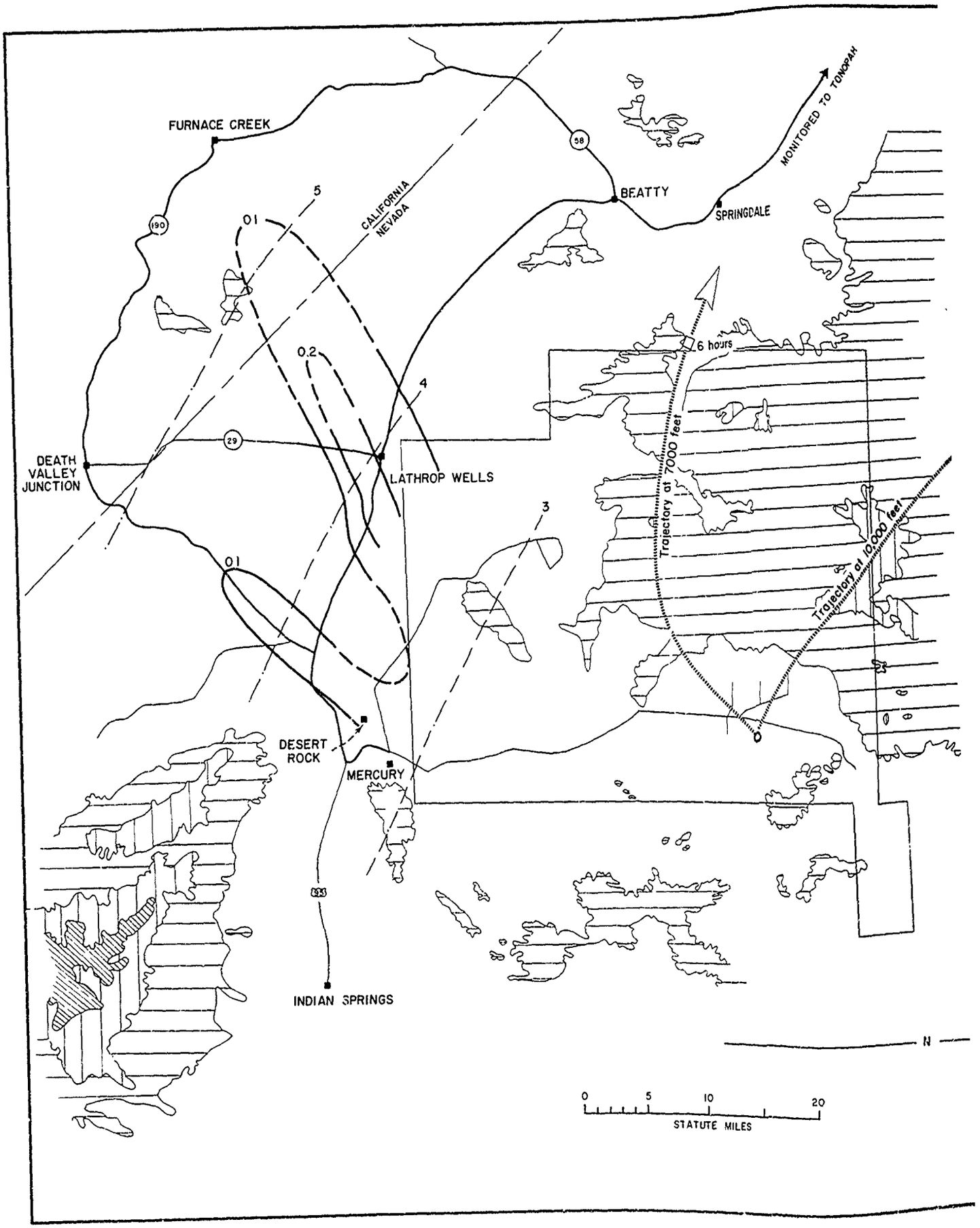
DOÑA ANA (450 FT BALLOON) MAP A

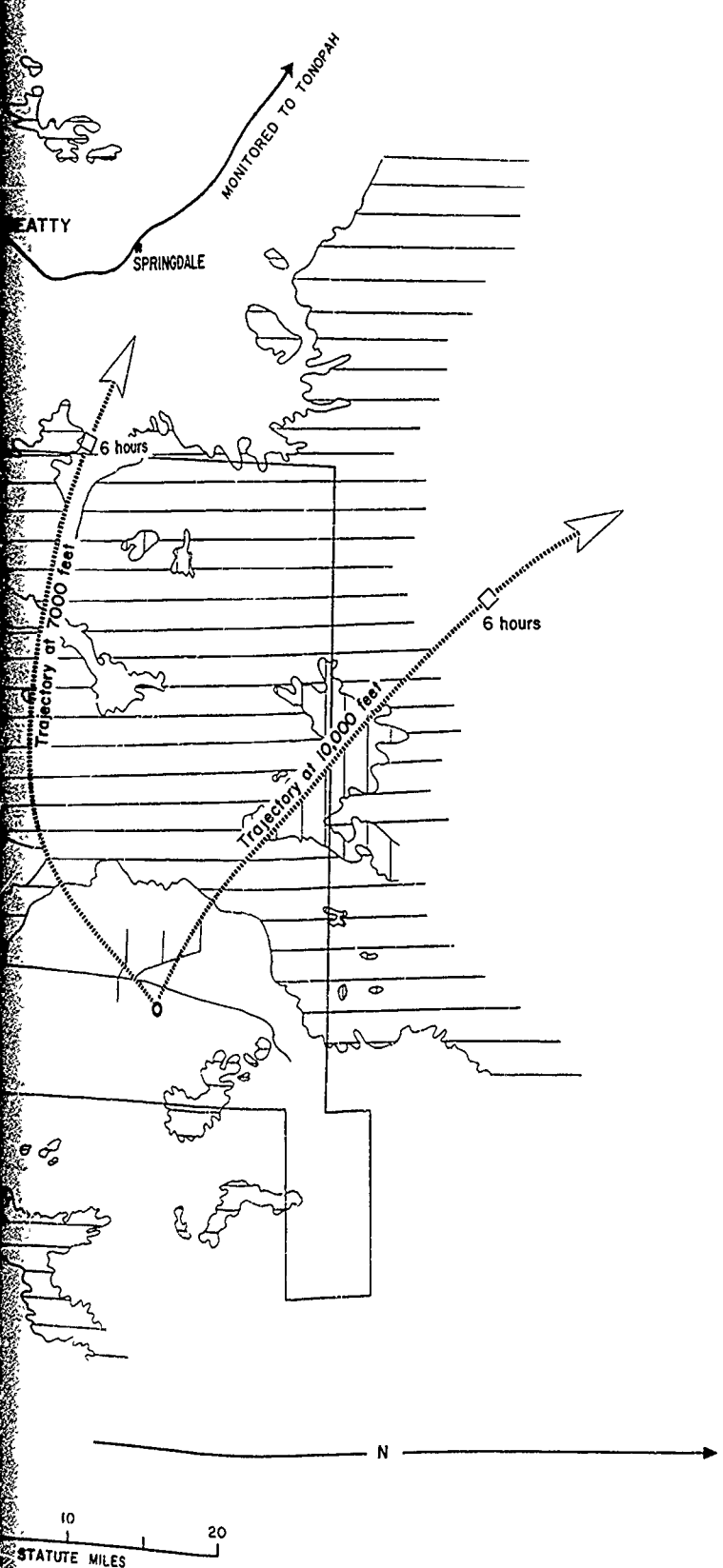
H-HR = 0620 PST 16 OCT. 1958
CLOUD TOP- 11,000 FT. M.S.L.

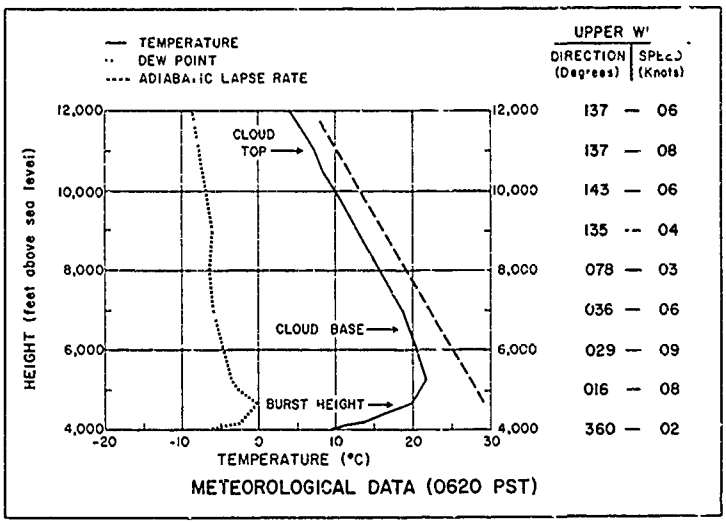
RESIDUAL GAMMA RADIATION
MR/HR AT H + 1 HOUR

- LEGEND -

——— DOSE RATE CONTOURS, MEASURED
– – – – DOSE RATE CONTOURS, ESTIMATED


FURNACE CREEK
58
BEATTY
SPRINGDALE
MONITORED TO TONOPAH
190
5
CALIFORNIA
NEVADA
01
0.2
4
6 hours
29
DEATH
VALLEY
JUNCTION
LATHROP WELLS
3
Trajectory at 7000 feet
Trajectory at 10,000 feet
01
DESERT
ROCK
MERCURY
95
INDIAN SPRINGS
N
0
5
10
20
STATUTE MILES





METEOROLOGICAL DATA (0620 PST)

REMARKS

Since there were no monitoring runs between the immediate ground zero area and Highway 95, it is not known whether there was any fallout between the on-site and off-site patterns as drawn.

The correlation between the trajectories shown and the fallout pattern is rather poor. The low-level winds were toward the south for approximately 6 hours after shot time; therefore, any fallout originating at 7,000 to 10,000 feet m.s.l. should have been spread out over the area south to northwest of the burst point. The air sampling of beta activity did indicate values above background at Tonopah, Goldfield, Beatty, and Lathrop Wells. Also, some gamma activity was reported by the monitors from 15 miles north of Springdale to Lathrop Wells. Thus, in addition to the fallout area shown, there was most likely some very light fallout in the general area from Lathrop Wells to Tonopah.

Although there were monitoring runs along a large number of roads off site, the pattern as drawn is not considered to be very reliable because of the uncertainties in dealing with activity often only two or three times the background value.

DOÑA ANA (450 FT BALLOON) MAP B

H-HR = 0620 PST 16 OCT. 1958

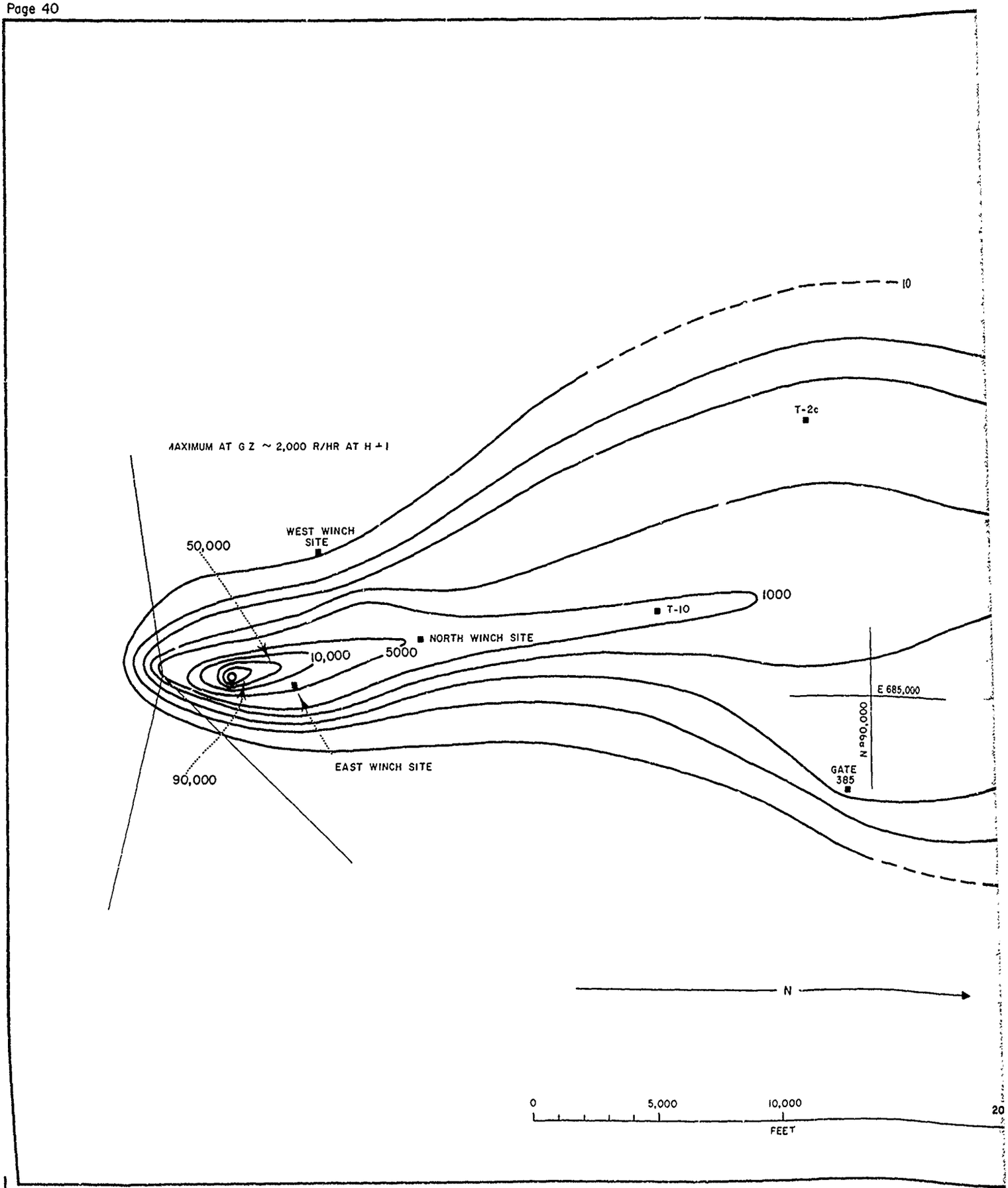
CLOUD TOP - 11,000 FT. M.S.L.

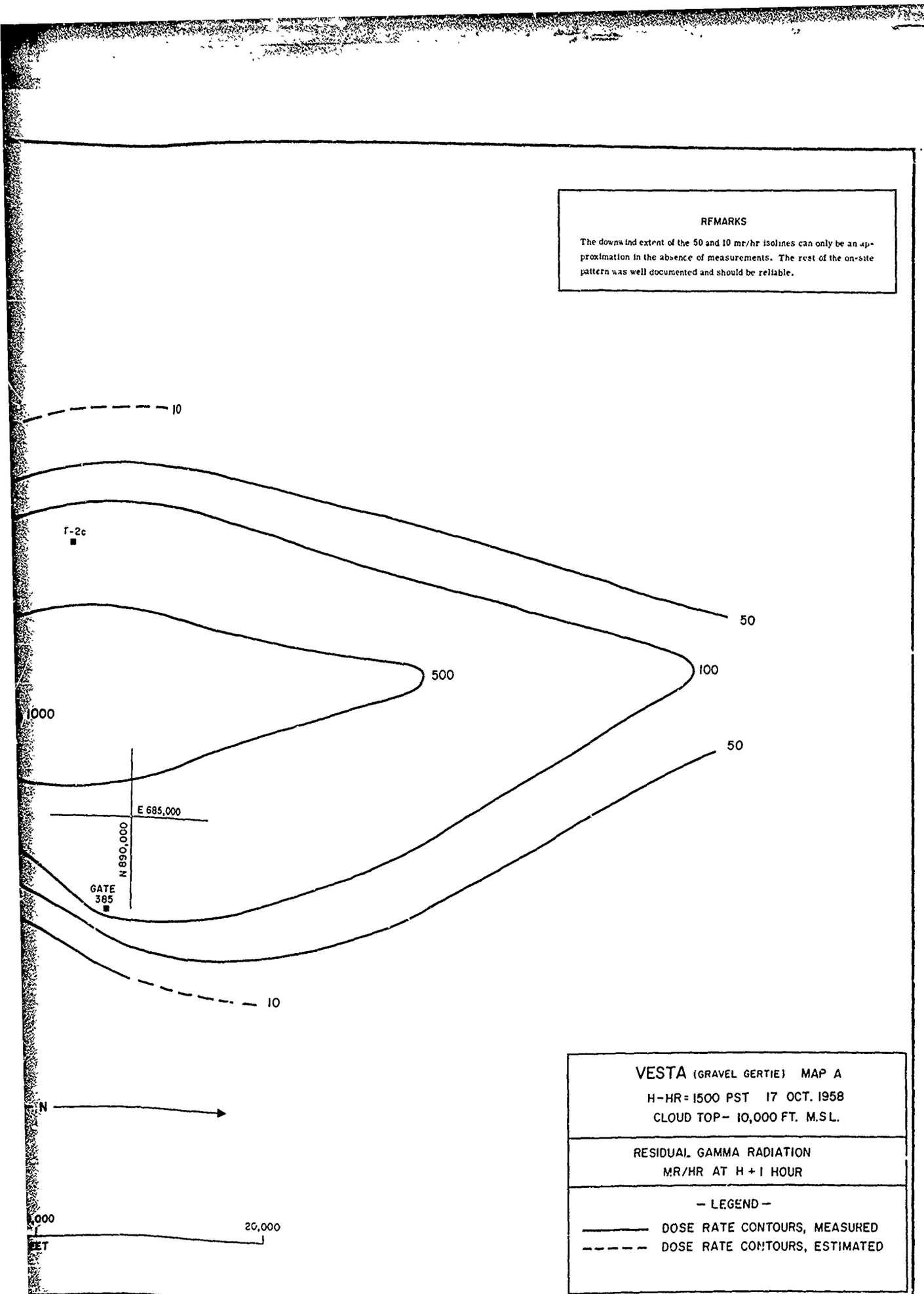
RESIDUAL GAMMA RADIATION
MR/HR AT H + 1 HOUR

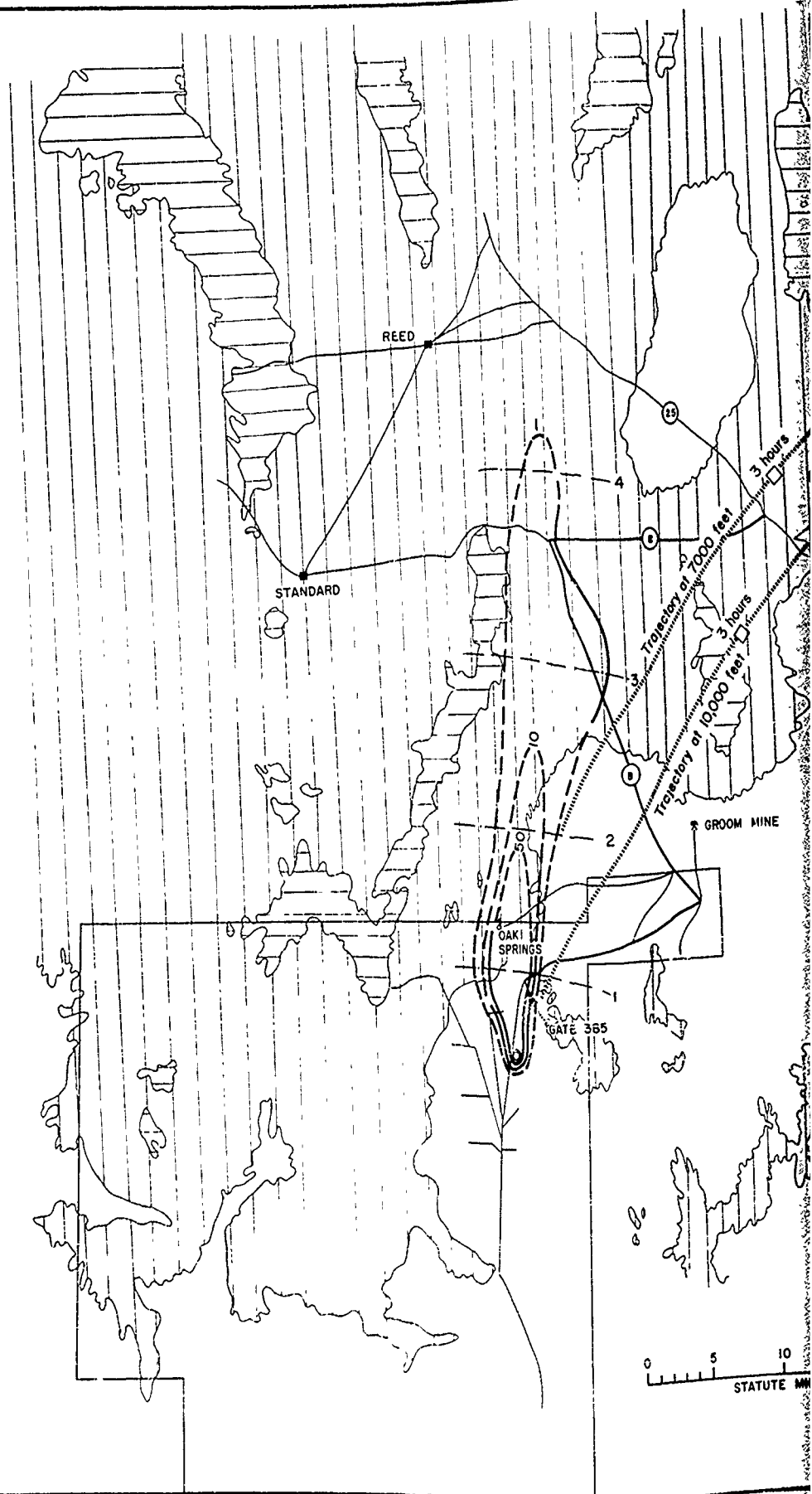
— LEGEND —

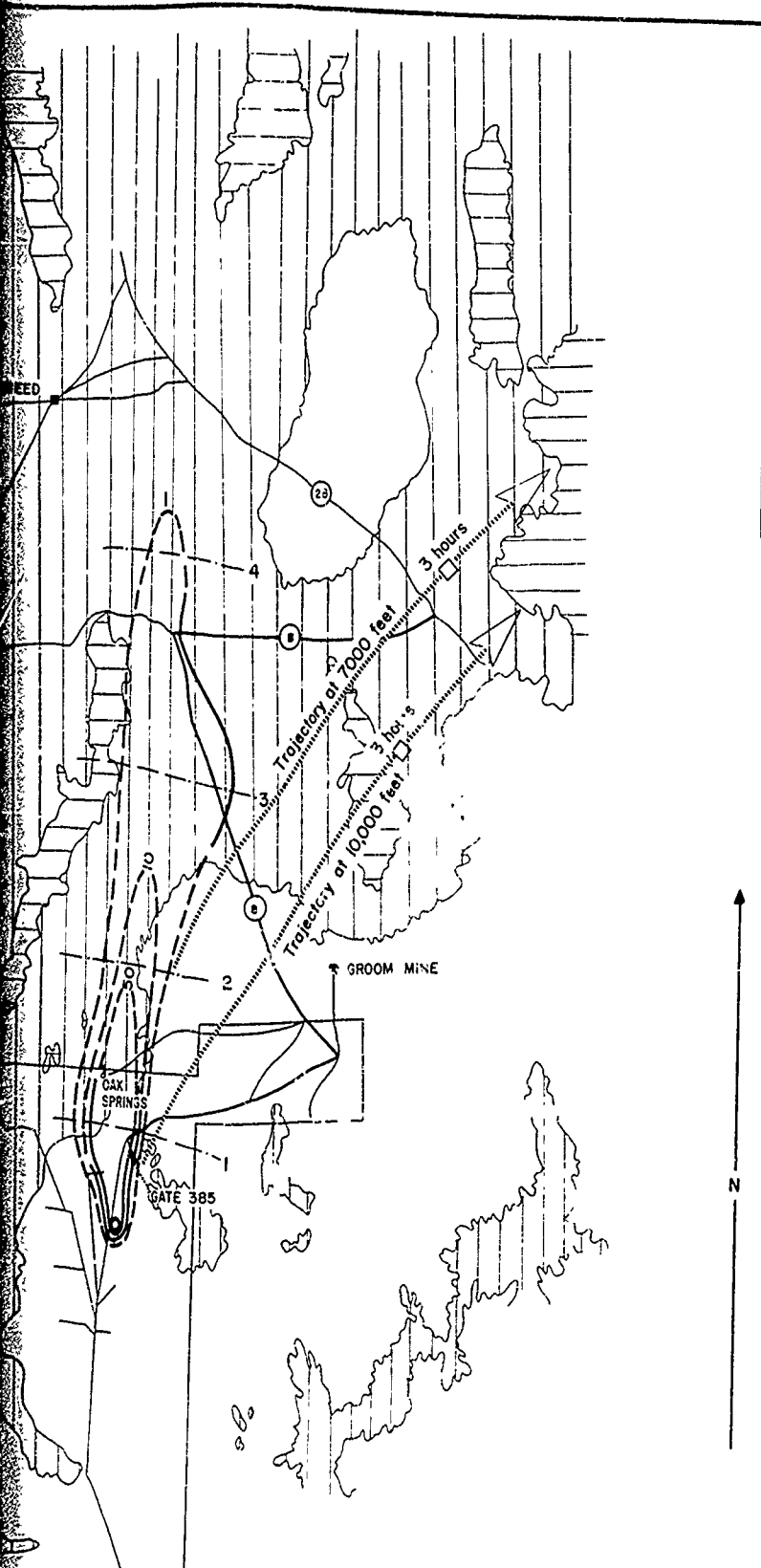
- DOSE RATE CONTOURS, MEASURED
- DOSE RATE CONTOURS, ESTIMATED
- TIME OF ARRIVAL, ESTIMATED, H + HOURS
- ELEVATION 5000 TO 7000 FEET
- ELEVATION 7000 TO 9000 FEET
- ELEVATION MORE THAN 9000 FEET
- ROAD (THICK LINE INDICATES MONITORED SECTION)

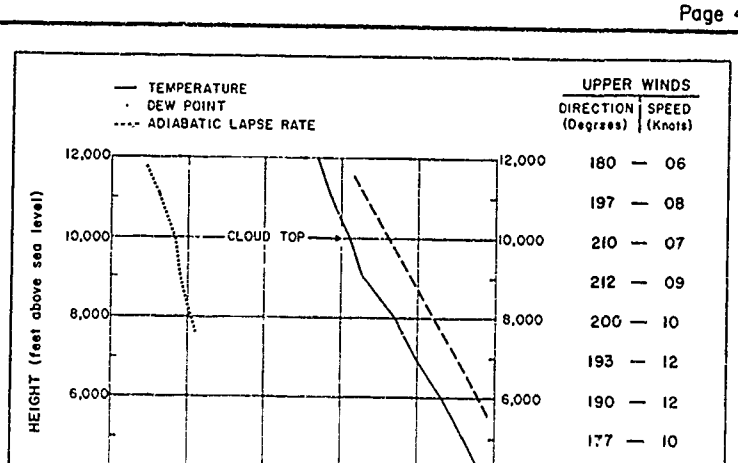
2


MAXIMUM AT G Z ~ 2,000 R/HR AT H + 1
10
T-2c
WEST WINCH SITE
50,000
1000
T-10
NORTH WINCH SITE
10,000
5000
E 685,000
N 890,000
GATE 385
90,000
EAST WINCH SITE
N
0
5,000
10,000
FEET


REMARKS
The downwind extent of the 50 and 10 mr/hr isolines can only be an approximation in the absence of measurements. The rest of the on-site pattern was well documented and should be reliable.
10
T-2c
50
500
100
1000
50
E 685,000
N 890,000
GATE 385
10
N
20,000
VESTA (GRAVEL GERTIE) MAP A
H-HR = 1500 PST 17 OCT. 1958
CLOUD TOP- 10,000 FT. M.S.L.
RESIDUAL GAMMA RADIATION
MR/HR AT H + 1 HOUR
- LEGEND -
DOSE RATE CONTOURS, MEASURED
DOSE RATE CONTOURS, ESTIMATED


REED
STANDARD
GROOM MINE
OAK SPRINGS
GATE 365
Trajectory at 7000 feet
3 hours
Trajectory at 10,000 feet
3 hours
4
3
2
1
50
25
B
D
0
5
10
STATUTE





METEOROLOGICAL DATA (1500 PST)

REMARKS

The cloud from Vesta was observed to rise initially to about 7,500 or 8,000 feet m.s.l. Then from the top of the cloud a large bulge rose in the manner of a cumulus cloud, reaching an altitude of about 10,000 feet at about 20 minutes after the detonation. Although the trajectories in the 7,000- to 10,000-foot layer were estimated to have passed somewhat to the east of the areas where fallout was observed, fallout from these upper parts of the cloud would have been displaced westward by the winds in the lower levels. Thus, it is not possible to say whether there was fallout from the late-rising upper part of the cloud.

The off-site portion of the fallout pattern is considered rather uncertain, since there were few radiation measurements; however, its orientation is consistent with the wind analysis.

N

VESTA (GRAVEL GERTIE) MAP B

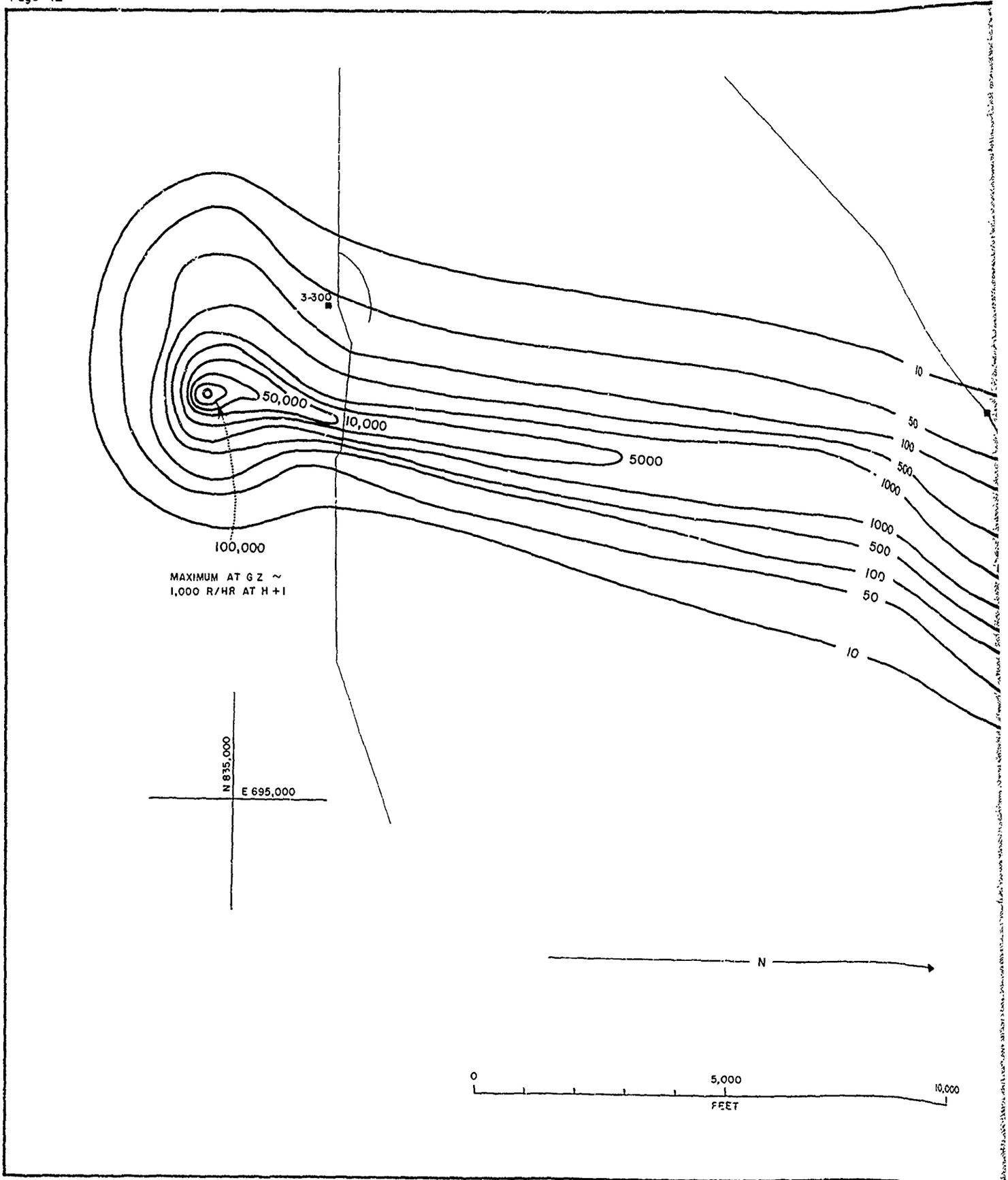
H-HR= 1500 PST 17 OCT. 1958

CLOUD TOP- 10,000 FT. M.S.L.

RESIDUAL GAMMA RADIATION
MR/HR AT H + 1 HOUR

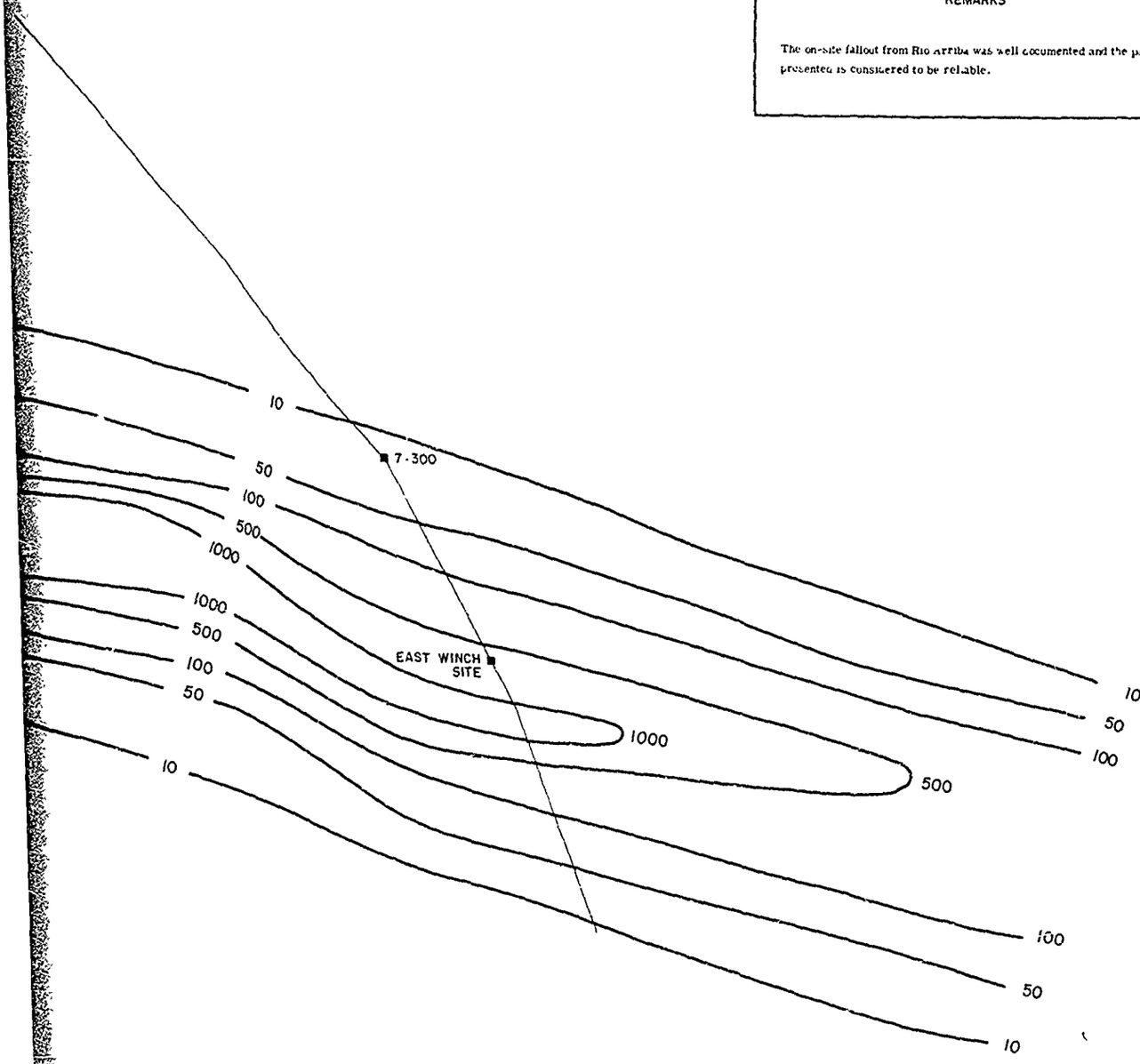
— LEGEND —

- DOSE RATE CONTOURS, MEASURED
- DOSE RATE CONTOURS, ESTIMATED
- TIME OF ARRIVAL, ESTIMATED, H+HOURS
- ELEVATION 5000 TO 7000 FEET
- ELEVATION 7000 TO 9000 FEET
- ELEVATION MORE THAN 9000 FEET
- ROAD (THICK LINE INDICATES MONITORED SECTION)


3-300
50,000
10,000
5000
100,000
MAXIMUM AT G Z ~
1,000 R/HR AT H+1
10
50
100
500
1000
1000
500
100
50
10
N 835,000
E 695,000
N
0
5,000
10,000
FEET

REMARKS

The on-site fallout from Rio Arriba was well documented and the pattern presented is considered to be reliable.



RIO ARRIBA (72 1/2 FT WOOD TOWER) MAP A

H-HR = 0625 PST 18 OCT 1958

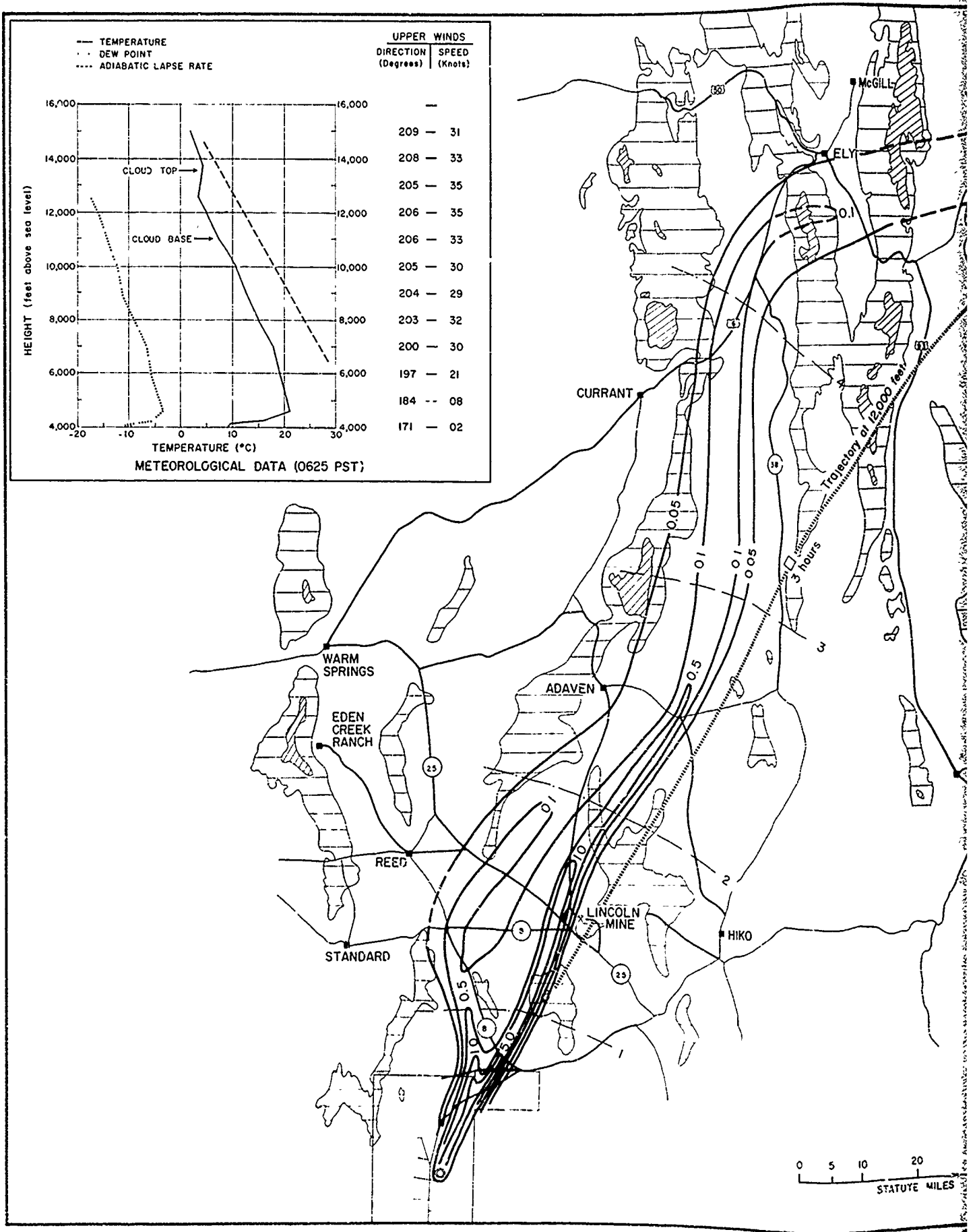
CLOUD TOP – 13,500 FT M.S.L.

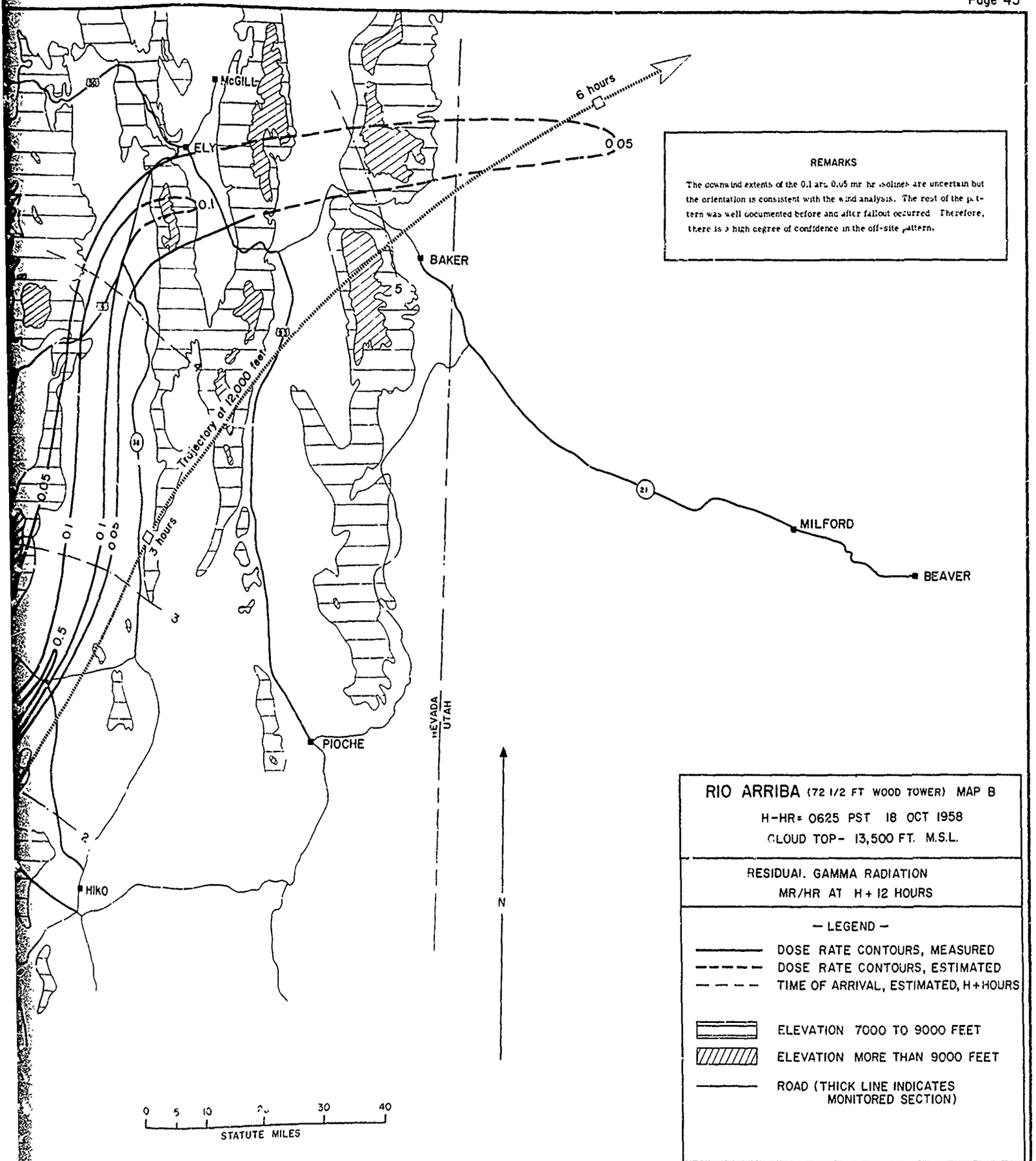
RESIDUAL GAMMA RADIATION
MR/HR AT H + 1 HOUR

– LEGEND –

——— DOSE RATE CONTOURS, MEASURED

– – – – – DOSE RATE CONTOURS, ESTIMATED


TEMPERATURE
DEW POINT
ADIABATIC LAPSE RATE
UPPER WINDS
DIRECTION (Degrees) | SPEED (Knots)
209 — 31
208 — 33
205 — 35
206 — 35
206 — 33
205 — 30
204 — 29
203 — 32
200 — 30
197 — 21
184 -- 08
171 — 02
HEIGHT (feet above sea level)
16,000
14,000
12,000
10,000
8,000
6,000
4,000
CLOUD TOP
CLOUD BASE
-20
-10
0
10
20
30
TEMPERATURE (°C)
METEOROLOGICAL DATA (0625 PST)
McGILL
ELY
CURRANT
Trajectory at 12,000 feet
3 hours
WARM SPRINGS
ADAVEN
EDEN CREEK RANCH
REED
LINCOLN MINE
HIKO
STANDARD
0.005
0.01
0.05
0.1
0.5
1.0
5.0
0
5
10
20
STATUTE MILES



REMARKS

The downwind extents of the 0.1 and 0.05 mr hr isolines are uncertain but the orientation is consistent with the wind analysis. The rest of the pattern was well documented before and after fallout occurred. Therefore, there is a high degree of confidence in the off-site pattern.

RIO ARRIBA (72 1/2 FT WOOD TOWER) MAP B

H-HR= 0625 PST 18 OCT 1958

CLOUD TOP- 13,500 FT. M.S.L.

RESIDUAL GAMMA RADIATION
MR/HR AT H+12 HOURS

— LEGEND —

DOSE RATE CONTOURS, MEASURED

DOSE RATE CONTOURS, ESTIMATED

TIME OF ARRIVAL, ESTIMATED, H+HOURS

ELEVATION 7000 TO 9000 FEET

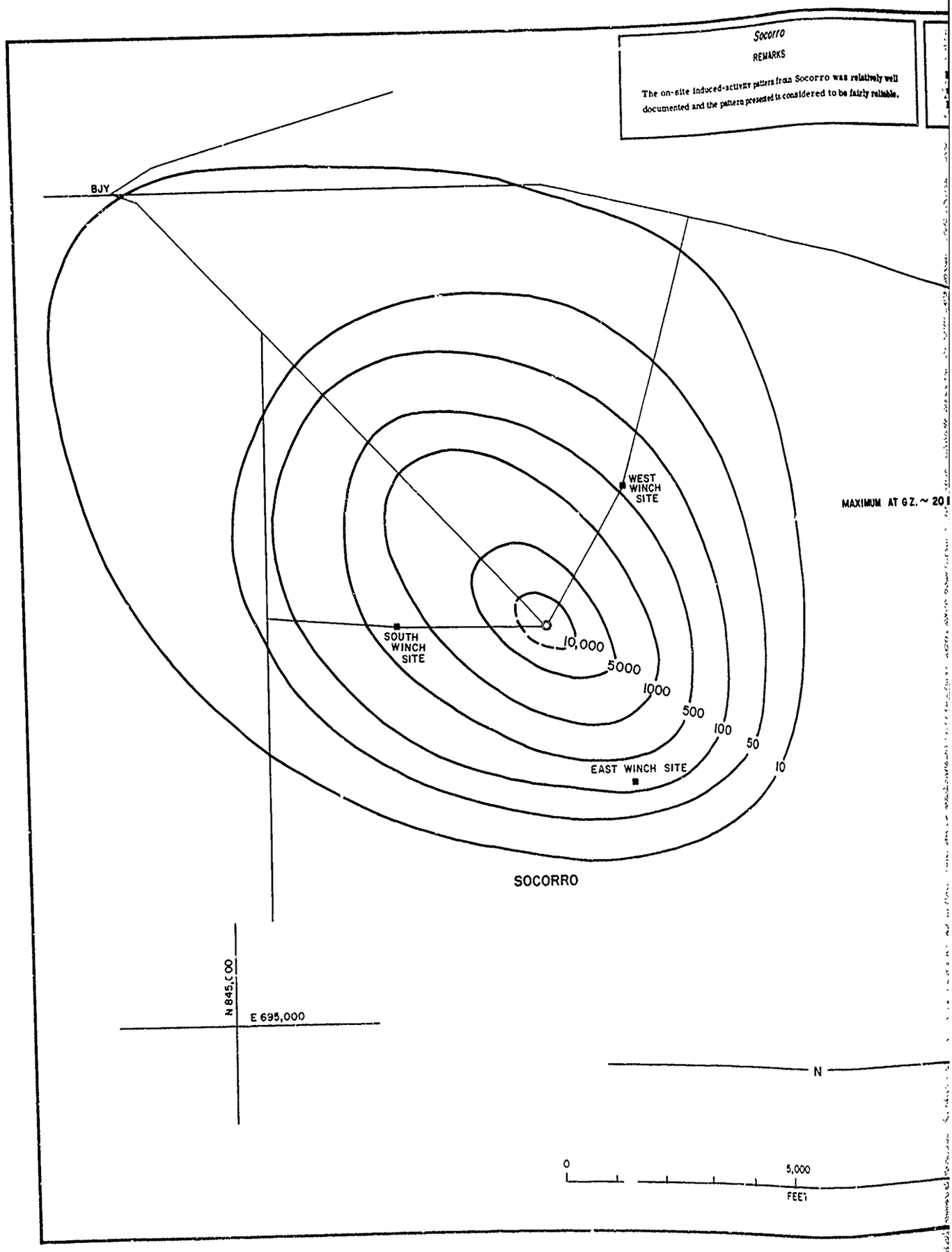
ELEVATION MORE THAN 9000 FEET

ROAD (THICK LINE INDICATES MONITORED SECTION)

Socorro

REMARKS

The on-site induced-activity pattern from Socorro was relatively well documented and the pattern presented is considered to be fairly reliable.



MAXIMUM AT G.Z. ~ 20

Socorro

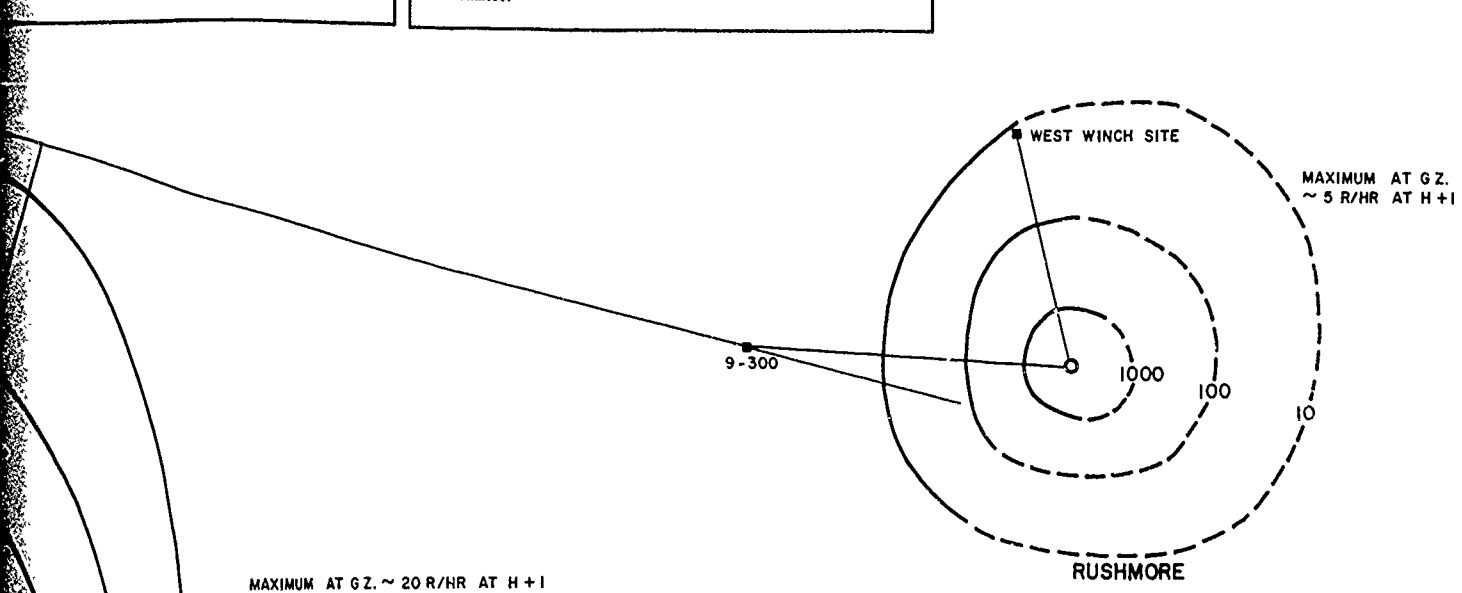
REMARKS

...-site induced-activity pattern from Socorro was relatively well ...ined and the pattern presented is considered to be fairly reliable.

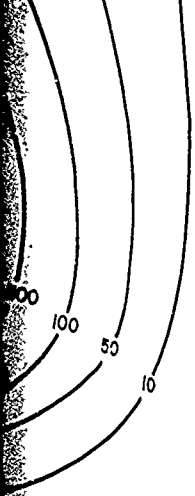
Rushmore

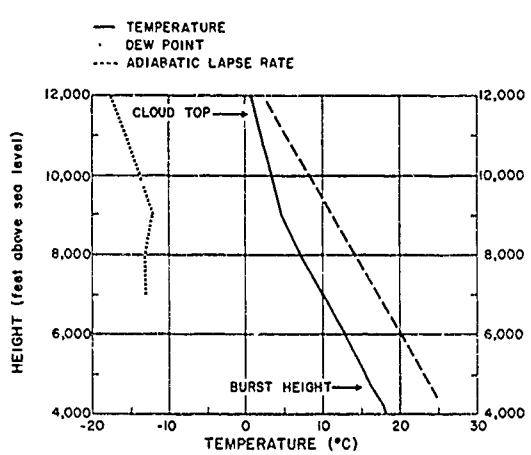
REMARKS

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 for Rushmore.



MAXIMUM AT G.Z. ~ 20 R/HR AT H+1





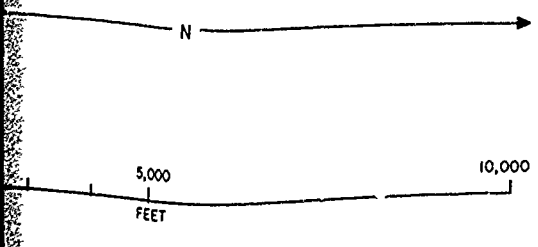
UPPER WINDS	
DIRECTION (Degrees)	SPEED (Knots)
221	23
220	20
222	17
229	15
220	14
206	12
190	09
170	07
135	04

METEOROLOGICAL DATA (1540 PST)

RUSHMORE (500 FT. BALLOON) MAP A
H-HR= 1540 PST 22 OCT. 1958
CLOUD TOP- 11,500 FT M.S.L.

SOCORRO (1450 FT. BALLOON) MAP A
H-HR= 0530 PST 22 OCT. 1958
CLOUD TOP- 26,000 FT. M.S.L

RESIDUAL GAMMA RADIATION
MR/HR AT H+1 HOUR

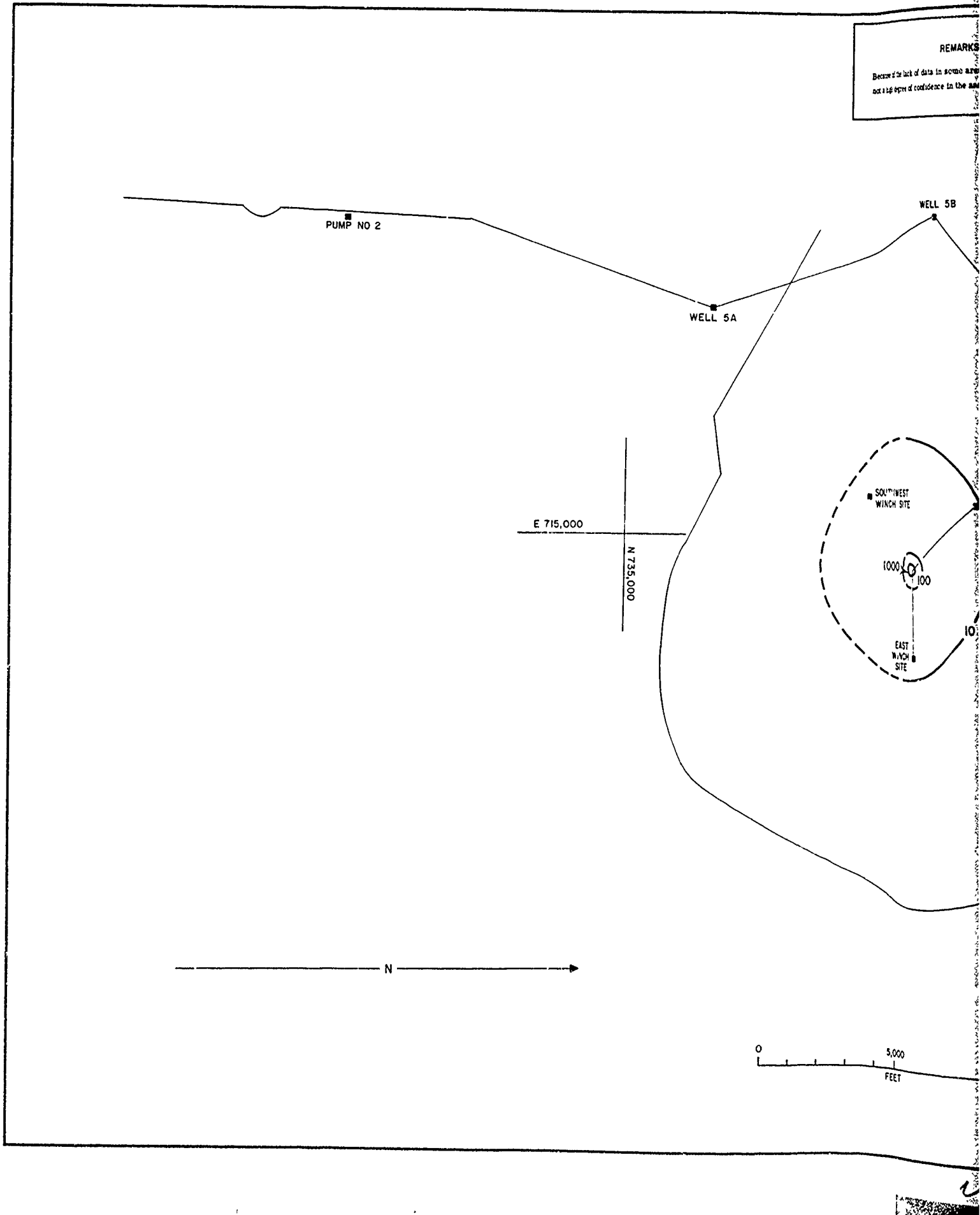


— LEGEND —

——— DOSE RATE CONTOURS, MEASURED

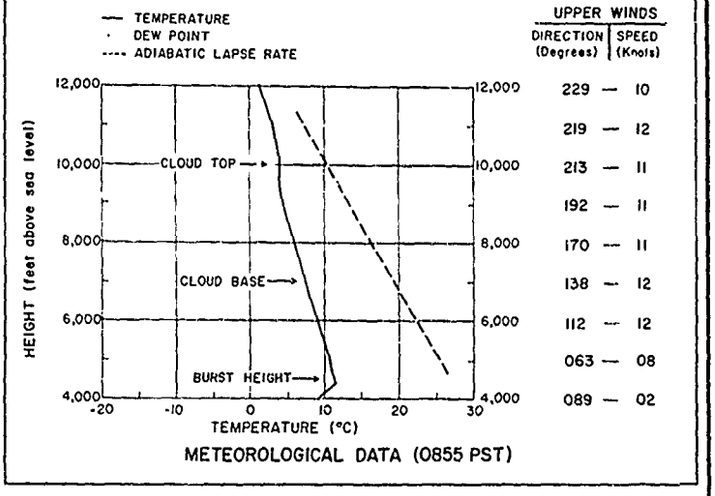
– – – – DOSE RATE CONTOURS, ESTIMATED

1/

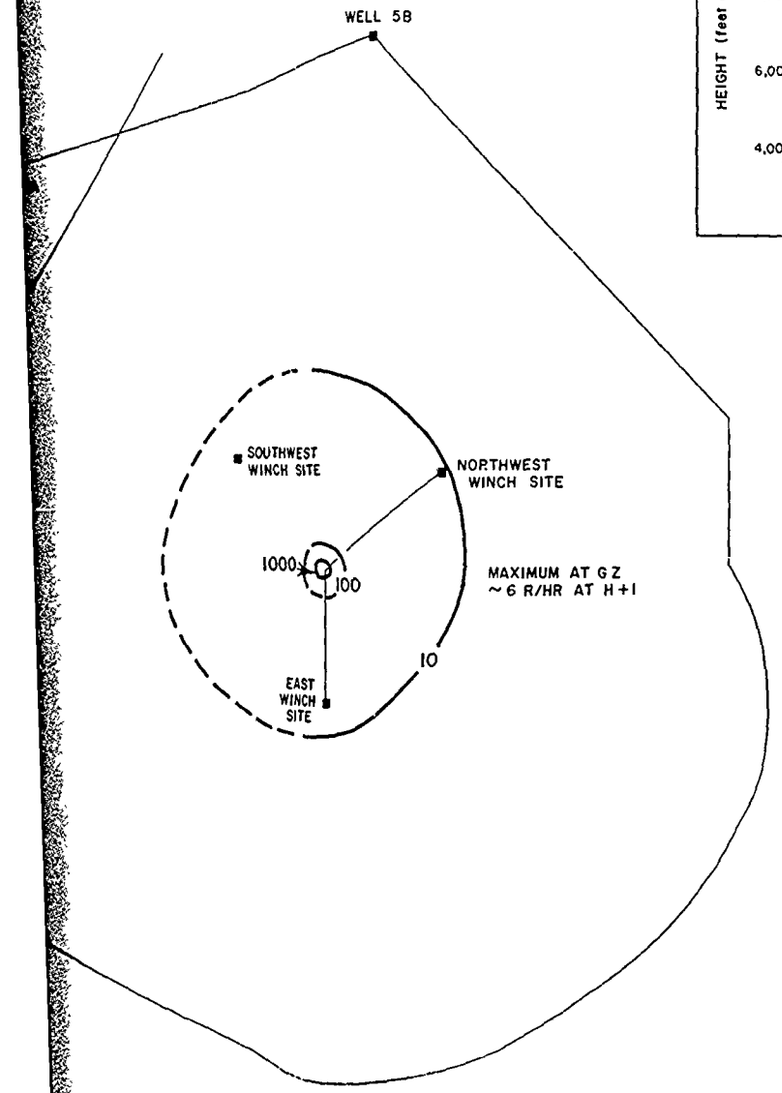

REMARKS
PUMP NO 2
WELL 5A
WELL 5B
E 715,000
N 735,000
SOUTHWEST WINCH SITE
1000
100
EAST WINCH SITE
N
0
5,000
FEET

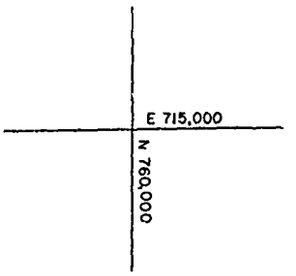
REMARKS

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.



METEOROLOGICAL DATA (0855 PST)





WRANGELL (1500 FT BALLOON) MAP A

H-HR= 0850 PST 22 OCT 1958

CLOUD TOP- 10,000 FT M.S.L

RESIDUAL GAMMA RADIATION
MR/HR AT H + 1 HOUR

— LEGEND —

——— DOSE RATE CONTOURS, MEASURED

– – – – – DOSE RATE CONTOURS, ESTIMATED

REMARKS

Socorro was the first of three nuclear detonations to occur on the same day. The trajectory analysis for these three events indicated that the clouds should all have been transported in the same general direction.

The 20,000 foot trajectory for Socorro (not shown) had approximately the same direction and displacement as did the 25,000 foot trajectory for the first 6 hours.

Although the Wrangell trajectory was toward the north and northeast, the lower level winds would have transported any fallout originating at 9,000 feet m.s.l. toward the north and northwest.

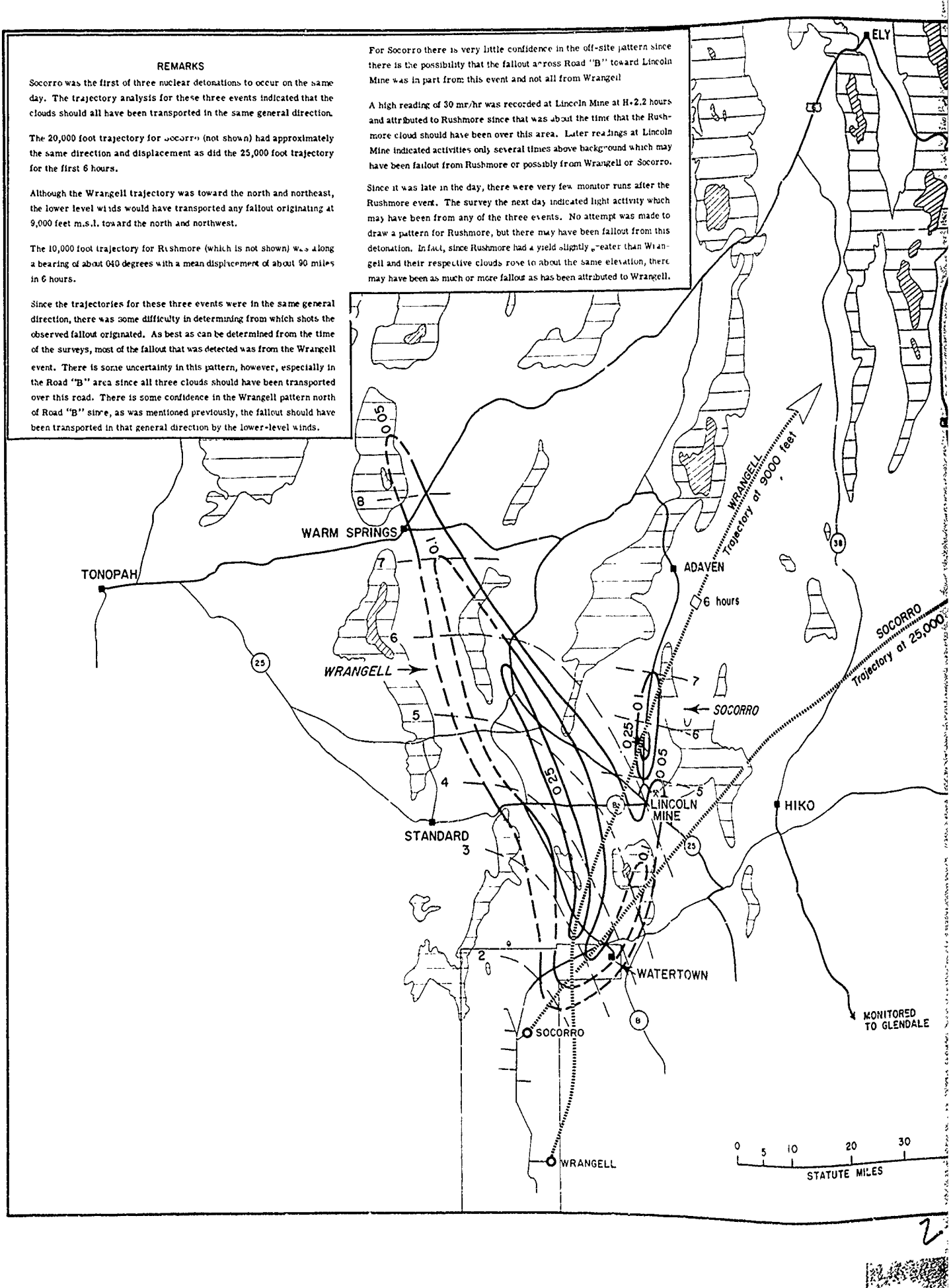
The 10,000 foot trajectory for Rushmore (which is not shown) was along a bearing of about 040 degrees with a mean displacement of about 90 miles in 6 hours.

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. As best as can be determined from the time of the surveys, most of the fallout that was detected was from the Wrangell event. There is some uncertainty in this pattern, however, especially in the Road "B" area since all three clouds should have been transported over this road. There is some confidence in the Wrangell pattern north of Road "B" since, as was mentioned previously, the fallout should have been transported in that general direction by the lower-level winds.

For Socorro there is very little confidence in the off-site pattern since there is the possibility that the fallout across Road "B" toward Lincoln Mine was in part from this event and not all from Wrangell.

A high reading of 30 mr/hr was recorded at Lincoln Mine at H+2.2 hours and attributed to Rushmore since that was about the time that the Rushmore cloud should have been over this area. Later readings at Lincoln Mine indicated activities only several times above background which may have been fallout from Rushmore or possibly from Wrangell or Socorro.

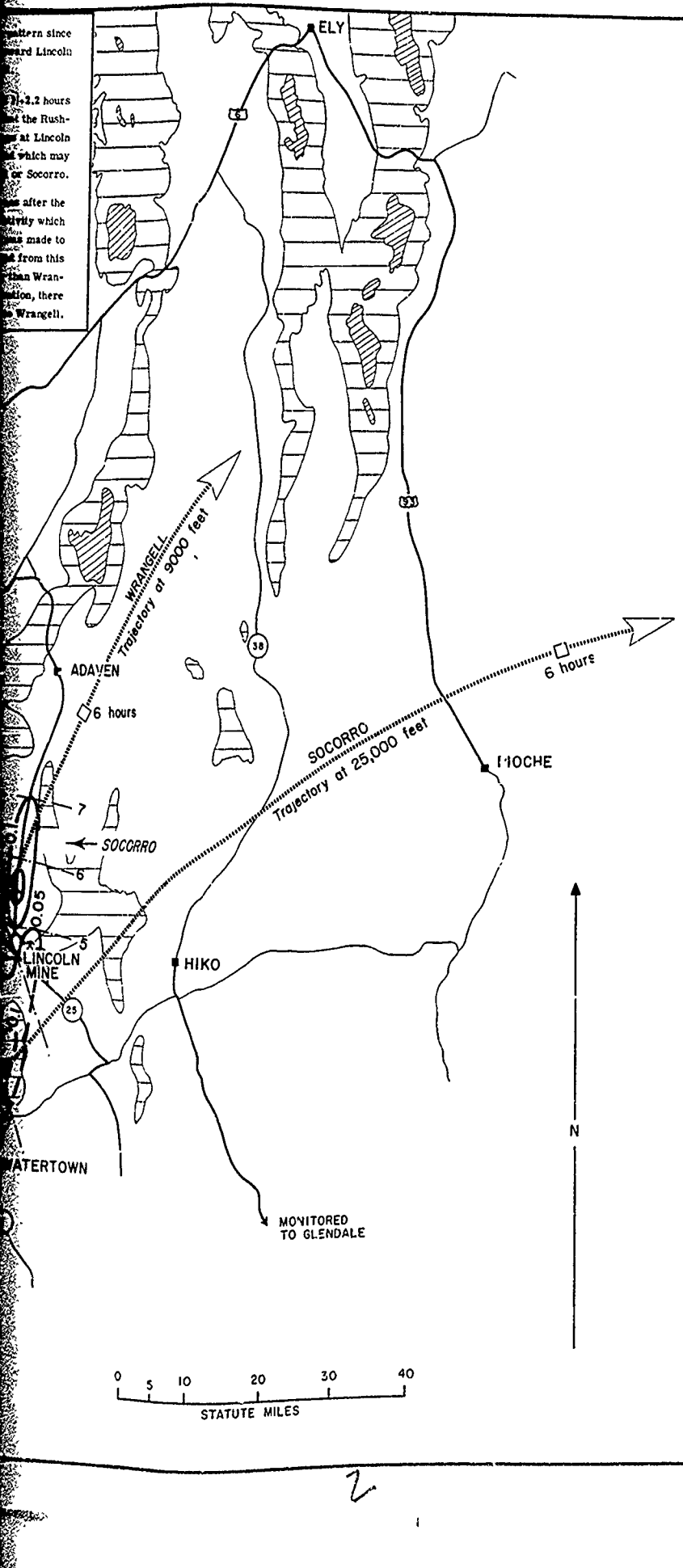
Since it was late in the day, there were very few monitor runs after the Rushmore event. The survey the next day indicated light activity which may have been from any of the three events. No attempt was made to draw a pattern for Rushmore, but there may have been fallout from this detonation. In fact, since Rushmore had a yield slightly greater than Wrangell and their respective clouds rose to about the same elevation, there may have been as much or more fallout as has been attributed to Wrangell.

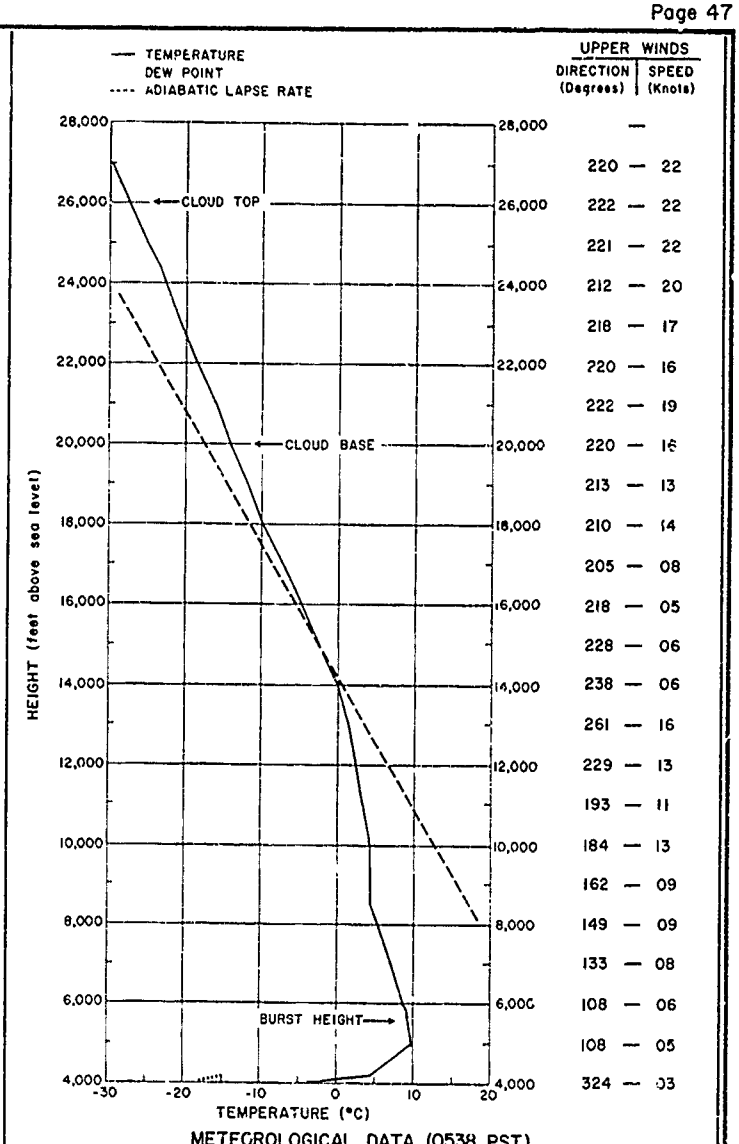


...ttern since
...ard Lincoln

...).+2.2 hours
...t the Rush-
...s at Lincoln
...which may
...or Socorro.

...s after the
...ivity which
...s made to
...t from this
...than Wran-
...tion, there
...Wrangell.





METEOROLOGICAL DATA (0538 PST)

SOCORRO (1450 FT BALLOON) MAP B
H-HR= 0530 PST 22 OCT 1958
CLOUD TOP- 26,000 FT M.S.L.

WRANGELL (1500 FT BALLOON) MAP B
H-HR= 0850 PST 22 OCT. 1958
CLOUD TOP- 10,000 FT. M.S.L.

RESIDUAL GAMMA RADIATION
MR/HR AT H+12 HOURS

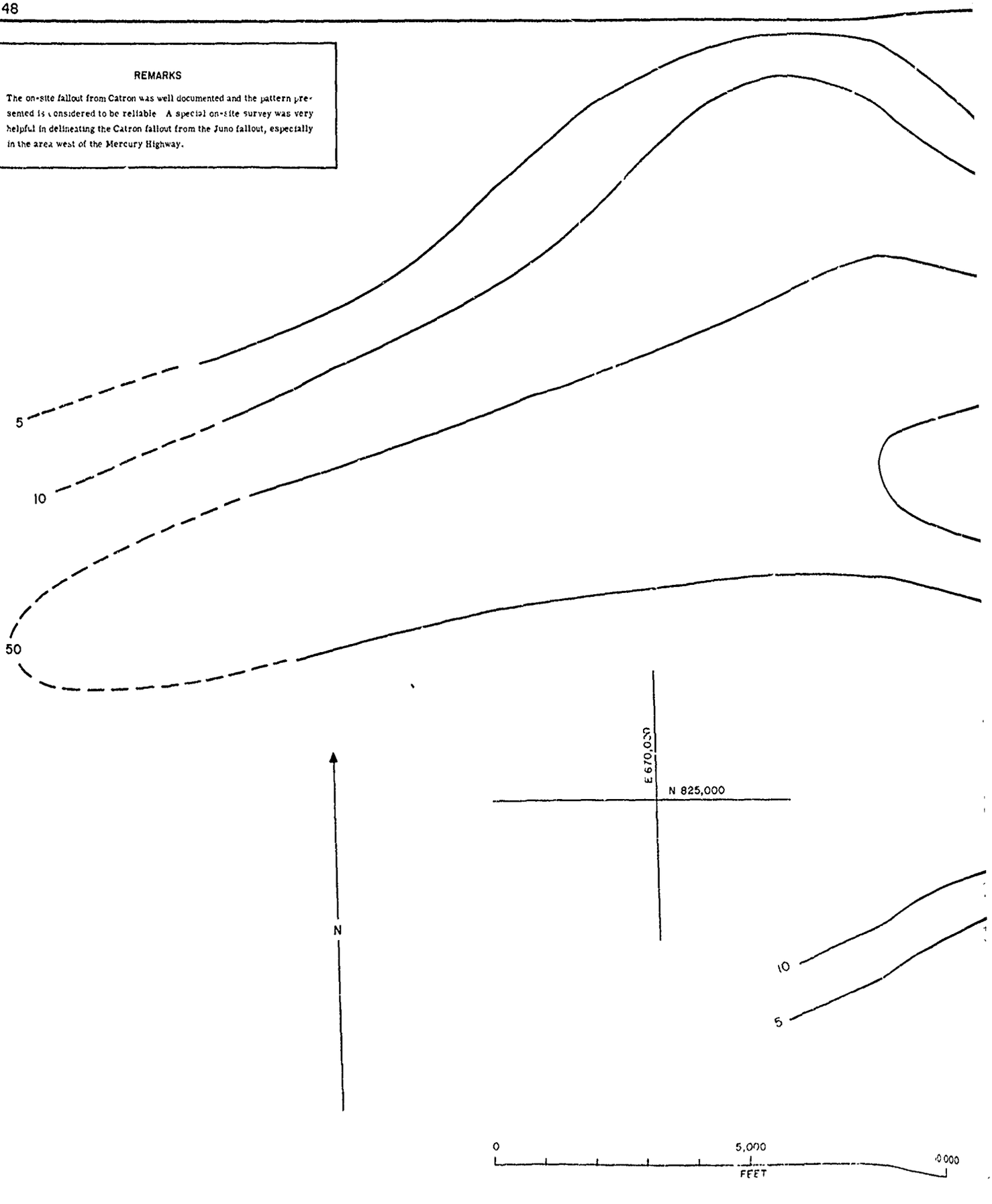
— LEGEND —

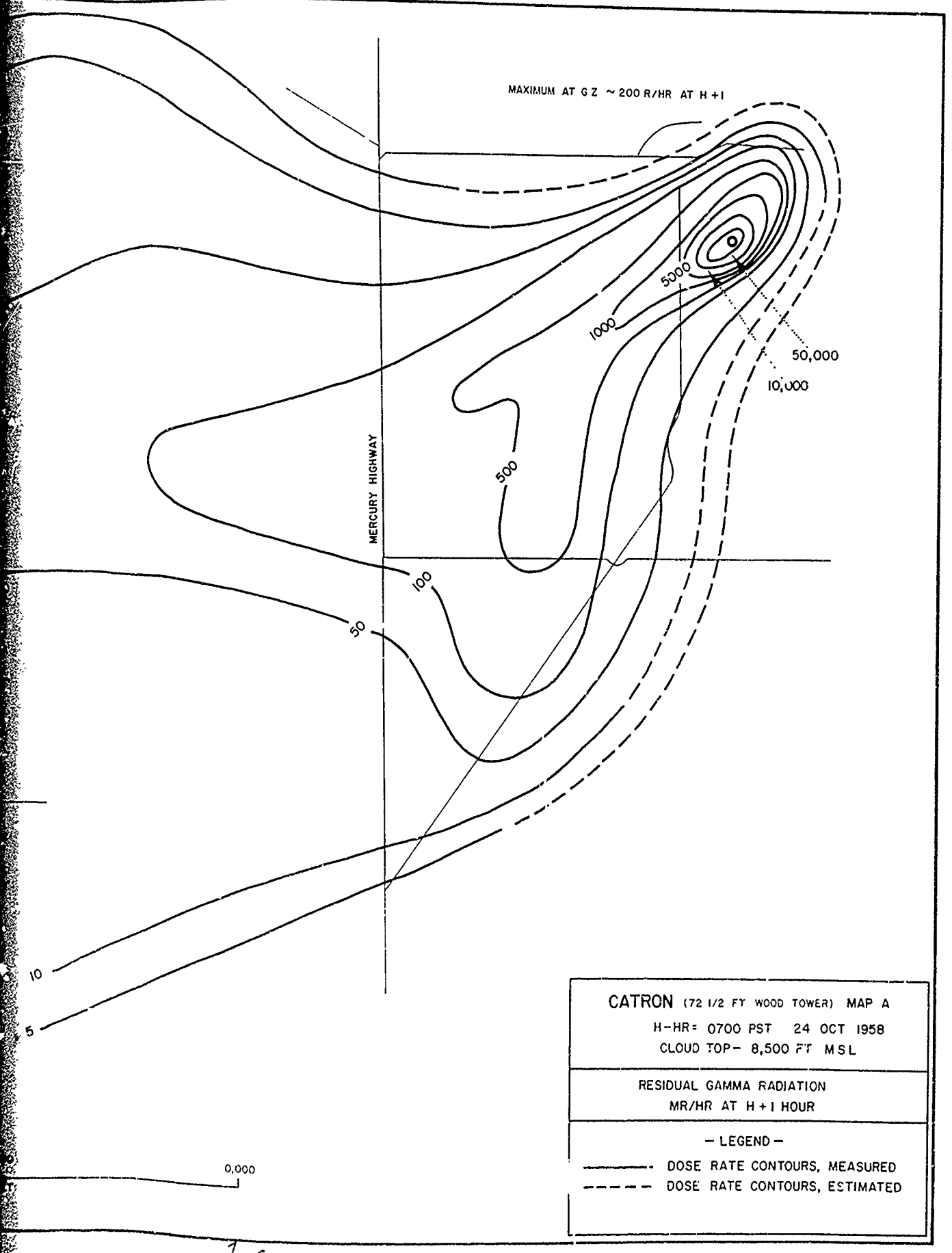
- DOSE RATE CONTOURS, MEASURED
- DOSE RATE CONTOURS, ESTIMATED
- TIME OF ARRIVAL, ESTIMATED, H+HOURS
- ELEVATION 7000 TO 9000 FEET
- ELEVATION MORE THAN 9000 FEET
- ROAD (THICK LINE INDICATES MONITORED SECTION)

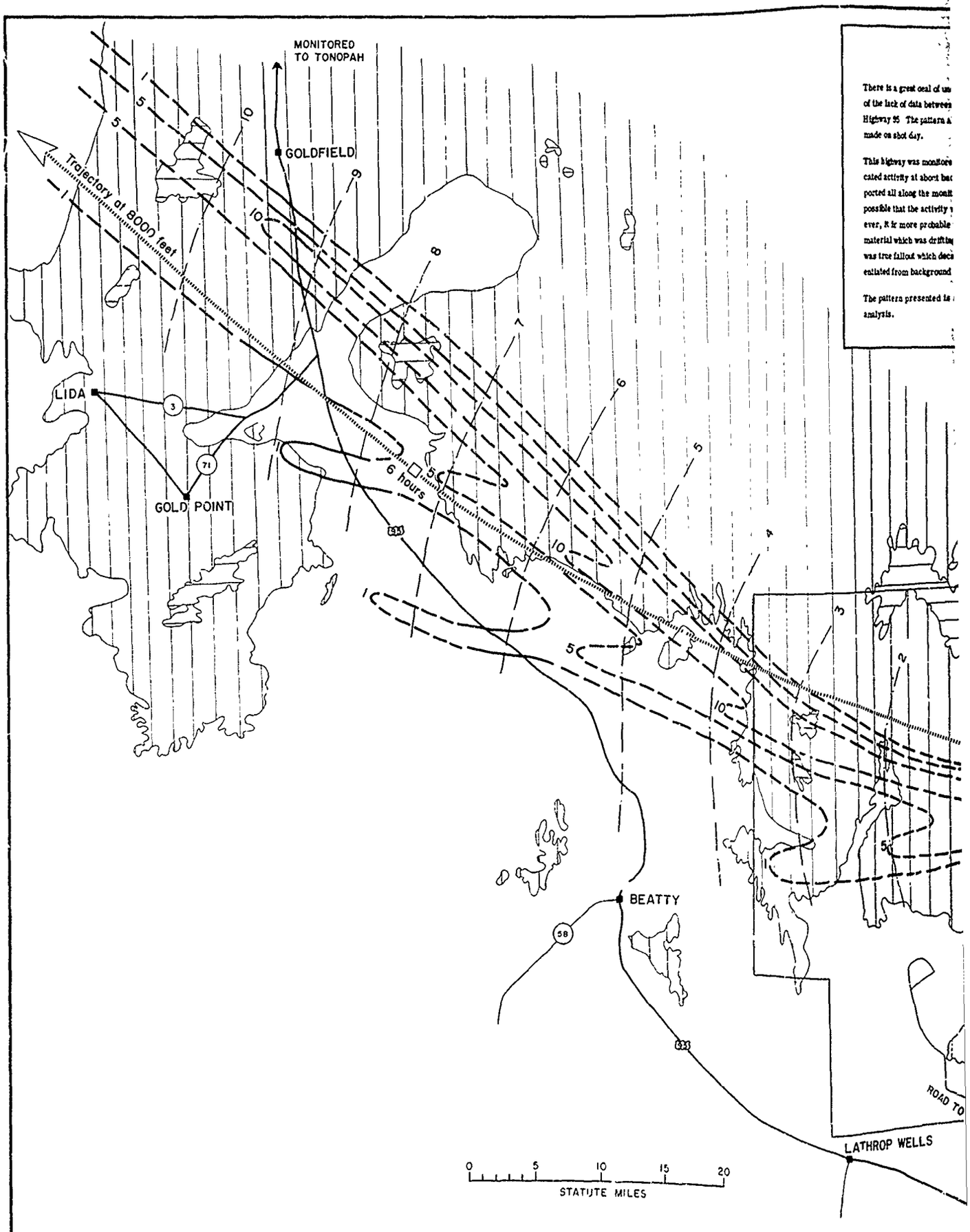
2

REMARKS

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 delineating the Catron fallout from the Juno fallout, especially in the area west of the Mercury Highway.




MAXIMUM AT G Z ~200 R/HR AT H+1
5000
1000
50,000
10,000
500
MERCURY HIGHWAY
100
50
10
5
0.000
CATRON (72 1/2 FT WOOD TOWER) MAP A
H-HR= 0700 PST 24 OCT 1958
CLOUD TOP- 8,500 FT MSL
RESIDUAL GAMMA RADIATION
MR/HR AT H+1 HOUR
- LEGEND -
DOSE RATE CONTOURS, MEASURED
DOSE RATE CONTOURS, ESTIMATED



There is a great deal of un
of the lack of data between
Highway 95 The pattern
made on shot day.

This highway was monitore
cated activity at short ba
ported all along the monit
possible that the activity
ever, it is more probable
material which was drifti
was true fallout which deca
entiated from background

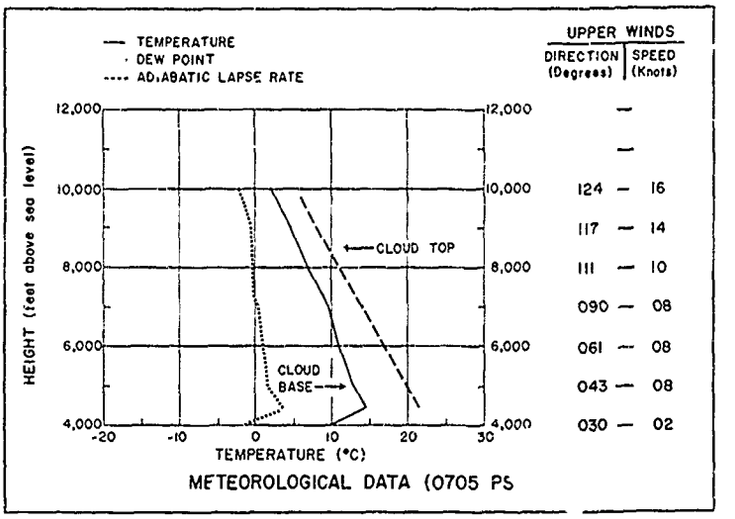
The pattern presented is
analysis.

REMARKS

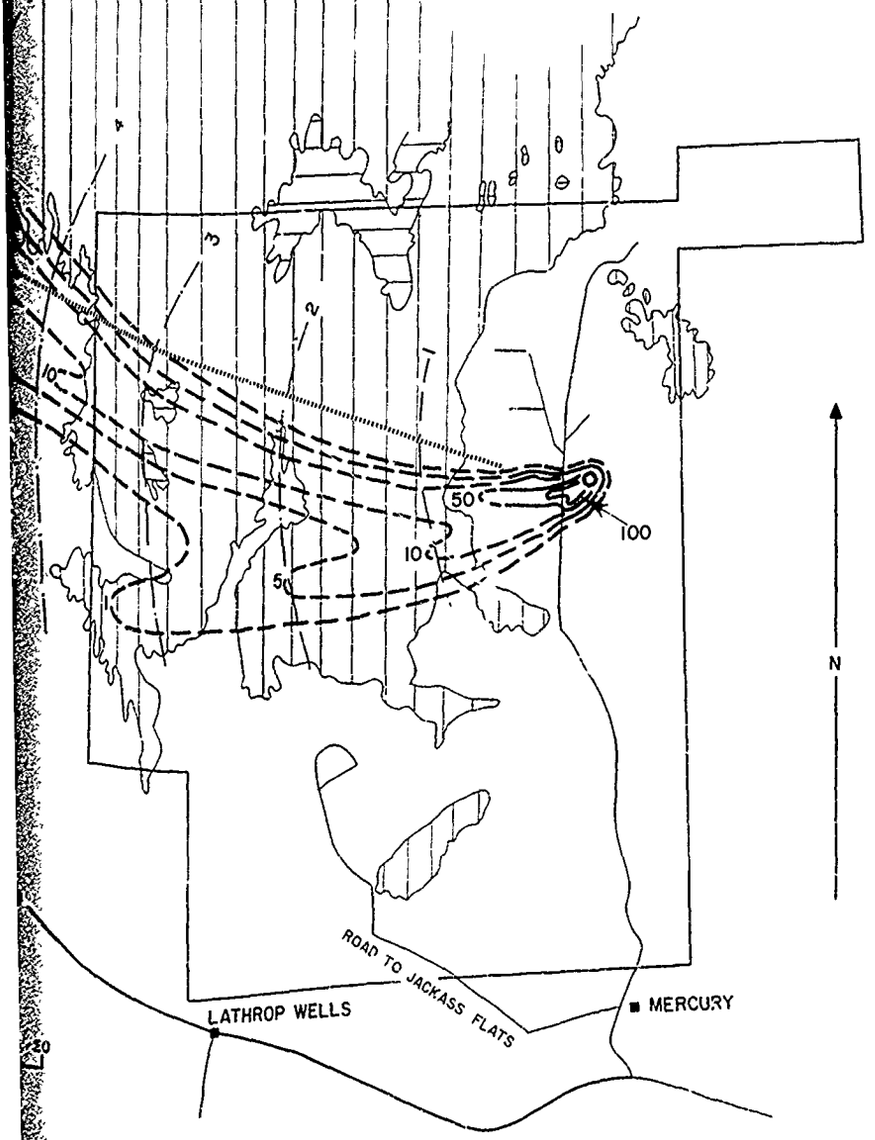
There is a great deal of uncertainty in the Catron pattern off-site because of the lack of data between the immediate area around the burst site and Highway 95 The pattern along Highway 95 is based on the measurements made on shot day.

This highway was monitored again the following day, and all reports indicated activity at about background levels. Scattered showers were reported all along the monitored part of this highway on shot day, so it is possible that the activity was washed into the ground by the rain However, it is more probable that the activity reported was due to airborne material which was drifting by while it was being monitored or that there was true fallout which decayed by the next day to levels not easily differentiated from background radiation

The pattern presented is at least qualitatively consistent with the wind analysis.



METEOROLOGICAL DATA (0705 PS

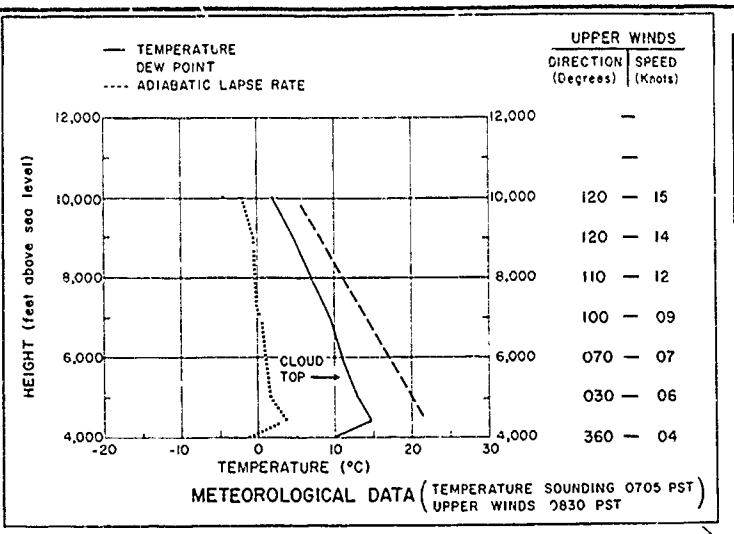


CATRON (72 1/2 FT WOOD TOWER) MAP B
H-HR= 0700 PST 24 OCT. 1958
CLOUD TOP- 8,500 FT. M.S.L.

RESIDUAL GAMMA RADIATION
MR/HR AT H+1 HOUR

— LEGEND —

- DOSE RATE CONTOURS, MEASURED
- DOSE RATE CONTOURS, ESTIMATED
- TIME OF ARRIVAL, ESTIMATED, H+HOURS
- ELEVATION 5000 TO 7000 FEET
- ELEVATION 7000 TO 9000 FEET
- ELEVATION MORE THAN 9000 FEET
- ROAD (THICK LINE INDICATES MONITORED SECTION)



REMARKS

...be on site fallout from Juno was well d...
...sented here is considered to be reliable...

No significant activity off site was reported...
Juno event

5 10 5

E 675,000

N 855,000

50

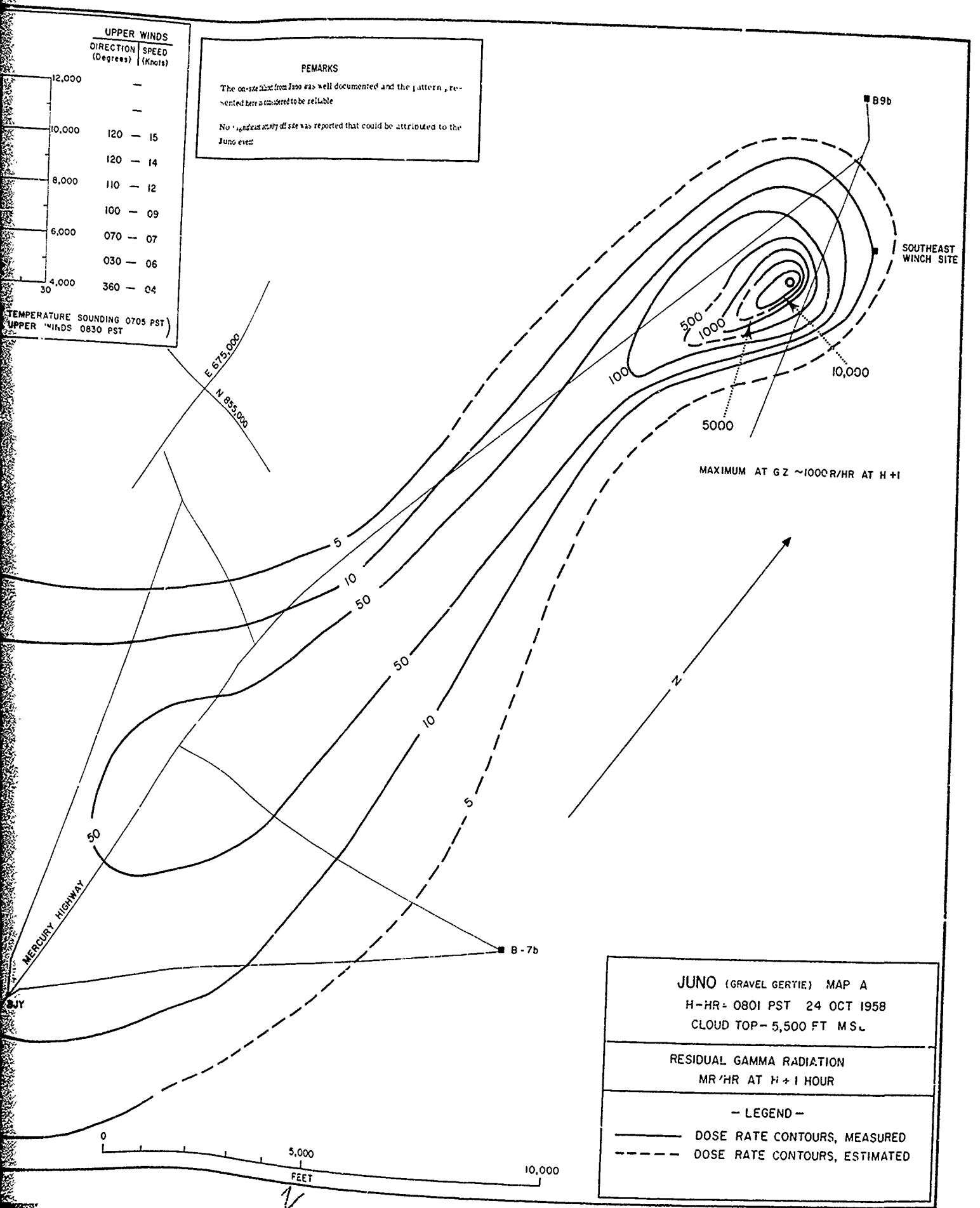
MERCURY HIGHWAY

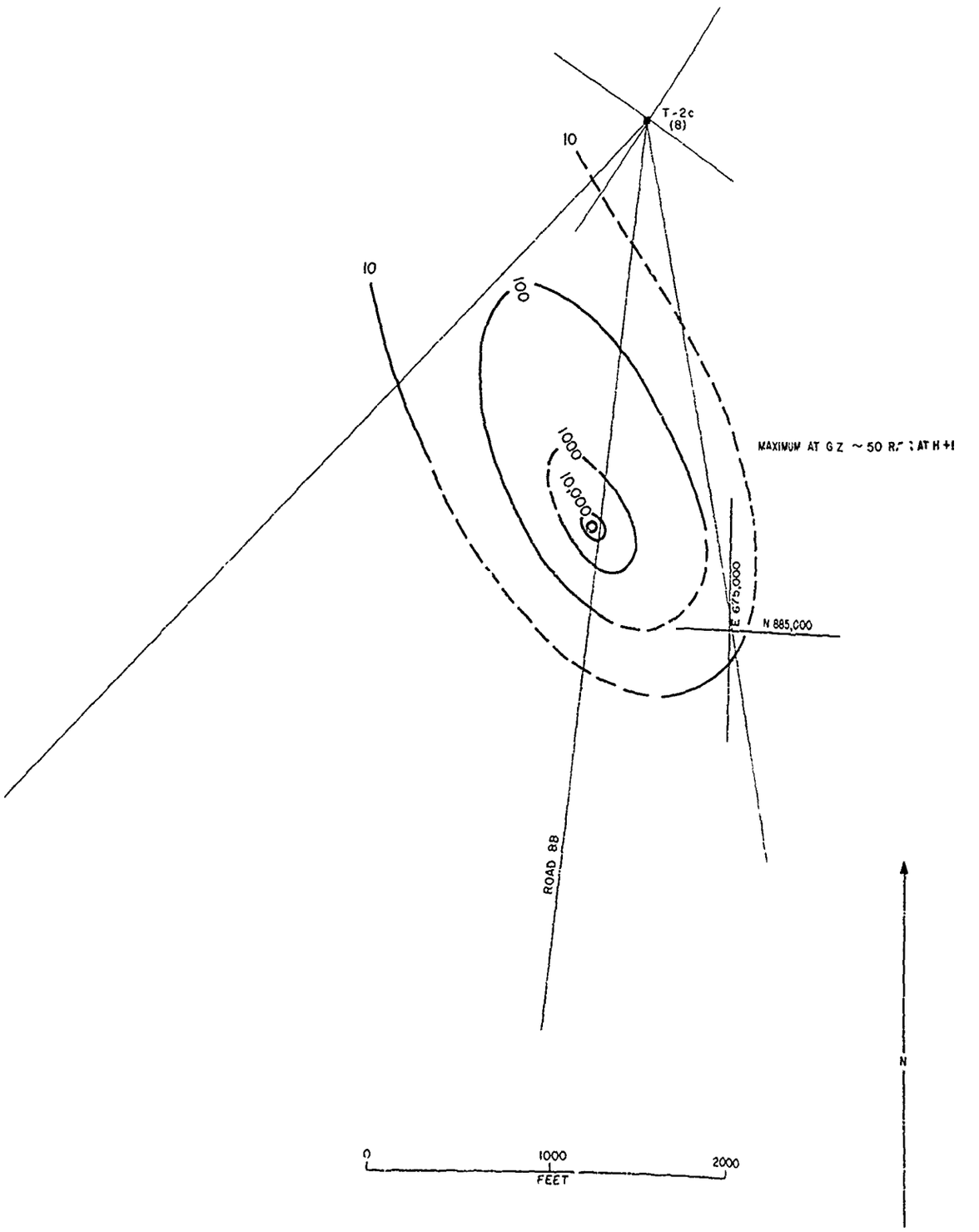
BJY

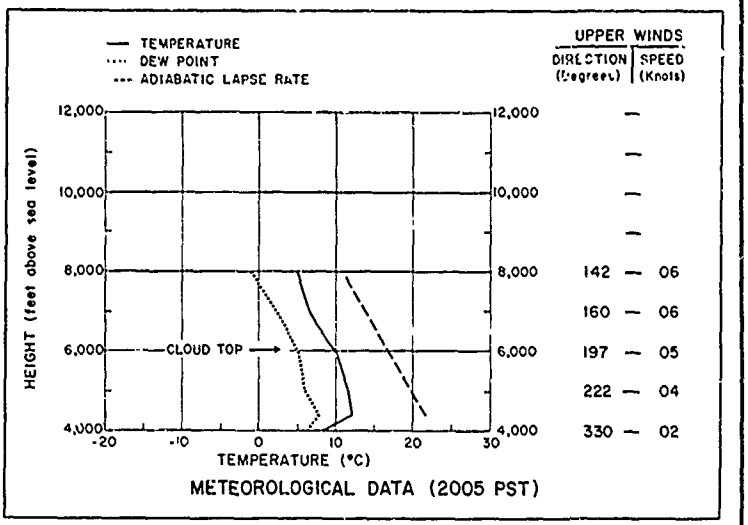
0

5,00

FEE


UPPER WINDS
DIRECTION (Degrees)
SPEED (Knots)
12,000
10,000
120 — 15
120 — 14
8,000
110 — 12
100 — 09
6,000
070 — 07
030 — 06
4,000
360 — 04
30
TEMPERATURE SOUNDING 0705 PST
UPPER WINDS 0830 PST
REMARKS
The on-site wind from Juno was well documented and the pattern represented here is considered to be reliable
No significant activity off site was reported that could be attributed to the Juno event
B9b
SOUTHEAST WINCH SITE
500
1000
100
10,000
5000
MAXIMUM AT G Z ~1000 R/HR AT H+1
E 675,000
N 855,000
5
10
50
50
10
5
50
MERCURY HIGHWAY
B-7b
BJY
0
5,000
10,000
FEET
JUNO (GRAVEL GERTIE) MAP A
H-HR = 0801 PST 24 OCT 1958
CLOUD TOP - 5,500 FT MSL
RESIDUAL GAMMA RADIATION
MR/HR AT H+1 HOUR
— LEGEND —
DOSE RATE CONTOURS, MEASURED
DOSE RATE CONTOURS, ESTIMATED


T-2c
(8)
10
10
100
1000
10,000
MAXIMUM AT G Z ~ 50 R
AT H+1
E 675,000
N 885,000
ROAD 8B
N
0
1000
2000
FEET



METEOROLOGICAL DATA (2005 PST)

REMARKS

There was a trivial yield from Ceres, and a cloud height of about 6,000 feet m.s.l. (a rise of about 1,500 feet) was observed. Because of the lateness of the day, the proximity of the mountainous terrain and the low cloud height, the lowest portion of the nuclear cloud was under the influence of drainage winds. The shot-time surface wind observations at Station 353 (located about 2-1/2 miles south of the burst point on Road 8B) and at the Yucca Lake station (located about 15 miles south of the burst point) indicated that the drainage winds had set in by shot time and were approximately from the northwest.

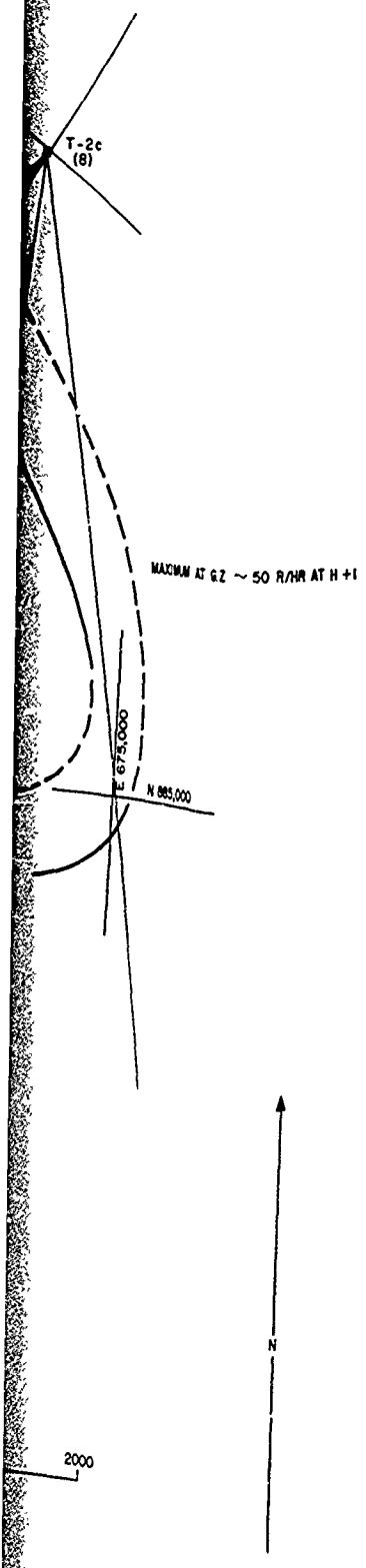
According to the Yucca Lake winds from above the drainage level to the top of the cloud the debris should have been deposited toward the northeast of the burst point. The radiation data strongly suggests that the debris was deposited toward the northwest. A possible explanation of the discrepancy between 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 of the air flow over Area 6 at these low levels.

No activity above background was detected off site.

15-Minute Average Winds

20-foot Tower at Station 353
(Surface Elevation About 4325 feet m.s.l.)

Time (PST)	Direction (degrees)	Speed (m.p.h.)
1745-1800	160	05
1845-1900	275	03
1945-2000	320	03
2045-2100	310	06

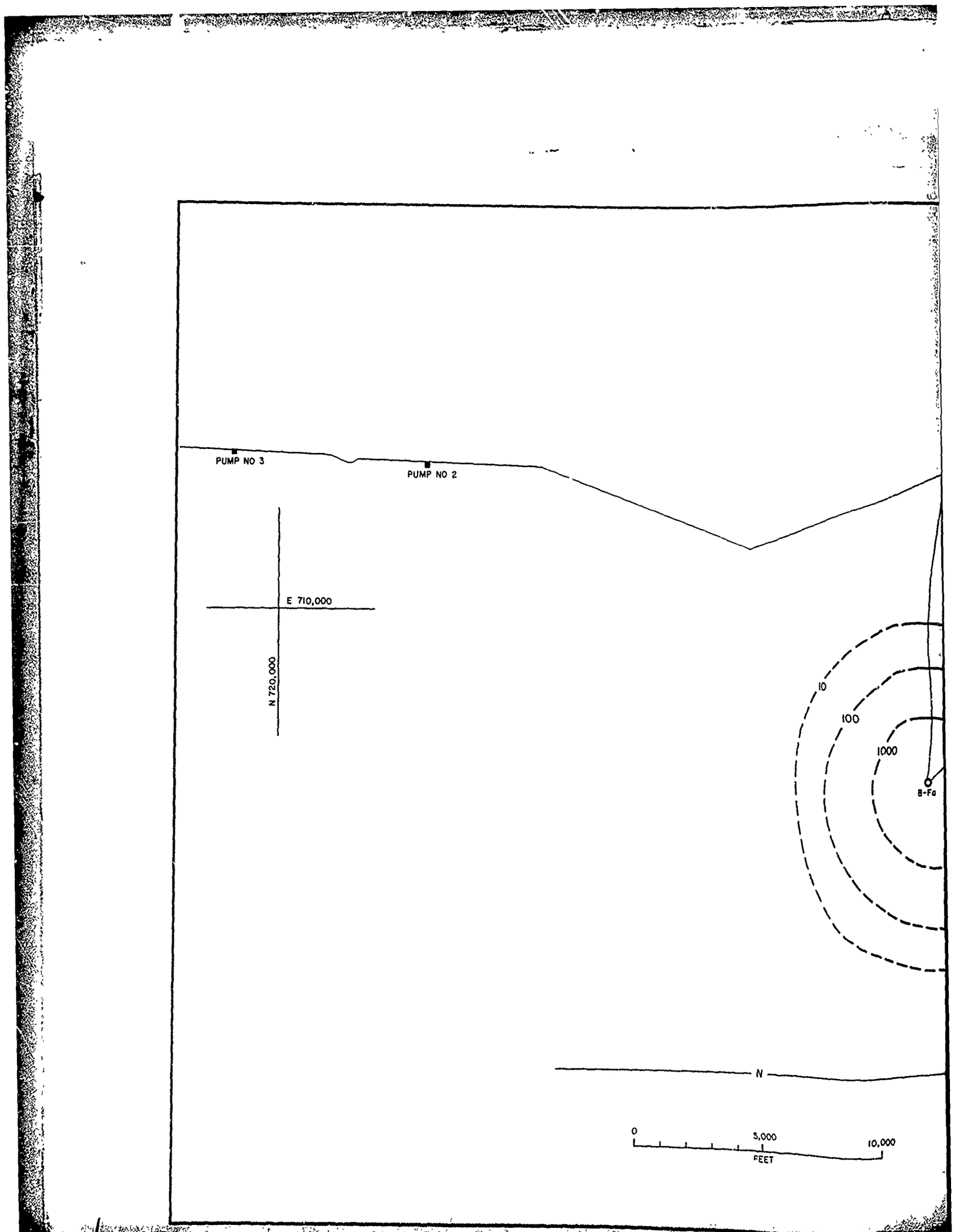


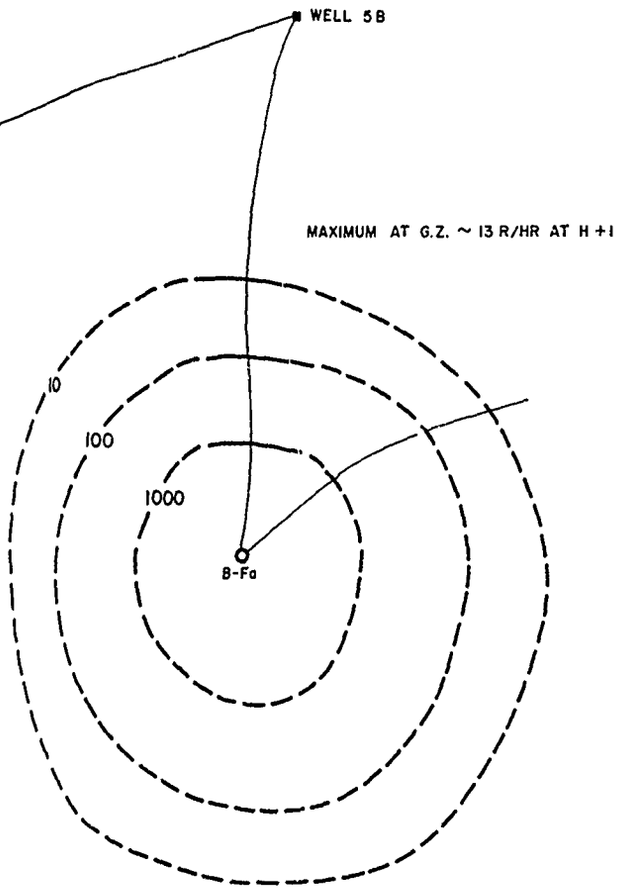
CERES (25 FT. WOOD TOWER) MAP A
H-HR = 2000 PST 25 OCT 1958
CLOUD TOP - 6000 FT M S L

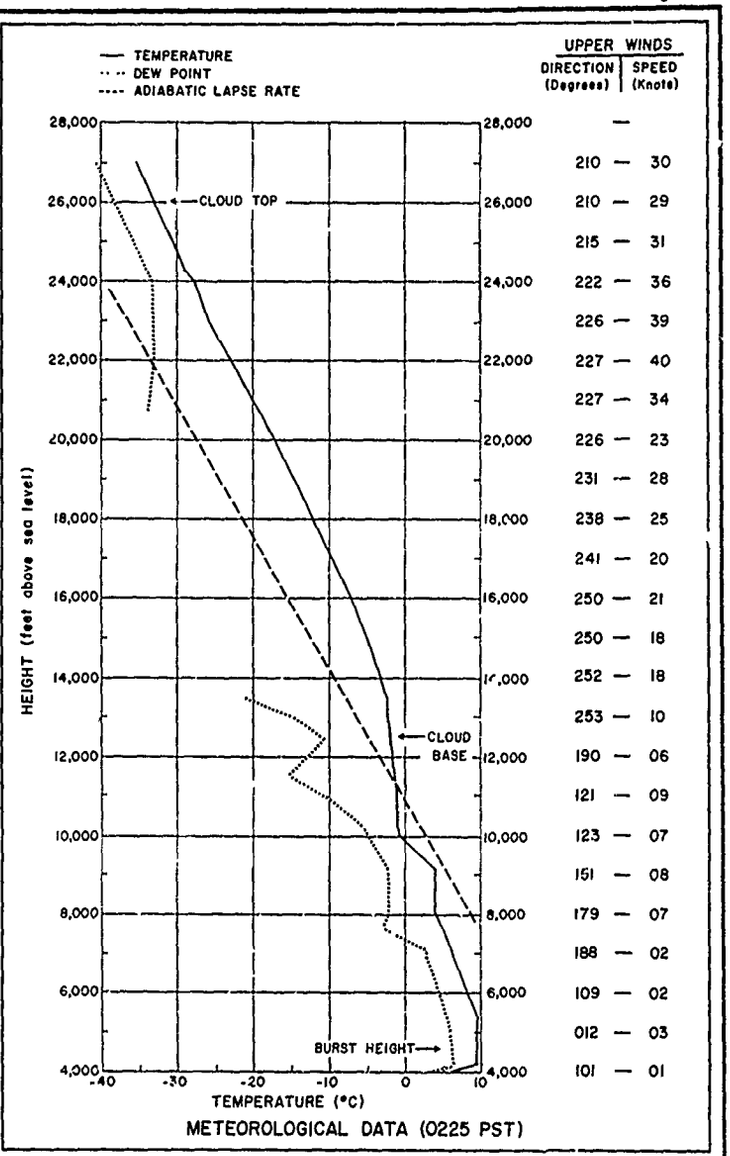
RESIDUAL GAMMA RADIATION
MR/HR AT H+1 HOUR

— LEGEND —

——— DOSE RATE CONTOURS, MEASURED
– – – – DOSE RATE CONTOURS, ESTIMATED


PUMP NO 3
PUMP NO 2
E 710,000
N 720,000
10
100
1000
B-Fa
N
0
5,000
10,000
FEET





METEOROLOGICAL DATA (0225 PST)

REMARKS

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.

N

10,000

SANFORD (1500 FT BALLOON) MAP A
H-HR = 0220 PST 26 OCT. 1958
CLOUD TOP - 26,000 FT. M.S.L.

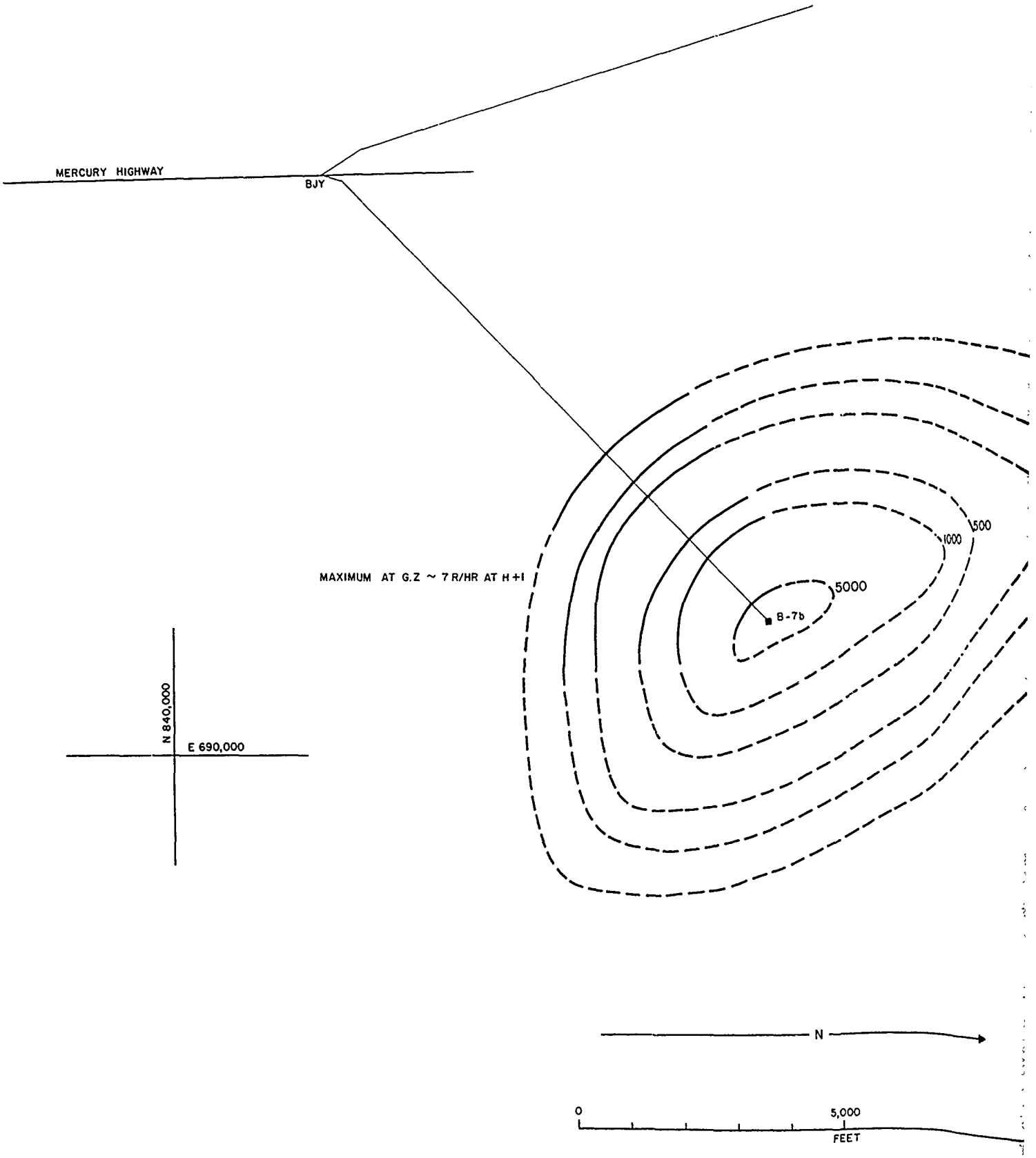
RESIDUAL GAMMA RADIATION
MR/HR AT H + 1 HOUR

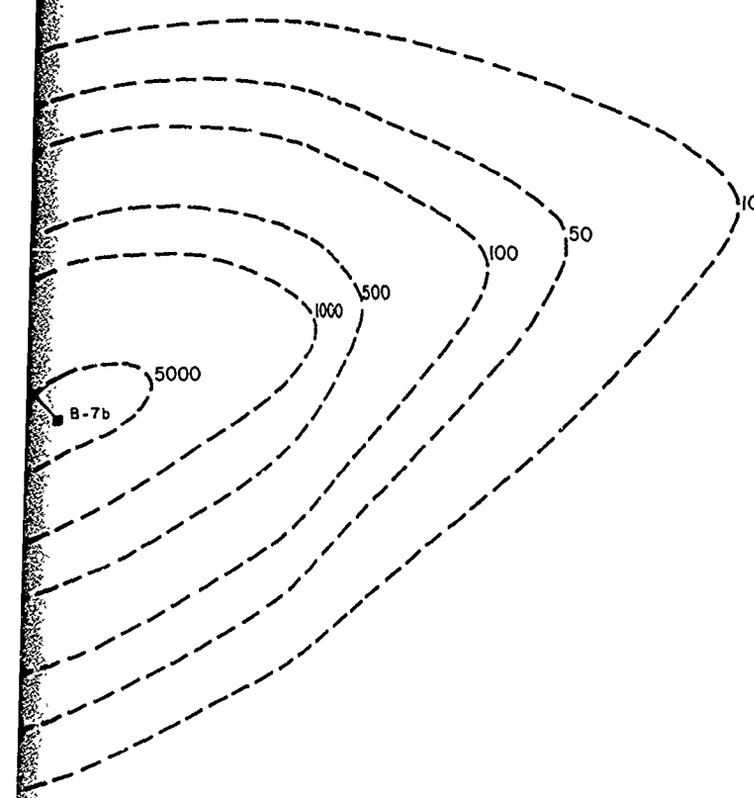
— LEGEND —

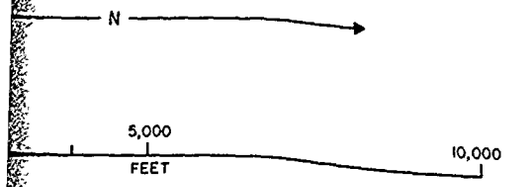
——— DOSE RATE CONTOURS, MEASURED

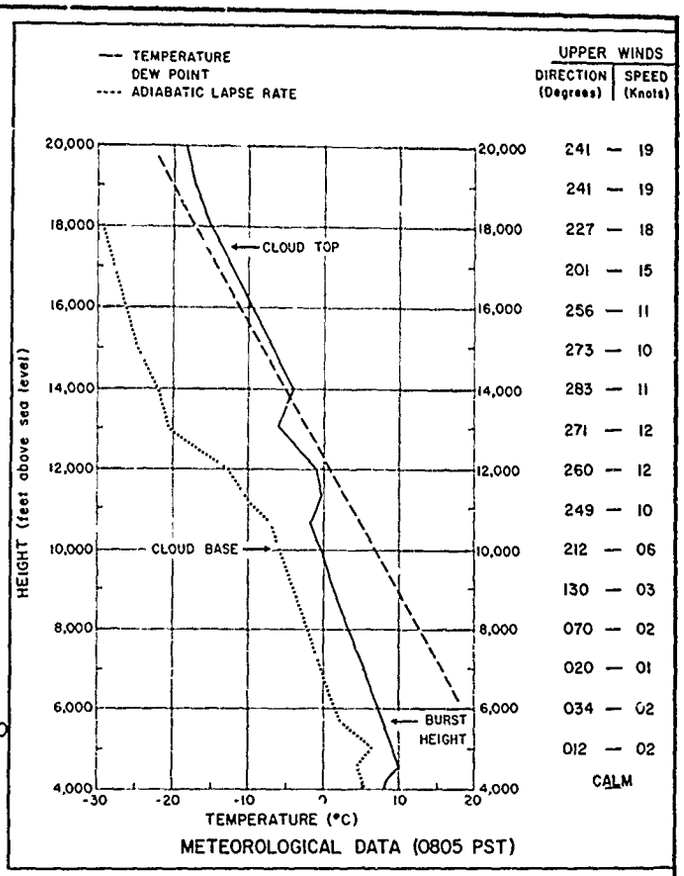
– – – – DOSE RATE CONTOURS, ESTIMATED

2


MERCURY HIGHWAY
BJY
MAXIMUM AT G.Z ~ 7 R/HR AT H+1
500
1000
5000
B-7b
N 840,000
E 690,000
N
0
5,000
FEET







METEOROLOGICAL DATA (0805 PST)

REMARKS

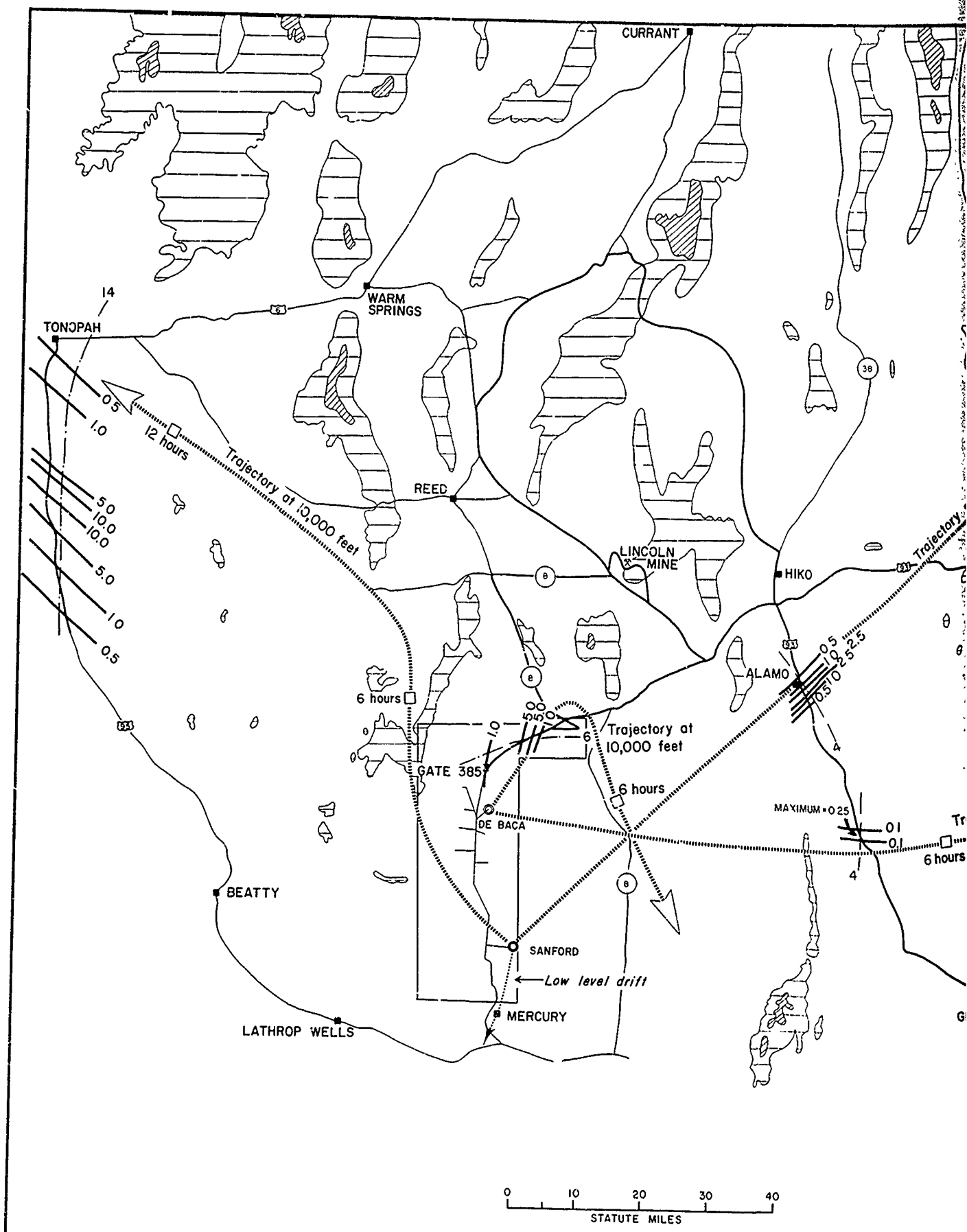
Indications from the on-site data around Area 9 and about 2 miles southeast of ground zero are that the cloud sheared and travelled in two different directions. The readings at these two locations were taken at very early times and were in all probability due to shine. Between these two areas, that is, in the northeast quadrant, activity recorded was very low. Because of the lack of data in most areas around ground zero there is not a very high degree of confidence in this pattern.

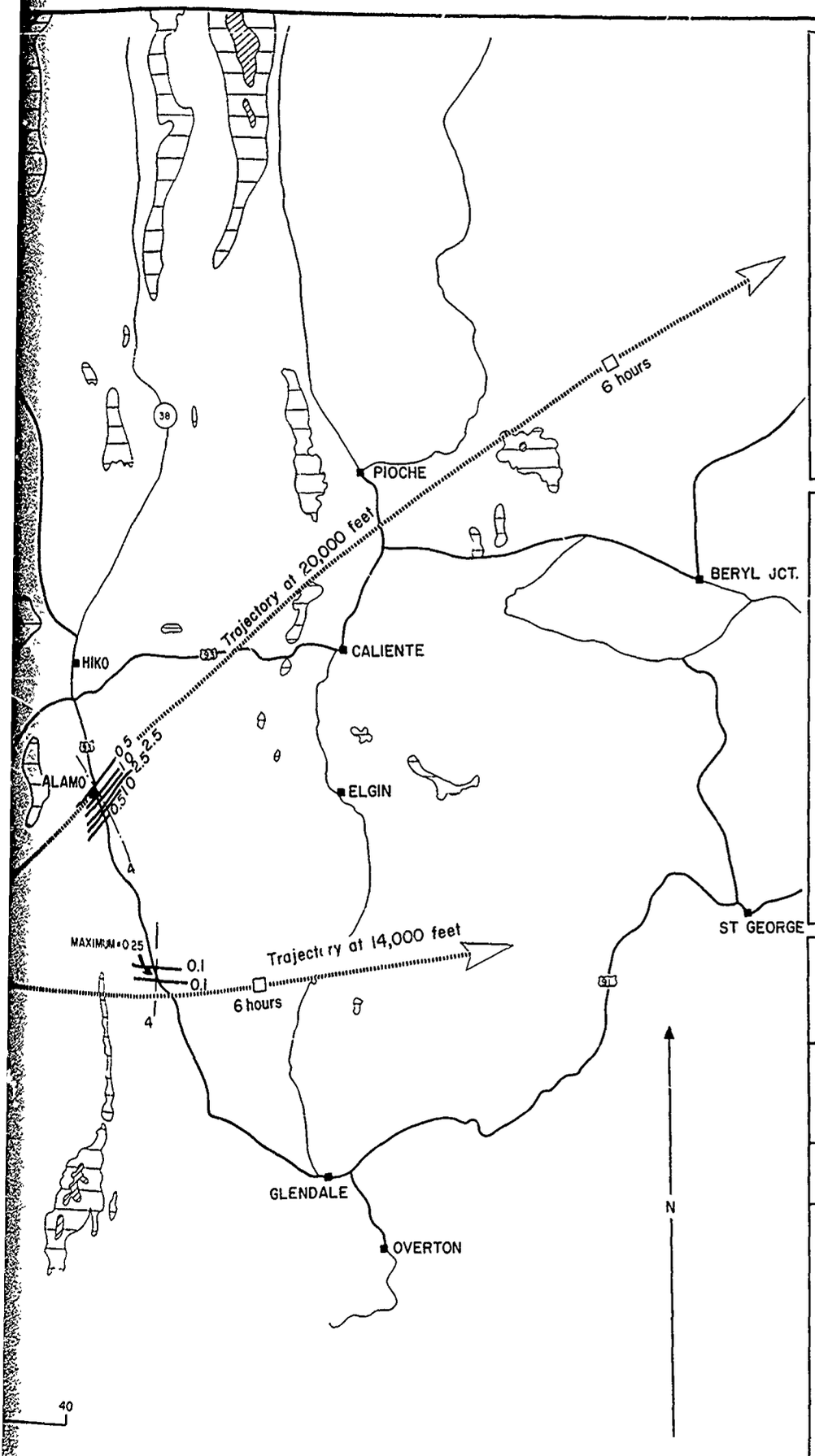
DE BACA (1500 FT. BALLOON) MAP A
H-HR = 0800 PST 26 OCT. 1958
CLOUD TOP - 17,500 FT. M.S.L.

RESIDUAL GAMMA RADIATION
MR/HR AT H + 1 HOUR

— LEGEND —

——— DOSE RATE CONTOURS, MEASURED
– – – – DOSE RATE CONTOURS, ESTIMATED


CURRANT
WARM SPRINGS
TONOPAH
14
0.5
1.0
12 hours
Trajectory at 10,000 feet
REED
5.0
10.0
10.0
5.0
1.0
0.5
LINCOLN MINE
HIKO
Trajectory
ALAMO
0.5
1.0
2.5
2.5
0.5
1.0
6 hours
1.0
5.0
6.0
6
Trajectory at 10,000 feet
GATE 385
6 hours
DE BACA
MAXIMUM = 0.25
0.1
0.1
4
4
6 hours
BEATTY
SANFORD
Low level drift
MERCURY
LATHROP WELLS
0
10
20
30
40
STATUTE MILES



Sanford

REMARKS

Activity along Highway 95 just south of Tonopah was attributed to the Sanford event. From the wind analysis it is evident that this activity must have originated from about 14,000 feet m.s.l. or less, while the activity found around the Alamo area and attributed to Sanford must have originated from 18,000 to 26,000 feet m.s.l.

The portion of the cloud that had a trajectory toward the northeast should have crossed the Hiko-Caliente-Pioche-Beryl Junction roads. No activity above background was found along these roads, which would suggest that no activity fell across these roads, that the activity was extremely light and decayed to almost nothing by the time the roads were monitored, or that the fallout, if any, occurred more toward the east. No activity above background was detected north of St. George, however, so that curving toward the east is considered unlikely.

Monitoring and air-sampling data indicated that radioactivity from Sanford passed over Mercury. No estimate of the decay rate could be determined, due to the large fluctuations in the dose rates. Since the winds in the lower layers were from the north, it seems likely that some of the dust raised by the burst in Frenchman Flat drifted past Mercury. The radiation detected was probably due to neutron-induced radioactivity in the Frenchman Flat soil.

De Baca

REMARKS

Activity that was found from Gate 385 to Road "B" and also south of Alamo along U. S. 93 was attributed to De Baca. The activity to the north most likely originated from about 10,000 feet m.s.l. or less in the nuclear cloud while the activity to the east most likely came from about 12,000 to 17,000 feet m.s.l.

The 14,000 foot De Baca trajectory and the winds above this elevation indicated that the cloud was over U. S. 93 at about the time that fallout was estimated to have arrived (about 4 hours after burst time) The estimate of the trajectory speed may be in error and what was observed may have been either true fallout, or shine since there was only one survey along this road for the De Baca event, it is not certain which of the two explanations is the correct one.

No activity above background levels was found from St. George to Glendale, indicating that if any fallout occurred in this direction it was so light that it was not distinguishable from background radiation. The wind analysis showed that it was unlikely that the fallout could have curved to the north, that is, between Hiko and Beryl Junction The monitors surveyed this road for Sanford, and not for De Baca It is not known for certain, therefore, if fallout did occur across this road.

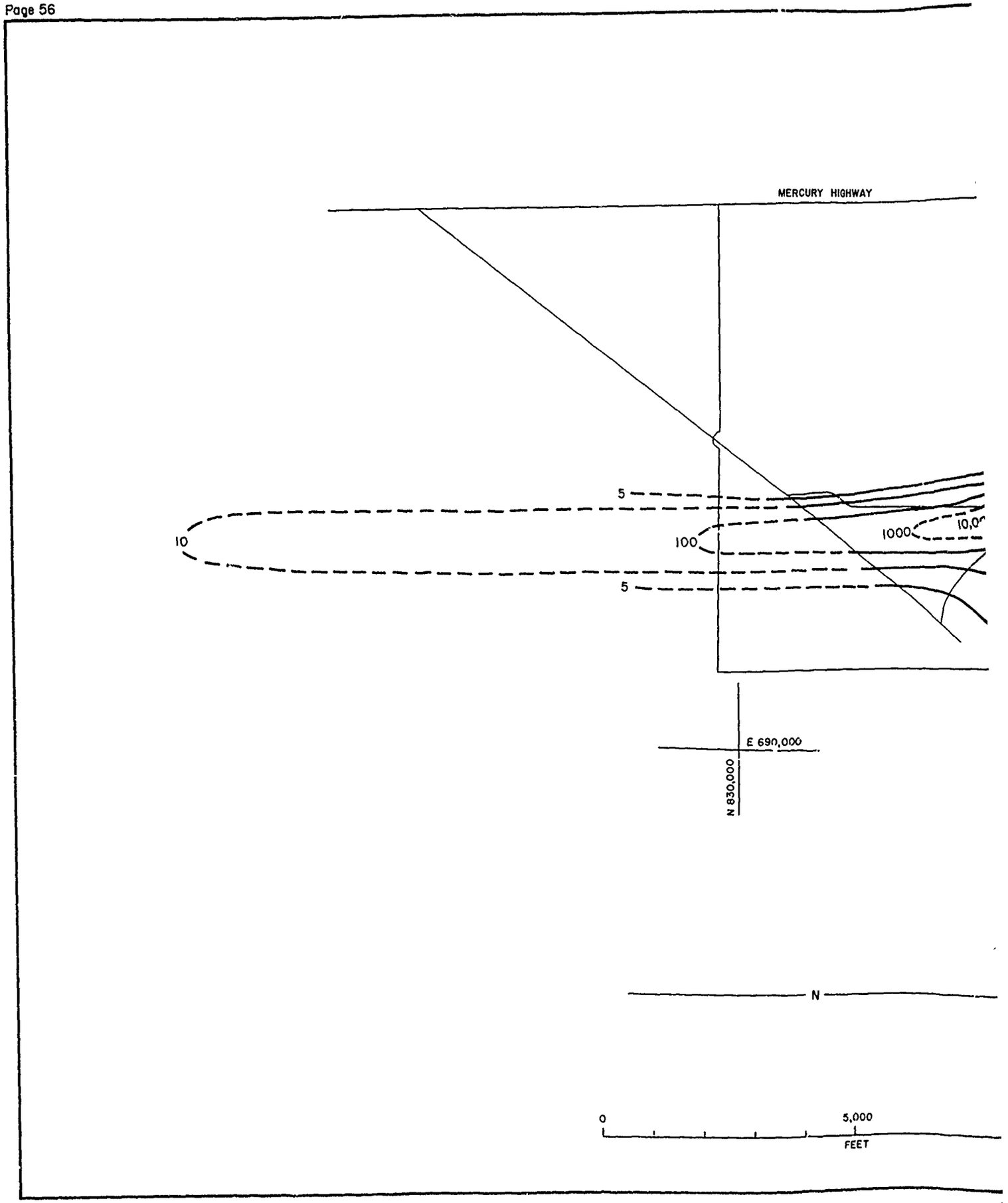
SANFORD (1500 FT BALLOON) MAP B
H-HR= 0220 PST 26 OCT. 1958
CLOUD TOP- 26,000 FT. M.S.L.

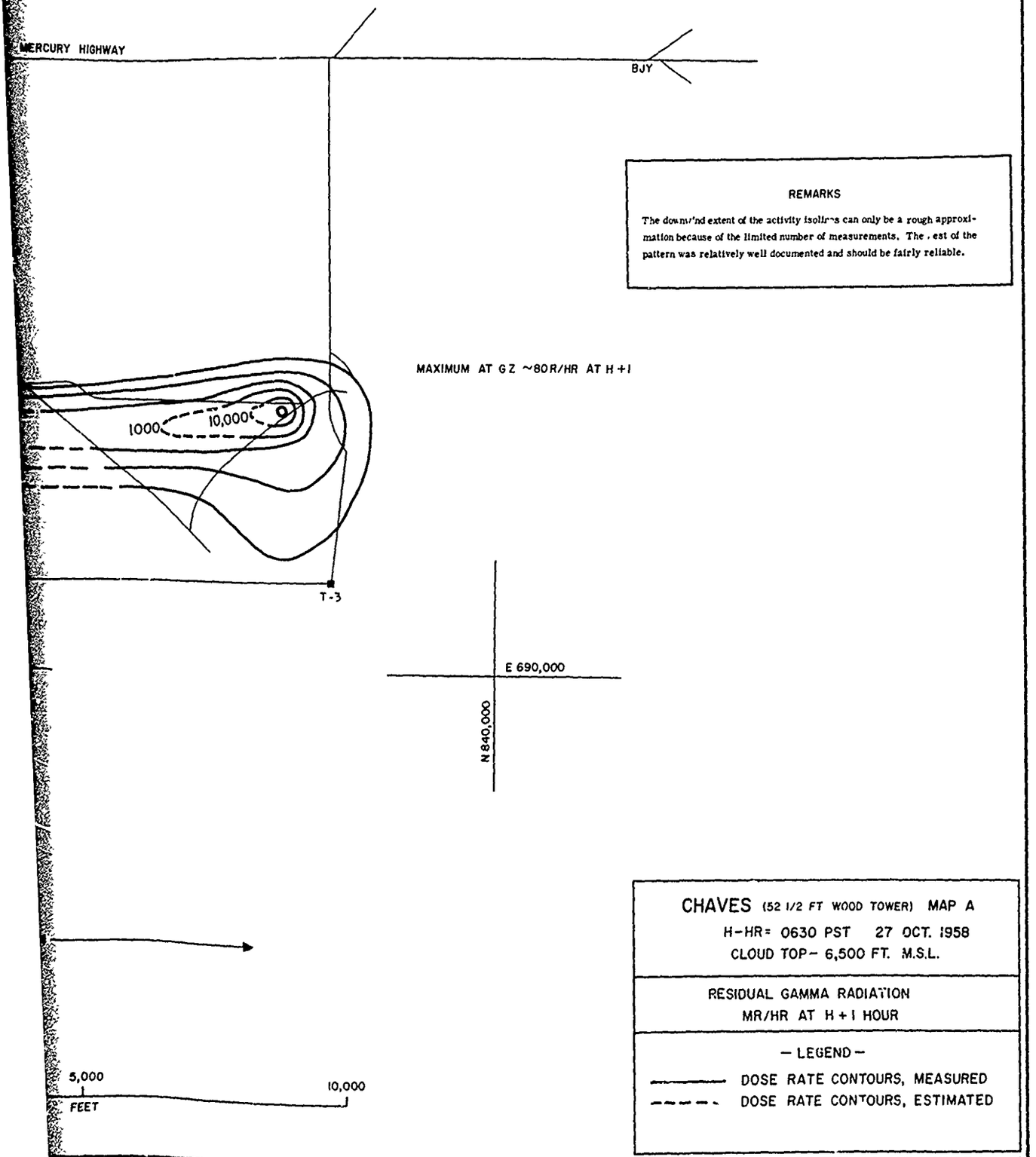
DE BACA (1500 FT BALLOON) MAP B
H-HR= 0800 PST 26 OCT 1958
CLOUD TOP- 17,500 FT. M.S.L.

RESIDUAL GAMMA RADIATION
MR/HR AT H+1 HOUR

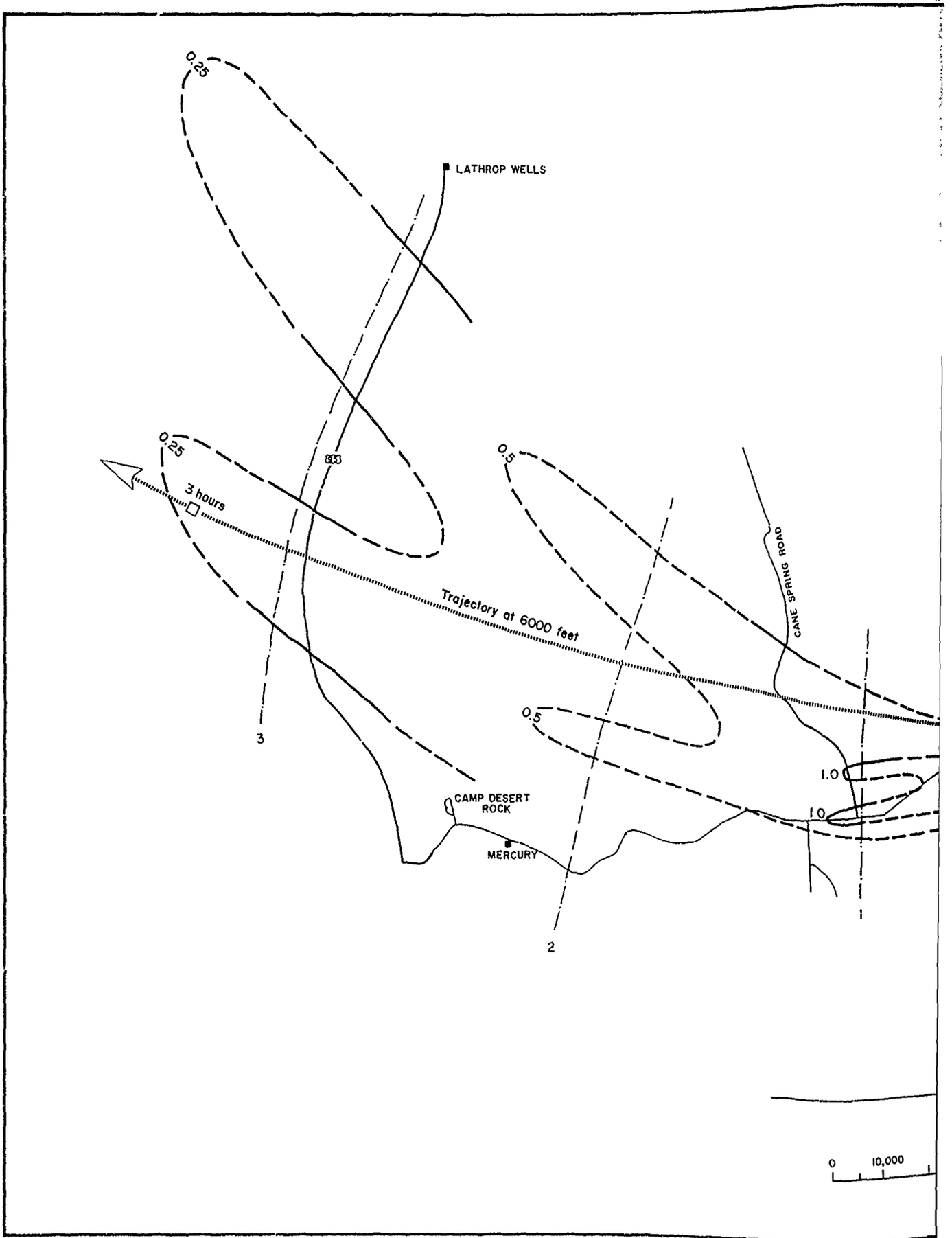
— LEGEND —

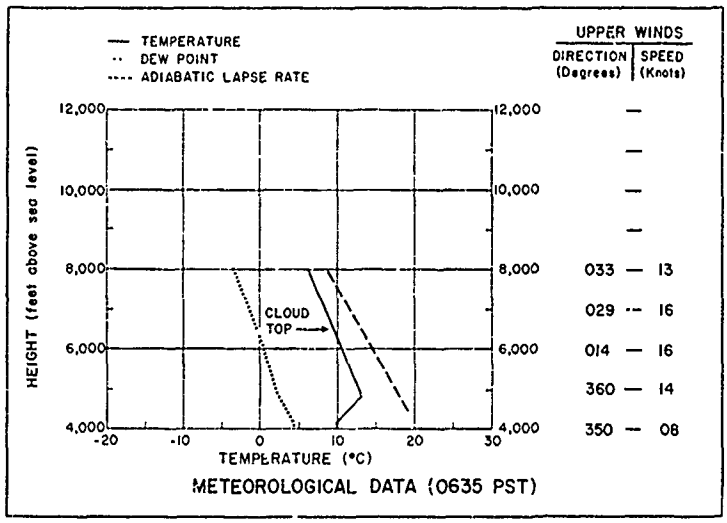
- DOSE RATE CONTOURS, MEASURED
- DOSE RATE CONTOURS, ESTIMATED
- TIME OF ARRIVAL, ESTIMATED, H+HOURS
- ELEVATION 7000 TO 9000 FEET
- ELEVATION MORE THAN 9000 FEET
- ROAD (THICK LINE INDICATES MONITORED SECTION)


MERCURY HIGHWAY
5
10
100
1000
10,0
5
E 690,000
N 830,000
N
0
5,000
FEET


MERCURY HIGHWAY
BJY
REMARKS
The downwind extent of the activity isolines can only be a rough approximation because of the limited number of measurements. The west of the pattern was relatively well documented and should be fairly reliable.
MAXIMUM AT GZ ~80R/HR AT H+1
1000
10,000
T-3
E 690,000
N 840,000
CHAVES (52 1/2 FT WOOD TOWER) MAP A
H-HR= 0630 PST 27 OCT. 1958
CLOUD TOP- 6,500 FT. M.S.L.
RESIDUAL GAMMA RADIATION
MR/HR AT H+1 HOUR
— LEGEND —
DOSE RATE CONTOURS, MEASURED
DOSE RATE CONTOURS, ESTIMATED
5,000
10,000
FEET

2

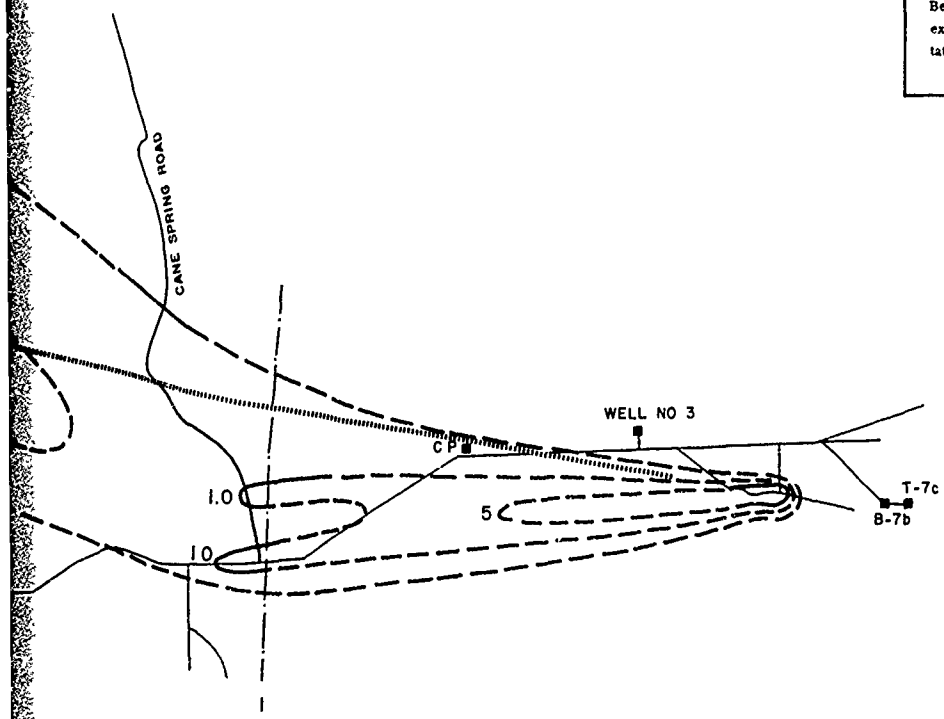

0.25
LATHROP WELLS
0.25
95
3 hours
Trajectory at 6000 feet
0.5
CANE SPRING ROAD
0.5
3
1.0
1.0
CAMP DESERT ROCK
MERCURY
2
0
10,000

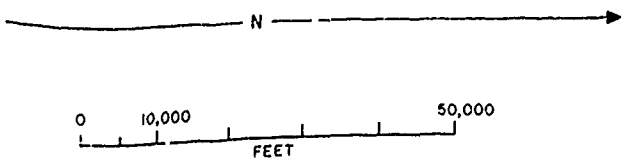


METEOROLOGICAL DATA (0635 PST)

REMARKS

Because of the limited area that was and could be monitored the downwind extents of the various isolines are rough approximations, but their orientation, at least, is consistent with the wind analysis.



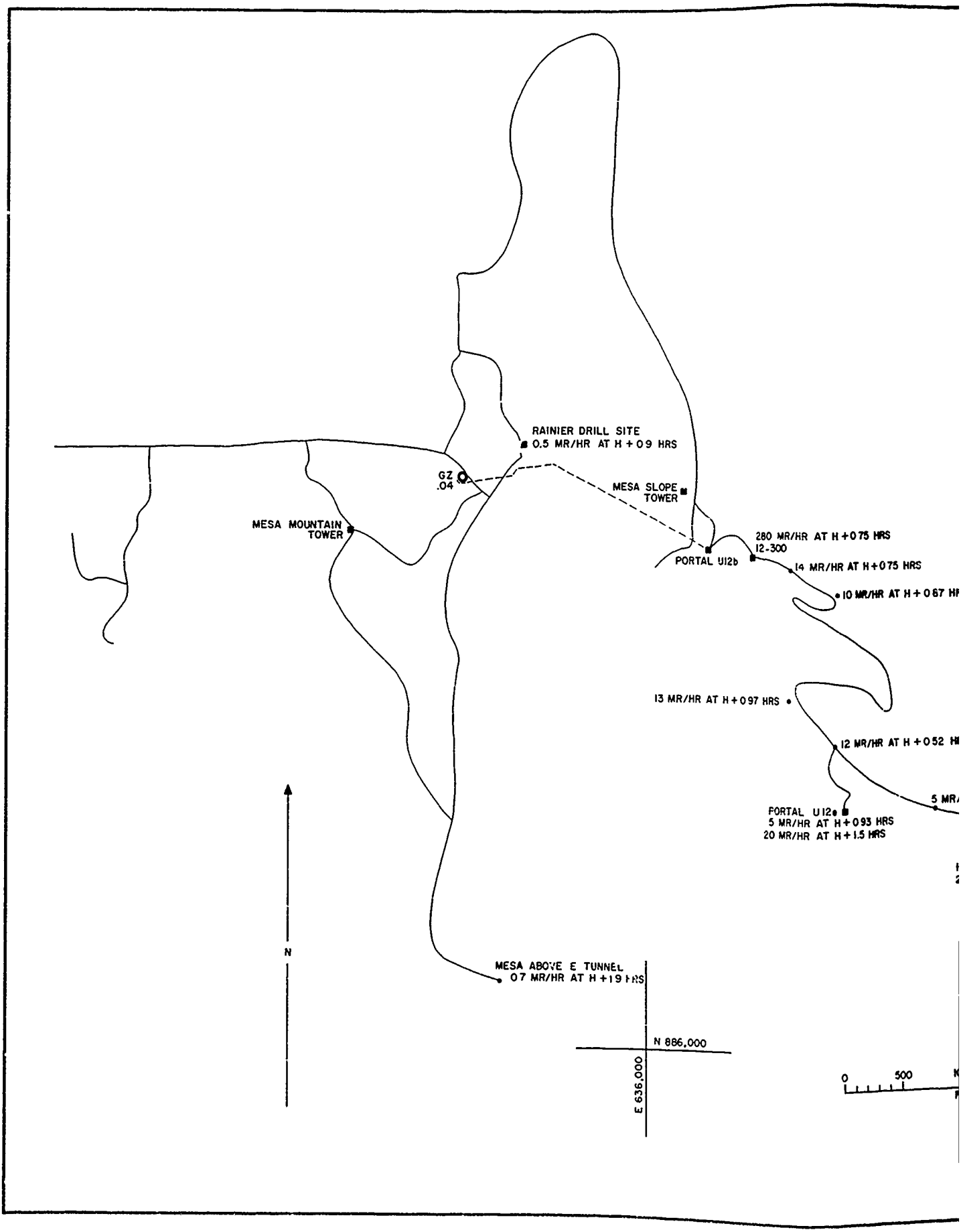


CHAVES (52 1/2 FT WOOD TOWER) MAP B
H-HR= 0630 PST 27 OCT. 1958
CLOUD TOP- 3,500 FT M.S.L.

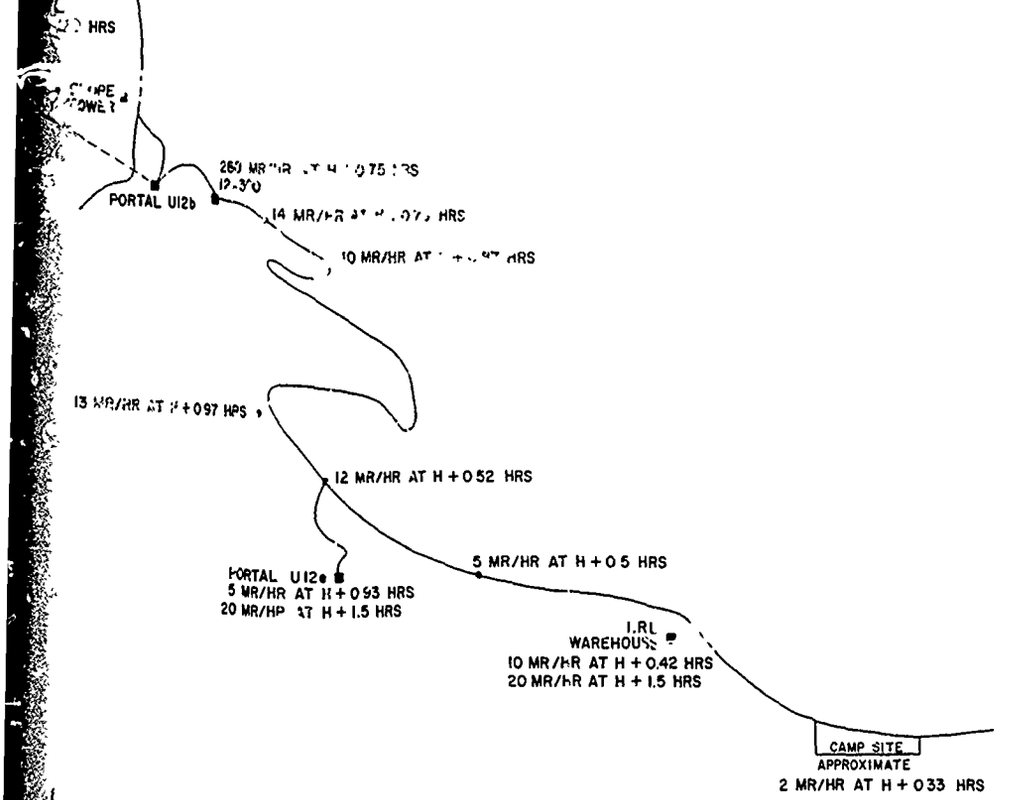
RESIDUAL GAMMA RADIATION
MR/HR AT H + 1 HOUR

— LEGEND —

——— DOSE RATE CONTOURS, MEASURED
– – – – – DOSE RATE CONTOURS, ESTIMATED


RAINIER DRILL SITE
0.5 MR/HR AT H + 0 9 HRS
GZ
.04
MESA SLOPE TOWER
MESA MOUNTAIN TOWER
280 MR/HR AT H + 0 75 HRS
12-300
PORTAL U12b
14 MR/HR AT H + 0 75 HRS
10 MR/HR AT H + 0 67 HR
13 MR/HR AT H + 0 97 HRS
12 MR/HR AT H + 0 52 HR
5 MR/
PORTAL U12e
5 MR/HR AT H + 0 93 HRS
20 MR/HR AT H + 1 5 HRS
N
MESA ABOVE E TUNNEL
0 7 MR/HR AT H + 1 9 HRS
N 886,000
E 636,000
0
500

11



REMARKS

Although there was no organized cloud from the Evans burst, a small amount of smoke was seen to vent from the portal, on the mesa slope at an elevation of about 6,650 feet.

Since the winds at the mesa slope tower were from the west, the vented material should have been transported toward the east or possibly toward the southeast because of the channelling effect of the canyon between the "B" and "E" portals.

There were two monitoring reports at the LRL Warehouses. 10 mr/hr at 0.42 hours and 20 mr/hr at 1.5 hours after the burst. Also, at the portal of Tunnel U12e there were readings of 5 mr/hr at 0.93 hours and 20 mr/hr at 1.5 hours after the burst. The radiation at these sites cannot logically be attributed to any previous burst. Since after these early surveys there was no further monitoring reported until after the Blanca burst, it is not possible to say whether this radiation was due to airborne debris or due to true fallout. There is a suggestion, however, that the greater part was from airborne material.

The reading at the Rainier Drill Site is believed to be from residual contamination from Neptune. It is uncertain whether the activity on the mesa above the "E" tunnel is residual or from Evans.

15-Minute Average Winds

	9 foot Mesa Slope Tower (Surface Elevation-6725 feet m.s.l.)		100 foot Mesa Mountain Tower (Surface Elevation-7465 feet m.s.l.)	
Time (PST)	Direction (degrees)	Speed (m.p.h.)	Direction (degrees)	Speed (m.p.h.)
1445-1000	290	07	010	Missing
1545-1600	290	08	360	Missing
1645-1700	280	08	360	Missing
1745-1800	260	05	360	Missing

EVANS (TUNNEL) MAP A

H-HR = 1600 PST 28 OCT. 1958

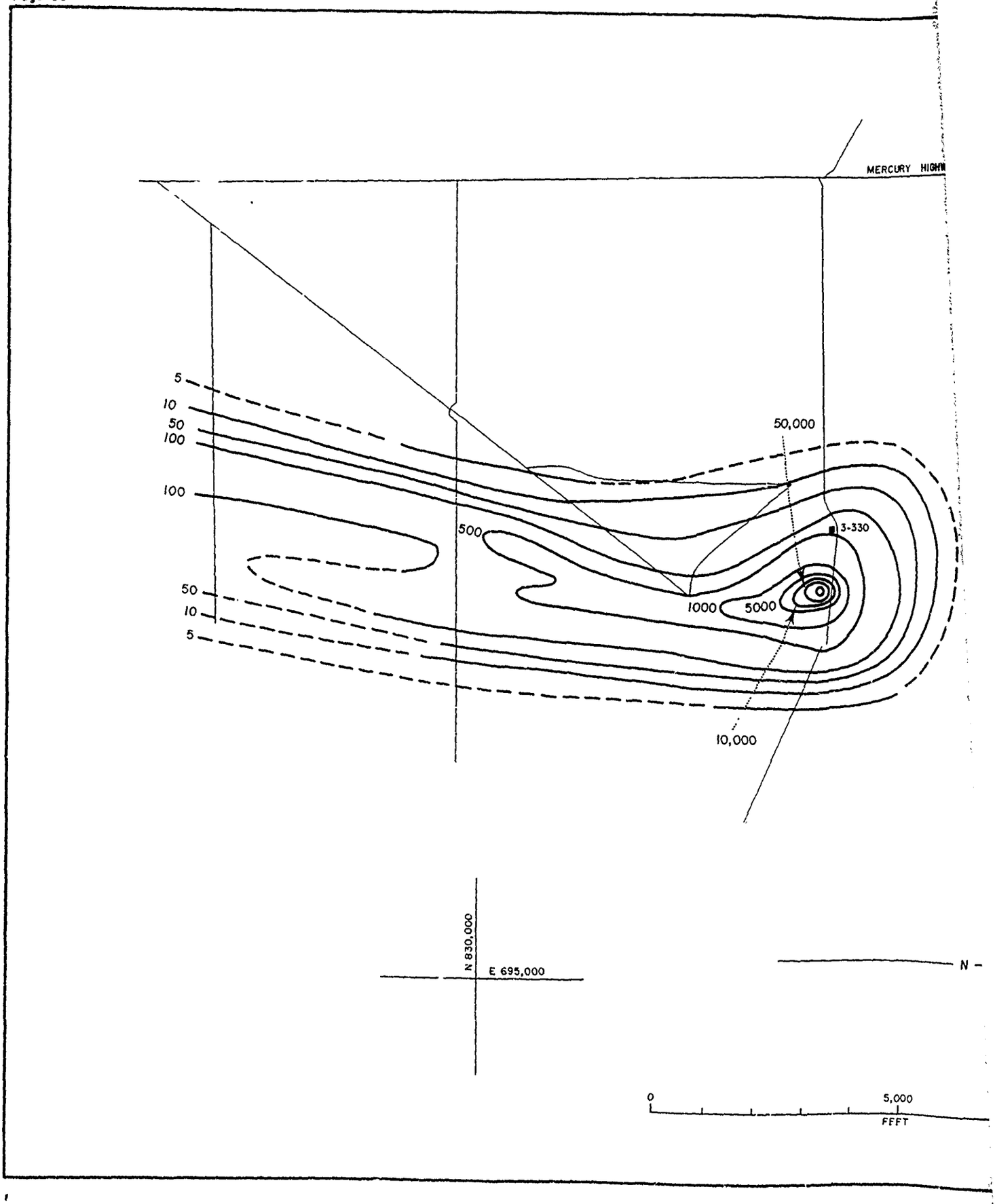
CLOUD TOP - NO ORGANIZED CLOUD

RESIDUAL GAMMA RADIATION
MR/HR AT TIME OF OBSERVATION

- LEGEND -

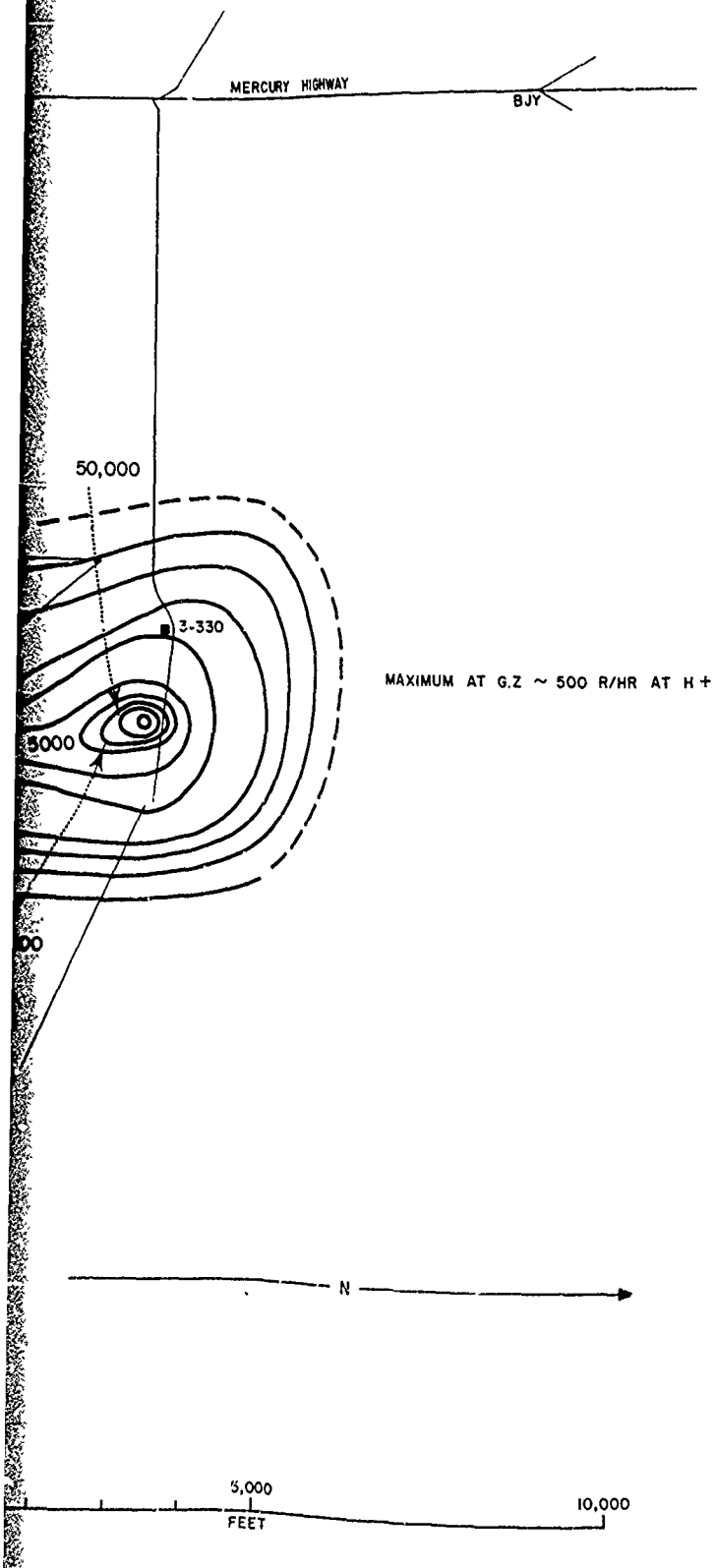
——— DOSE RATE CONTOURS, MEASURED

– – – – DOSE RATE CONTOURS, ESTIMATED


MERCURY HIGHW
5
10
50
100
100
50
10
5
50,000
500
3-330
1000
5000
10,000
N 830,000
E 695,000
N –
0
5,000
FEET

REMARKS

The on-site fallout from Humboldt was well documented and the pattern is considered reliable.



HUMBOLDT (25 FT. WOOD TOWER) MAP A

H-HR = 0645 PST 29 OCT. 1958

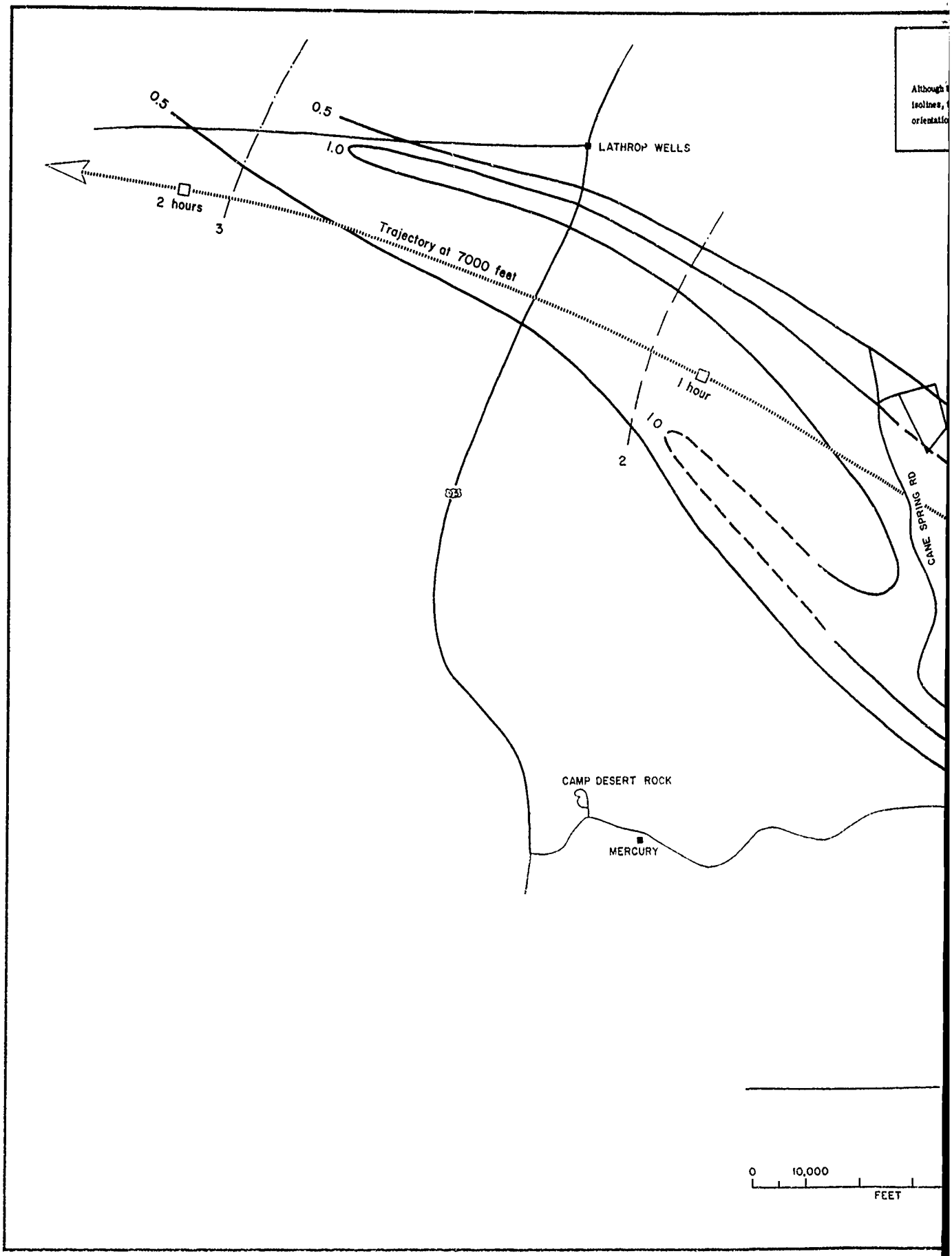
CLOUD TOP - 7,500 FT M.S.L.

RESIDUAL GAMMA RADIATION
MR/HR AT H+1 HOUR

- LEGEND -

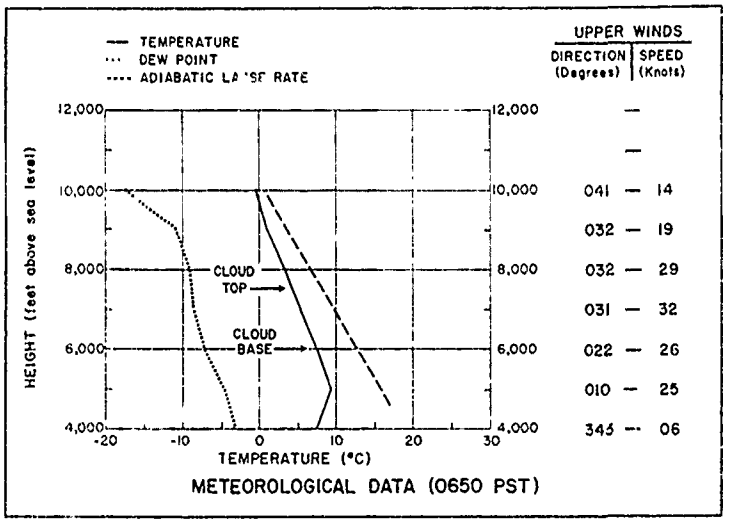
——— DOSE RATE CONTOURS, MEASURED

– – – – DOSE RATE CONTOURS, ESTIMATED

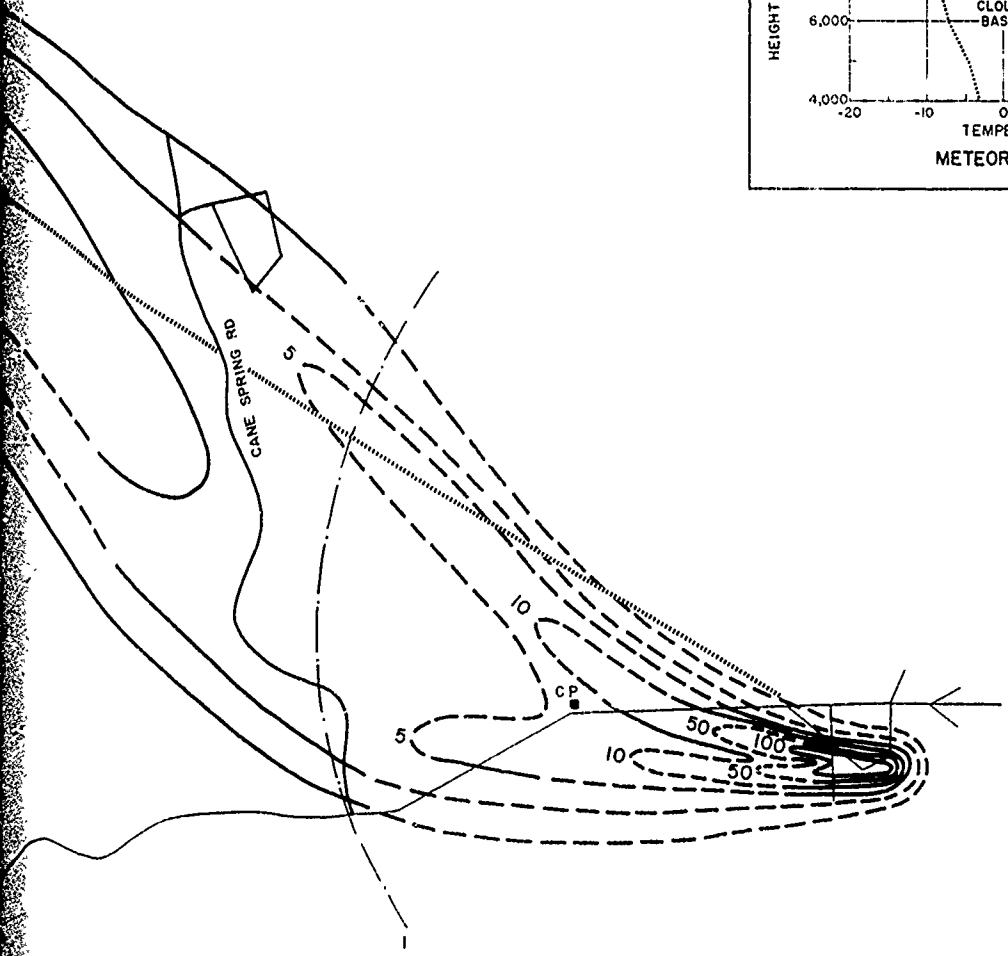

0.5
0.5
1.0
LATHROP WELLS
2 hours
3
Trajectory at 7000 feet
1 hour
1.0
2
CANE SPRING RD
CAMP DESERT ROCK
MERCURY
0
10,000
FEET

REMARKS

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.



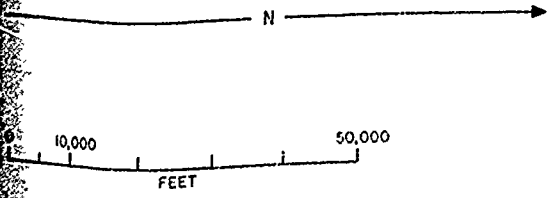
METEOROLOGICAL DATA (0650 PST)



HUMBOLDT (25 FT WOOD TOWER) MAP B
H-HR= 0645 PST 29 OCT. 1958
CLOUD TOP- 7,500 FT. M.S.L.

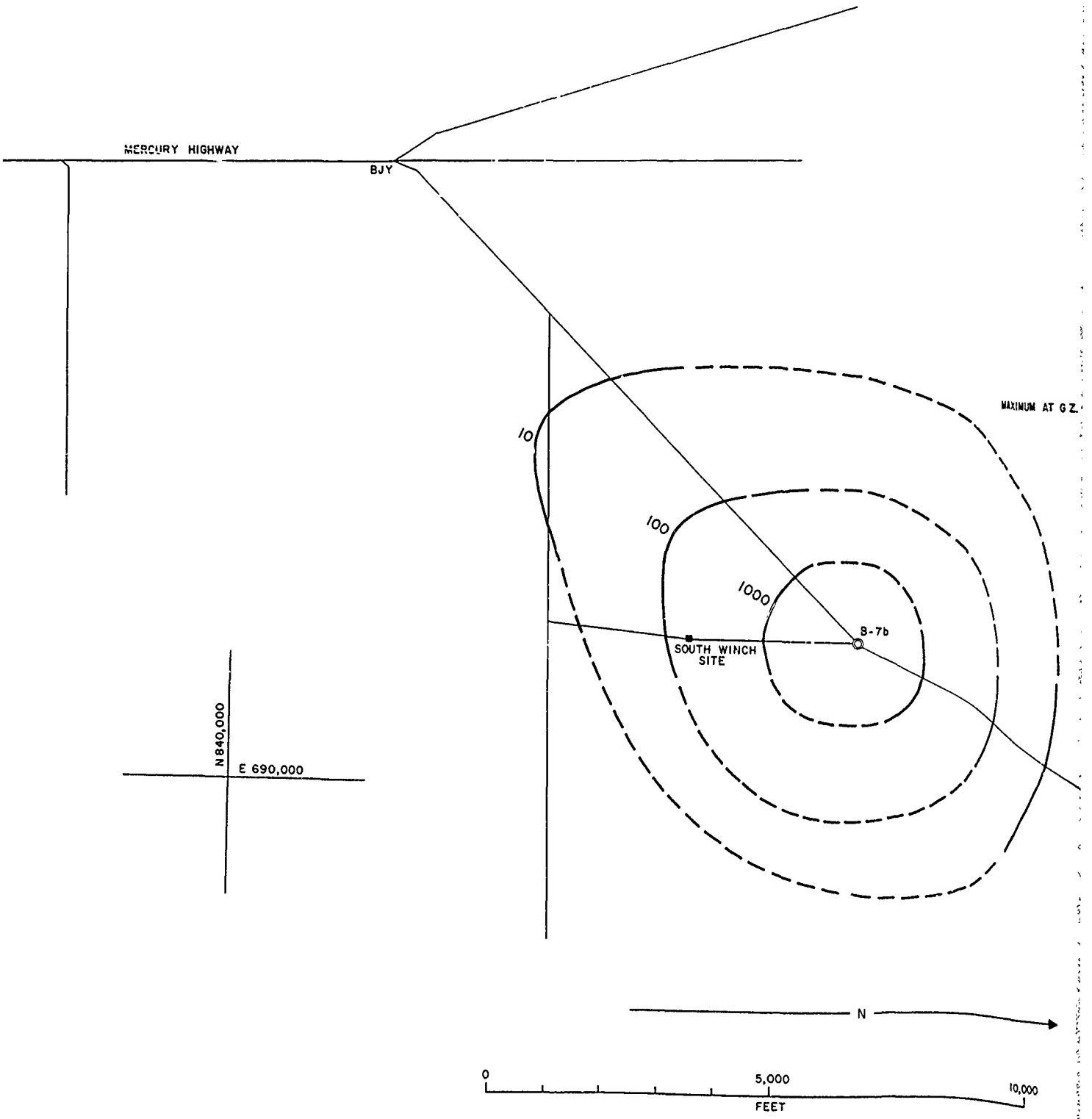
RESIDUAL GAMMA RADIATION
MR/HR AT H + 1 HOUR

— LEGEND —
——— DOSE RATE CONTOURS, MEASURED
– – – – DOSE RATE CONTOURS, ESTIMATED



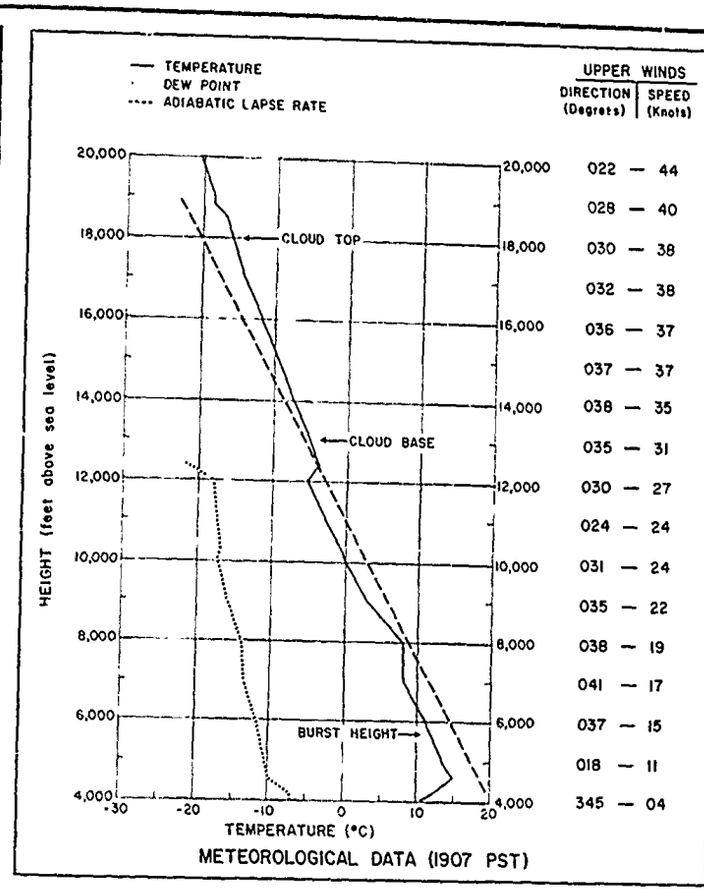
REMARKS

The lateral activity on site was relatively
should be fairly reliable

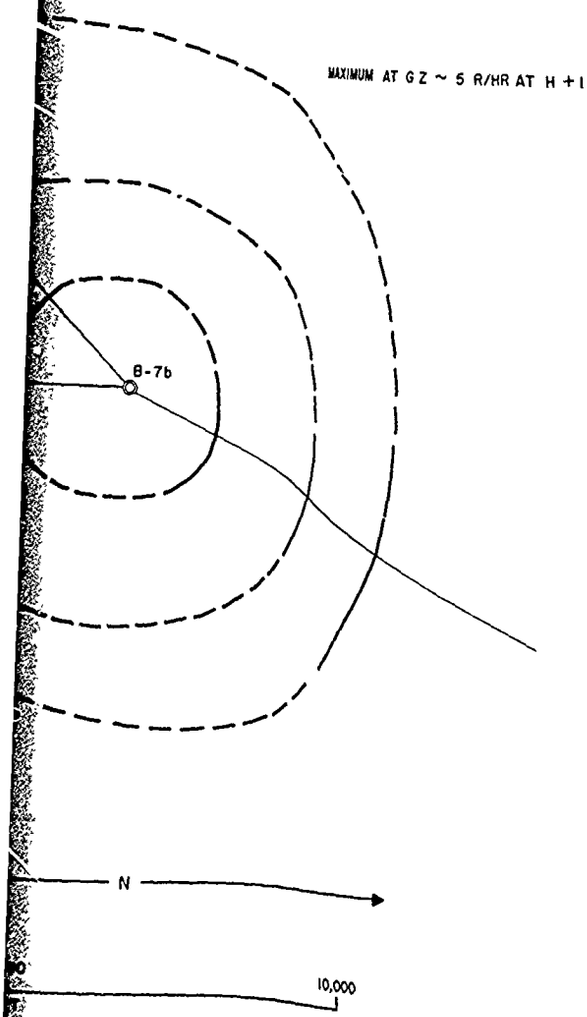


REMARKS

The fallout pattern on site was relatively well monitored and the pattern should be fairly reliable.



METEOROLOGICAL DATA (1907 PST)



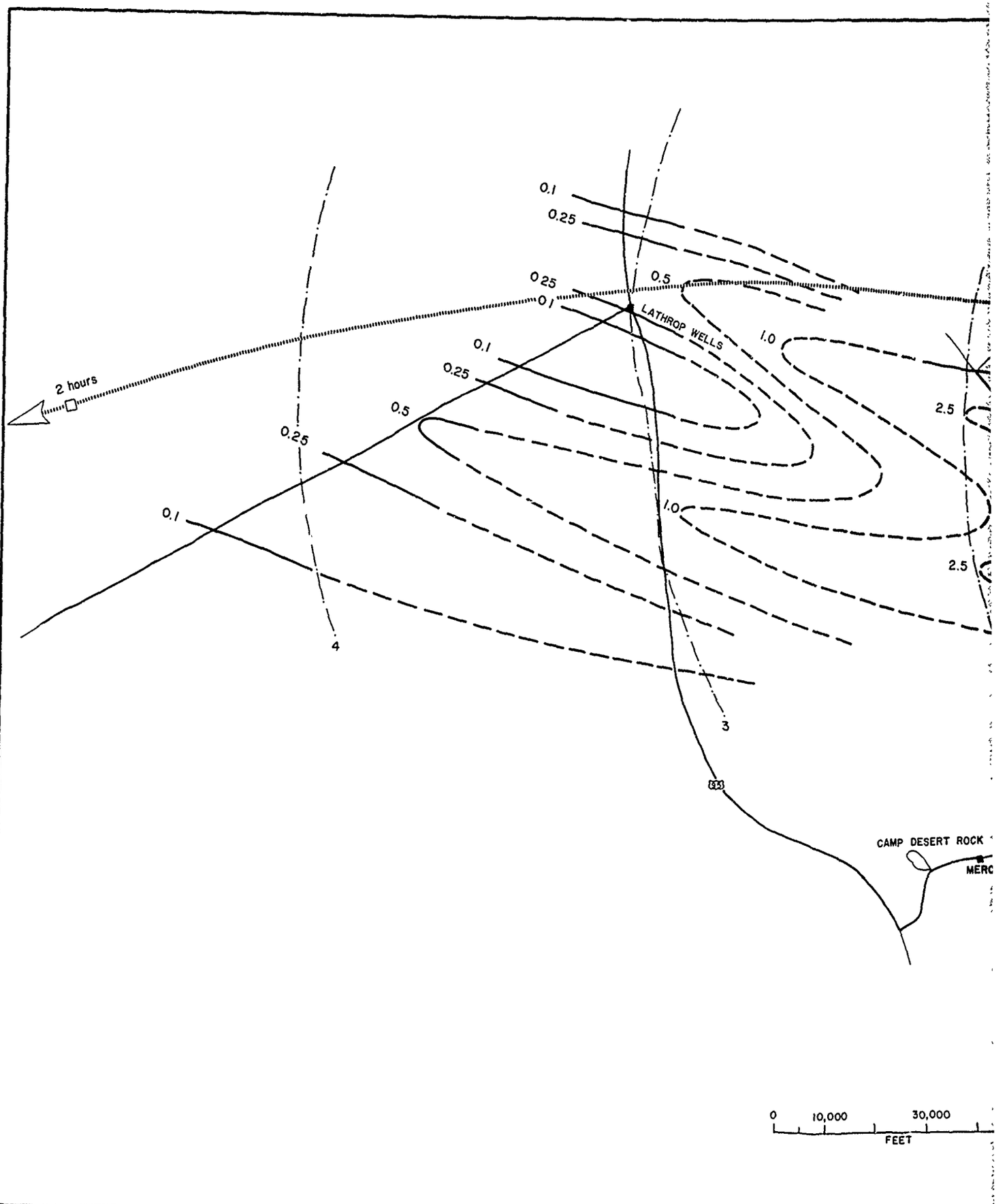
SANTA FE (1500 FT. BALLOON) MAP A
H-HR = 1900 PST 29 OCT. 1958
CLOUD TOP - 18,000 FT. M.S.L.

RESIDUAL GAMMA RADIATION
MR/HR AT H + 1 HOUR

— LEGEND —

——— DOSE RATE CONTOURS, MEASURED
- - - - - DOSE RATE CONTOURS, ESTIMATED

2.

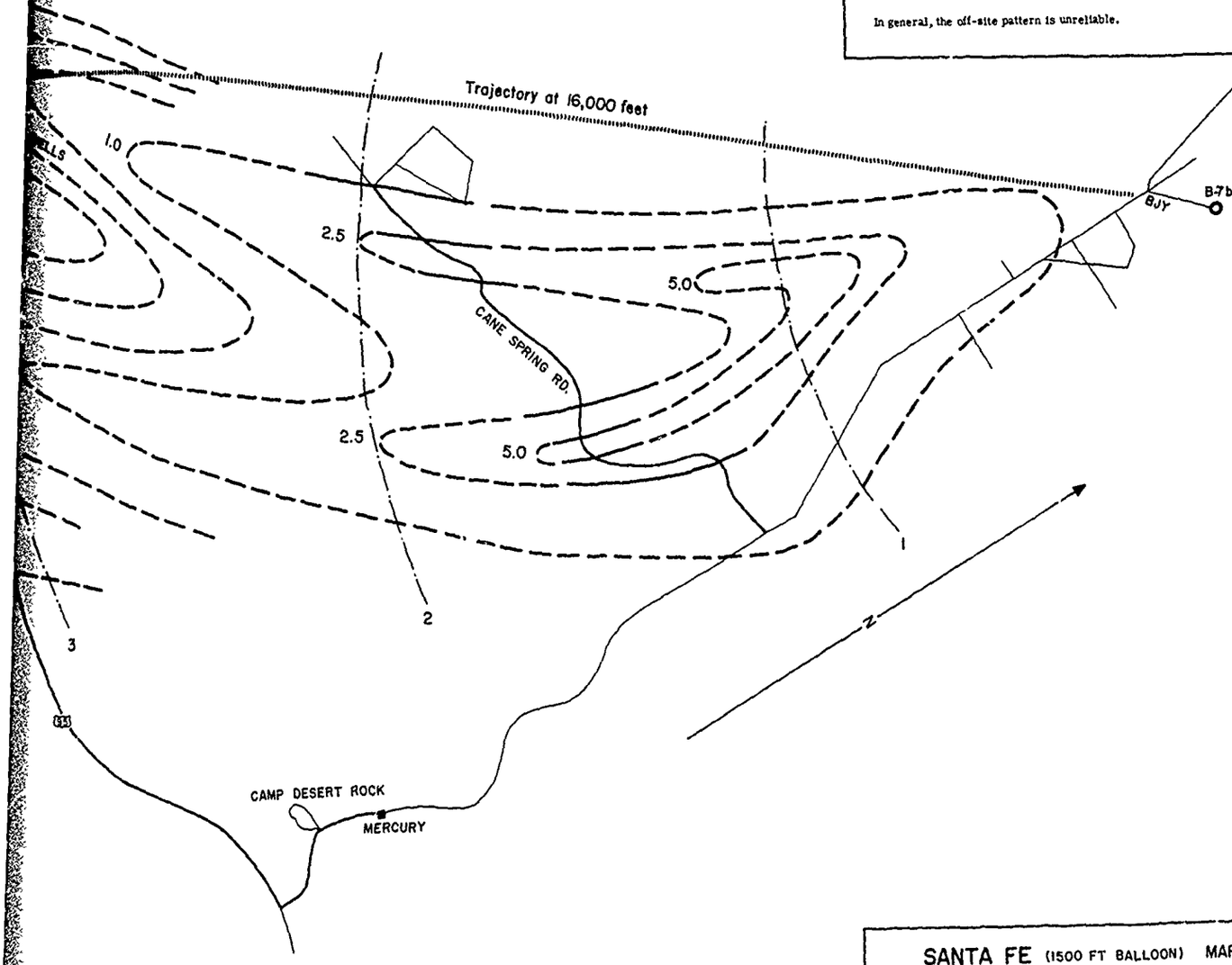

0.1
0.25
0.5
1.0
2.5
LATHROP WELLS
2 hours
3
4
CAMP DESERT ROCK
0
10,000
30,000
FEET

REMARKS

The part of the pattern between the area of induced activity very near the burst site and Cane Spring Road is highly speculative, and it is not known whether or not there was a continuous pattern of very light fallout from the burst area to the Cane Spring Road.

Along Highway 95 from Mercury to about 4 miles east of Lathrop Wells no activity distinguishable from background was observed in a survey made between 1.5 and 2.2 hours after the detonation. It is suspected, however, that the survey was made before fallout arrived. Based on the fallout recorded at Lathrop Wells, the arrival should have been at about 3 hours after the burst.

In general, the off-site pattern is unreliable.



SANTA FE (1500 FT BALLOON) MAP B
H-HR = 1900 PST 29 OCT. 1958
CLOUD TOP - 18,000 FT. M.S.L.

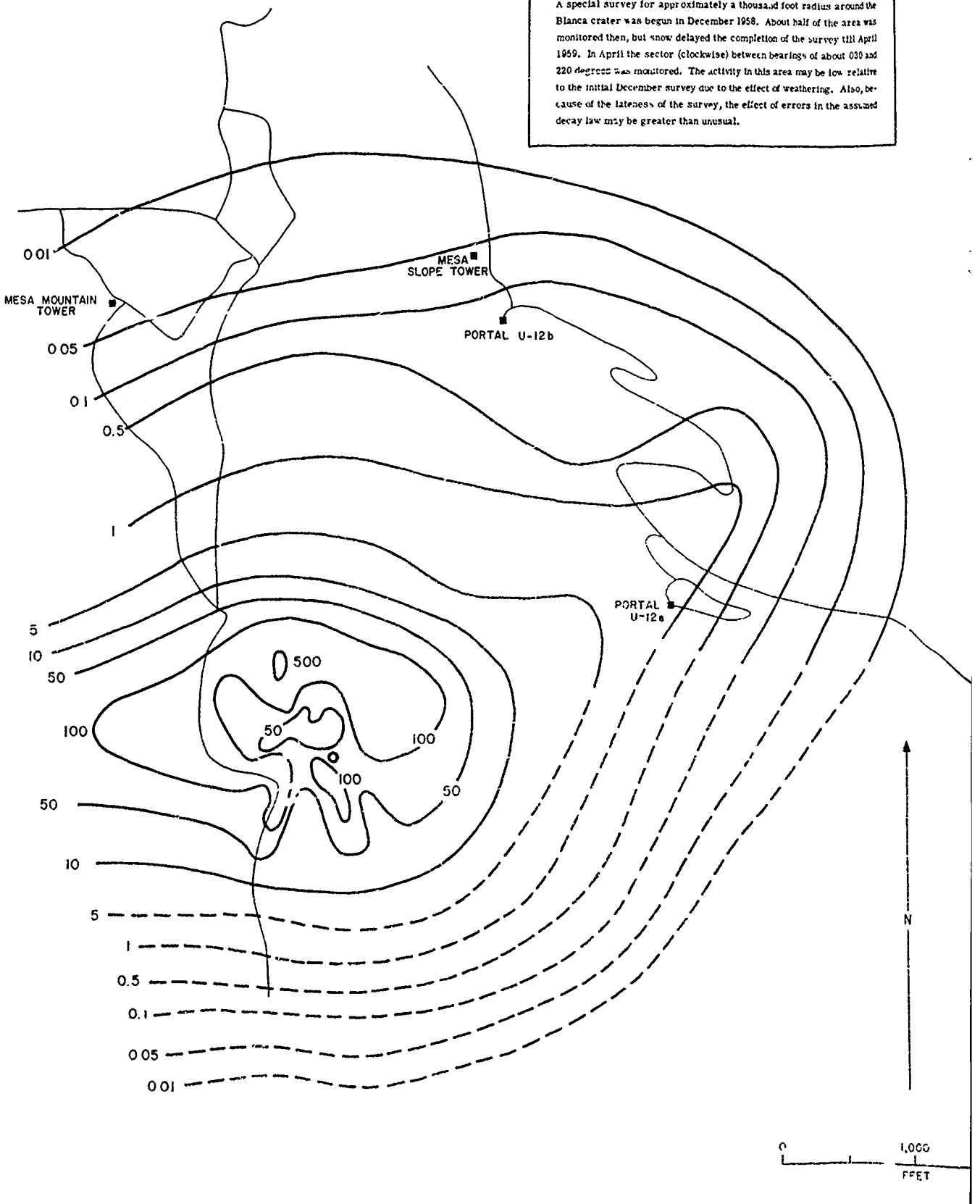
RESIDUAL GAMMA RADIATION
MR/HR AT H + 1 HOUR

- LEGEND -
——— DOSE RATE CONTOURS, MEASURED
– – – – DOSE RATE CONTOURS, ESTIMATED

0 10,000 30,000 50,000
FEET

REMARKS

A special survey for approximately a thousand foot radius around the Blanca crater was begun in December 1958. About half of the area was monitored then, but snow delayed the completion of the survey till April 1959. In April the sector (clockwise) between bearings of about 030 and 220 degrees was monitored. The activity in this area may be low relative to the initial December survey due to the effect of weathering. Also, because of the lateness of the survey, the effect of errors in the assumed decay law may be greater than usual.



ARKS

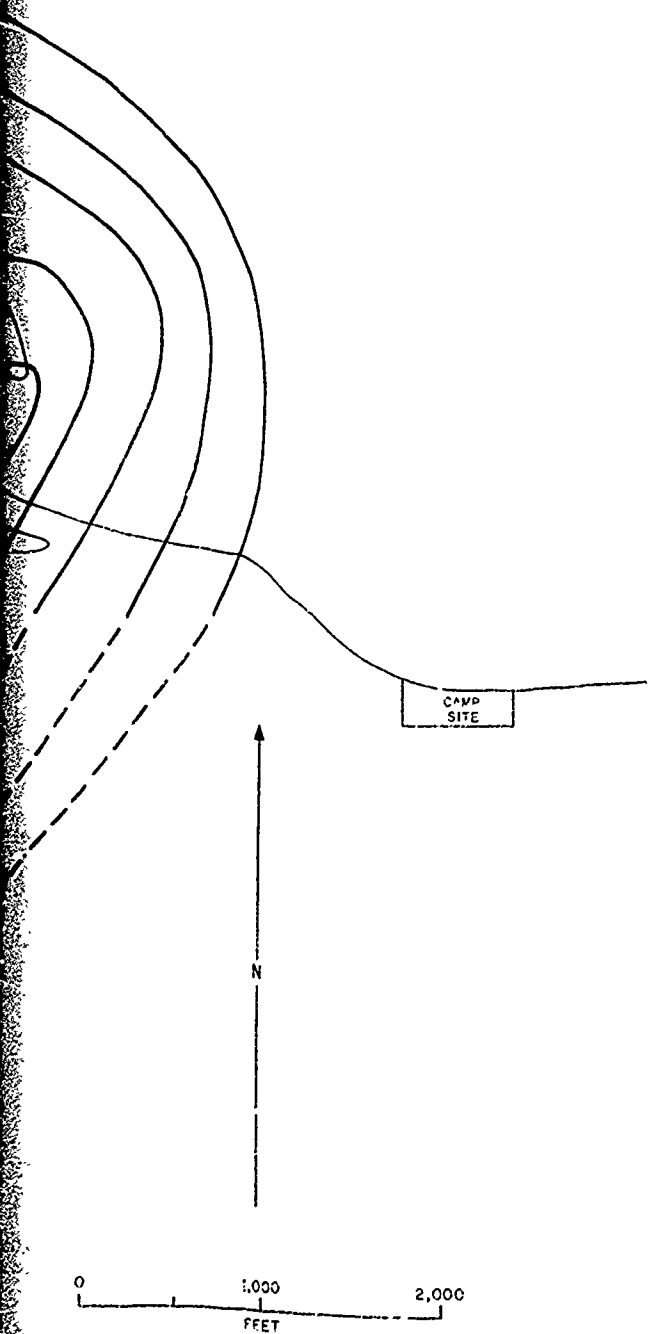
...y a thousand foot radius around the ...er 1958. About half of the area was ...e completion of the survey till April ...) between bearings of about 030 and ...tivity in this area may be low relative ... to the effect of weathering. Also, be... the effect of errors in the assumed ...ual.

REMARKS

The small-scale on-site map shows three tongues of activity crossing the back road to the mesa also referred to as the Castle Rock Road. This road was monitored shortly after the Blanca detonation and again about 7 months later. Due to inadequate mapping and the scarcity of good reference points, there is considerable uncertainty in the location of the peak or peaks of activity on this rem... road. One of the two teams making the initial surveys reported a peak 0.5 mile south of Castle Rock which would have been about 10 r/hr at H+1. The other team reported a peak 2.6 miles north of Castle Rock of 50 r/hr as of H+1.

When the survey was made 7 months later, reference stakes were available at half-mile intervals along this road, so that the location of the fallout detected is much more certain than in the initial surveys. This late survey indicated three peaks 0.5, 1.5 and 2.8 miles north of Castle Rock. The conversion by the $t^{-1.2}$ approximation would indicate H+1 dose rates respectively of about 1, 1.5 and 5 r/hr. Since this was a careful survey with accurate positioning, three peaks were assumed to have existed at the locations indicated. However, because of the probable reduction in radiation by weathering and the errors probably attendant in assuming a simple decay law to be valid for such a long period, the H+1 dose rates were estimated from the initial survey. It should be noted that there is an order of magnitude discrepancy in the estimation of the H+1 dose rates from the early to late surveys.

With the uncertainties mentioned above and the large areas that could not be monitored between the venting site and the Castle Rock Road and west of this road, there is very little confidence in this pattern.



BLANCA (TUNNEL) MAP A

H-HR=0700 PST 30 OCT. 1958

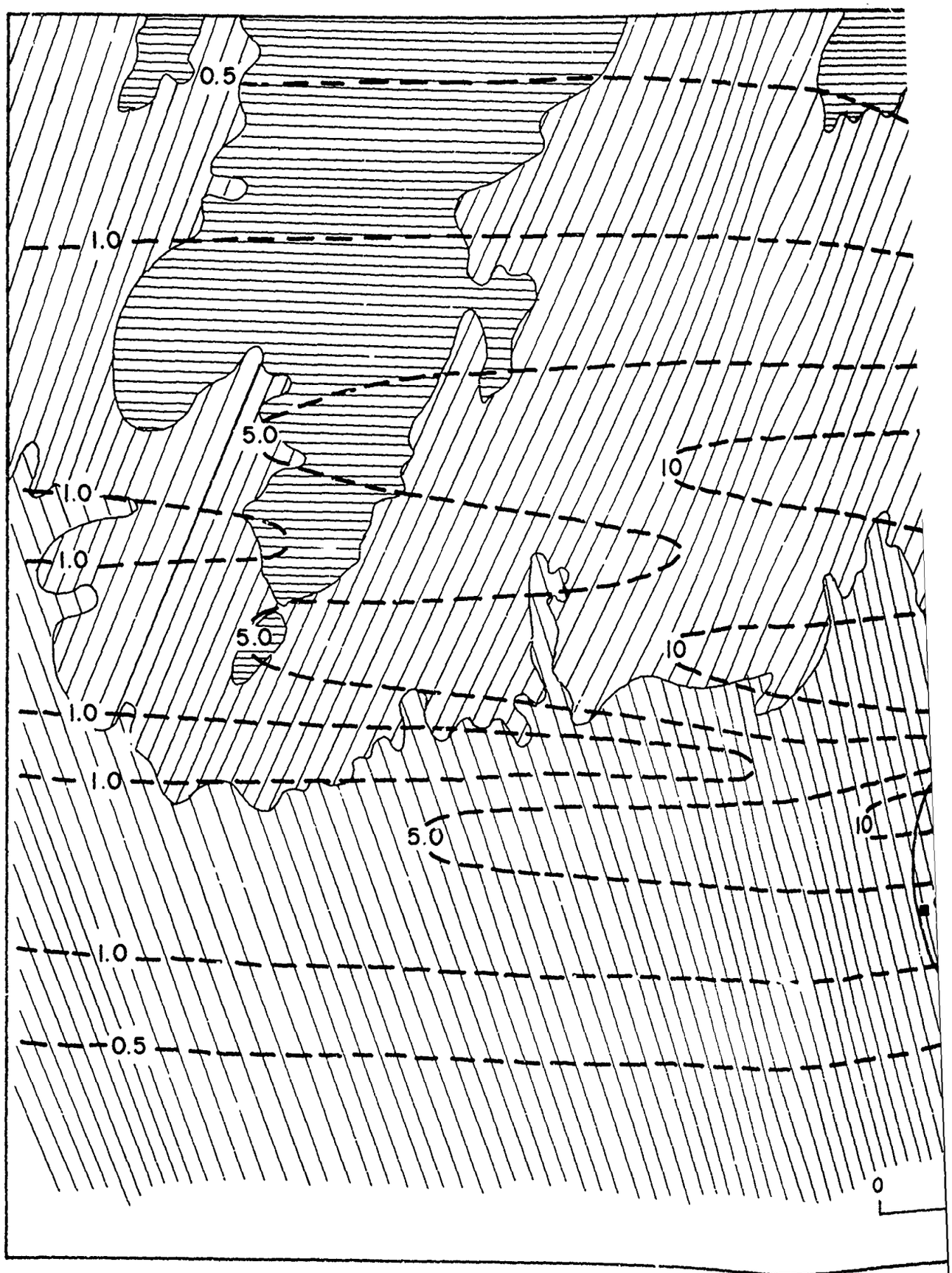
CLOUD TOP- 7,700 FT. M.S.L.

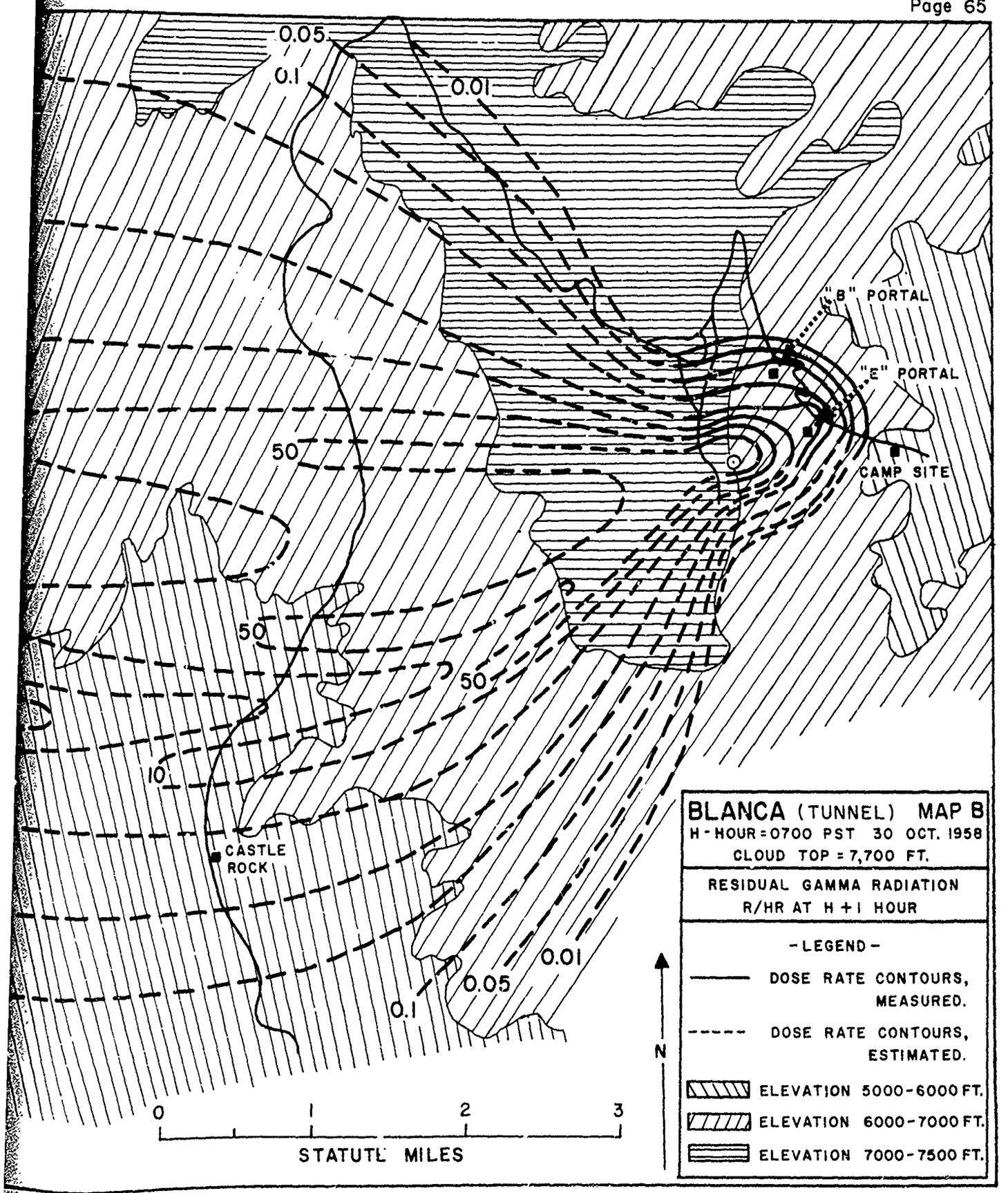
RESIDUAL GAMMA RADIATION
R/HR AT H + 1 HOUR

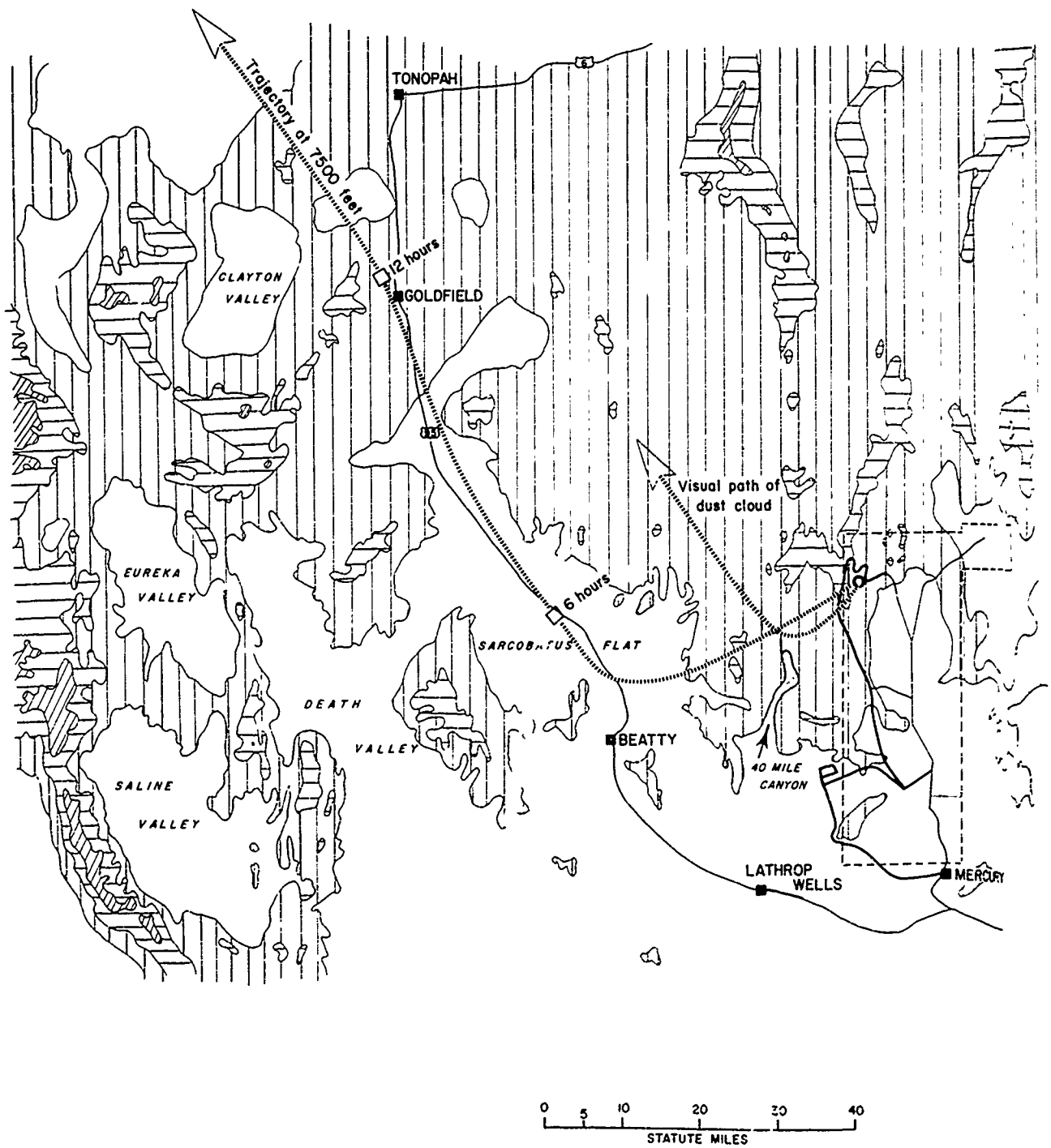
— LEGEND —

——— DOSE RATE CONTOURS, MEASURED

– – – – DOSE RATE CONTOURS, ESTIMATED


0.5
1.0
5.0
10
1.0
1.0
5.0
10
1.0
1.0
5.0
10
1.0
0.5
0

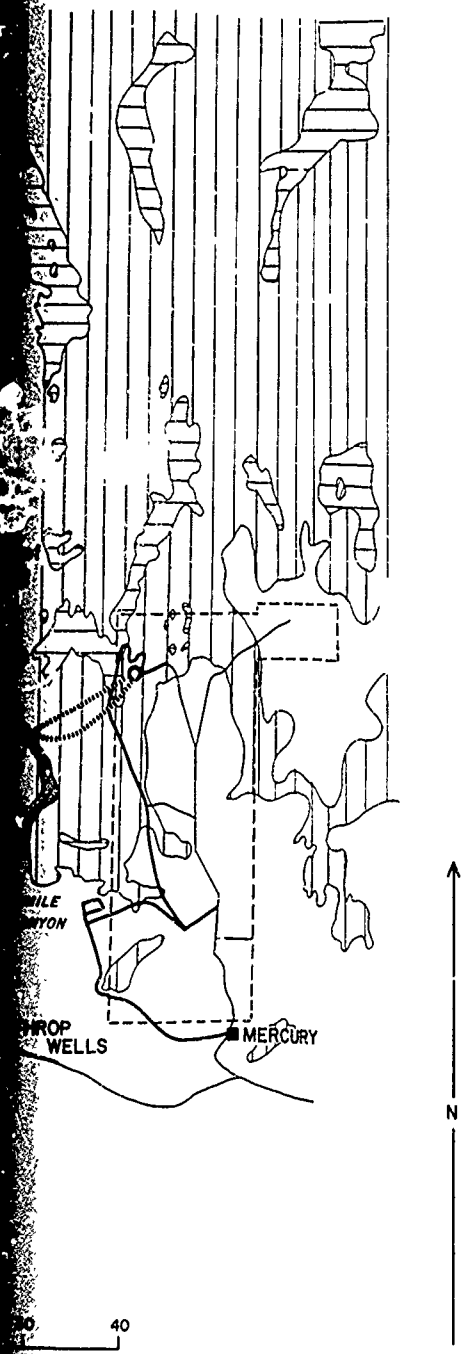

0.05
0.1
0.01
"B" PORTAL
"E" PORTAL
CAMP SITE
50
50
50
10
CASTLE ROCK
0.01
0.05
0.1
N
0
1
2
3
STATUTE MILES
BLANCA (TUNNEL) MAP B
H - HOUR = 0700 PST 30 OCT. 1958
CLOUD TOP = 7,700 FT.
RESIDUAL GAMMA RADIATION
R/HR AT H + 1 HOUR
- LEGEND -
DOSE RATE CONTOURS, MEASURED.
DOSE RATE CONTOURS, ESTIMATED.
ELEVATION 5000-6000 FT.
ELEVATION 6000-7000 FT.
ELEVATION 7000-7500 FT.


Trajectory at 7500 feet
TONOPAH
6
12 hours
GOLDFIELD
CLAYTON VALLEY
95
Visual path of dust cloud
6 hours
EUREKA VALLEY
SARCOBATUS FLAT
DEATH VALLEY
BEATTY
40 MILE CANYON
SALINE VALLEY
LATHROP WELLS
MERCURY
0 5 10 20 30 40
STATUTE MILES

REMARKS

The dust cloud from Blanca was observed to be travelling toward the southwest at about ten minutes after the burst. About 30 minutes later it was reported to be travelling up Forty Mile Canyon. The rough trajectory of this dust cloud is indicated on the map. Also shown is the meteorological trajectory for 7,500 feet m.s.l. This trajectory was estimated to have moved initially toward the southwest for about 4 hours and then to have veered northwest-ward over Sarcobatus Flat, toward Tonopah.

Air sampling off-site showed a significant increase in alpha activity at Tonopah, Goldfield, and Beatty, which is attributed to Blanca. The beta activity measurements showed only a slight increase at these locations. Since the area west of the Test Site along Highway 95 was not monitored except near Lathrop Wells, it is not certain that fallout from Blanca occurred off site; but the alpha measurements, the trajectories, and possibly the beta measurements indicate that some light fallout did occur off site.



BLANCA (TUNNEL) MAP C

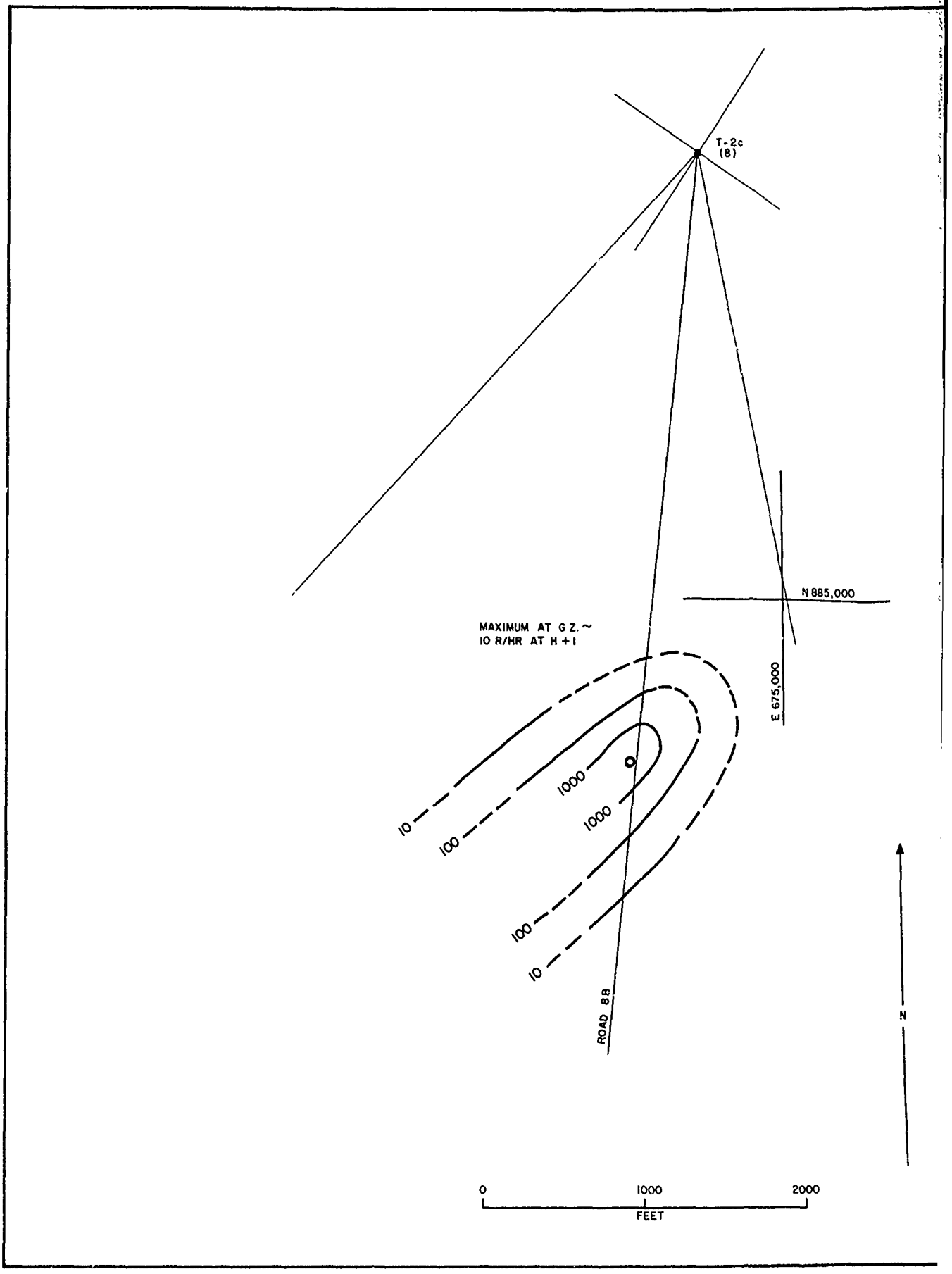
H-HR = 0700 PST 30 OCT. 1958

CLOUD TOP - 7700 FT M S L.

TRAJECTORY MAP

— LEGEND —

- ELEVATION 5000 TO 7000 FEET
- ELEVATION 7000 TO 9000 FEET
- ELEVATION MORE THAN 9000 FEET
- ROAD (THICK LINE INDICATES MONITORED SECTION)


T-2c
(8)
N 885,000
E 675,000
MAXIMUM AT G Z. ~
10 R/HR AT H + 1
10
100
1000
1000
100
10
ROAD 8B
N
0
1000
2000
FEET

REMARKS

There was a trivial yield from Titania and a cloud height of about 6,000 feet m.s.l. was observed (a rise of about 1,500 feet). The only available meteorological data at about shot time were the wind observations at Yucca Lake (about 15 miles south of the burst point) and at Station 353 (about 2-1/2 miles south of the burst point on Road 8B). Based on these observations the pattern has been oriented toward the southwest and the isoline left open in the southwest quadrant.

No off-site contamination was detected.

Upper Winds at Yucca Lake Weather Station

(Elevation 3924 feet m.s.l.)

Observation at 1257 PST

Height (m.s.l.)	Direction (degrees)	Speed (knots)
4,000	080	08
5,000	060	13
6,000	060	13
7,000	060	12
8,000	070	11

15-Minute Average Winds

20-foot Tower at Station 353

(Surface Elevation About 4325 feet m.s.l.)

Time (PST)	Direction (degrees)	Speed (m.p.h.)
1045-1100	045	14
1145-1200	075	13
1245-1300	075	12
1345-1400	065	11

N 865,000

N

2000

TITANIA (25 FT. WOOD TOWER) MAP A
H-HR = 1234 PST 30 OCT. 1958
CLOUD TOP- 6000 FT. M.S.L.

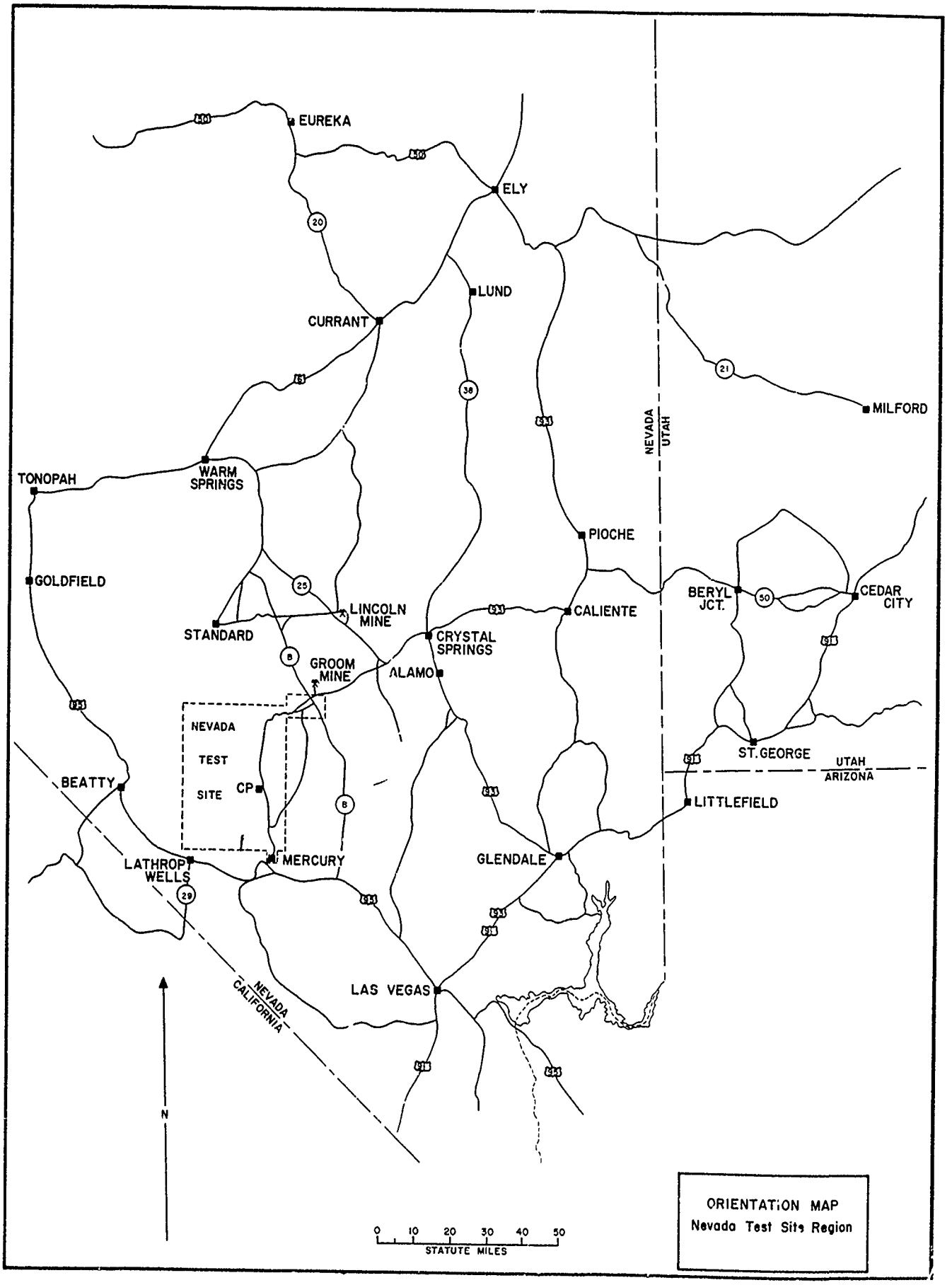
RESIDUAL GAMMA RADIATION
MR/HR AT H + 1 HOUR

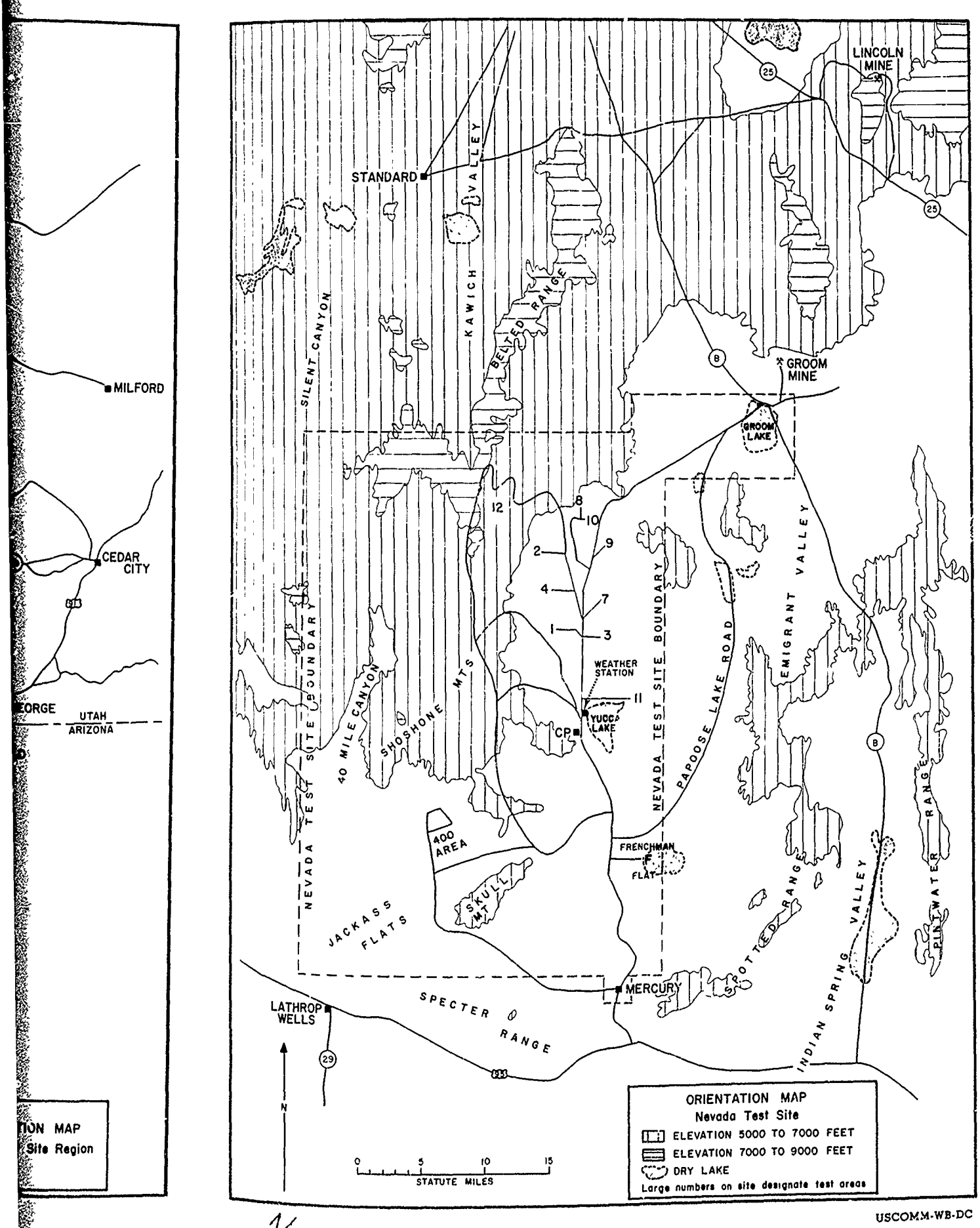
- LEGEND -

——— DOSE RATE CONTOURS, MEASURED

– – – – DOSE RATE CONTOURS, ESTIMATED

2


EUREKA
ELY
LUND
CURRANT
MILFORD
NEVADA
UTAH
TONOPAH
WARM SPRINGS
PIOCHE
GOLDFIELD
BERYL JCT.
CEDAR CITY
LINCOLN MINE
CALIENTE
STANDARD
CRYSTAL SPRINGS
GROOM MINE
ALAMO
NEVADA TEST SITE
CP
ST.GEORGE
UTAH
ARIZONA
BEATTY
LITTLEFIELD
LATHROP WELLS
MERCURY
GLENDALE
NEVADA
CALIFORNIA
LAS VEGAS
N
0 10 20 30 40 50
STATUTE MILES
ORIENTATION MAP
Nevada Test Site Region


LINCOLN MINE
STANDARD
SILENT CANYON
KAWICH VALLEY
BELTED RANGE
GROOM MINE
GROOM LAKE
MILFORD
CEDAR CITY
UTAH
ARIZONA
12
8
10
9
2
4
7
1
3
11
WEATHER STATION
YUCCA LAKE
CP
40 MILE CANYON
SHOSHONE MTS
NEVADA TEST SITE BOUNDARY
PAPOOSE LAKE ROAD
EMIGRANT VALLEY
400 AREA
FRENCHMAN FLAT
SKULL MT
JACKASS FLATS
SPECTER RANGE
MERCURY
LATHROP WELLS
SPOTTED RANGE
INDIAN SPRING VALLEY
PINTWATER RANGE
N
0 5 10 15
STATUTE MILES
ORIENTATION MAP
Nevada Test Site
ELEVATION 5000 TO 7000 FEET
ELEVATION 7000 TO 9000 FEET
DRY LAKE
Large numbers on site designate test areas
TION MAP
Site Region

USCOMM-WB-DC