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FALLOUT FROM NUCLEAR TESTS AT THE NEVADA TEST SITE

By
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Division of Biology and Medicine

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Washington, D. C.

About one megaton of energy from fission has been released at the Nevada Test Site from nuclear test detonations. The total resultant fission product activity, if measured at one hour after formation, would have been about 400-600 billion curies. There was nothing that could be done to lessen the production of radioactive isotopes from a fission reaction, thus the utmost care and skill were required in the conduct of the tests to minimize the deposition of the activity outside the Test Site.

There follows a summary of the data on fallout from nuclear detonations at the Nevada Test Site.

I. EXTERNAL GAMMA EXPOSURES

Table I summarizes the data on external gamma exposures in areas around the Nevada Test Site resulting from all past nuclear test detonations. Since the estimates are based on potential exposures in areas _if_ persons had continued to live there continuously, full use should be made of the notes at the end of the Table. For example, the Table shows 10.80 roentgens for Dodge Construction Camp, Nevada, but the estimated exposure to persons was about 2.7 roentgens since no one was living in the area previous to Operation Plumbbob (Spring-Summer 1957). On the other hand, the Table indicates a zero population for Riverside, Nevada which is correct for the present, but during the time of heaviest fallout (Operation Upshot-Knothole Spring 1953) some persons were in the area.

To summarize Table I:

1. The highest estimated exposures were up to about 13 1/2 roentgens for one person and 10 1/2 roentgens for another at Butler Ranch, Nevada.

2. The highest estimated exposure at any "community" (Lincoln Mine) was about 6 roentgens.

3. Between the above two radiation dose levels there might have been up to 30 persons so exposed.

It may be noted that many of the estimated exposures according to Table I are higher than preliminary reports[1.]. This has resulted from continuing studies of several factors, i.e. radiological decay rates, weathering effects, instrument cross-calibration and the like. As with any such data there are associated uncertainty factors. The Committee has estimated these as follows.

for doses less than 0.1 roentgen	$\pm$ 80%
for doses 0.1 - 1.0 roentgens	$\pm$ 60%
for doses greater than 1.0 r	$\pm$ 40%

It will also be noted that some areas are included in Table I that did not appear in the preliminary data. After all the monitoring data were collected, evaluated and plotted, interpolations between data points were made to include these areas.

The map Estimated Radiation Doses presents the highlights of the data in pictorial form.

As one of the monitoring programs, film badges were worn by persons in many localities around the Nevada Test Site. Assuming these were worn properly on the person, they represent one of the best estimates of actual exposures. Of interest is the ratio of these film badge readings to those badges placed out of doors in the same general area. These data are summarized in Table II based on 87 locations. The lower ratios would be expected due in part to shielding effects when persons were indoors. Those with higher ratios are more difficult to explain. One factor is the normal movement of persons with some going to areas of higher contamination for periods of time.

The information from another study[2] which analyzed data of dose rate readings inside and outside various type structures around the Nevada Test Site during Operation Plumbbob is summarized in Table III.

II. Environmental Contamination

A. General

Relatively fresh fission product fallout, such as that originally placed into the troposphere from a nuclear detonation, contains a wide variety of isotopes. The composition (relative percentage of isotopes) varies with time after formation. Also fractionation may occur, i.e. there may be a deviation from the expected isotopic abundance due to the fact that some isotopes have gaseous precursors. However, the percentage of isotopes present may be approximated by the use of such data as contained in Reference Three.

The fallout that occurs around the Nevada Test Site from nuclear detonations at that location does so at relatively short times after an explosion. This radioactive material contains a large percentage of short-lived radioisotopes which contribute significantly to the external gamma dose but little to the accumulated dose accruing from those isotopes internally deposited. This is due to the short half-lives and to the relatively low uptake and deposition of most of these isotopes in the body.

The isotope of principal concern in terms of internal irradiation is strontium-90. It would be desirable to determine the strontium-90 content of fresh fission product activity found associated with foodstuffs and water. The isotopic analysis for this isotope, however, is not a simple and quick procedure. In an understandable desire to make conservative estimates of potential health hazards, all of the fission product activity found in foods and water has at times been ascribed to strontium-90. This can lead to erroneous evaluations. For example, if fresh fission product activity is measured one week after formation as little as one part in 7000 of this activity might be due to strontium-90 (assuming no fractionation). In making such an approximation one does not intend that it is precise but it does more accurately estimate the strontium-90 content than does the method of ascribing all of the fission product activity to the one isotope. This type of approximation may be more nearly correct for surface contamination on objects (including exposed foodstuffs) and in rain-water, than in waters that have passed through or over soils, since some selective absorption would be expected in the latter case.

As a result of the fallout that occurred in Southern California in the Fall of 1958, such foodstuffs as lettuce, spinach and celery were found to contain gross beta activity (as counted about two weeks after the fallout occurred) amounting to a few - several tens of disintegrations per minute per gram. Yet when five of these samples were later analyzed for strontium-90, the values ranged from 2.71 to 4.9 strontium units - values which are not significantly different from foods grown elsewhere in the country and, in fact, are on the low side of the average. Additional samples are being analyzed and somewhat higher values will probably be found in some of these, but it would appear that whatever strontium-90 there may have been in the fresh fallout it was not a major addition to that already in the plants (strontium-90 originating from past tests).

B. Milk - Soils

Considerable data on contamination of soils, plants and animals have been collected by the Offsite Rad-Safe Group of the Nevada Test Organization under Mr. Oliver Placak of the U. S. Public Health Service and by several projects under Mr. Kermit Larson of the University of California at Los Angeles. These data may be found in the reports from these organizations. The information given here is only a very small part of these data. They were chosen to illustrate the general levels of strontium-90 activity in the environment.

Milk

Prior to Operation Plumbbob and again following the completion of that test series sets of milk samples from around the Nevada Test Site were collected and analyzed by Mr. Kermit Larson of UCLA. With one possible exception (Panguitch, Utah) the values are not significantly different from those found in most other localities in the United States. These data are summarized in Table IV.

Milk collections have also been made in the Glendale, Nevada and the St. George-Cedar City, Utah areas by the Offsite Rad-Safe Group and analyzed by the Division of Radiological Research, Robert A. Taft

Sanitary Engineering Center, Public Health Service, Cincinnati, Ohio. These data are summarized in Table V. These values are no higher than for most other areas sampled in the United States.

Soils

Soil samples from areas around the Nevada Test Site experiencing some of the heaviest fallout from tests at the Nevada Test Site were collected following Operation Plumbbob (1957) and are being analyzed for their strontium-90 content. Values from cultivated lands are given in Table VI. Some preliminary data from non-tilled soils show, in general, higher values. These will be reported when completed.

C. Concentration of Activity in the Air

The increase of small amounts of fallout debris in the air can be readily determined by the use of standard air sampling techniques. The sensitivity of this method provides an excellent monitor to determine the time of the appearance and the relative amounts of fallout. At the same time these data are subject to misinterpretations in terms of a "health hazard". For example, concentrations for short periods of fallout material in the air in amounts hundreds of times above background may not constitute a serious situation. This may be illustrated by the fallout that occurred in the Los Angeles, California area in the Fall of 1958. (See California Fallout Data report below.)

The peak concentrations of radioactivity in the air over Los Angeles were due principally to the nuclear detonations at the Nevada Test Site on October 29, 1958. Mixed with this there was a smaller amount of longer-lived material originating from either previous detonations in Nevada or from the Russian explosions, or both. The recurrence of higher than normal activities in the air the first week in November was undoubtedly due to the meteorology conditions present whereby the air masses passed seaward over Los Angeles, then returned and remained in the general area, accompanied by an inversion layer.

The concentration of fallout debris in the air peaked at 700 micromicrocuries per cubic meter on October 30, 1958, dropped to

38 of these units on November 1, and reached a second high of 370 units on November 3rd. Prior to this fallout the "background values" were about 1 - 2 micromicrocuries per cubic meter.

The biological evaluation of such data is quite tenuous, yet some estimates may be made. Using the methods described in Reference Four, it was estimated that the dose to the lungs from inhalation of air during the week of highest fallout activity in the air amounted to a few millirems. During the same period of time the estimated exposure to the lungs from naturally occurring radiation substances in the air (radon and thoron, together with their daughter products) probably was several times this amount.

In addition to irradiation of the lungs there is the probability that some of the activity may find its way to other organs of the body. However, fallout around the Nevada Test Site has been found to be quite insoluble.[5.] Only rough estimates can be made but these indicate that the strontium-90 that might be deposited in the body (other than the lungs) by the inhalation route, even on the day of peak air concentrations (700 micromicrocuries per cubic meter) would be only a very small quantity compared to the normal daily strontium-90 intake by ingestion of foodstuffs.

Concurrent with the fallout debris in the air over Los Angeles there was a deposition of some of this material on the ground. Fortunately, automatic gamma recorders were in operation and they showed that the total external gamma exposure from this fallout was a few tenths of a milliroentgen at most - an amount received every day or two from naturally occurring radioactive substances in our environment.

The highest measured concentration of radioactive fallout in the air over populated areas of the United States was at St. George, Utah on May 19-20, 1953 (as previously reported in the Congressional Hearings on fallout - 1957). A recalculation of these data indicates a lung dose of about 230 millirems[4.]. The radiation exposure to the lungs from inhalation of naturally occurring radioactive substances varies from place to place and from time to time, but a value of about 25 millirems per week is a rough estimate. This is a lower estimate than was previously used[6.]. Knowledge on radiation doses to the lungs from naturally occurring radioactive substances in the air is still sparce, and such estimates that have been made encompass a rather wide range. A more conservative value of 25 millirems per week is used here. Thus, the calculated exposure to the lungs from inhalation of fallout debris in the air at St. George might have been equivalent to that received in about 10 weeks from naturally occurring radioactive substances in the air.

D. Concentration in Water

Customarily, only gross beta counts have been made on fallout activity in water. Without further analyses one can only make estimates as to isotopic content, and thus potential radiation doses. One method for doing this is given in Reference Five.

The highest measured concentration of fallout activity in a potential drinking water supply (this is not a known supply for humans) was at upper Pahranagat Lake, Nevada during the 1955 test series at the Nevada Test Site amounting to 1.4 x 10^{-4} microcuries per milliliter at three days after the detonation (as previously reported in the Congressional Hearings on fallout - 1957). If this water had been stored and used as a sole supply for 70 years, the total internal doses may be estimated as follows:

Bones	~1.0 rad
Lower large intestine (with lesser doses to other parts of the GI tract)	~0.25 rad
Thyroid	~0.25 rad

E. More Distant Fallout

Nuclear detonations occurring on or near the ground result in relatively heavy nearby fallout. Conversely, there is some evidence that nuclear detonations occurring from balloons suspended well above the ground may produce more fallout at greater distances than would surface bursts. It has also been shown that rain will bring down fallout present in the troposphere. Following several nuclear detonations of devices suspended from balloons during Operation Plumbbob (Spring-Summer 1957), the trajectories were over the North Central States. There was precipitation in many of these areas during passage of these trajectories.

The trajectories as given by the accompanying maps were prepared by the Special Projects Section of the U. S. Weather Bureau under Dr. Lester Machta. These trajectories do not represent actual measurements of the activity in the air since the relatively rapid radiological decay and the dilution factor usually make it impossible to trace the activity for more than a few hundred miles from the test site by aircraft. Rather, the trajectories represent a series of computations as to probable movements of air (together with any contained activity).

Table VII shows the relatively high strontium-90 in wheat collections in Minnesota during 1957. Although the data are not extensive enough to be conclusive, it will be noted that there was a higher average value of strontium-90 in wheat for 1957 (the time of Operation Plumbbob) than 1956 or 1958. Additional samples of wheat are being collected and analyzed.

Better estimates are needed as to the relative methods whereby the wheat was contaminated, i.e. by surface contamination or by soil uptake. Tropospheric fallout probably contributes heavily to surface contamination, and since it has a half-time of residence of about one month, this effect should now have essentially ceased from all past tests. A factor in the opposite direction is the increase of strontium-90 in the soils - and thus plant uptake - since strontium-90 is continually dropping from the stratosphere. It is hoped that the 1959 samples of wheat will shed further light on this factor.

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ESTIMATED RADIATION DOSES (Roentgens)

FROM ALL NUCLEAR TESTS

.... 1959

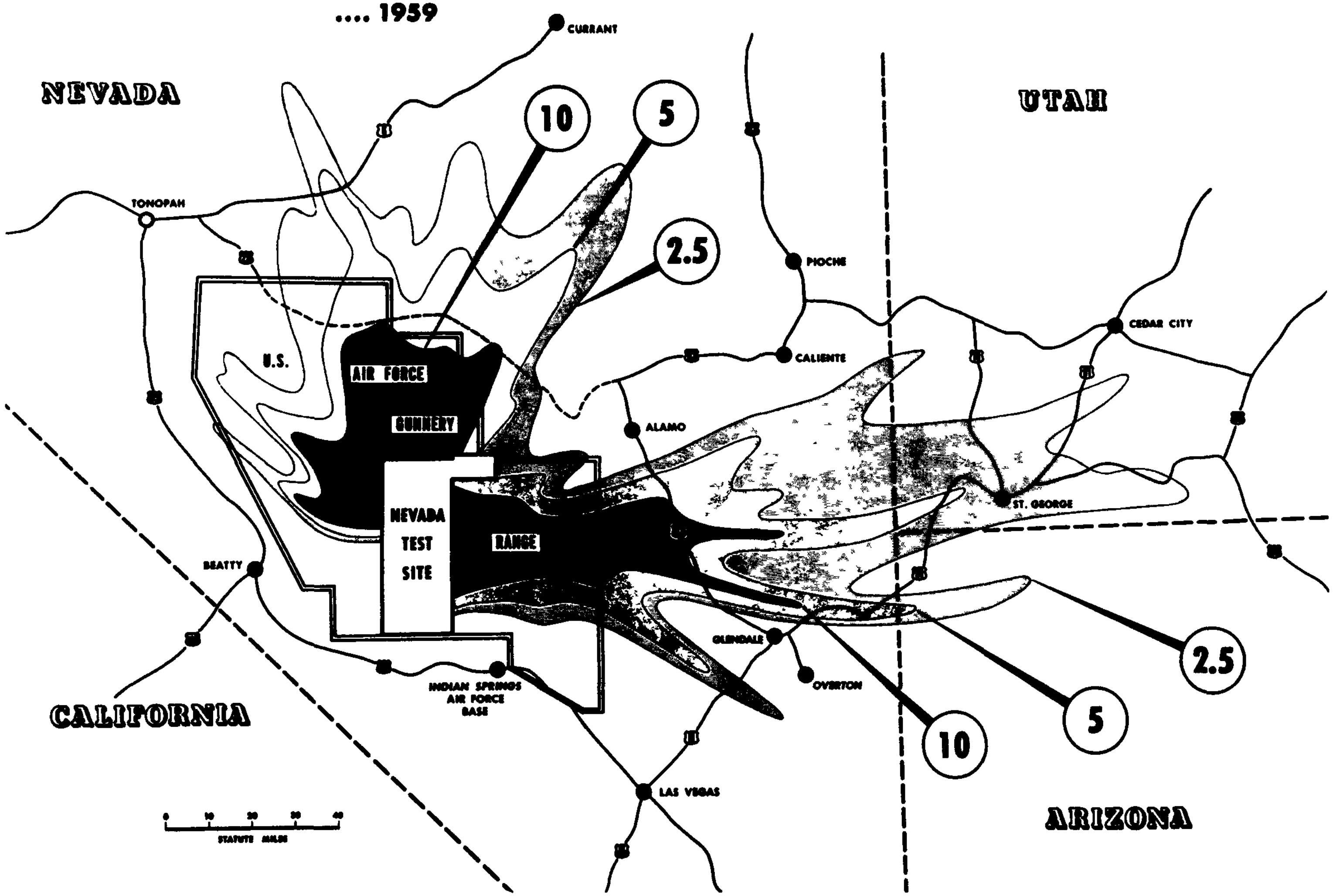


TABLE I.

Estimated Radiation Doses (Roentgens)[a]

Location	Population	Pre-Plumbbob	Plumbbob	Hardtack II	Cumulative
		ARIZONA			
Beaver Dam	5	2.00	0.30	-[b]	2.30
Big Bend Ranch	5	(2.00)[c]	0.19	-	2.19
Bullhead	500	-	0.02	-	0.02
Catherine Ranger Station	d.	-	-	-	-
Chloride	160	-	0.02	-	0.02
Davis Dam	15	-	-	-	-
Grasshopper Junction	2	-	0.03	-	0.03
Hackberry	100	-	0.01	-	0.01
Hughes Ranch	Transient	(2.00)	0.30	-	2.30
Kingman	5,500	0.03	0.01	-	0.04
Lake Mohave	2[1/]	-	0.02	-	0.02
Littlefield	44	1.60	0.32	-	1.92
Mount Trumbull	100	0.16	-	-	0.16
Oatman	40	-	-	-	-
Peach Spring	600	-	-	-	-
Short Creek	90	1.60	-	-	1.60
Topock	80	-	-	-	-
Truxton	26	-	-	-	-
Valentine	50	-	0.01	-	0.01
Walapai	15	-	-	-	-
Warm Springs	d.	-	-	-	-
Willow Beach	5	-	.	-	-
Wolf Hole	5	1.30	-	-	1.30
Yucca	150	-	-	-	-

a. Prepared by a Committee composed of the following members:
A. Vay Shelton, Chairman, Lawrence Radiation Laboratory, University of California.
Roscoe H. Goeke, Albuquerque Operations Office, U. S. Atomic Energy Commission (On loan from the U. S. Public Health Service)
William R. Kennedy, Los Alamos Scientific Laboratory
Kermit H. Larson, University of California, Los Angeles
Kenneth M. Nagler, U. S. Weather Bureau
Oliver R. Placak, Las Vegas Branch Office, U. S. Atomic Energy Commission (Officer-in-charge U. S. Public Health Service)

b. A dash implies no fallout or fallout not readily distinguishable from background radiation.

c. Parentheses indicate that the community was not included in the October, 1956, list of Pre-Plumbbob doses.

d. Population figures not available.

1/ Footnotes concerning populations of communities are at end of this table.

CALIFORNIA

Estimated Radiation Doses (Roentgens)

Location	Population	Pre-Plumbbob	Plumbbob	Hardtack	Cumulative
Amboy	1,004	-	-	-	-
Baker	726	-	0.03	-	0.03
Barstow	10,017	-	0.01	-	0.01
Benton Station	300	-	0.07	-	0.07
Big Pine	556	-	0.03	-	0.03
Bishop	2,891	-	0.06	-	0.06
Boron	592	-	-	-	-
Camp Irwin	Variable	-	-	-	-
Cantil	100	-	-	-	-
Cartago	126	-	0.03	-	0.03
Chalfant	25	-	0.10	-	0.10
China Lake	10,000	-	-	-	-
Crest View	25	-	-	-	-
Daggett	525	-	-	-	-
Death Valley Junction	20	-	-	0.15	0.15
Deep Springs	100	-	0.03	-	0.03
Emigrant Springs Ranger Station	2	-	0.01	0.08	0.09
Essex	75	-	0.02	-	0.02
Four Corners	d.	-	-	-	-
Furnace Creek	50	-	-	0.15	0.15
Hinkley	780	-	-	-	-
Independence	875	-	0.02	-	0.02
Inyokern	600	-	-	-	-
Johannesburg	300	-	0.03	-	0.03
Kalso	271	-	0.03	-	0.03
Laws	72	-	0.07	-	0.07
Lenwood	2,600	-	0.01	-	0.01
Littlelake	32	-	-	-	-
Lone Pine	1,415	-	0.03	0.05	0.08

CALIFORNIA

Estimated Radiation Doses (Roentgens)

Location	Population	Pre-Plumbbob	Plumbbob	Hardtack	Cumulative
Ludlow	250	-	-	-	-
Manix	10	-	-	-	-
Mojave	2,055	-	-	-	-
Mountain Pass	10	-	-	-	-
Needles	5,480	-	-	-	-
Newberry	700	-	-	-	-
Oasis	12	-	0.10	-	0.10
Olancha	275	-	0.03	-	0.03
Randsburg	281	-	-	-	-
Red Mountain	320	-	0.03	-	0.03
Ridgecrest	4,000	-	0.02	-	0.02
Ryan Mine	1	-	0.06	0.15	0.21
Shoshone	100	-	-	-	-
Silver Lake	10	-	0.05	-	0.05
South Haiwee	25	-	-	-	-
Stovepipe Wells	2	-	0.01	0.05	0.06
Tecopa	25	-	-	-	-
Tom's Place	Variable	-	0.02	-	0.02
Troma	3,500	-	-	-	-
Wheaton Springs	d.	-	-	-	-
Yermo	700	-	0.01	-	0.01
ZZYZX Springs	40	-	-	-	-

NEVADA

Estimated Radiation Doses (Roentgens)

Location	Population	Pre-Plumbbob	Plumbbob	Hardtack	Cumulative
A&B Mine	4 - 12	(0.50)	2.90	-	3.40
Acoma	10	3.00	-	-	3.00
Adam's Ranch	d.	(1.00)	0.37	0.80	2.17
Alamo	250	1.30	0.04	0.05	1.39
Apex	50 2/	0.10	0.03	-	0.13
Ash Meadows	8	0.05	0.01	0.15	0.21
Ash Springs	5	0.60	0.06	-	0.66
Atlanta	2	(0.30)	0.26	-	0.56
Austin	520	0.05	0.15	-	0.20
Babbitt	2,464	-	0.23	0.05	0.28
Baker	60	0.80	0.25	-	1.05
Barclay	10	2.00	0.04	-	2.04
Bardoli Ranch	4 3/	(1.70)	0.26	0.08	2.04
Basalt	8	-	0.15	0.05	0.20
Beatty	550	0.05	0.11	0.05	0.21
Belew Ranch	3	(1.19)	0.47	0.08	1.74
Belmont	6	(0.10)	1.10	0.05	1.25
Blue Diamond	400	(0.05)	-	-	0.05
Blue Eagle School	11	(1.04)	0.46	0.05	1.55
Bonansa Boy Scout Camp	Variable 4/	(0.12)	-	-	0.12
Bond Ranch	d.	(0.05)	0.70	-	0.75
Boulder City	4,000	0.08	-	-	0.08
Boyd	Variable 5/	(1.50)	0.04	-	1.54
Bristol Silver Mine	25 - 50	(0.64)	0.06	0.08	0.78
Buckhorn Ranch (US 93)	12	0.90	0.08	-	0.98
Buskerville	250	4.30	0.17	0.05	4.52
Butler Ranch	2 6/	(8.40)	6.60	-	15.00

NEVADA

Estimated Radiation Doses (Roentgens)

Location	Population	Pre-Plumbbob	Plumbbob	Hardtack	Cumulative
Cactus Springs	18	0.03	0.05	-	0.08
Caliente	970	0.70	0.01	0.05	0.76
Carp	25	3.60	0.30	-	3.90
Caselton Mine	40 - 147	(0.70)	0.02	-	0.72
Charleston Lodge	60	0.15	-	-	0.15
Cherry Creek	112	(0.26)	0.24	-	0.50
Clark's Station	0- 5	0.80	0.81	-	1.61
Cloud	Variable[5/]	(3.00)	0.65	-	3.65
Coaldale	25	-	0.88	0.10	0.98
Cole & Dolan Ranch	3	(0.50)	0.26	0.05	0.81
Corn Creek	11	(0.40)	-	-	0.40
Cove	20	(0.55)	0.30	-	0.85
Crestline	22	0.70	-		0.70
Crystal	5[7/]	4.00	0.06	-	4.06
Currant	75	0.50	0.33	-	0.83
Delmue	7	(0.60)	0.01	-	0.61
Desert Rock	Variable[8/]	0.05	0.02	0.08	0.15
Dodge Construction Camp	175[9/]	(8.00)	2.70	0.10	10.80
Donahue Ranch	4	(0.25)	0.05	0.05	0.35
Dry Lake	20	1.00	0.03	-	1.03
Duckwater	50	0.80	0.21	-	1.01
D-X Ranch	d.	(0.85)	0.20	-	1.05
Dyer	35	-	0.13	0.05	0.18
East Ely	1,000	0.60	0.55	0.05	1.20
El Dorado	3	(0.45)	0.60	-	1.05
Eldridge Ranch (N. of Eureka)	4	(0.20)	0.34	-	0.54
Eldridge Ranch (Mt. Wheeler Inn)	d.	(o.85)	0.13	-	0.98
Elgin	30	3.50	0.06	-	3.56
Ely	3,558	0.60	0.55	0.05	1.20

NEVADA

Location	Population	Pre-Plumbbob	Plumbbob	Hardtack	Cumulative
		Estimated Radiation Doses (Roentgens)			
Etna	Variable[5/]	(0.80)	0.02	-	0.82
Eureka	500	0.20	0.60	0.05	0.85
Fallini Ranch	15	0.80	1.10	0.08	1.98
Fallon	2,400	-	0.14	-	0.14
Fish Creek Ranch	d.	(0.50)	0.60	0.05	1.15
Gabbs	625	-	0.38	-	0.38
Galt	Variable[5/]	(6.00)	4.90	-	10.90
Garnet	Variable[5/]	(0.85)	0.05	-	0.90
Geyser Maintenance Station	10	(1.00)	0.42	-	1.42
Geyser Ranch	5	(1.05)	0.50	-	1.55
Glendale	75	0.70	0.10	).05	0.85
Goldfield	220	0	1.10	0.10	1.20
Goldpoint	10	(0.90)	0.30	0.10	1.30
Goodsprings	160	-	-	-	-
Groom Mine	0[10/]	2.00	2.80	0.10	4.90
Gubler Ranch	d.	(0.90)	0.44	0.05	1.39
Hawthorne	1,861	-	0.23	0.05	0.28
Henderson	14,000	0.02	-	-	0.02
Hiko	55	1.00	0.08	-	1.08
Hollinger's Ranch	1	(0.30)	0.02	0.05	0.37
Hoover Dam	d.	0.05	-	-	0.05
Hoya	Variable[5/]	(3.70)	2.20	-	5.90
Indian Creek Ranch	d.	(0.80)	0.18	-	0.98
Indian Springs	2,650[11/]	0.05	0.10	-	0.15
Ione	40	-	0.24	-	0.24
Johnnie	5	0	-	-	-
Kimberly	120	0.50	0.37	0.05	0.92
Kyle	Variable[5/]	(3.20)	0.26	-	3.46

NEVADA

Estimated Radiation Doses (Roentgens)

Location	Population	Pre-Plumbbob	Plumbbob	Hardtack	Cumulative
Laboard Ranch	x	(0.06)	0.39	-	0.45
Lake Mead Base	5	0.05	0.04	-	0.09
Lane City	40	(0.55)	0.38	0.05	0.98
Las Vegas	47,000	0.20	0.01	-	0.21
Lathrop Wells	9 - 15	0.05	0.03	0.08	0.16
Lehman Caves	Variable 12/	(0.95)	0.25	-	1.20
Leith	Variable 5/	(3.00)	0.32	-	3.32
Lida	25	(0.50)	0.32	0.05	0.87
Lida Junction	3	(0.40)	0.78	0.10	1.28
Lincoln Mine	100-500	4.00	1.90	0.05	5.95
Lockes	4	1.30	0.31	-	1.61
Logandale	300	0.40	0.16	-	0.56
Lund	250	0.80	0.44	0.05	1.29
Luning	50	-	0.44	0.05	0.49
M&M Mine	2	(0.50)	2.90	-	3.40
Manhattan	42	(0.08)	0.26	0.05	0.39
McGill	2,297	0.40	0.32	0.05	0.77
Mercury	300-3,500	0.10	0.02	0.10	0.22
Mesquite	590	1.80	0.24	0.05	2.09
Millett	5	(0.04)	0.40	-	0.44
Mina	450		0.50	0.08	0.58
Moapa	52	0.80	0.10	0.05	0.95
Moapa Indian Reservation	100-150	(0.80)	0.17	-	0.97
Moon River Ranch	3	(1.48)	0.52	0.08	2.08
Mounts Ranch	d.	(0.85)	(0.24)	-	1.09
Nellis Air Force Base	8,000	0.05	-	-	0.05
Nelson	100	-	-	-	-
Nivloc	250	-	0.35	0.08	0.43
North Las Vegas	13,000	0.20	-	-	0.20

NEVADA

Estimated Radiation Doses (Roentgens)

Location	Population	Pre-Plumbbob	Plumbbob	Hardtack	Cumulative
Nyala	6	1.70	0.28	0.08	2.06
Overton	750	0.35	0.08	-	0.43
Pahrump	89	0.20	-	-	0.20
Pahrump Mining Co.	d.	(0.09)	0.01	-	0.10
Panaca	500	0.65	0.01	-	0.66
Parmon's Ranch	6 - 8	(0.10)	0.25	0.10	0.45
Pioche	1,392	0.70	0.04	-	0.74
Pittman	d.	(0.10)	-	-	0.10
Pony Springs	d.	(0.65)	0.45	0.08	1.18
Pop's Oasis	d.	-	-	-	-
Potts	17	(0.20)	0.19	-	0.39
Preston	60	0.70	0.48	0.05	1.23
Rattlesnake Maintenance Station	4	(0.75)	0.80	0.10	1.65
Reed	0[13/]	4.00	2.66	0.08	6.74
Reveille Mill	6[14/]	(0.70)	4.70	0.10	5.50
Riverside	0[15/]	7.80	0.10	0.05	7.95
Rhyolite	7	-	0.06	0.05	0.11
Rogers Ranch	10	(0.76)	0.21	0.05	1.02
Rose Valley	10	(0.65)	-	-	0.65
Round Mountain	200	0.05	0.36	0.08	0.49
Rox	Variable[5/]	3.00	0.30	-	3.30
Ruby Hill Mine	50	(0.18)	0.65	0.05	0.88
Ruth	1,244	0.50	0.40	0.05	0.95
Sarcobatus	3	(0.10)	0.08	0.05	0.23
Schurz	100	-	0.22	-	0.22
Searchlight	150	-	0.08	-	0.08
Searls Ranch	16	(0.70)	0.23	0.05	0.98
Seven L. Ranch	1	(0.40)	0.02	-	0.42

NEVADA

Estimated Radiation Doses (Roentgens)

Location	Population	Pre-Plumbbob	Plumbbob	Hardtack	Cumulative
Sharps (Adaven)	25	1.20	0.41	0.08	1.69
Shoshone	250	0.70	0.24	-	0.94
Silver Peak	7	-	0.65	0.10	0.75
South Paw Mine	3	(1.00)	0.79	0.05	1.84
Springdale	15	0.02	0.04	0.05	0.11
State Line	90	-	-	-	-
Steward, R. Ranch	6	(0.70)	0.52	0.08	1.30
Stine	Variable[5/]	(1.10)	0.06	-	1.16
Stone Cabin Ranch	8	(0.60)	0.37	0.05	1.02
Sunnyside	26	1.20	0.48	0.05	1.73
Swallow Ranch	d.	(0.80)	0.22	-	1.02
Tonopah	1,375	0	0.98	0.10	1.08
Tonopah Airport	4	-	0.70	0.10	0.80
Uhaldi Ranch	5 - 8	(1.33)	0.47	0.08	1.88
Urretias Ranch	d.	(1.10)	0.63	0.05	1.78
Ursine	25	0.60	0.01	-	0.61
Vigo	Variable[5/]	(3.00)	0.52	-	3.52
Walch Pine Creek Ranch	4 - 6	(2.25)	0.45	0.08	2.78
Warm Springs	55	0.50	0.35	0.08	0.93
Warm Springs Ranch	58[16/]	1.00	0.23	-	1.23
Watertown	300[17/]	(2.40)	(1.30)	0.10	3.80
Whipple Ranch	10	(1.00)	0.10	-	1.10
Whitney	78	00	-	-	-

UTAH

Estimated Radiation Doses (Roentgens)

Location	Population	Pre-Plumbbob	Plumbbob	Hardtack	Cumulative
Adamsville	98	(0.23)	-	-	0.23
Alton	154	0.80	0.03	-	0.83
Anderson Junction	17	1.20	0.68	-	1.88
Bear Valley Junction	10	0.40	0.55	-	0.95
Beaver	1,685	0.25	-	-	0.25
Beryl	15	0.50	0.03	-	0.53
Beryl Junction	8	1.00	0.05	-	1.05
Black Rock	9	(0.05)	-	-	0.05
Bryce Canyon	Variable 18/	(0.55)	0.01	-	0.56
Cedar City	6,106	0.40	0.24	-	0.64
Central	49	(1.50)	0.41	-	1.91
Cove Fort	8	0.07	-	-	0.07
Desert Range Experimental Station	5	(0.10)	-	-	0.10
Duck Creek Forest Camp	d.	(0.90)	0.17	-	1.07
Enoch	250	(0.50)	0.04	-	0.54
Enterprise	800	0.70	0.09	-	0.79
Garrison	125	0.70	0.18	-	0.88
Glendale	275	(0.24)	-	-	0.24
Greenville	173	(0.24)	-	-	0.24
Gunlock	127	2.60	0.52	0	3.12
Hamilton Fort	26	0.60	0.20	-	0.80
Hamlin Valley	Variable	(0.50)	0.01	-	0.51
Hatch	24	(0.50)	0.14	-	0.64
Hilldale	10	(0.30)	0.14	-	0.44
Hurricane	1,375	4.20	0.15	-	4.35
Kanab	1,900	1.60	0.02	-	1.62
Kanarrville	263	1.20	0.73	-	1.93
Kanosh	476	(0.05)	-	-	0.05
La Verkin	387	(3.50)	0.16	-	3.66
Leeds	215	3.00	0.70	-	3.70

UTAH

Estimated Radiation Doses (Roentgens)

Location	Population	Pre-Plumbbob	Plumbbob	Hardtack	Cumulative
Long Valley Junction	10	0.80	0.07	-	0.87
Lund	75	0.50	-	-	0.50
Manderfield	62	(0.20)	0.03	-	0.23
Milford	1,673	0.10	-	-	0.10
Minersville	593	0.20	-	-	0.20
Modena	100	0.50	0.04	-	0.54
Mount Carmel	125	0.85	0.09	-	0.94
Mount Carmel Junction	10	(0.80)	0.05	-	0.85
New Castle	115	0.60	0.05	-	0.65
New Harmony	126	1.20	0.68	-	1.88
Orderville	371	1.50	0.10	-	1.60
Paiute Indian Reservation	95	(0.30)	-	-	0.30
Panguitch	1,500	0.20	0.50	-	0.70
Paragonah	404	0.40	0.02	-	0.42
Parowan	1,455	0.40	0.02	-	0.42
Pintura	50	1.20	1.00	-	2.20
Rockville	125	3.00	0.10	-	3.10
Saint George	5,000	3.00	0.70	-	3.70
Santa Clara	319	3.50	0.77	-	4.27
Shivwits	95	2.80	0.80	-	3.60
Springdale	209	2.60	0.09	-	2.69
Summit	146	(0.50)	0.02	-	0.52
Toquerville	219	2.00	0.33	-	2.33
Uvada	15	(0.70)	-	-	0.70
Veyo	100	2.00	0.82	-	2.82
Vic's Place	3	(1.20)	0.68	-	1.88
Vic's Service Station	2	(3.00)	0.90	-	3.90
Virgin	147	1.50	0.12	-	1.62

UTAH

Estimated Radiation Doses (Roentgens)

Location	Population	Pre-Plumbbob	Plumbbob	Hardtack	Cumulative
Washington	435	3.00	0.30	-	3.30
Zane	25	0.30	-	-	0.30
Zion Lodge	Variable[18/]	(1.00)	0.16	-	1.16

Footnotes concerning populations of communities

1. Lake Mohave - also some transients.
2. Apex - about 50 day workers; generally only a watchman at night.
3. Bardoli Ranch - population only 1 after Plumbbob.
4. Bonanza Boy Scout Camp - variable population, summer months only.
5. Railroad maintenance stations (Boyd, Cloud, Etna, Galt, Garnet, Hoya, Kyle, Leith, Rox, Stine, Vigo)-population variable from 0 to about 15.
6. Butler Ranch - Mrs. Butler was absent during the important fallout in Plumbbob, (from the Smoky burst) and Mr. Butler was evacuated for a few hours shortly after the fallout arrived. Personnel film badges indicated that Mrs. Butler received less than 2 Roentgens and that Mr. Butler received less than 5 Roentgens.
7. Crystal - unpopulated after Plumbbob.
8. Desert Rock - unpopulated except during major test series.
9. Dodge Construction Camp - unpopulated except Plumbbob series.
10. Groom Mine - population variable 2-10 prior to Plumbbob, intermittent during Plumbbob but only trivial doses indicated by personnel film badges during Plumbbob.
11. Indian Springs - population variable, about 250 plus 2400 on military post during Plumbbob.
12. Lehman Caves - tourists during summer season.
13. Reed - population 3 during the Teapot series only, and these were evacuated for 7-10 days during the highest fallout activity.
14. Revèille Mill - unpopulated prior to Plumbbob.
15. Riverside - population 2-14 through Upshot-Knothole, 2 during Teapot and 0 after Teapot.
16. Warm Springs Ranch - up to 500 people on weekends during the summer.
17. Watertown - population 0 prior to Plumbbob; about 300 during first month of Plumbbob, and 2 thereafter.
18. Bryce Canyon and Zion Lodge - many tourists during summer.

TABLE II

Comparison of Film Badge Readings*

Ratio Persons/Area	Percentage of total Number of Badges
Film badge readings on persons not distinguishable above background	6.
> 0 < .2	6.
0.2 - 0.4	13.
0.4 - 0.6	26.
0.6 - 0.8	13.
0.8 - 1.0	6.
1.0 - 1.2	13.
1.2 - 1.4	6.
1.4 - 1.6	1.
1.6 - 1.8	1.
1.8 - 2.0	1.
> 2.0	5.
Area film badge readings not distinguishable above background	3.

* Tabulated by Dr. A. Vay Shelton, Chairman, Lawrence Radiation Laboratory, University of California

TABLE III

Ranking	Shielding Factor	Range of Shielding Factors
1. Heavy Construction	4.60	2.27 - 8.50
2. Large Light Storage Type Buildings	2.87	2.45 - 3.66
3. Light Construction Domicile Types	2.36	1.26 - 4.11
4. Vehicles (Pickup Trucks)	2.21	1.45 - 4.5
5. Trailer Type Domiciles	1.56	1.22 - 1.82

TABLE IV
MILK SAMPLES

PRE- AND POST-PLUMBBOB SERIES SR90 AND CS137 CONTENT IN MILK

Location	Date Sampled	Type and Origin of Feed as Indicated by Owner of Herd	Sr90 μμc/g Ca	Cs137 d/m/quart
Alamo, Nevada	5/2/57	Idaho hay, St. George concentrate	17.4	27
" "	8/3/57	No information available	5.3	75
" "	10/31/57	Alfalfa pasture, St. George concentrate	5.0	44
Antimony, Utah	9/20/57	No information available	13.6	119
" "	10/21	Dry feeding exclusively	10.0	121
Bishop, Calif.	11/6/57	Hay from local source	3.2	32
Fremont, Utah	9/9/57	Hay 20 %, pasture 80 %, commercial feed	12.1	99
" "	9/21/57	No information	9.5	83
" "	10/19/57	Alfalfa pasture, commercial feed	4.9	56
Lund, Nevada	11/4/57	1957 hay, alfalfa pasture, local grain	3.2	71
Mesquite, Nevada	8/2/57	No information available	-	70
" "	10/23/57	Local hay, St. George feed	6.1	58
Milford, Utah	4/29/57	1956 hay, home grown grain	3.1	63
" "	10/26/57	50 % pasture, 50 % 1957 hay, grain	2.7	29
Pahrump, Nevada	11/1/57	Home grown hay, ensilage, grain	6.0	31
Panguitch, Utah	9/8/57	Local pasture	37.3	159
" "	9/20/57	Local pasture	17.0	94
" "	10/21/57	Old hay	26.2	182
St. George, Utah	8/31/57	1957 hay, third cutting, grain	2.6	45
" "	10/28/57	1957 hay and ensilage, grain	4.6	103
Veyo, Utah	7/9/57	Hay from Enterprise, local pasture	7.2	68
" "	7/15	No record taken	8.2	52
" "	8/3/57	No record taken	5.1	65
" "	9/10/57	Hay from Enterprise and local pasture	4.1	38
" "	10/27/57	Hay from 1957 cutting	4.0	45

TABLE V

MILK SAMPLES

Sample	Date of Collection	Ash (gm/l)	Gross Activity (μμc/g ash)	Ca (gm/l)	I^{131}*≠	Total Sr	Sr^{90}	Ba^{140}*	Cs^{137}
					μμc/l				
Glendale, Nevada area	6-20-58			1.066	0	14.1 ± 1.3	4.5 ± 0.7	3.1 ± 1.4	45.0 ± 1.6
	7-16-58	7.27	209.1 ± 5.1	1.070	84	17.9 ± 1.4	3.5 ± 0.6	9.8 ± 1.8	46.5 ± 1.7
	8-26-58	7.26	191.5 ± 5.0	1.226	16.3**	16.9 ± 1.5	2.0 ± 0.6	0.7 ± 0.7	44.2 ± 1.8
	9-17-58	7.33	192.4 ± 5.0	1.097	18	26.6 ± 1.6	3.5 ± 0.5	5.0 ± 1.6	47.1 ± 1.8
	10-28-58	7.55	196.5 ± 5.1	1.056	293**	24.8 ± 1.7	1.8 ± 0.3	16.2 ± 1.0**	24.7 ± 1.2
	11-26-58	7.75	182.9 ± 5.0	1.145	49**	40.9 ± 1.9	3.2 ± 0.7	3.6 ± 0.8**	43.7 ± 1.3
	12-28-58	7.43	187.4 ± 4.5	1.157	27*≠	9.9 ± 1.9	2.9 ± 0.7	0*	26.1 ± 1.2
	1-26-59	7.57	191.4 ± 4.8	1.172	0	5.4 ± 1.4	5.0 ± 0.7	0	32.1 ± 1.3
	2-18-59	7.59	189.8 ± 7.8	1.154	3	5.5 ± 1.2	3.1 ± 0.5	2.1 ± 1.6	25.8 ± 1.1
St. George-Cedar City area Utah	6-21-58			1.072	0	17.1 ± 1.4	3.5 ± 0.7	3.4 ± 1.4	45.1 ± 1.6
	7-11-58	7.26	197.6 ± 5.1	1.040	43	10.6 ± 1.3	3.2 ± 0.6	5.4 + 1.2	35.7 ± 1.5
	8-16-58	8.44	171.5 ± 4.9	1.086	25.8	23.6 ± 1.4	2.3 ± 0.7	3.6 ± 1.4	32.7 ± 1.7
	10-15-58	7.47	204.7 ± 5.0	1.074	0.0	30.7 ± 1.9	2.6 ± 0.7	0.0	32.4 ± 1.3
	11-14-58	7.99	172.1 ± 5.0	1.121	0	30.8 ± 2.1	4.1 ± 1.0	1.8 ± 2.0	32.0 ± 1.3
	1-13-59	7.59	185.9 ± 5.4	1.135	0	9.9 ± 1.3	3.5 ± 0.5	0	34.4 ± 1.3
	2-10-59	7.62	195. ± 5.3	1.154	3	5.9 ± 1.2	4.1 ± 0.5	0	29.1 ± 1.2

* Corrected for decay to time of collection
** Uncorrected for decay to time of collection
≠I^{131} values had an error of ± 20 μμc/l when analyzed

TABLE VI

Soils *

Location	Strontium-90 (millicuries per square mile)
Tempiute, Nevada	42.3
Cedar City, Utah	36.2
Lund, Nevada	30.7
Beaver, Utah	29.6
Eureka, Nevada	25.6
St. George, Utah	24.1
Alamo, Nevada	15.3
Bishop, California	14.9
Caliente, Nevada	14.6
Overton, Nevada	9.7
Mesquite, Nevada	5.2
Barstow, California	1.96

* Samples collected by Mr. Kermit Larson of UCLA, prepared for analyses by Dr. Lyle Alexander of the U. S. Department of Agriculture and analyzed by the Health and Safety Laboratory of the Atomic Energy Commission.

TABLE VII

Results of Sr^{90} Analyses

Minnesota Wheat

As Reported January 25, 1959

Sample No.	Location	Varieties (Spring Wheat)	Year	% ash of wt. rec'd	d/m Sr^{90} per g ash	% Ca in ash	μμc Sr^{90}/ /g. Ca	μμc Sr^{90}/ whole /kgm.wheat
1	Rosemount	Henry, Selkirk, Mida, Rushmore, Lee, Thatcher	1956	1.93	8.83 ± 0.35	2.44	163 ± 7	77
2.	Southwest	Lee, Mida, Thatcher, Henry Selkirk, Rushmore	1956	2.07	7.06 ± 0.34	2.02	157 ± 7	67
					8.20 ± 0.47	2.04	181 ± 10	77
3	Grand Rapids	Lee, Mida, Thatcher, Henry, Selkirk, Rushmore	1956	2.21	3.66 ± 0.28	1.87	88.2 ± 7.0	37
4	Morris	Lee, Mida, Rushmore, Thatcher, Selkirk, Henry	1956	2.00	3.09 ± 0.27	1.70	81.8 ± 7.1	28
5	Duluth	Lee, Henry, Mida, Rushmore, Selkirk, Conley	1956	2.27	3.74 ± 0.28	2.04	82.4 ± 6.4	38
6	Crookston	Henry, Rushmore, Lee, Mida, Thatcher	1956	1.55	2.33 ± 0.33	1.47	71.4 ± 10.2	16
					2.42 ± 0.29	1.42	76.8 ± 9.2	17
7	Waseca	Mida, Lee, Rushmore, Thatcher, Selkirk, Henry	1956	2.07	4.91 ± 0.38	2.36	93.6 ± 7.2	46
8	North Minnesota	Lee, Selkirk, Henry, Russell, (Lee x Kenya Farmer)	1957	1.91	5.43 ± 0.29	1.98	124 ± 7	47
9	Rosemount	Selkirk, Lee, Thatcher	1957	2.26	6.36 ± 0.42	1.91	150 ± 10	65
10	Morris	Thatcher	1957	2.21	8.11 ± 0.36	1.88	194 ± 8	81
					7.85 ± 0.49	1.73	205 ± 13	78
11	Grand Rapids	Lee, Selkirk, Russell (Lee x Kenya Farmer)	1957	2.06	6.54 ± 0.42	1.58	187 ± 12	61
12	Crookston	Thatcher, Lee, Selkirk, Conley	1957	3.64	6.78 ± 0.42	0.50	610 ± 38	111
					6.95 ± 0.33	0.52	602 ± 29	114

Results of Sr^{90} Analyses - Continued

Minnesota Wheat

As Reported January 25, 1959

Sample No.	Location	Varieties (Spring Wheat)	Year	% ash of wt. rec'd	d/m Sr^{90} per g. ash	%Ca in ash	μμc Sr^{90} / /g. Ca	μμc Sr^{90} / whole /kgm. wheat
13	Southwest	Thatcher, Selkirk, Lee, (Lee x Kenya Farmer), Russell	1957	2.12	5.38 ± 0.31	1.66	146 ± 8	51
14	Waseca	Thatcher, Selkirk, Conley (Lee x Kenya Farmer)	1957	2.15	4.80 ± 0.37	2.06	105 ± 8	47
15	Duluth	Selkirk, Russell	1958	1.84	4.28 ± 0.31	1.60	121 ± 9	36
					4.09 ± 0.28	1.82	101 ± 7	34
16	Grand Rapids	Varieties not known	1958	1.77	7.52 ± 0.35	1.84	184 ± 9	60
17	Rosemount	Selkirk, Conley	1958	1.35	5.88 ± 0.32	2.13	124 ± 7	36
18	Unknown	Russell, MO58	1958	1.70	6.99 ± 0.32	1.86	169 ± 8	54
19	Southwest	Conley, Selkirk	1958	1.84	4.48 ± 0.29	1.06	191 ± 12	37
20	Unknown	Conley, UF58	1958	2.05	5.78 ± 0.34	1.65	158 ± 9	53
21	Waseca	Selkirk	1958	1.84	4.89 ± 0.32	1.70	129 ± 8	41
22	Crookston	Conley	1958	2.00	4.58 ± 0.29	0.97	212 ± 13	41
					4.84 ± 0.31	1.02	214 ± 14	43
23	International Falls	Unknown	1958	1.98	4.59 ± 0.30	1.73	120 ± 8	41
					4.78 ± 0.31	1.76	122 ± 8	43

CALIFORNIA FALLOUT DATA
(FALL-1958)

Report of the Department and Laboratories of Nuclear Medicine and Radiation Biology - UCLA

24 Hr. Air Sample and Gum Paper - June through November 1958.

1 Hour "Grab" Air Samples.

Decay of Routine 24 Hr Air Filter Sample.

External Gamma Radiation.

Report of the Los Angeles City Health Department

Radioactive Concentrations in Air - June through November 1958.

Decay Rates for Air Samples.

Rain.

Report of Los Angeles Department of Water and Power

Radioactivity in Air - Using California Disaster Office Filters.

Radioactivity in Air - Sampled with Millipore Type AA Filter.

Report by the Metropolitan Water District of Southern California

Average Beta Activity in Colorado River
Water Influent - Softening Plant.

Data on Gross Beta Radioactivity in Water, Tables I-V.

REPORT OF THE
DEPARTMENT AND LABORATORIES OF NUCLEAR MEDICINE
AND RADIATION BIOLOGY
UNIVERSITY OF CALIFORNIA AT LOS ANGELES

	24 HR. AIR SAMPLE (a)		GUM PAPER
June 1958 Date	Beta $\mu\mu c/M^3$ 4 Hr ct	Beta $\mu\mu c/M^3$ 4 Day ct	Beta $\mu\mu c/ft^2$ Per 24 hr Exp.
1	7.0	3.3	58
2	4.6	2.3	65
3	5.2	2.4	78
4	6.6	2.6	13
5	3.6	1.9	23
6	5.0	2.4	120
7	6.3	2.7	36
8	5.2	1.9	46
9	4.8	1.0	29
10	5.2	1.6	23
11	5.0	1.7	53
12	3.2	1.6	19
13	3.5	1.9	46
14	6.0	2.2	1.8
15	5.3	1.8	52
16	3.5	2.0	40
17	6.0	2.0	6.4
18	7.5	3.2	16
19	6.4	3.5	36
20	6.8	2.2	17
21	7.5	2.5	32
22	6.5	2.9	28
23	8.6	2.7	64
24	6.5	2.2	17
25	6.2	2.0	26
26	5.2	2.4	35
27	8.9	3.1	14
28	6.5	2.7	40
29	7.3	3.1	69
30	6.1	2.7	39

NOTES:
(1) No rain during month of June 1958.
(2) Gamma Background readings for June at 3 ft. above ground averaged 0.009 mr/hr. with no reading higher than 0.013 mr/hr.
(a) Air sample collected for 24 hours followed by a four hour then a four day lapse until counting time.

July 1958 Date	24 HR. AIR SAMPLE Beta $\mu\mu c/M^3$ 4 hr ct	Beta $\mu\mu c/M^3$ 4 Day ct	GUM PAPER Beta $\mu\mu c/ft^2$ Per 24 hr Exp.
1	7.9	2.3	18.0
2	6.4	2.8	34
3	5.9	3.1	28
4	7.3	3.9	28
5	6.4	3.9	19
6	7.0	2.6	26
7	6.8	2.7	61
8	6.4	1.8	22
9	7.4	2.3	27
10	6.5	2.5	26
11	6.7	2.9	50
12	6.3	1.6	41
13	6.5	3.2	32
14	7.3	2.2	41
15	6.1	2.4	26
16	5.9	2.1	24
17	6.8	1.4	10
18	6.1	2.2	35
19	5.1	1.3	23
20	5.4	2.0	27
21	4.7	1.5	36
22	5.7	1.4	10
23	4.7	1.5	10
24	4.2	1.2	8
25	5.6	1.4	28
26	3.8	1.5	26
27	4.4	0.5	11
28	4.1	1.5	41
29	6.8	2.3	38
30	8.6	4.5	34
31	5.7	3.0	50

NOTES: No rain during month of July, 1958.

Gamma background readings for July at 3 ft. above ground averaged 0.006 mr/hr with no reading higher than 0.010 mr/hr.

Aug. 1958 Date	24 HR. AIR SAMPLE Beta μμc/M³ 4 hr ct	Beta μμc/M³ 4 Day ct	GUM PAPER Beta μμc/ft² Per 24 hr Exp.
1	4.6	2.9	50
2	7.7	3.3	20
3	9.6	3.1	77
4	5.9	2.2	2.0
5	3.5	1.8	37
6	3.5	1.6	55
7	3.9	2.1	5.9
8	5.0	2.8	35
9	6.8	3.2	50
10	5.5	2.9	14
11	6.4	2.9	5.9
12	5.9	1.6	7.3
13	5.5	2.6	220*
14	7.7	3.6	200*
15	6.4	2.6	14
16	6.8	3.2	160*
17	5.5	2.4	27
18	5.5	1.7	5.0
19	5.9	1.9	37
20	3.0	1.2	40
21	2.8	1.3	21
22	4.5	2.0	23
23	4.4	2.1	44
24	5.0	2.4	21
25	5.0	1.8	43
26	5.0	1.8	11
27	3.3	1.7	10
28	3.5	1.8	26
29	5.0	2.2	40
30	6.5	2.9	5.5
31	5.9	2.6	14

NOTES:

(1) *Trace rains on the 13th and 15th affected the gum papers removed for analysis on the 13th, 14th and 16th of this month.

(2) There was no measurable volume of rain during August 1958.

(3) Gamma Background readings for August 1958 at 3 ft. above the ground averaged 0.007 mr/hr. with no reading higher than 0.012 mr/hr.

Sept. 1958 Date	24 HR. AIR SAMPLE Beta $\mu\mu c/M^3$ 4 hr ct	Beta $\mu\mu c/M^3$ 4 Day ct	GUM PAPER Beta $\mu\mu c/ft^2$ Per 24 hr Exp.
1	4.5	1.3	44.0
2	4.2	2.1	17.0
3	3.5	2.2	33
4	3.7	1.4	67
5	5.5	1.6	0.0
6	4.4	2.1	9.2
7	4.6	2.5	7.3
8	8.6	1.7	57.0
9	7.7	2.4	2.9
10	6.9	1.9	46.
11	4.3	1.4	19.
12	4.6	1.2	1.8
13	4.7	1.8	17.
14	4.8	2.3	27.
15	4.7	1.9	8.2
16	8.0	3.0	17.
17	9.1	3.1	30.
18	7.4	2.4	5.5
19	8.8	3.0	19.
20	5.9	2.3	8.4
21	5.3	1.6	31.
22	3.7	1.1	14.
23	3.5	2.6	130.*
24	4.4	2.2	140.*
25	6.1	2.4	18.
26	8.8	2.5	24.
27	7.0	2.2	19.
28	8.2	2.3	39.
29	6.5	2.2	24.
30	6.1	1.7	39.

NOTES:

(1) *Two slight rains on the 23rd of September affected the gum papers removed for analysis on the 23rd and 24th. Total volume collected for the morning rain was 1.2 ml which indicated 40.μμc/ml beta activity and 0.13 μμc/ml alpha activity. The afternoon rain volume collected was 2.0 ml which indicated 7.5 μμc/ml beta activity and 0.01 μμc/ml alpha activity. Alpha counts on these samples were made after natural radon-thoron products had decayed.

(2) Gamma Background readings for September 1958 at 3 ft. above the ground averaged 0.007 mr/hr. with no reading higher than 0.013 mr/hr.

	24 HR. AIR SAMPLE		GUM PAPER
Oct. 1958 Date	Beta μμc/M³ 4 hr ct	Beta μμc/M³ 4 Day ct	Beta μμc/ft² Per 24 hr Exp.
1	5.3	1.7	47
2	6.5	1.7	24
3	6.6	2.3	16
4	6.1	1.7	11
5	6.4	3.5	33
6	6.6	2.2	14
7	6.4	2.7	22
8	7.0	2.6	25
9	5.7	2.0	11
10	5.4	2.4	19
11	5.8	2.0	22
12	4.0	1.2	11
13	6.4	1.3	14
14	8.8	2.2	31
15	7.2	2.0	53
16	7.4	2.2	26
17	7.8	2.5	100
18	9.8	3.4	16
19	8.0	2.5	14
20	7.7	2.8	60
21	17.	9.2	19
22	40.	33.	22
23	50.	37.	150
24	44.	32.	1210*
25	26.	18.	1770*
26	17.	10.	110
27	13.	5.6	86
28	50.	19.	6660
29	87.	35.	210
30	700.	145.	3400
31	163.	72.	1600

NOTE:

(1) * Trace rains on 24th and 25th affected the gum papers removed for analysis on 24th and 25th of October, 1958.

(2) There was no measurable volume of rain during October, 1958.

(3) Gamma background readings for October, 1958 at 3 ft above the ground averaged 0.007 mr/hr. There was one significant increase recorded on Oct. 29, 1958 at 4:20 PM the background record started to increase until 5:30 PM when a maximum reading of 0.017 mr/hr was recorded. The background remained at this level almost 2 hours and then dropped to an average of .013 mr/hr until 8:30 AM on Oct. 30, 1958. At 8:45 AM on Oct. 30 the level dropped to .008 mr/hr and during the remainder of that day and the following day the average background level was 0.007 mr/hr.

Nov. 1958 Date	24 HR. AIR SAMPLE Beta $\mu\mu c/M^3$ 4 hr ct	24 HR. AIR SAMPLE Beta $\mu\mu c/M^3$ 4 Day ct	GUM PAPER Beta $\mu\mu c/ft^2$ Per 24 hr Exp.
1	38	23	1100
2	180	90	1500
3	370	160	1000
4	260	130	680
5	190	120	410
6	130	84	240
7	72	47	140
8	70	43	130
9	41	25	140
10	29	20	40
11	16	10	5000*
12	26	19	680
13	16	13	60
14	25	14	100
15	13	10	210
16	17	13	220
17	13	9.2	170
18	12	9.8	36
19	25	19	39
20	17	14	66
21	19	17	170
22	21	14	98
23	20	15	78
24	21	7.6	48
25	27	8.6	50
26	11	7.2	98
27	23	8.4	19
28	17	10	31
29	26	23	22
30	30	28	34

NOTES:

(1) *A rainout during the early hours of Nov. 11 affected the gum paper removed on the 11th. Total volume of rain collected was 17 ml which indicated 19 $\mu\mu c/ml$ beta activity, and the alpha count was 0.09 $\mu\mu c/ml$. The rainout was 2.9 $\mu\mu c/cm^2$ for beta and 0.014 $\mu\mu c/cm^2$ for the alpha activity. Alpha counts on this sample were made after natural radon-thoron products had decayed.

(2) Gamma background readings for the first half of November, 1958 at 3 ft. above the ground averaged 0.007 mr/hr with no reading higher than 0.012 mr/hr.

REPORT OF THE
DEPARTMENT AND LABORATORIES OF NUCLEAR MEDICINE
AND RADIATION BIOLOGY
UNIVERSITY OF CALIFORNIA AT LOS ANGELES

1 HOUR "GRAB" AIR SAMPLES TAKEN AT 15 CFM
(β GROSS ACTIVITY IN $\mu\mu c/M^3$)

DATE 1958	Hour Taken Off Sampler	Initial Activity				(a)				
10-28	10:30A	530	267(4)		151(48)				44(360)	25(840)
"	1:00P	300		126(45)						
"	2:30P	300		20(44)						
"	3:30P	267		18(44)						
"	4:30P	360		44(46)						
10-29	9:30A	130	27(2)		14(52)					3.9(916)
10-29	2:20P	160			23(48)					8.9(816)
"	3:20P	200		31(44)						
"	4:40P	1300								
10-30	9:20A	2200	1200(4)	590(24)		210(96)	110(223)	81(288)	79(312)	31(816)
"	10:35A	890	260(4)	130(24)		68(96)				10(816)
"	11:35A	450	200(4)	130(24)		50(96)				18(816)
"	12:45A	180	180(4)	84(24)						
"	1:45P	280		41(24)						
"	3:10P	180		61(24)						
"	4:10P	290		72(24)						
10-31	9:35A	290	78(2)	48(8)				27(288)		
"	10:38A	230	49(4)							
"	11:38A	140	45(4)							
"	12:38P	130	55(4)							
"	1:48P	96	39(2)							
"	2:48P	180	47(2)							
"	3:48P	250	78(2)							
11-1	1:10P			58(45)						
11-3	10:15A	670	410(4)	400(24)		230(102)				
"	11:15A	750	437(4)	320(24)						
"	12:30P	620	300(4)	240(24)						
"	1:45P	890		230(24)						
"	2:45P	630		210(24)						
"	3:45P	670		260(24)						
"	4:50P	560		200(24)						
11-4	10:15A	540	200(4)	160(24)						
"	11:15A	700	250(4)	190(24)						
"	2:15P	280		140(24)						
"	4:30P	300								
11-5	7:30A	610	130(4)							
11-6	7:30A	410	97(4)							
11-7	7:30A	450	31(24)							
"		300	49(4)	32(28)						
"		230								

(a) Numbers enclosed in parenthesis represent number of hrs of decay time after sample was removed until counting time.

1 HOUR "GRAB" AIR SAMPLES TAKEN AT 15 CFM
(β GROSS ACTIVITY IN μμc/M³)

DATE 1958	Hour Taken Off Sampler	Initial Activity		(a)
11-10	7:30A	53	13(6)	3.4(24)
11-12	7:30A	160		14(24)
11-13	10:30A	220	15(2)	
11-14	9:25A	250	25(2)	
11-17	9:30A	53	29(4)	8.9(24)
11-18	10:30A		120(4)	21(24)
11-19	9:30A		210(4)	
11-20	12:20P		27(4)	
11-21	10:30A	150		
11-24	12:00	110	26(4)	11(24)
11-25	10:00A	170		3.6(24)
11-26	11:30A	151		

(a) Numbers enclosed in parenthesis represent number of hrs of decay time after sample was removed until counting time.

REPORT OF THE DEPARTMENT AND LABORATORIES OF NUCLEAR MEDICINE AND RADIATION BIOLOGY UNIVERSITY OF CALIFORNIA AT LOS ANGELES

DECAY OF ROUTINE 24 HR AIR FILTER SAMPLE REMOVED ON 10-30-58

Count Time After Collection	Activity $\mu\mu c/M^3$
2 hour	710
4 hour	700
1 day	400
4 day	145
5 day	130
13 day	58
15 day	52
18 day	43
21 day	36
25 day	31
32 day	24

REPORT OF THE DEPARTMENT AND LABORATORIES OF NUCLEAR MEDICINE AND RADIATION BIOLOGY - UCLA

GAMMA BACKGROUND RECORD ON ESTERLINE ANGUS CHART FOR OCTOBER 1 - NOVEMBER 30, 1958

1958 Date	Time	Average Rdg. cts/min	Equiv. mr/hr
10-1		300	0.008
10-2		250	0.007
10-3		200	0.006
10-4		250	0.007
10-5		250	0.007
10-6		250	0.007
10-7		250	0.007
10-8		250	0.007
10-9		250	0.007
10-10		250	0.007
10-11		250	0.007
10-12		300	0.008
10-13		250	0.007
10-14		200	0.006
10-15		250	0.007
10-16		250	0.007
10-17		250	0.007
10-18		250	0.007
10-19		300-350	0.008-0.010
10-20		300	0.008
10-21		300	0.008
10-22		250-300	0.007-0.008
10-23		250	0.007
10-24		250	0.007
10-25		300	0.008
10-26		250-350	0.007-0.010
10-27		250	0.007
10-28		250-300	0.007-0.008
10-29	Midnite - 9:00A	300	0.008
	9:00A - 4:20P	250	0.007
	4:20P - 5:00P	350	0.010
	5:00P - 5:20P	400	0.012
	5:20P - 7:10P	600	0.017
	7:10P - 7:40P	500	0.014
	7:40P - 9:00P	450	0.013
	9:00P -11:30P	400	0.012
	11:30P - Midnite	350	0.010
10-30	Midnite - 5:30A	350	0.010
	5:30A - 8:20A	450	0.013
	8:20A - 8:35A	550	0.016
	8:35A - 8:45A	400	0.012
	8:45A -10:15A	350	0.010
	10:15A - 1:00P	300	0.008
	1:00P - 3:45P	250	0.007
	3:45P - 6:00P	250	0.007
	6:00P - Midnite	300	0.008

1958 Date	Time	Average Rdg. cts/min	Equiv. mr/hr
10-31	Midnite - 8:00A	300	0.008
	8:00A - 6:00P	250	0.007
	6:00P - Midnite	300	0.008
11-1	Midnite - 1:00P	300	0.008
	1:00P - 7:00P	250	0.007
	7:00P - Midnite	300	0.008
11-2	Midnite -10:00A	300	0.008
	10:00A - 8:00P	250	0.007
	8:00P - Midnite	300	0.008
11-3	Midnite - 7:30A	300	0.008
-	7:30A - Midnite	250	0.007
11-4	Midnite - Midnite	250	0.007
11-5		250	0.007
11-6		250	0.007
11-7		250	0.007
11-8		250	0.007
11-9		250	0.007
11-10		250	0.007
11-11		250	0.007
11-12		250	0.007
11-13		250	0.007
11-14		250	0.007
11-15		250	0.007
11-16		250	0.007
11-17		250	0.007
11-18	Midnite - 2:00A	250	0.007
	2:00A - 5:00P	300	0.008
	5:00P - 5:30P	450	0.013
	5:30P -10:00P	350	0.010
	10:00P - Midnite	400	0.012
11-19	Midnite - 1:30A	350	0.010
	1:30A - 2:50A	250	0.007
	2:50A - 4:20A	350	0.010
	4:20A - 5:00A	250	0.007
	5:00A - 9:00A	300	0.008
	9:00A - Midnite	350	0.010
11-20	Midnite - 1:30A	400	0.012
	1:30A - 2:30A	300	0.008
	2:30A - Midnite	250	0.007
11-21		250	0.007
11-22		250-300	0.007-0.008
11-23		250	0.007
11-24	Midnite - 8:45A	250	0.007
	8:45A - Midnite	350	0.010
11-25	Midnite - 9:00P	350	0.010
	9:00P - Midnite	250	0.007
11-26		250	0.007
11-27, 28, 29, 30 (each)		250	0.007

NOTE: The average γ Background level for Oct. and Nov. has remained essentially the same 0.007 mr/hr irrespective of the high peaks.

REPORT OF THE
LOS ANGELES CITY HEALTH DEPARTMENT

RADIOACTIVE CONCENTRATIONS IN AIR

Date Filter Removed From Pump		Beta-Gamma Activity $\mu\mu c/M^3$ (1)	Average Per Month
June	2	5.4	
	3	5.1	
	4	8.7	
	5	5.8	
	6	8.8	
	7	5.6	
	9	6.3	
	10	5.1	
	11	4.8	
	12	6.0	
	13	7.6	
	14	6.0	
	16	4.5	
	17	7.3	
	18	8.0	
	19	13.1	
	20	9.3	
	21	9.0	
	23	10.0	
	24	6.8	
	25	10.7	
	26	8.2	
	27	12.7	
	28	9.9	
	30	11.7	
			7.9

(1) Recorded activity taken on basis of 24 hour decay, after removal from pump.

RADIOACTIVE CONCENTRATIONS IN AIR

Date Filter Removed From Pump		Beta-Gamma Activity $\mu\mu c/M^3$ (1)	Average Per Month
July	1	8.2	
	2	6.1	
	3	8.4	
	5	10.7	
	7	9.0	
	8	8.0	
	9	8.5	
	10	9.1	
	11	9.3	
	14	7.7	
	15	7.5	
	16	4.9	
	17	2.9	
	18	5.6	
	21	5.1	
	22	3.6	
	23	3.6	
	24	5.8	
	25	4.9	
	28	4.5	
	29	5.8	
	30	5.9	
	31	11.0	
			6.9
August	1	13.0	
	2	6.9	
	4	7.9	
	5	6.9	
	6	4.9	
	7	7.0	
	8	9.0	
	9	8.7	
	11	9.8	
	12	8.7	
	13	4.1	
	14	8.0	
	15	3.9	
	16	7.9	
	18	6.0	
	19	2.8	
	20	2.3	
	21	3.1	
	22	3.0	
	23	7.7	
	25	5.7	
	26	8.2	
	27	4.0	
	28	4.2	
	29	5.5	
			6.2

(1) Recorded activity taken on basis of 24 hour decay, after removal from pump.

RADIOACTIVE CONCENTRATIONS IN AIR

Date Filter Removed From Pump		Beta-Gamma Activity $\mu\mu c/M^3$ (1)	Average Per Month
Sept.	2	5.4	
	3	8.1	
	4	5.8	
	5	5.4	
	6	6.1	
	8	5.8	
	10	6.9	
	11	7.2	
	12	4.9	
	13	3.7	
	15	8.7	
	16	7.9	
	17	11.9	
	18	9.3	
	19	9.1	
	20	7.2	
	22	5.3	
	23	5.2	
	24	7.5	
	25	10.7	
	26	14.8	
	27	8.5	
	29	7.6	
	29	13.3	
	30	16.2	
	30	3.9	
			7.5
Oct.	1	3.7	
	2	6.8	
	3	12.5	
	4	10.3	
	6	6.6	
	7	7.9	
	8	9.6	
	9	8.6	
	10	5.8	
	11	8.7	
	13	5.4	
	14	5.5	
	15	10.1	
	16	10.5	
	17	8.4	
	18	11.4	
	20	11.7	
	21	14.3	
	22	90.3	
	22	95.0	
	23	124.5	
	23	86.4	
	24	114.0	

(1) Recorded activity taken on basis of 24 hour decay, after removal from pump.

RADIOACTIVE CONCENTRATIONS IN AIR

Date Filter Removed From Pump		Beta-Gamma Activity $\mu\mu c/M^3$ (1)	Average Per Month
Oct.	25	59.8	
	26	33.2	
	27	25.4	
	28	214	
	29	320	
	30	920	
	31	363	80.7
Nov.	1	83.5	
	3	170	
	4	683	
	5	689	
	6	471	
	7	457	
	8	191.5	
	8	131.1	
	9	88.2	
	10	80.2	
	11	28.6	
	12	47.9	
	13	50.0	
	14	32.2	
	15	23.1	
	16	14.3	
	17	7.0	
	18	31.7	
	19	46.0	
	20	66.4	
	21	63.7	
	22	41.6	
	23	58.5	
	24	36.7	
	25	18.3	
	26	16.0	
	28	23.2	
	29	52.5	
			132.2

(1) Recorded activity taken on basis of 24 hour decay, after removal from pump.

REPORT OF THE LOS ANGELES CITY HEALTH DEPARTMENT

DECAY RATES FOR AIR SAMPLES

Date Assayed	Time Assayed	Hours Decay	$\mu\mu c/M^3$
10/22/58	9:50 a.m.	0	111.0
10/22/58	3:50 p.m.	6	107.2
10/23/58	8:00 a.m.	24	90.5
10/24/58	8:45 a.m.	35	83.0
10/25/58	10:25 a.m.	60	62.5
10/26/58	9:50 a.m.	83	63.1
10/27/58	10:00 a.m.	107	60.9
10/29/58	8:30 a.m.	153	50.6
10/31/58	9:00 a.m.	177	44.4
11/03/58	12:45 p.m.	253	39.3
10/22/58	5:10 p.m.	0	143.5
10/23/58	8:00 a.m.	15	103.5
10/23/58	3:25 p.m.	22	95.0
10/24/58	8:20 a.m.	39	93.5
10/25/58	10:35 a.m.	65	84.7
10/26/58	10:00 a.m.	89	75.1
10/27/58	9:30 a.m.	112	68.4
10/29/58	9:10 a.m.	160	65.1
10/23/58	8:14 a.m.	0	187.0
10/23/58	2:00 p.m.	6	140.2
10/24/58	8:05 a.m.	24	124.5
10/25/58	10:45 a.m.	51	1117.8
10/26/58	10:35 a.m.	75	99.6
10/27/58	9:15 a.m.	98	102.0
10/29/58	9:45 a.m.	146	93.5
11/03/58	1:20 p.m.	269	74.2
10/23/58	4:30 p.m.	0	130.0
10/24/58	7:50 a.m.	15	76.0
10/24/58	4:20 p.m.	24	86.4
10/25/58	10:55 a.m.	43	80.5
10/26/58	10:45 a.m.	67	69.8
10/27/58	8:45 a.m.	90	61.2
10/29/58	10:15 a.m.	139	60.9
10/24/58	7:40 a.m.	0	214.0
10/24/58	2:00 p.m.	6	129.0
10/25/58	11:10 a.m.	27	114.0
10/26/58	11:00 a.m.	51	100.0
10/27/58	8:30 a.m.	72	94.3
10/29/58	11:00 a.m.	123	88.3
11/03/58	2:10 p.m.	246	67.3

DECAY RATES FOR AIR SAMPLES

Date Assayed	Time Assayed	Hours Decay	μμc/M^3
10/25/58	10:15 a.m.	0	66.4
10/26/58	11:20 a.m.	25	60.0
10/27/58	8:15 a.m.	46	56.0
10/28/58	8:30 a.m.	70	51.2
10/29/58	11:30 a.m.	97	47.1
10/30/58	10:10 a.m.	120	46.0
11/03/58	3:25 p.m.	221	37.6
10/26/58	9:40 a.m.	0	87.3
10/27/58	7:50 a.m.	22	33.2
10/28/58	9:00 a.m.	47	23.6
10/29/58	8:40 p.m.	70	21.8
10/30/58	11:10 a.m.	96	20.2
11/03/58	4:01 p.m.	197	15.5
10/27/58	7:40 a.m.	0	117.0
10/28/58	7:35 a.m.	24	25.4
10/29/58	2:00 p.m.	54	20.6
10/30/58	12:05 p.m.	76	18.25
11/03/58	11:50 a.m.	172	14.0
10/28/58	7:50 a.m.	0	407.0
10/28/58	10:35 a.m.	3	312.0
10/28/58	12:30 p.m.	5	298.0
10/28/58	2:10 p.m.	7	272.0
10/29/58	7:50 a.m.	24	214.0
10/29/58	9:15 p.m.	37	181.5
10/30/58	1:40 p.m.	54	159.2
10/31/58	9:40 a.m.	74	131.0
10/31/58	3:00 p.m.	79	130.5
11/01/58	9:25 a.m.	98	110.5
11/02/58	9:35 a.m.	122	99.8
11/03/58	10:45 a.m.	147	87.7
10/29/58	7:40 a.m.	0	501.0
10/29/58	11:55 a.m.	4	372.0
10/29/58	3:00 p.m.	7	391.0
10/29/58	3:40 p.m.	8	386.0
10/29/58	5:25 p.m.	10	379.0
10/29/58	7:40 p.m.	12	350.0
10/29/58	9:30 p.m.	14	366.0
10/30/58	7:50 a.m.	24	320.0
10/30/58	12:55 p.m.	29	302.0
10/30/58	5:35 p.m.	34	284.0
10/30/58	8:40 p.m.	37	286.0
10/30/58	9:15 p.m.	37.5	283.5
10/31/58	8:15 a.m.	48	258.
10/31/58	2:45 p.m.	54	240.
11/01/58	9:05 a.m.	73	214.

DECAY RATES FOR AIR SAMPLES

Date Assayed	Time Assayed	Hours Decay	$\mu\mu c/M^3$
11/02/58	9:20 a.m.	97	188.
11/03/58	10:20 a.m.	122	163.3
11/04/58	9:40 a.m.	145	143.5
11/05/58	9:55 a.m.	169	128.0
11/06/58	10:40 a.m.	194	114.3
10/30/58	7:40 a.m.	0	2220.0
10/30/58	9:15 a.m.	2	1950.0
10/30/58	9:25 a.m.	2	1955.0
10/30/58	12:35 p.m.	5	1710.0
10/30/58	2:30 p.m.	7	1540.0
10/30/58	5:25 p.m.	10	1340.0
10/30/58	8:55 p.m.	13	1190.0
10/30/58	9:05 p.m.	13.5	1178.0
10/31/58	8:00 a.m.	24	920.0
10/31/58	2:30 p.m.	30.5	765.0
10/31/58	7:45 p.m.	36	701.0
11/01/58	8:45 a.m.	49	553.0
11/02/58	9:00 a.m.	73	422.0
11/03/58	10:05 a.m.	98	351.0
11/04/58	9:40 a.m.	122	280.0
11/05/58	9:35 a.m.	146	248.0
11/06/58	10:25 a.m.	171	208.0
11/07/58	11:50 a.m.	196	196.0
10/31/58	7:25 a.m.	0	614.0
10/31/58	1:55 p.m.	6	469.0
10/31/58	4:35 p.m.	9	450.0
10/31/58	8:30 p.m.	13	427.0
11/01/58	7:50 a.m.	24	363.0
11/02/58	8:40 a.m.	49	276.0
11/03/58	9:35 a.m.	74	240.0
11/04/58	9:00 a.m.	98	208.0
11/05/58	9:10 a.m.	122	182.5
11/06/58	10:00 a.m.	147	159.5
11/07/58	11:20 a.m.	172	149.5
11/01/58	7:40 a.m.	0	198.0
11/02/58	7:55 a.m.	24	83.5
11/03/58	8:50 a.m.	49	75.3
11/04/58	8:35 a.m.	73	64.5
11/05/58	8:50 a.m.	97	58.5
11/06/58	9:40 a.m.	122	54.6
11/07/58	10:25 a.m.	147	48.8

DECAY RATES FOR AIR SAMPLES

Date Assayed	Time Assayed	Hours Decay	μμc/M³
11/02/58	7:45 a.m.	0	307.0
11/03/58	7:45 a.m.	24	170.0
11/04/58	8:20 a.m.	49	143.5
11/05/58	8:25 a.m.	73	127.5
11/06/58	9:20 a.m.	98	113.0
11/07/58	10:00 a.m.	123	98.0
11/03/58	7:35 a.m.	0	1000.0
11/03/58	11:40 a.m.	4	847.0
11/03/58	2:55 p.m.	7	807.0
11/03/58	5:05 p.m.	9	795.0
11/04/58	7:20 a.m.	24	683.0
11/05/58	8:00 a.m.	49	572.0
11/06/58	9:00 a.m.	74	493.0
11/07/58	9:35 a.m.	98	429.0
11/04/58	7:40 a.m.	0	850.0
11/04/58	10:35 a.m.	3	790.0
11/04/58	6:55 p.m.	11	754.0
11/05/58	7:50 a.m.	24	689.0
11/06/58	8:35 a.m.	49	555.0
11/07/58	9:15 a.m.	74	489.0
11/05/58	7:40 a.m.	0	700.0
11/05/58	10:35 a.m.	3	550.0
11/05/58	11:25 a.m.	4	555.0
11/05/58	12:25 p.m.	4.5	538.0
11/05/58	12:55 p.m.	5	545.0
11/05/58	1:20 p.m.	6	549.0
11/05/58	4:00 p.m.	9	543.0
11/06/58	7:50 a.m.	24	471.0
11/07/58	8:50 a.m.	49	382.0
11/06/58	7:30 a.m.	0	457.0
11/06/58	11:20 a.m.	4	358.0
11/06/58	4:15 p.m.	9	344.0
11/07/58	8:10 a.m.	25	299.0
11/08/58	11:40 a.m.	52	257.0
11/09/58	10:50 a.m.	75	233.0
11/10/58	8:35 a.m.	97	220.0
11/12/58	10:20 a.m.	147	185.2
11/13/58	10:50 a.m.	171	176.0
11/17/58	12:40 p.m.	269	130.8
11/07/58	7:45 a.m.	0	289.0
11/07/58	1:45 p.m.	6	206.0
11/08/58	10:15 a.m.	27	191.5
11/09/58	10:35 a.m.	51	168.9
11/10/58	8:15 a.m.	73	160.

DECAY RATES FOR AIR SAMPLES

Date Assayed	Time Assayed	Hours Decay	$\mu\mu c/M^3$
11/11/58	11:30 a.m.	100	145.5
11/12/58	10:05 a.m.	123	134.0
11/13/58	10:45 a.m.	148	122.6
11/17/58	12:15 p.m.	246	97.9
11/08/58	10:25 a.m.	0	197.0
11/09/58	10:25 a.m.	24	131.1
11/10/58	7:55 a.m.	45.5	121.5
11/11/58	11:15 a.m.	73	111.0
11/12/58	9:50 a.m.	96	105.2
11/13/58	10:10 a.m.	120	102.5
11/09/58	10:15 a.m.	0	148.3
11/10/58	7:35 a.m.	21	88.2
11/11/58	11:00 a.m.	49	77.5
11/12/58	9:10 a.m.	71	73.0
11/13/58	9:25 a.m.	95	69.4
11/14/58	10:00 a.m.	120	61.7
11/10/58	7:20 a.m.	0	117.0
11/11/58	10:40 a.m.	27	80.2
11/12/58	8:45 a.m.	49	74.5
11/13/58	9:00 a.m.	73	68.2
11/14/58	9:35 a.m.	98	67.6
11/17/58	10:50 a.m.	123.5	54.1
11/11/58	10:05 a.m.	0	44.4
11/12/58	8:00 a.m.	22	28.6
11/13/58	8:00 a.m.	46	23.9
11/14/58	8:50 a.m.	71	21.4
11/17/58	10:30 a.m.	145	17.3

REPORT OF
LOS ANGELES CITY HEALTH DEPARTMENT

RAIN

Date	Hours of Rainfall	μμc/1 (1)
3/14-15/58	7:45 a.m. to 2:15 p.m.	69.0
3/15-17/58	2:15 p.m. to 8:05 a.m.	116.
3/20-21/58	8:00 a.m. to 7:00 a.m.	214.
3/21-22/58	7:00 a.m. to 1:00 p.m.	854.
3/27/58	8:00 a.m. to 9:00 a.m.	1415.
3/27/58	9:00 a.m. to 12:00 noon	1775.
3/29-31/58	9:30 a.m. to 8:00 a.m.	864.
3/31-4/1/58	8:00 a.m. to 8:00 a.m.	345.
4/1/58	8:00 a.m. to 10:00 a.m.	258.
4/1-2/58	10:00 a.m. to 8:00 a.m.	334.
4/2-3/58	8:00 a.m. to 8:00 a.m.	407.
4/3-4/58	8:00 a.m. to 7:30 a.m.	330.
4/5-7/58	10:30 a.m. to 8:00 a.m.	342.
8/15/58	8:00 a.m. to 10:30 a.m.	1575.
8/15/58	10:30 a.m. to 3:00 p.m.	1655.
9/23-24/58	4:30 p.m. to 7:00 a.m.	1505. *
10/24-25/58	4:00 p.m. to 9:30 a.m.	5490.
	26 hours decay	5020
	46 " "	4730
	93 " "	3860
	116 " "	3420
	284 " "	2330

(1) Based on 500 ml sample
* Based on 170 ml sample

REPORT OF
LOS ANGELES DEPARTMENT OF WATER AND POWER

RADIOACTIVITY IN AIR

Using California Disaster Office Filters

24 hour sampling ending at	Date - time of measurement	Activity, gross beta-gamma, as micro-microcuries per cu. meter
10-14-58, 1:00 p.m.	141300	2.7
10-15-58, 1:00 p.m.	151300	3.0
10-16-58, 1:00 p.m.	161300	3.8
"	171300	2.9
10-17-58, 1:00 p.m.	171345	12.1
"	201500	3.0
10-18-58, 1:00 p.m.	201400	2.8
10-19-58, 1:00 p.m.	201300	4.9
10-20-58, 1:00 p.m.	201345	12.3
"	211300	4.4
10-21-58, 1:00 p.m.	211345	19.5
"	221300	12.2
"	231320	12.5
"	240955	11.5
10-22-58, 1:00 p.m.	221345	26.1
"	231300	18.5
"	240940	16.1
"	271245	12.2
10-23-58, 1:00 p.m.	231345	54.3
"	240930	42.7
"	271235	32.7
"	281440	28.8
"	291430	24.8
10-24-58, 1:00 p.m.	241345	31.5
"	271225	19.7
"	281430	20.5
"	291400	17.6
"	301230	16.7
"	311335	15.5
10-25-58, 1:00 p.m.	271200	7.9
"	281315	7.8
"	291200	7.3
"	301205	6.6
"	311430	55.9
10-26-58, 1:00 p.m.	271300	6.6
"	281400	6.3
"	291030	5.7
"	301135	4.9
"	311350	4.7
10-27-58, 1:00 p.m.	271345	25.9
"	281300	13.1
"	291310	7.6
"	301115	9.3
"	311315	8.1

24 hour sampling ending at	Date - time of measurement	Activity, gross beta-gamma, as micro-microcuries per cu. meter
10-28-58, 1:00 p.m.	281345	76.1
"	291300	57.1
"	301105	33.7
"	311305	27.0
"	011230	23.9
"	021245	19.1
"	031350	18.5
"	041405	17.2
10-29-58, 1:00 p.m.	291345	41.1
"	301245	32.0
"	311230	27.3
"	011210	24.8
"	021210	21.0
"	031325	19.5
"	041350	19.3
"	051405	18.7
10-30-58, 1:00 p.m.	301300	633
"	311255	345
"	011200	233
"	021200	178
"	031320	144
"	041335	125
"	051340	111
"	061422	101
10-31-58, 1:00 p.m.	311345	40.2
"	011300	30.6
"	021330	24.5
"	031310	22.9
"	041322	22.3
"	051335	19.4
"	061412	17.9
11-1-58, 1:00 p.m.	011345	40.2
"	021300	23.5
"	031230	23.3
"	041308	18.6
"	051320	18.5
"	061400	17.9
"	071405	16.2
11-2-58, 1:00 p.m.	021345	105
"	031300	75.8
"	041304	68.3
"	051310	58.8
"	061335	52.7
"	071337	47.8
"	081415	36.6

24 hour sampling ending at	Date - time of measurement	Activity, gross beta-gamma, as micro-microcuries per cu. meter
11-3-58, 1:00 p.m.	031345	262
"	041300	211
"	051305	177
"	061320	164
"	071335	135
"	101410	108
11-4-58, 1:00 p.m.	041345	180
"	051300	143
"	051310	123
"	071325	108
"	101405	76.3
11-5-58, 1:00 p.m.	051345	144
"	061300	115
"	071305	99.0
"	101355	71.2
11-6-58, 1:00 p.m.	061345	80.0
"	071300	60.4
"	101335	41.3
11-7-58, 1:00 p.m.	071345	52.6
"	101325	27.4
11-8-58, 1:00 p.m.	101310	17.3
"	121340	26.6
11-9-58, 1:00 p.m.	101300	27.1
"	121325	22.5
"	131420	20.6
11-10-58, 1:00 p.m.	101345	22.4
"	121300	17.4
"	131405	17.1
11-11-58, 1:00 p.m.	121230	13.2
11-12-58, 1:00 p.m.	131300	23.7
11-13-58, 1:00 p.m.	171510	27.2
11-14-58, 1:00 p.m.	171425	3.2
11-15-58, 1:00 p.m.	171405	7.0
11-16-58, 1:00 p.m.	177300	3.2

REPORT OF
LOS ANGELES DEPARTMENT OF WATER AND POWER

RADIOACTIVITY IN AIR

Sampled With Millipore Type AA Filter

24 Hour Sampling Ending At	Date-Time of Measurement	Activity, gross beta-gamma, as micro-microcuries per cu. meter
10-14-58, 8:30 a.m.	140915	20.0
"	150730	4.3
10-15-58, 8:30 a.m.	150915	3.2
10-16-58, 8:30 a.m.	160830	26.7
"	160915	16.1
"	170840	4.3
10-17-58, 8:30 a.m.	170830	30.5
"	170915	18.9
10-18-58, 8:30 a.m.	200840	4.1
10-19-58, 8:30 a.m.	200840	5.2
"	210730	3.4
10-20-58, 8:30 a.m.	200830	28.4
"	200915	19.0
"	210840	6.5
10-21-58, 8:30 a.m.	210830	51.3
"	210915	42.7
"	220835	21.9
"	230840	18.2
"	240815	16.4
"	270815	11.5
10-22-58, 8:30 a.m.	220830	92.1
"	220915	66.2
"	230730	45.7
"	240730	40.9
"	270800	29.6
10-23-58, 8:30 a.m.	230830	88.5
"	230915	78.6
"	240925	55.5
"	270745	43.7
"	280815	39.4
"	291105	32.1
"	300855	31.5
10-24-58, 8:30 a.m.	240830	70.8
"	240915	54.0
"	270730	31.6
"	280810	27.1
"	290900	27.1
"	300845	24.8
10-25-58, 8:30 a.m.	270930	20.0
"	280740	18.5
"	290805	18.5
"	300730	16.1
"	310840	15.9
10-26-58, 8:30 a.m.	270925	26.3
"	280750	20.4
"	290750	20.5

24 Hour Sampling Ending at	Date-Time of Measurement	Activity, gross beta-gamma, as micro-microcuries per cubic meter
10-26-58, 8:30 a.m.	300750	12.5
10-27-58, 8:30 a.m.	270830	50.2
"	270915	36.4
"	280755	14.2
"	290840	9.4
"	300810	8.1
10-28-58, 8:30 a.m.	280830	81.5
"	280915	75.9
"	281115	55.8
"	281530	51.4
"	290820	36.5
"	300820	25.0
"	310735	22.6
"	010745	18.3
10-29-58, 8:30 a.m.	290830	132.
"	290915	118.
"	291100	101.
"	300825	81.7
"	310725	70.9
"	010800	58.7
"	020850	47.2
"	030820	34.3
"	040805	39.8
"	050850	36.5
"	060820	34.4
10-30-58, 8:30 a.m.	300830	1140
"	300915	759
"	301100	759
"	301200	713
"	301300	670
"	301600	565
"	310800	421
"	010805	255
"	020848	110
"	030815	173
"	040800	140
"	050845	122
"	060817	109
10-31-58, 8:30 a.m.	310830	161
"	310915	140
"	010810	88.4
"	020845	69.7
"	030800	60.3
"	040855	54.0
"	050840	50.3
"	060812	44.7
11-1-58, 8:30 a.m.	010830	75.8
"	010915	62.4

24 Hour Sampling Ending at	Date-Time of Measurement	Activity, gross beta-gamma, as micro-microcuries per cu. meter
11 1-58, 8:30 a.m.	020840	33.5
"	030750	24.1
"	040845	26.4
"	050815	25.9
"	060805	23.5
"	070930	20.9
11-2-58, 8:30 a.m.	020830	158.
"	020915	116.
"	030745	84.8
"	040740	84.8
"	050810	70.8
"	060855	58.7
"	070900	52.8
11-3-58, 8:30 a.m.	030830	324.
"	030915	324.
"	031300	287.
"	031600	287.
"	040820	260.
"	050808	219.
"	060753	183.
"	070815	167.
"	100940	123.
11-4-58, 8:30 a.m.	040830	214.
"	040915	202.
"	041530	189.
"	050805	179.
"	060750	144.
"	070810	125.
"	100930	91.8
11-5-58, 8:30 a.m.	050830	61.6
"	050915	59.9
"	051515	58.3
"	060745	55.3
"	070800	50.3
"	100905	33.5
11-6-58, 8:30 a.m.	060830	161.
"	060915	131.
"	070740	94.5
"	100840	77.4
"	121050	54.0
11-7-58, 8:30 a.m.	070830	16.9
"	070915	16.3
"	080805	12.1
"	101045	9.9
11-8-58, 8:30 a.m.	100755	28.4
"	121030	24.2
11-9-58, 8:30 a.m.	100745	38.1
"	121015	32.8
11-10-58, 8:30 a.m.	100830	61.6
"	100915	46.2

24 Hour Sampling Ending at	Date-Time of Measurement	Activity, gross beta-gamma as micro-microcuries per cu. meter
11-10-58, 8:30 a.m.	120950	23.8
"	130840	24.2
11-11-58, 8:30 a.m.	120930	9.8
"	130755	8.3
"	171030	6.0
11-12-58, 9:15 a.m.	120915	66.5
"	121000	50.4
"	130745	33.9
"	171020	22.2
"	181015	21.9
11-13-58, 8:30 a.m.	130830	71.0
"	130915	50.3
"	171010	17.8
"	181000	15.7
"	191045	9.1
11-14-58, 8:30 a.m.	171000	21.9
"	180945	16.8
"	191030	16.6
11-15-58, 8:30 a.m.	170940	10.3
"	180930	8.0
"	191000	7.0
"	200955	6.7
11-16-58, 8:30 a.m.	170805	8.8
"	180840	6.0

REPORTED BY THE

METROPOLITAN WATER DISTRICT OF SOUTHERN CALIFORNIA

Average Beta Activity in Colorado River

Water Influent - Softening Plant

Month	Average Activity (μμc/liter)
June	7.5
July	11.5
August	11.2
September	11
October	31.5
November	23

REPORTED BY THE
METROPOLITAN WATER DISTRICT OF SOUTHERN CALIFORNIA
TABLE I
DATA ON GROSS BETA RADIOACTIVITY IN WATER

Source and Sampling Point	Date Sampled	Date of Analysis	Gross Beta μμc/l.
Garvey Reservoir			
West End	10/24/58	11/1/58	197 ± 21
" "	10/28/58 9:10 am	11/1/58	410 ± 25
Depth Sample near tower	10/28/58 9:00 am	11/1/58	47.5 ± 5.3
Effluent	10/30/58 6:45 pm	11/3/58	65.6 ± 6.7
Surface Sample near tower	10/31/58 8:00 am	11/5/58	119.4 ± 7.2
Surface Sample inside tower	10/31/58 8:15 am	11/5/58	34.1 ± 6.4
Surface Sample west end	10/31/58 8:10 am	11/10/58	26.5 ± 6.1
Surface Sample near tower	11/3/58	11/10/58	20.1 ± 6.0
Surface Sample inside tower	11/3/58 7:45 am	11/10/58	28.4 ± 6.1
Surface Sample near tower	11/5/58	11/11/58	23.9 ± 6.0
Surface Sample inside tower	11/5/58 8:00 am	11/11/58	22.7 ± 4.3
Surface Sample inside tower	11/7/58 8:15 am	11/14/58	17.7 ± 4.0
Surface Sample near tower	11/13/58 3:00 pm	11/18/58	26.2 ± 5.9

Source and Sampling Point	Date Sampled	Date of Analysis	Gross Beta μμc/l.
Palos Verdes Reservoir			
Surface	10/24/58 7:00 am	11/1/58	56.4 ± 6.5
Depth	10/26/58 3:20 pm	11/1/58	79.8 ± 6.8
Surface	10/28/58 3:20 pm	11/3/58	30.7 ± 3.1
"	10/31/58 7:40 am	11/4/58	37.1 ± 8.9
"	11/2/58 7:50 am	11/10/58	53.9 ± 6.4
"	11/4/58 7:05 am	11/11/58	46.5 ± 6.3
"	11/6/58 7:10 am	11/14/58	49.5 ± 6.3
"	11/8/58 7:30 am	11/14/58	25.9 ± 5.9
"	11/10/58 7:00 am	11/14/58	24.1 ± 5.9
"	11/12/58 7:00 am	11/18/58	35.5 ± 6.1

Source and Sampling Point	Date Sampled	Date of Analysis	Gross Beta μμc/l.
Garvey Reservoir			
Surface Sample inside tower	11/13/58 3:00 pm	11/18/58	26.7 ± 5.9
Orange County Res. Outlet	11/1/58 7:30 am	11/8/58	25.1 ± 6.0
Corona Del Mar Res. Outlet	11/1/58	11/8/58	19.1 ± 8.3

TABLE II

Source and Sampling Point	Date Sampled	Date of Analysis	Gross Beta μμc/l.
Decay Measurements:			
Garvey Reservoir West End	10/28/58	11/1/58 4:00 pm	410
		11/4/58 9:00 am	171
		11/6/58 10:30 am	150
		11/11/58 2:00 pm	123
		11/19/58 1:00 pm	98.8
		11/26/58 12:30 pm	75.3
Palos Verdes Res. Surface	10/24/58	11/1/58	56.4
		11/19/58	30.1
		11/25/58	20.2
Palos Verdes Res. Depth Sample	10/26/58	11/1/58	79.8
		11/4/58	66.0
		11/12/58	38.8
		11/19/58	44.9
		11/25/58	27.2

TABLE III

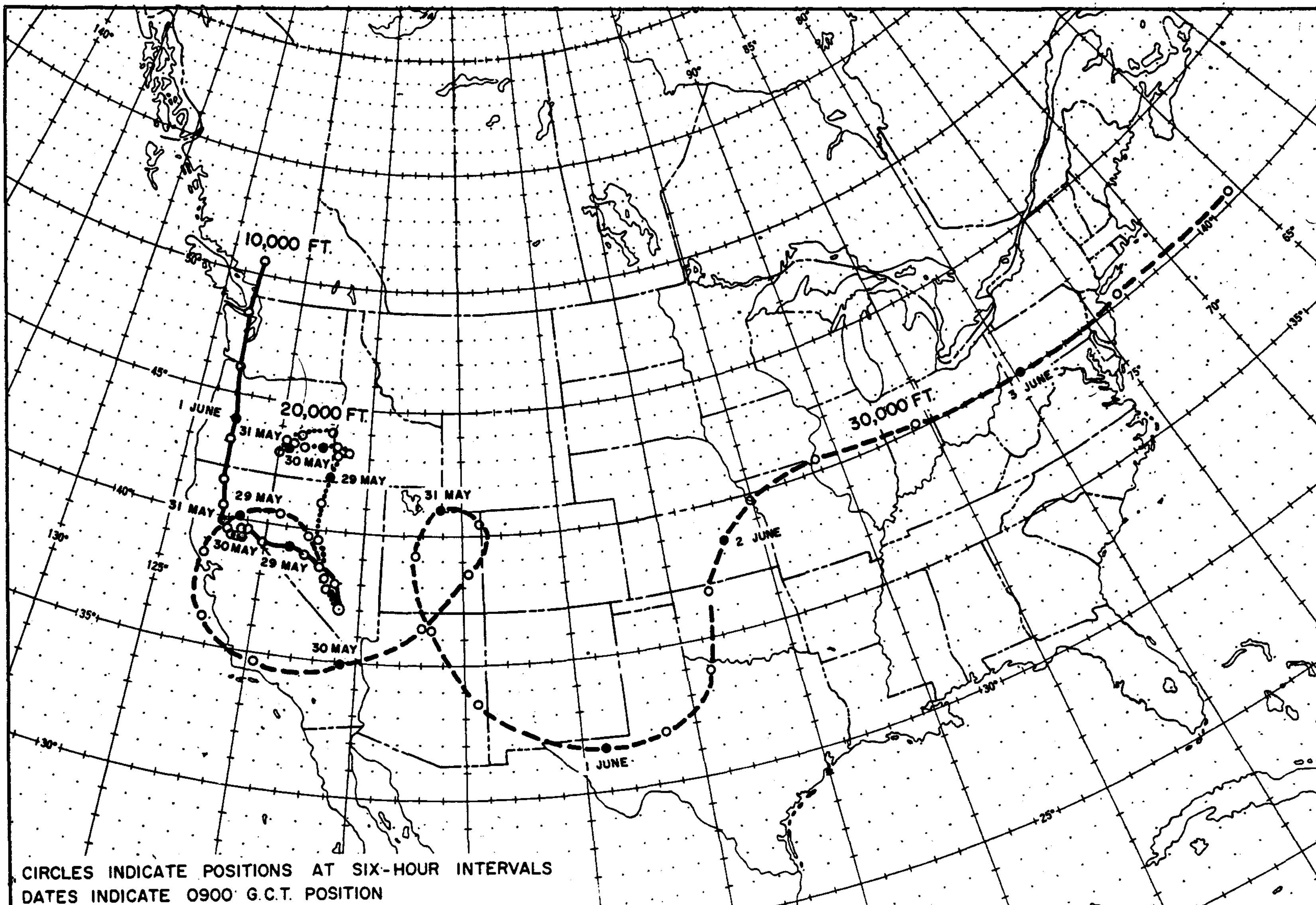
Source and Sampling Point	Date Sampled	Date of Analysis	Gross Beta µµc/l.
Influent - F. E. Weymouth Softening and Filtration Plant La Verne	9/29/58	10/10/58	25.8 ± 4.8
	9/30/58	10/10/58	26.4 ± 4.8
	10/2/58	10/10/58	28.6 ± 8.3
	10/29/58	11/1/58	48.7 ± 6.4
	10/30/58	11/3/58	96.9 ± 8.1
	10/31/58	11/3/58	42.0 ± 5.3
	11/1/58	11/4/58	36.9 ± 6.3
	11/3/58	11/8/58	53.0 ± 6.6
	11/4/58	11/8/58	48.5 ± 5.2
	11/5/58	11/12/58	28.3 ± 6.0
	11/6/58	11/13/58	32.6 ± 6.1
	11/7/58	11/13/58	30.7 ± 6.0
	11/10/58	11/13/58	24.0 ± 4.9
	11/11/58	11/14/58	20.2 ± 5.9
	11/12/58	11/17/58	24.4 ± 6.0

TABLE IV

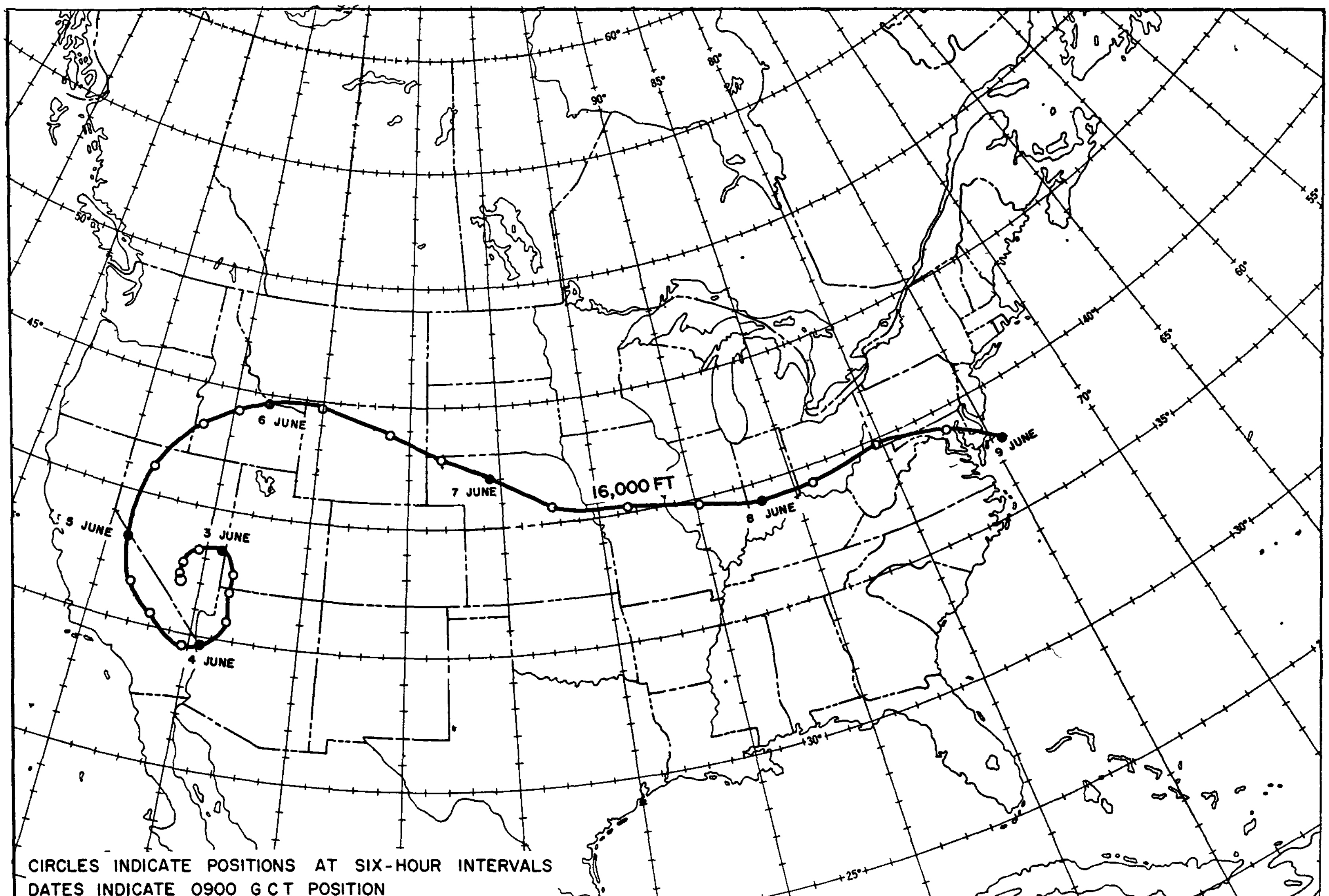
Source and Sampling Point	Date Sampled	Date of Analysis	Gross Beta μμc/l.
Effluent - F. E. Weymouth Softening and Filtration Plant La Verne	10/28/58	11/1/58	36.9 ± 6.2
	10/29/58	11/3/58	22.8 ± 5.1
	10/30/58	11/3/58	28.4 ± 5.1
	10/31/58	11/4/58	22.2 ± 5.0
	11/2/58	11/8/58	28.5 ± 6.1
	11/3/58	11/8/58	43.3 ± 6.3
	11/5/58	11/12/58	32.7 ± 6.1
	11/6/58	11/13/58	29.4 ± 6.0
	11/9/58	11/13/58	20.0 ± 4.8
	11/10/58	11/14/58	18.1 ± 4.3
	11/11/58	11/17/58	23.8 ± 6.0

TABLE V

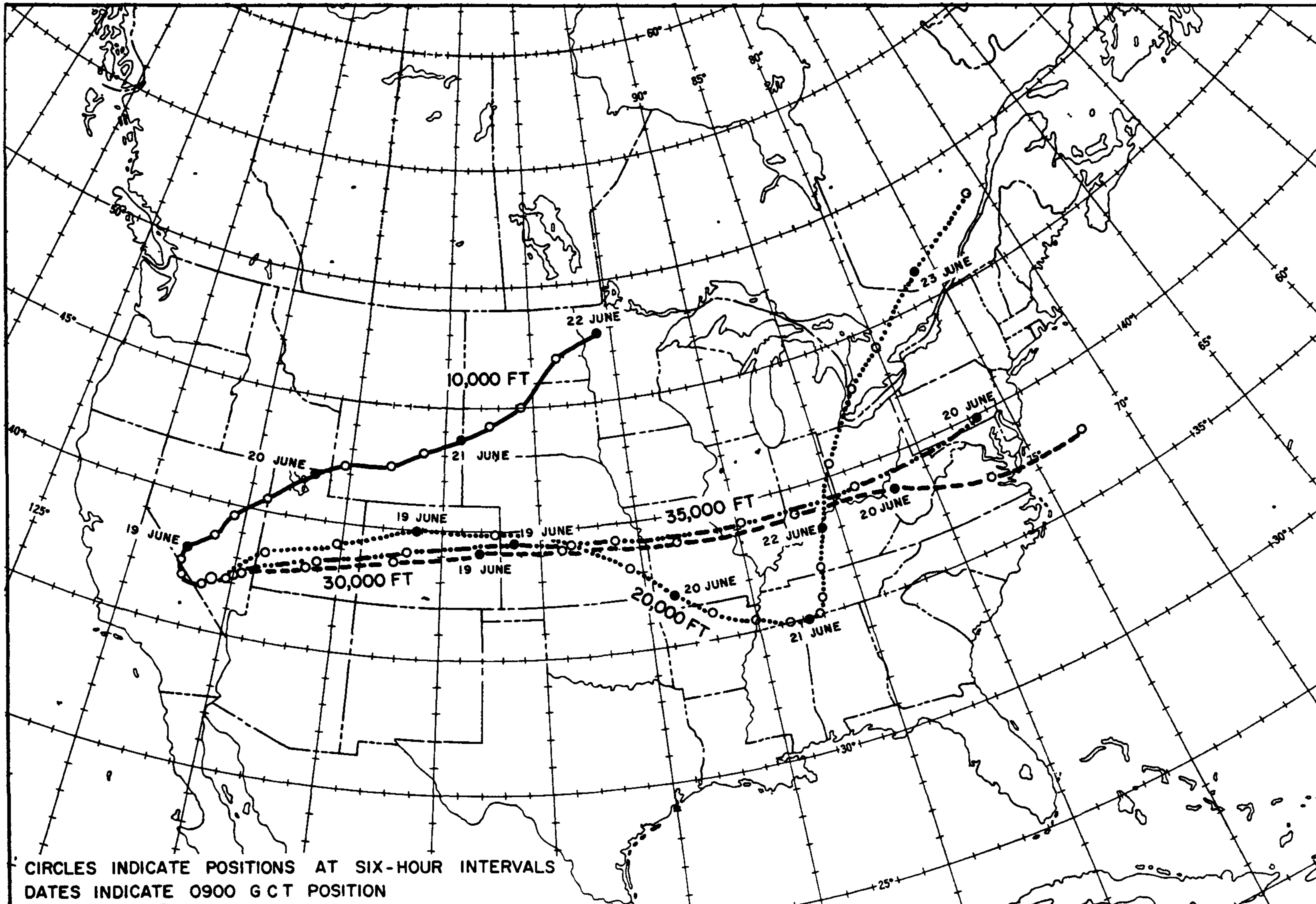
Source and Sampling Point	Date Sampled	Date of Analysis	Gross Beta $\mu\mu c/l$
Decay Measurements:			
Influent - F. E. Weymouth Softening and Filtration Plant	10/29/58	11/1/58 9:00 am	48.7
		11/5/58 10:00 am	37.8
		11/18/58 2:00 pm	39.2
Influent - F. E. Weymouth Softening and Filtration Plant	10/30/58	11/3/58 8:30 am	96.9
		11/4/58 11:30 am	86.7
		11/12/58 10:30 am	71.1
		11/20/58 12:30 pm	52.2
		11/26/58 2:30 pm	51.7
Effluent - F. E. Weymouth Softening and Filtration Plant	10/28/58	11/1/58 10:00 am	36.9
		11/5/58 12:05 pm	30.3
		11/19/58 8:15 am	25.6
		11/25/58 2:30 pm	11.9



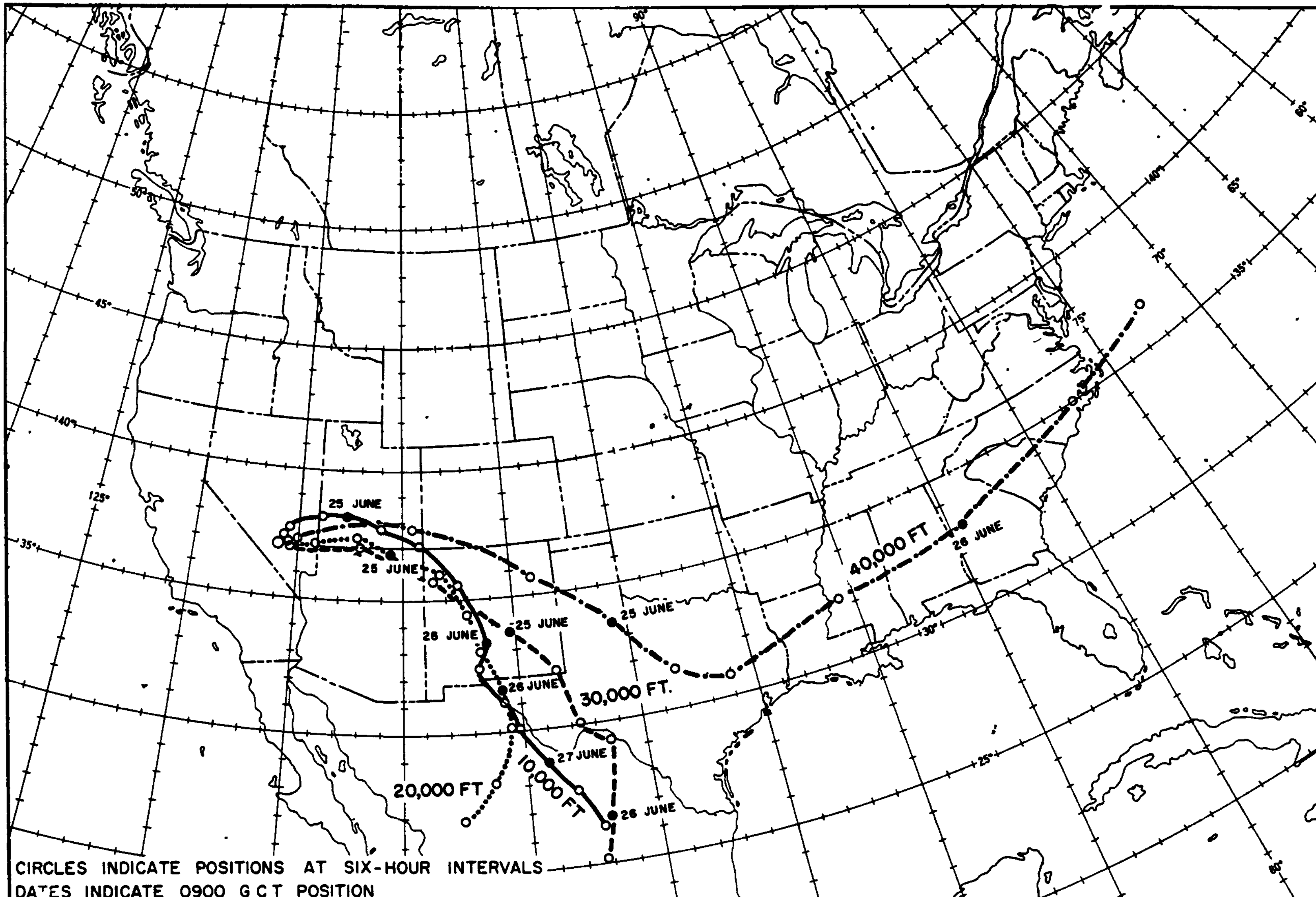
Boltzmann, 1155 G.C.T. May 28, 1957



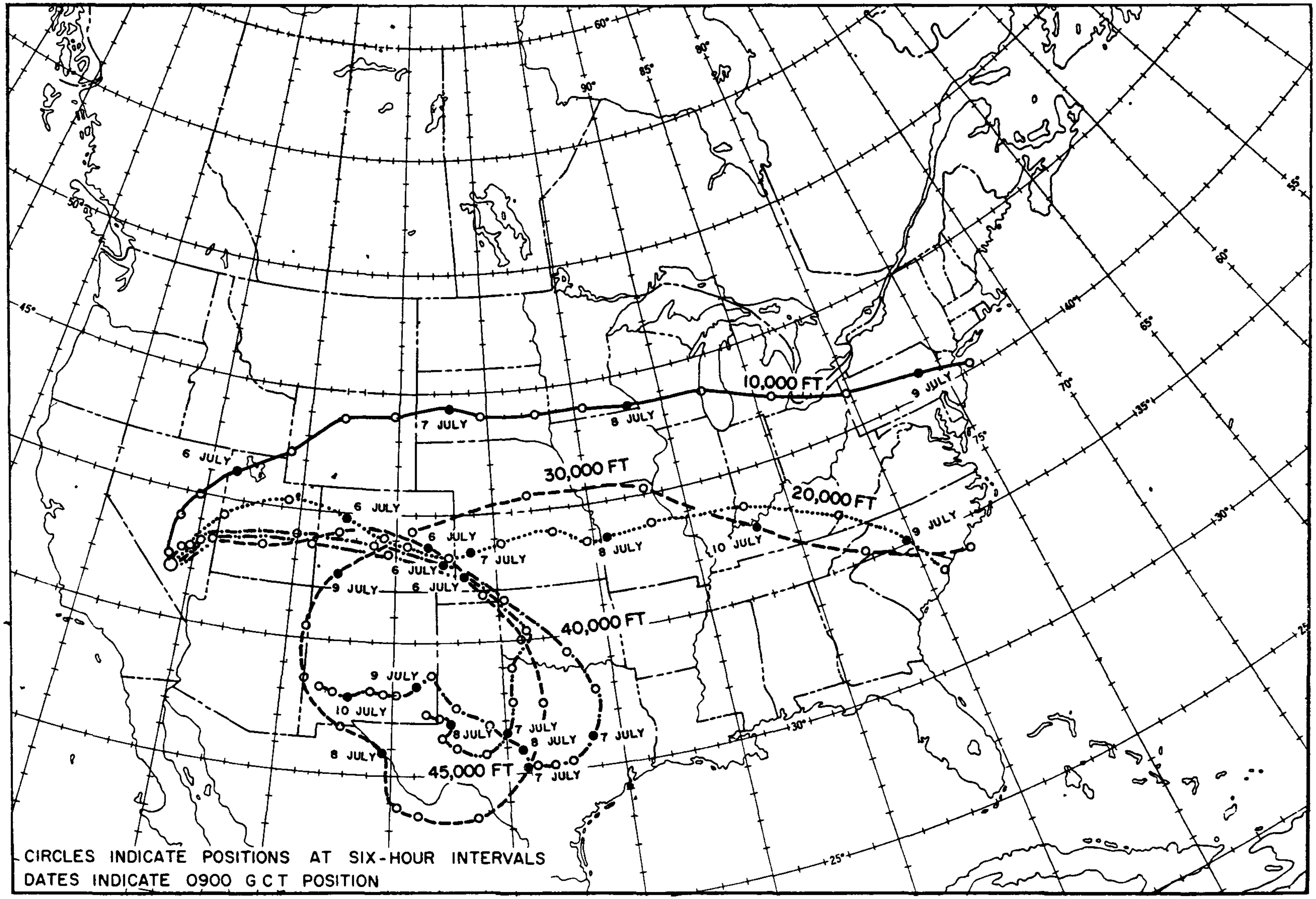
Franklin, 1155 G.C.T. June 2, 1957



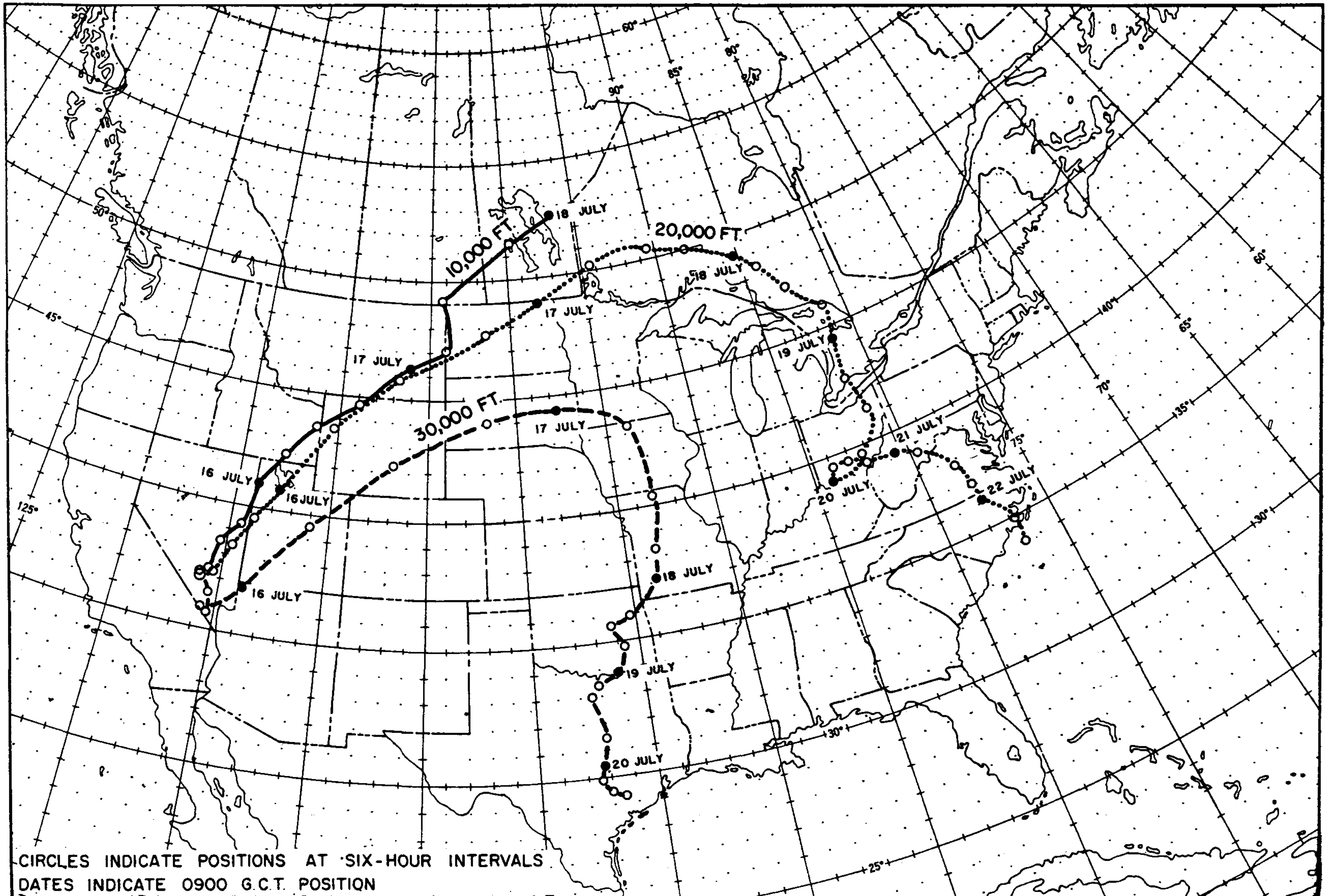
Wilson 1145 G.C.T. June 18, 1957



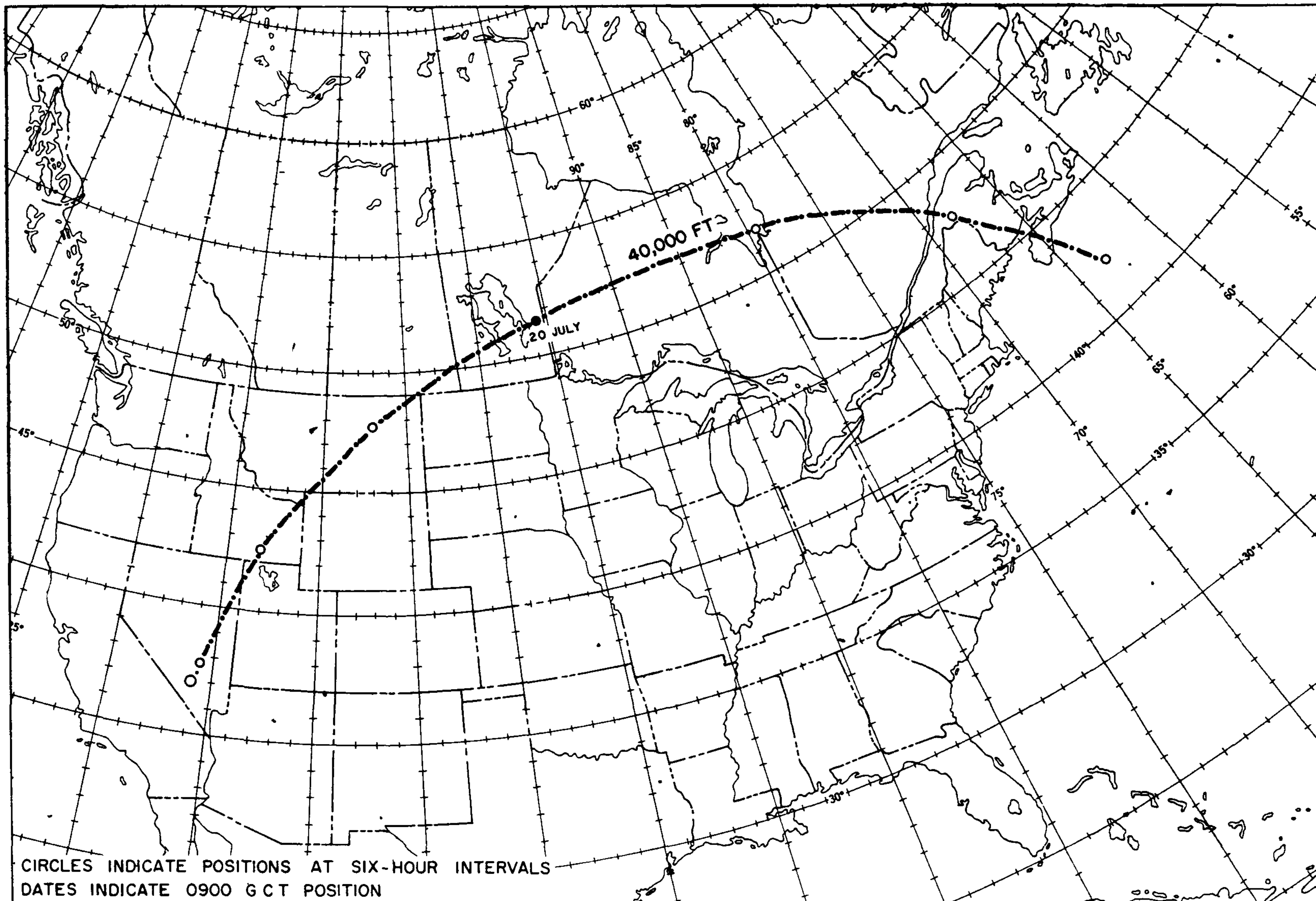
Priscilla, 1330 G.C.T. June 24, 1957



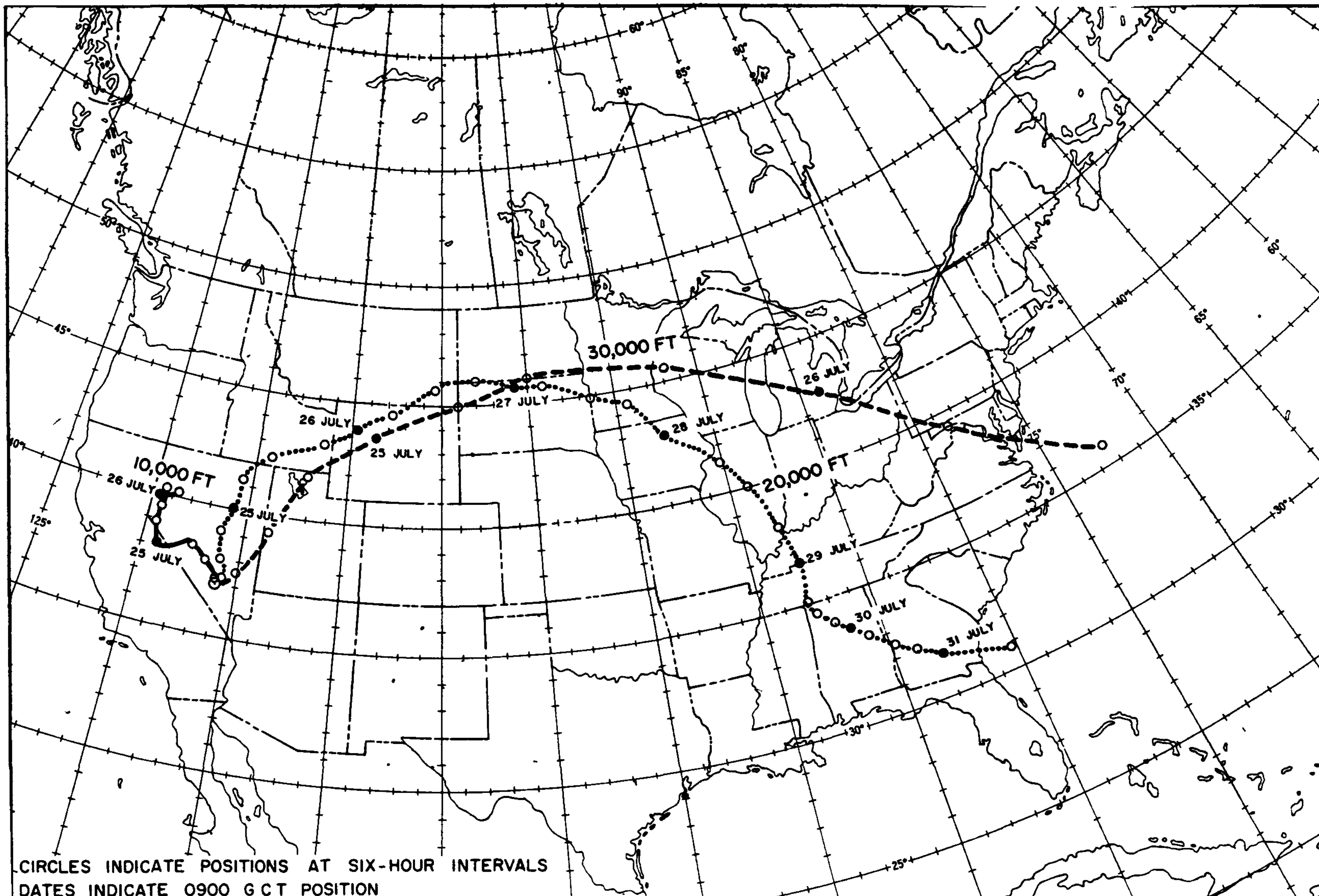
Hood, 1140 G.C.T. July 5, 1957



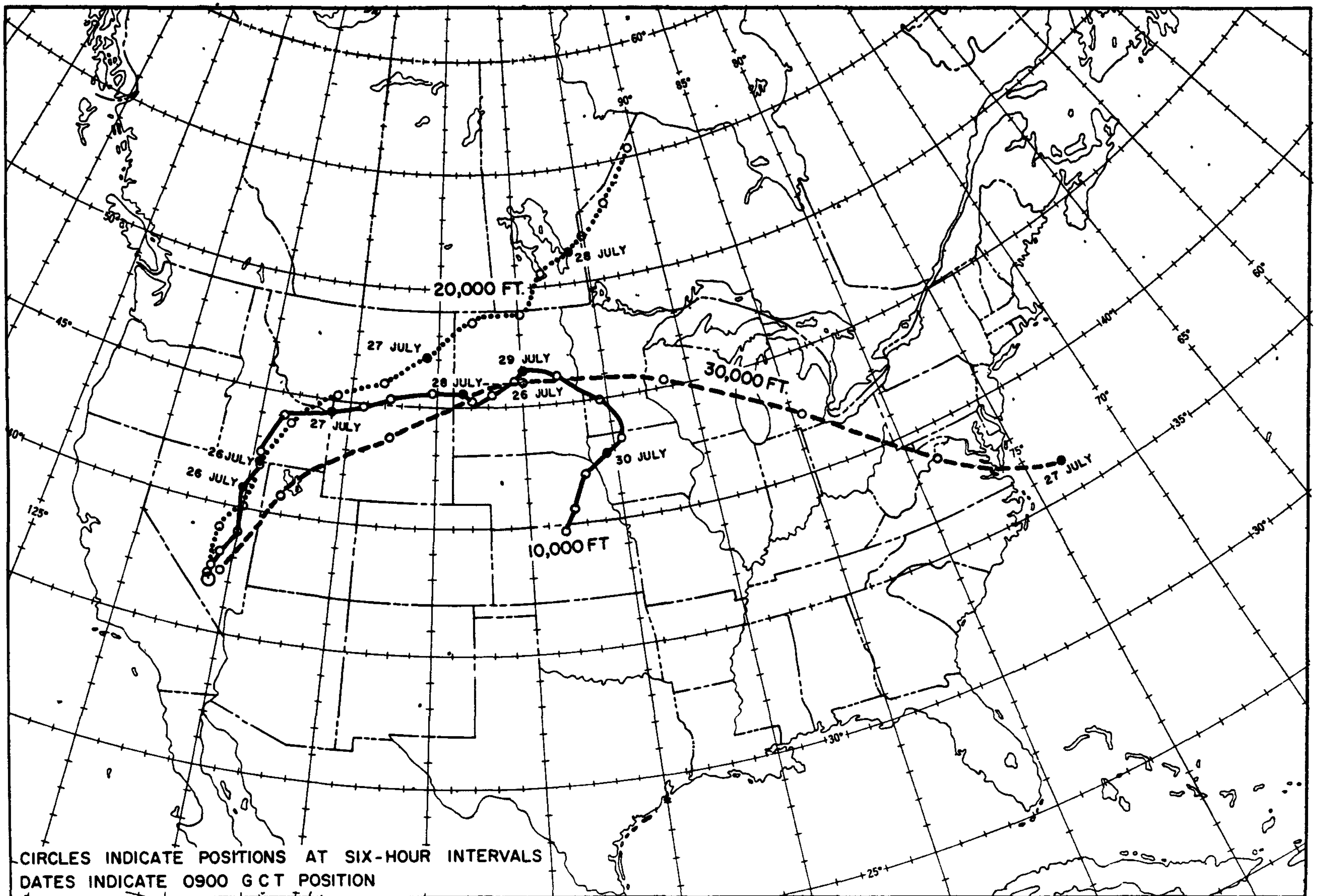
Diablo, 1130 G.C.T. July 15, 1957



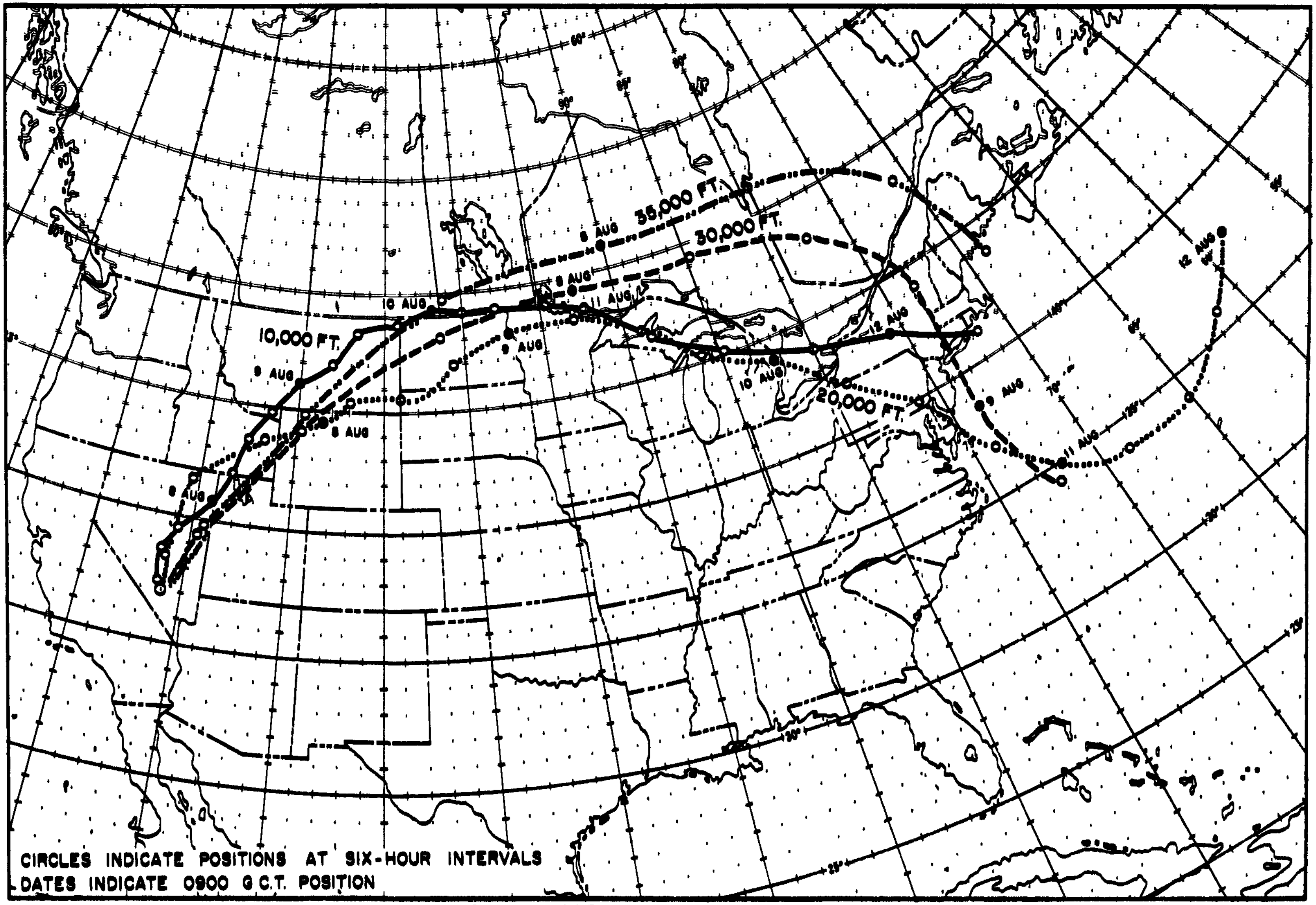
John, 1400 G.C.T. July 19, 1957



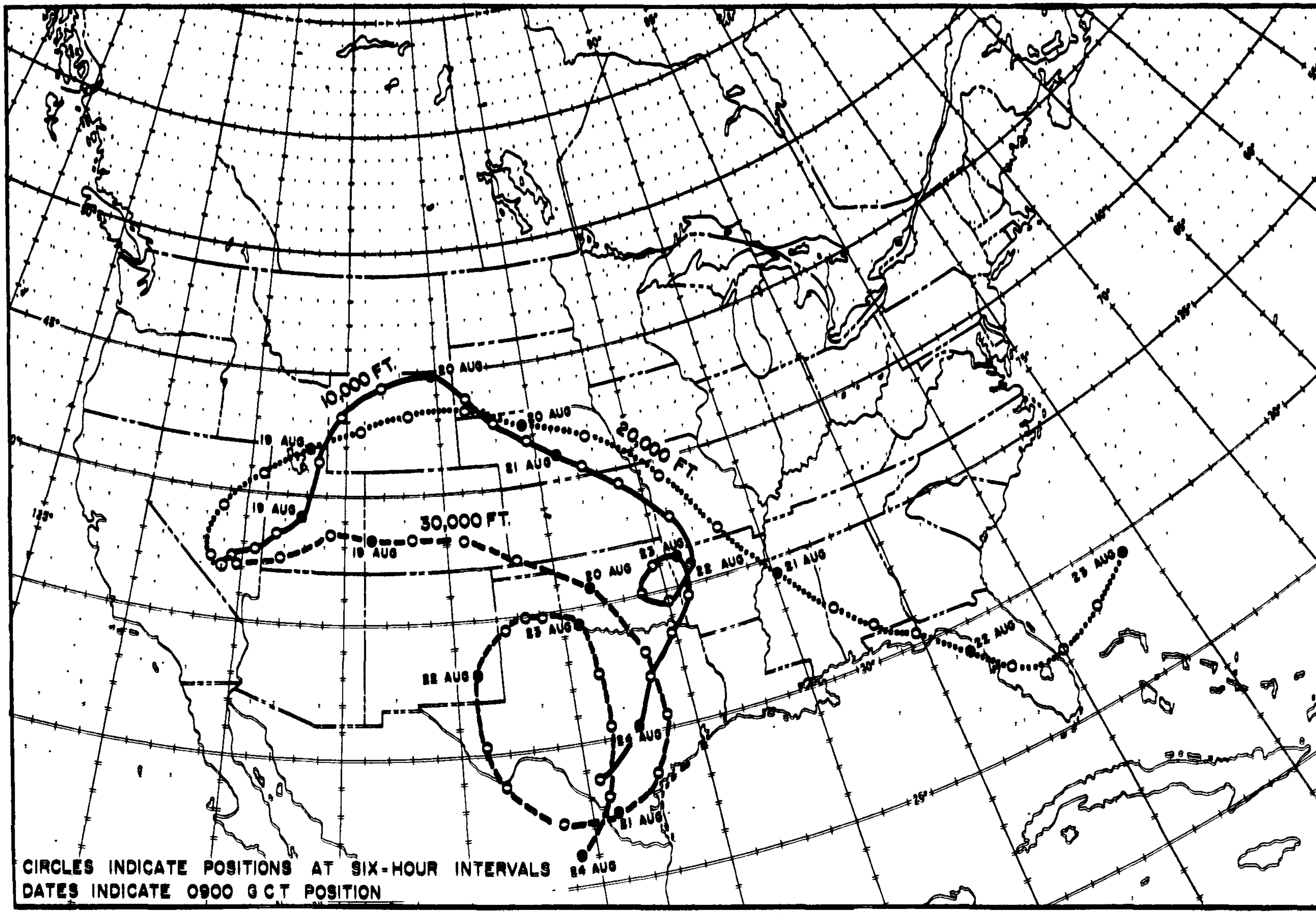
Kepler, 1150 G.C.T. July 24, 1957



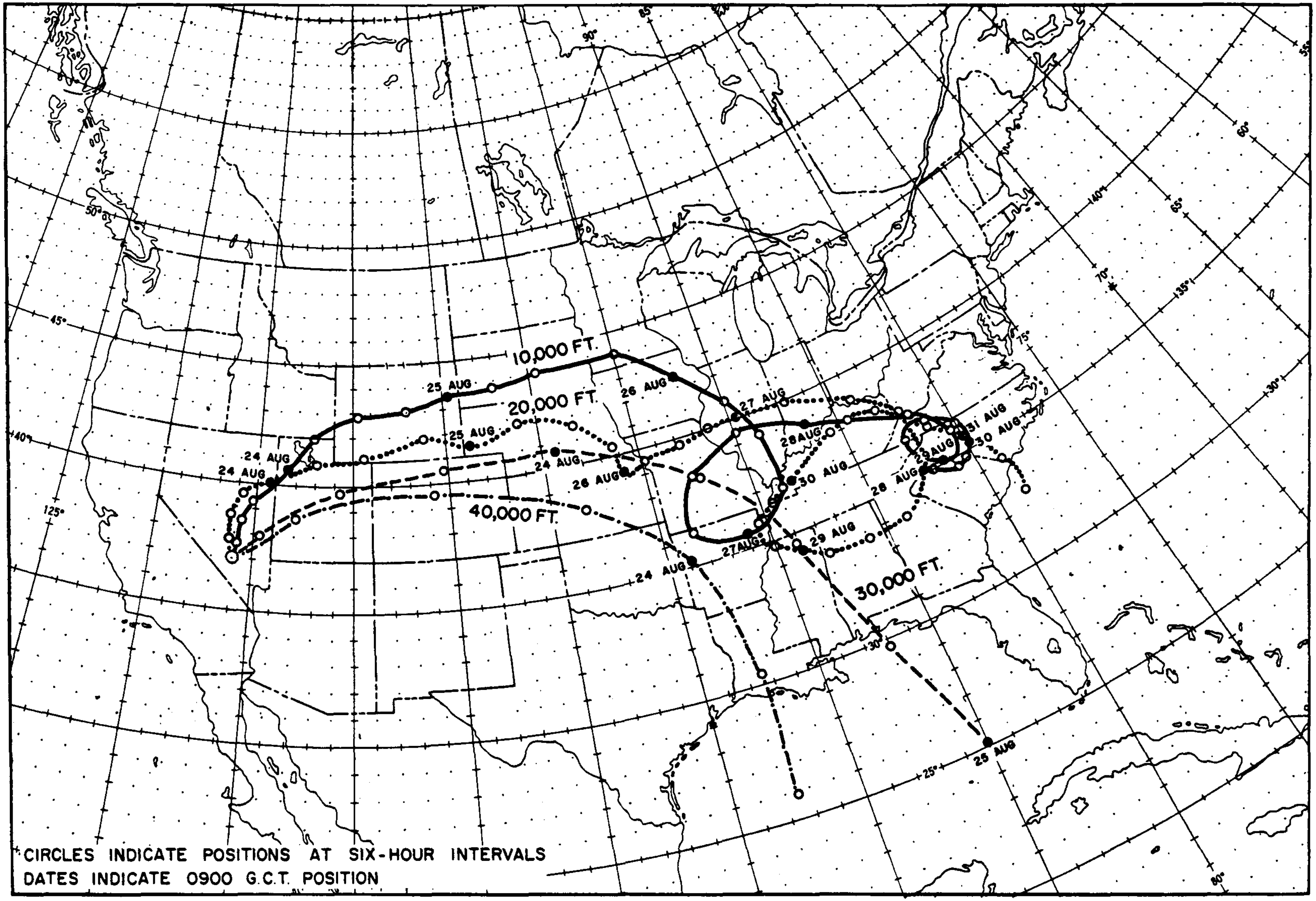
Owens, 1330 G.C.T. July 25, 1957



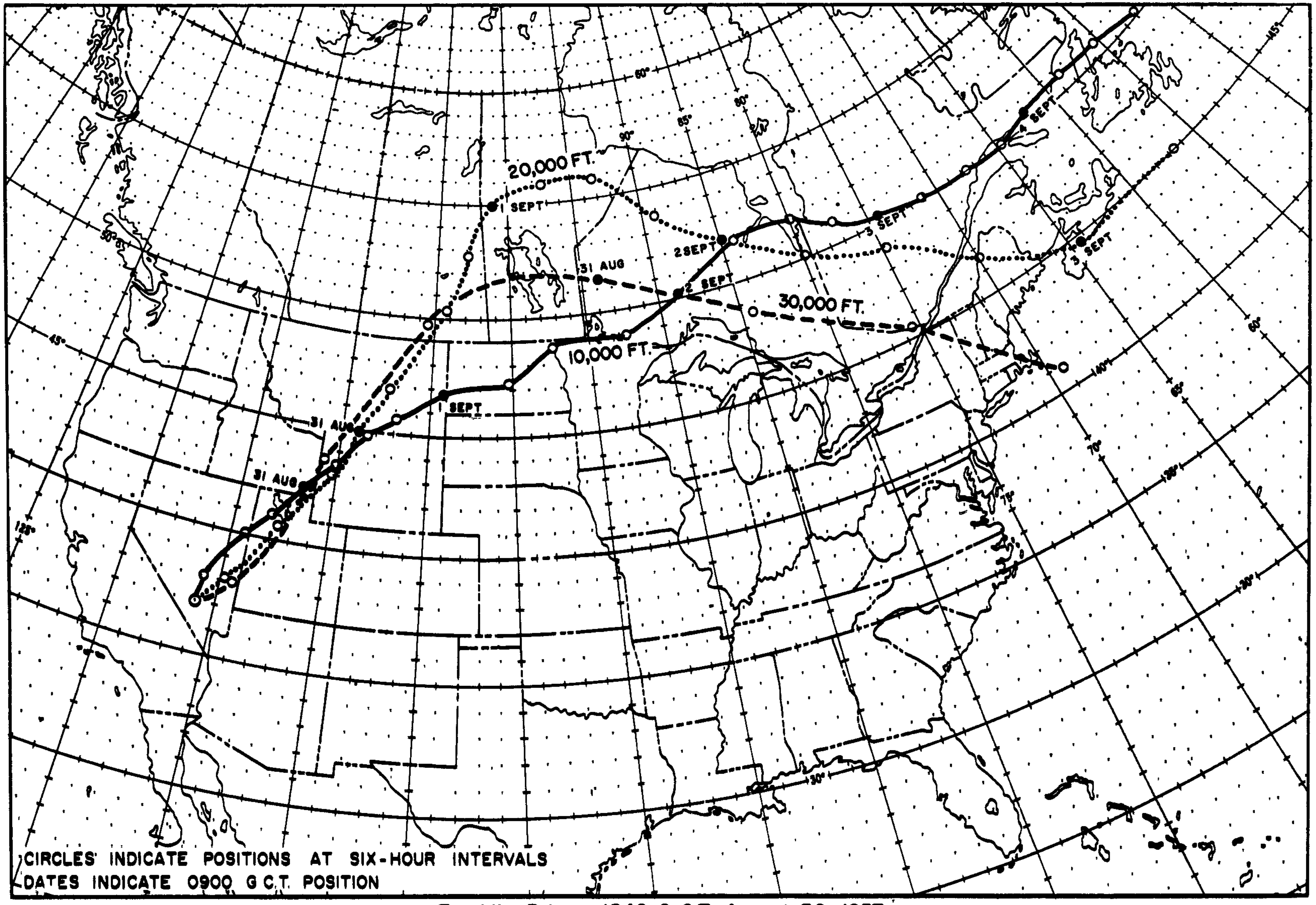
Stokes, 1225 G.C.T. August 7, 1957



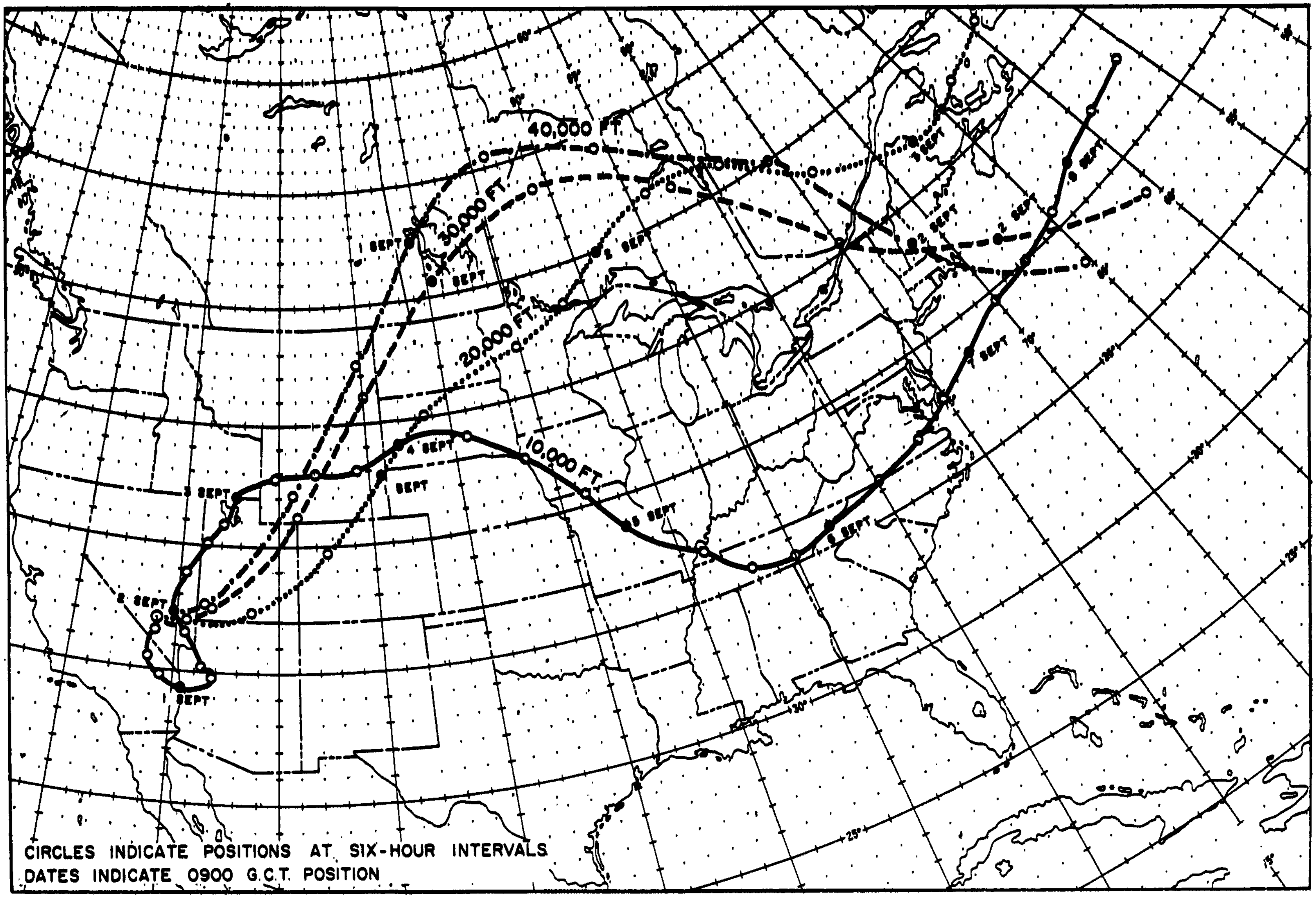
Shasta, 1200 G.C.T. August 18, 1957



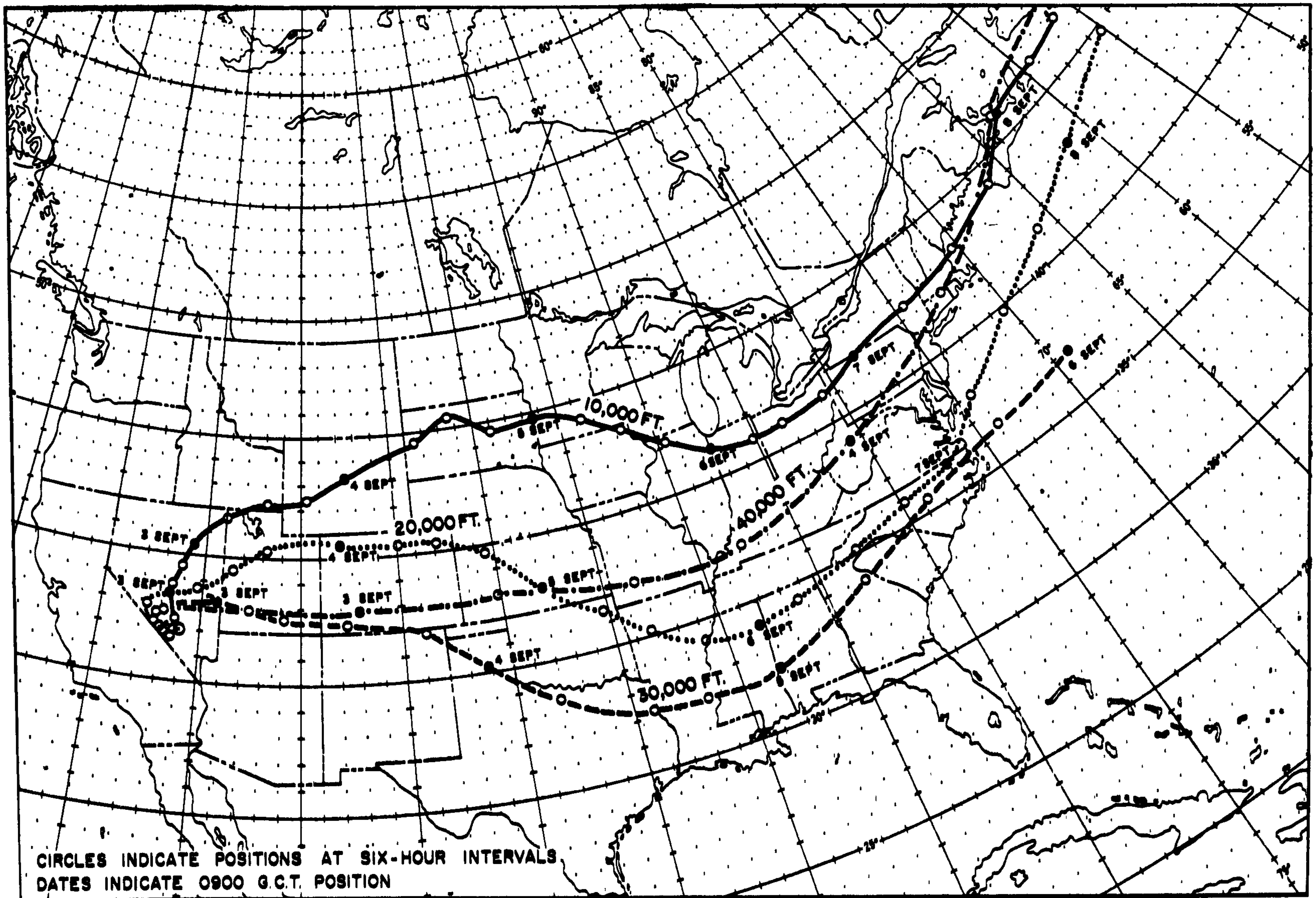
Doppler, 1230 G. C.T. August 23, 1957



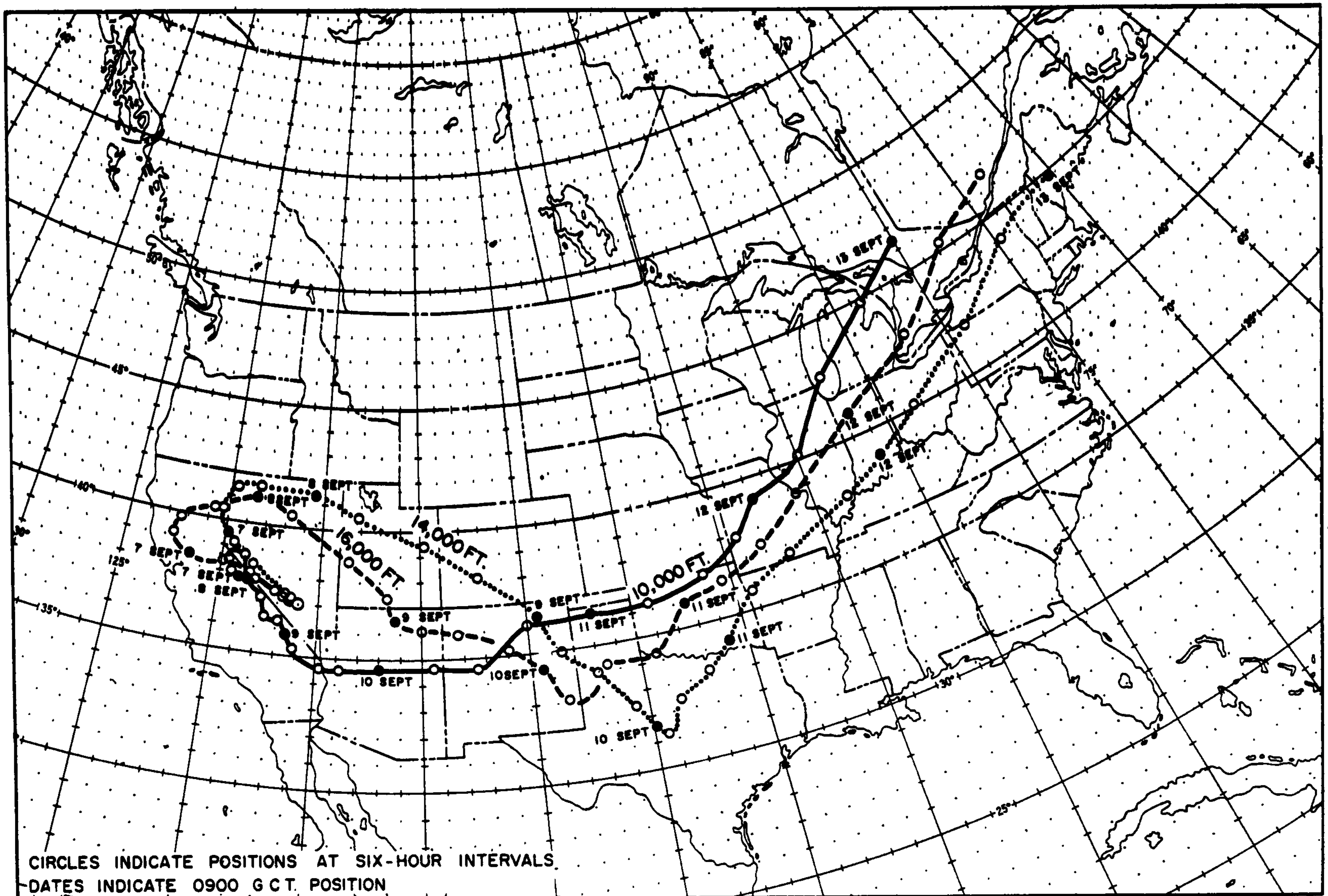
Franklin Prime, 1240 G.C.T. August 30, 1957



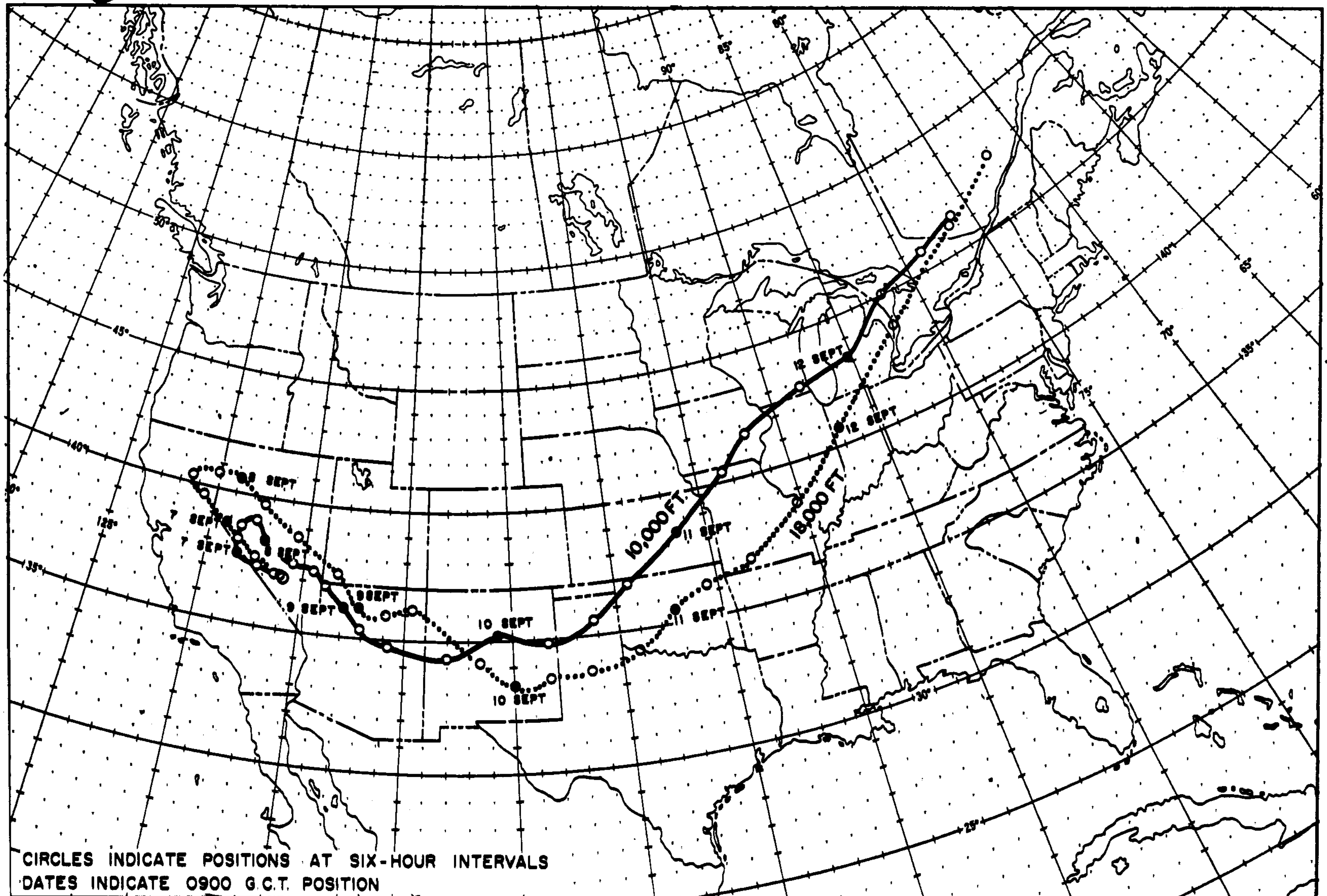
Smoky, 1230 G.C.T. August 31, 1957



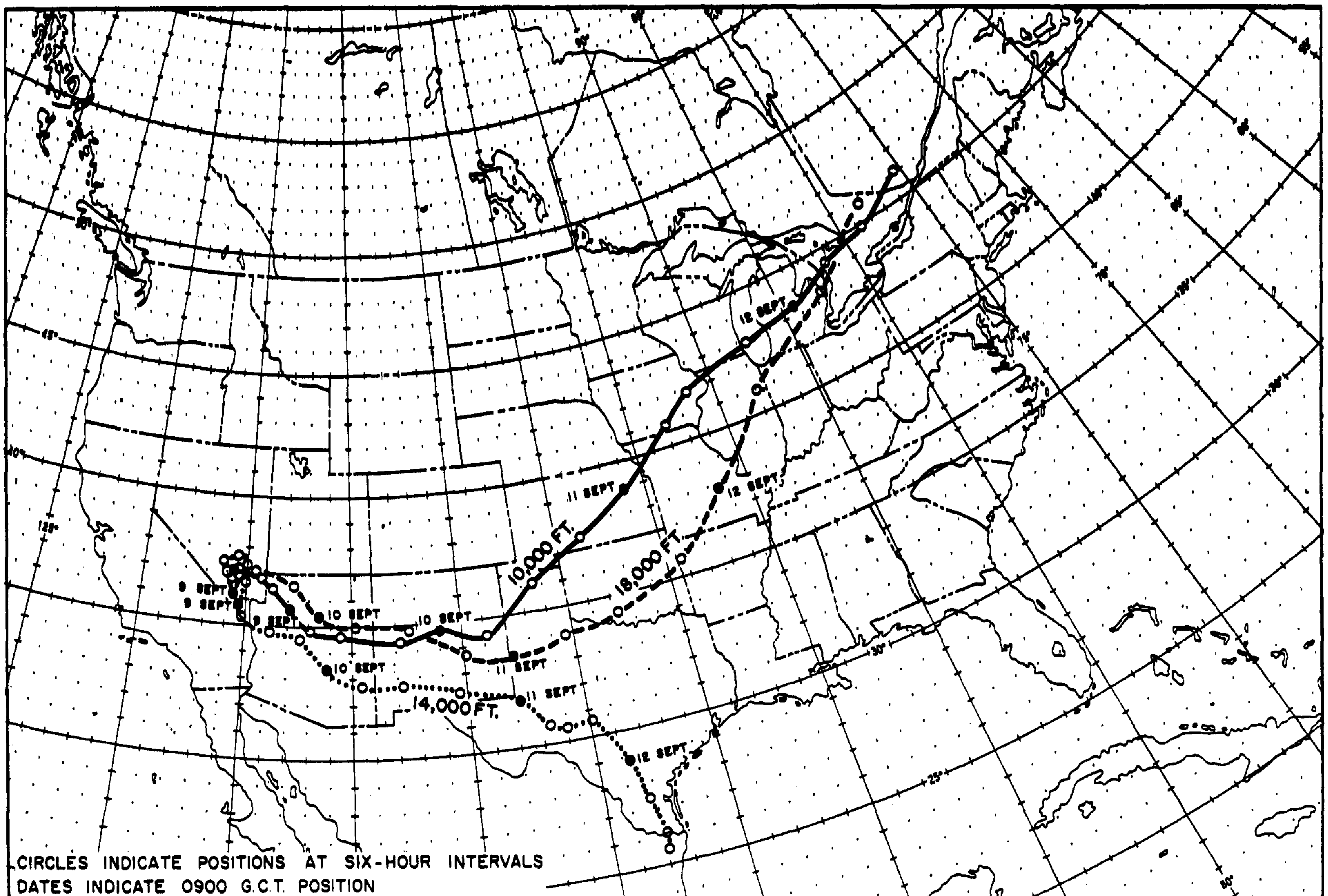
Galileo, 1240 G.C.T. September 2, 1957



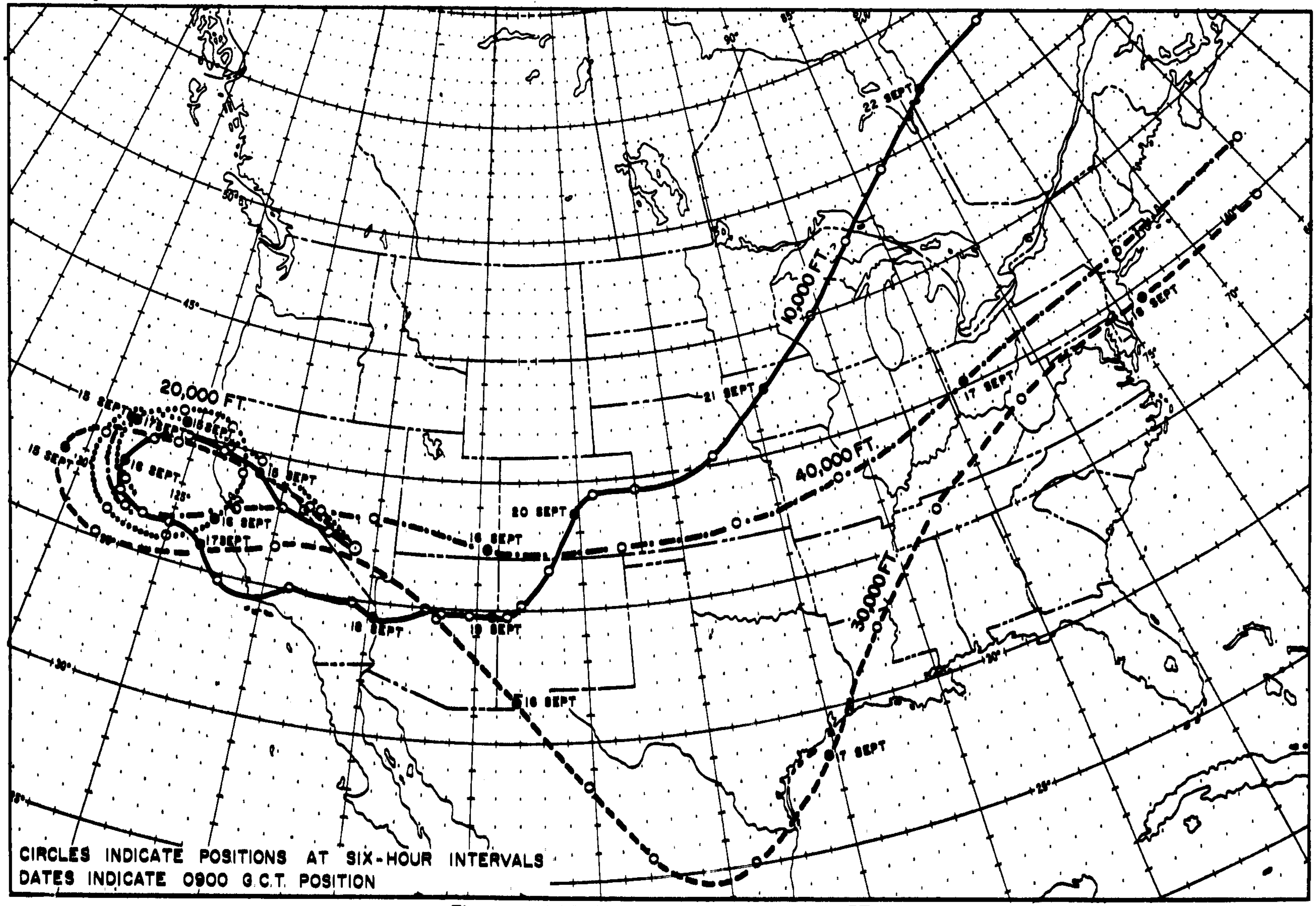
Wheeler, 1245 G. C. T. September 6, 1957



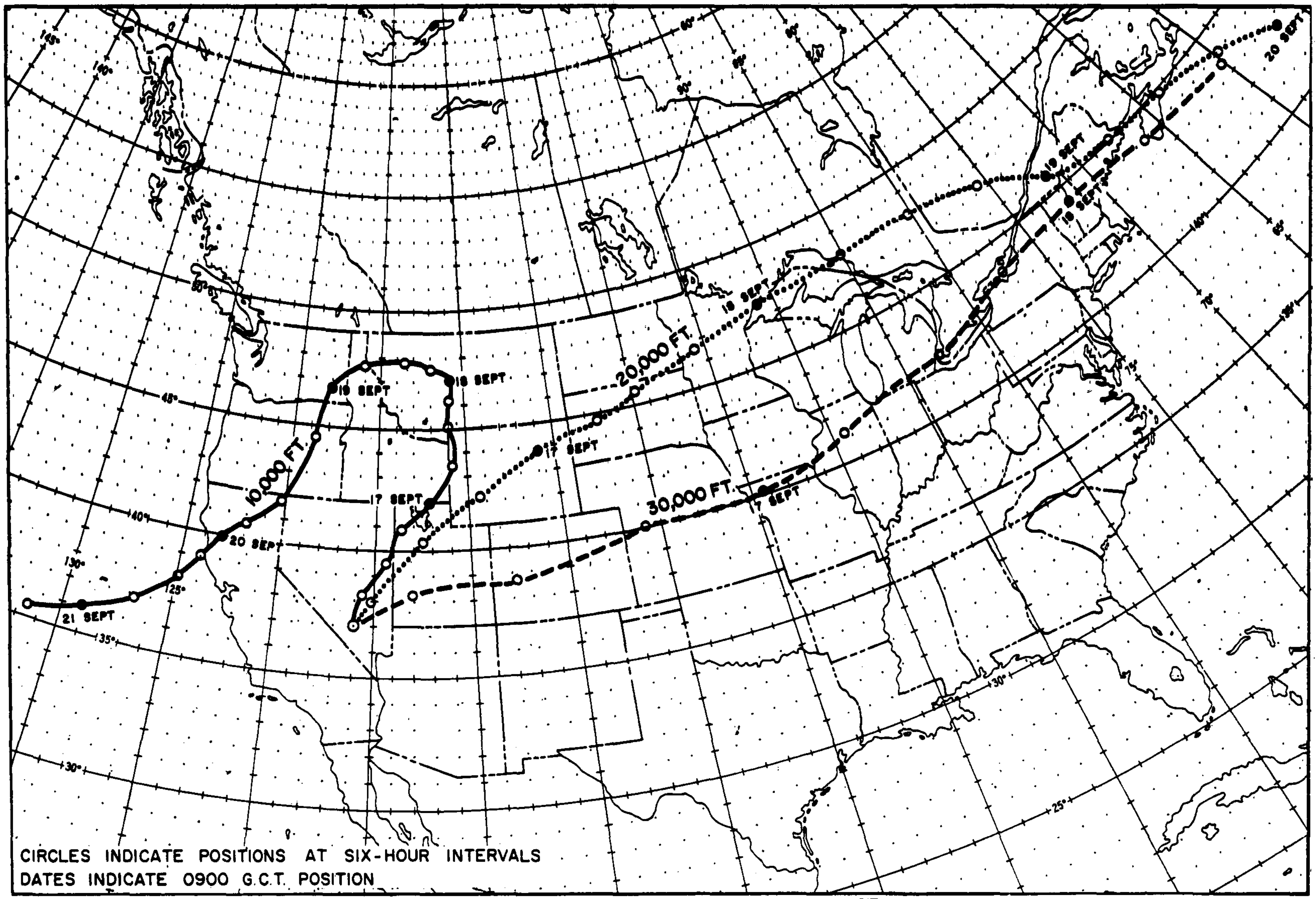
Coulomb B, 2005 G.C.T. September 6, 1957



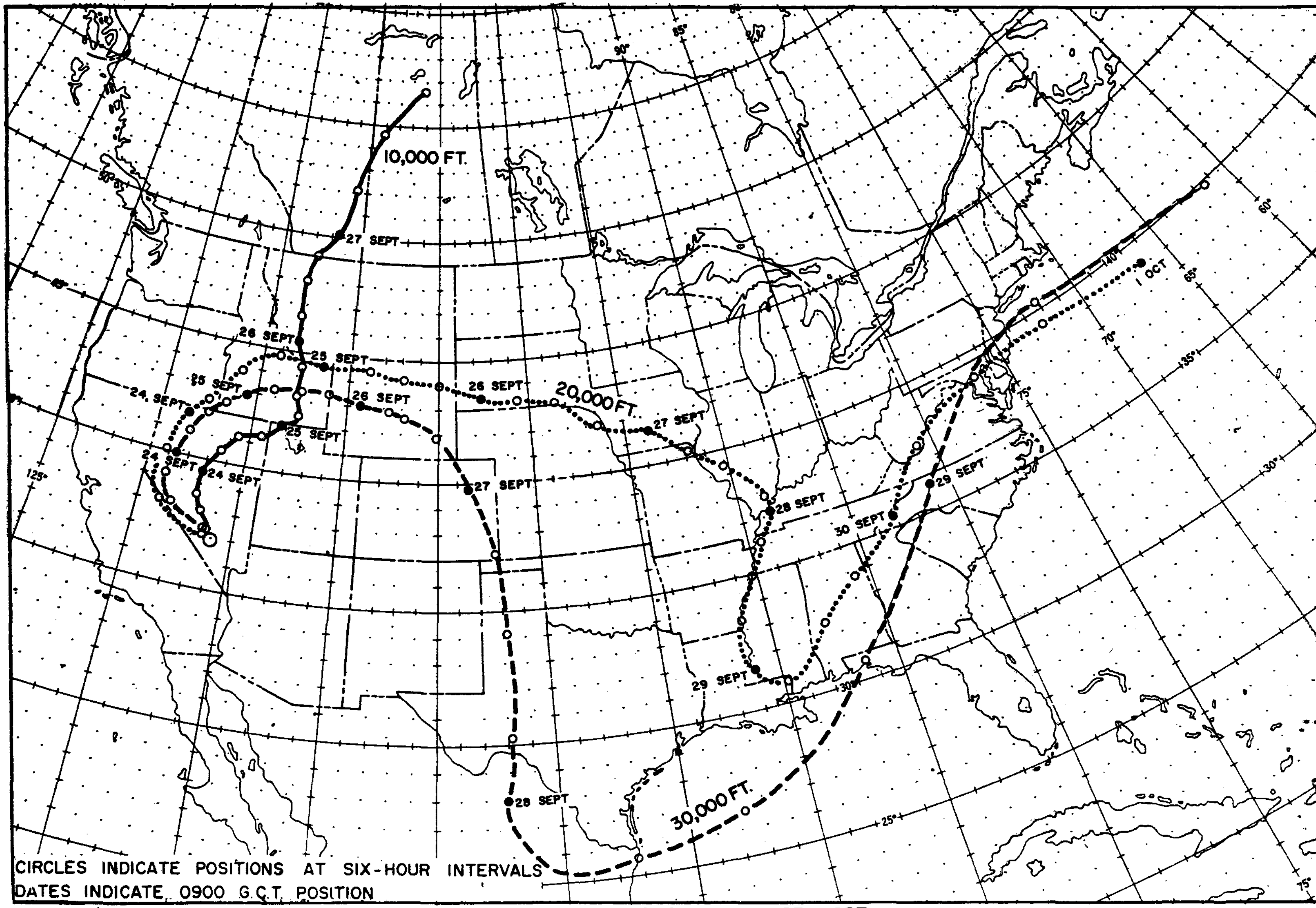
La Place, 1300 G.C.T. September 8, 1957



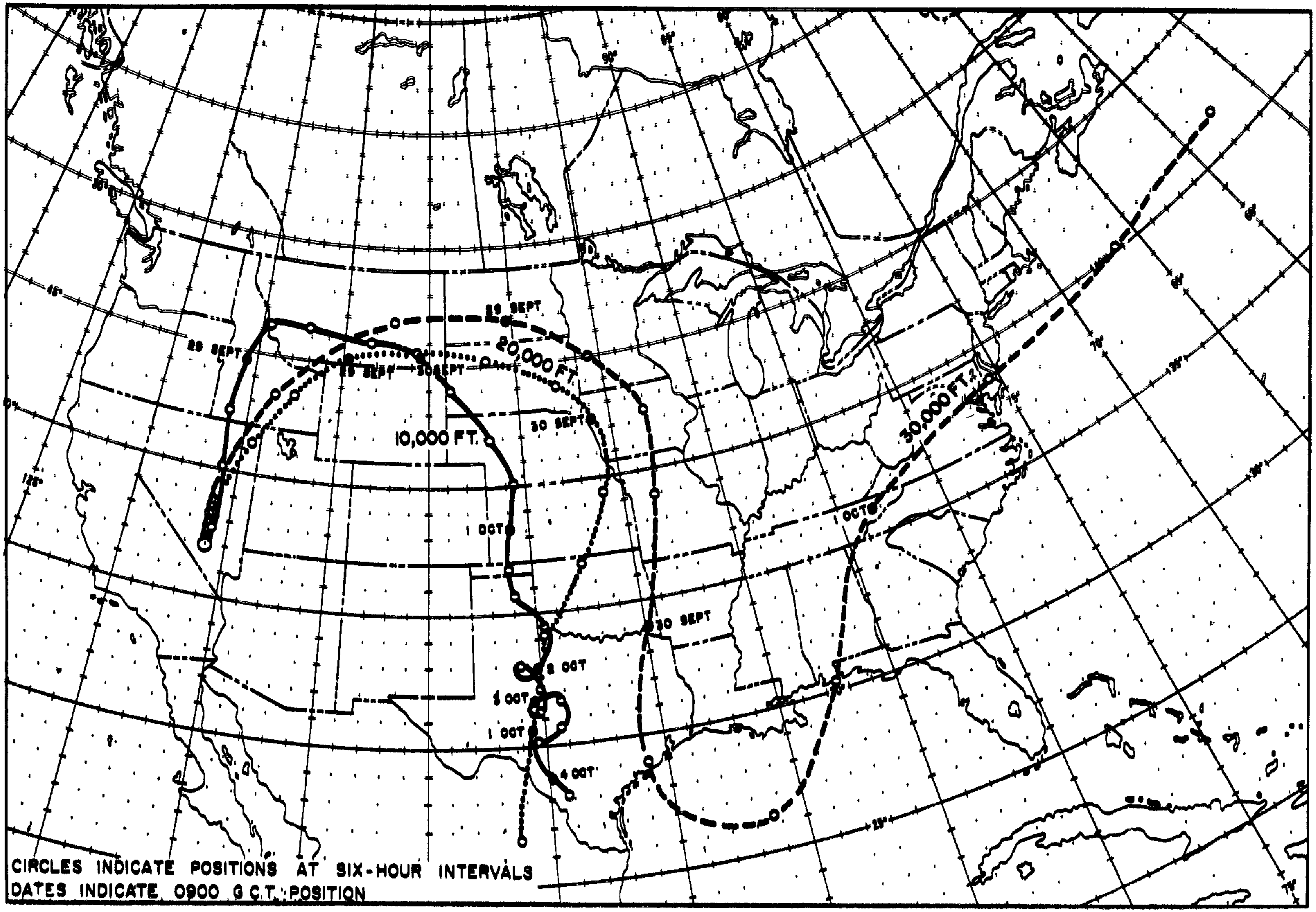
Fizeau, 1645 G. C. T. September 14, 1957



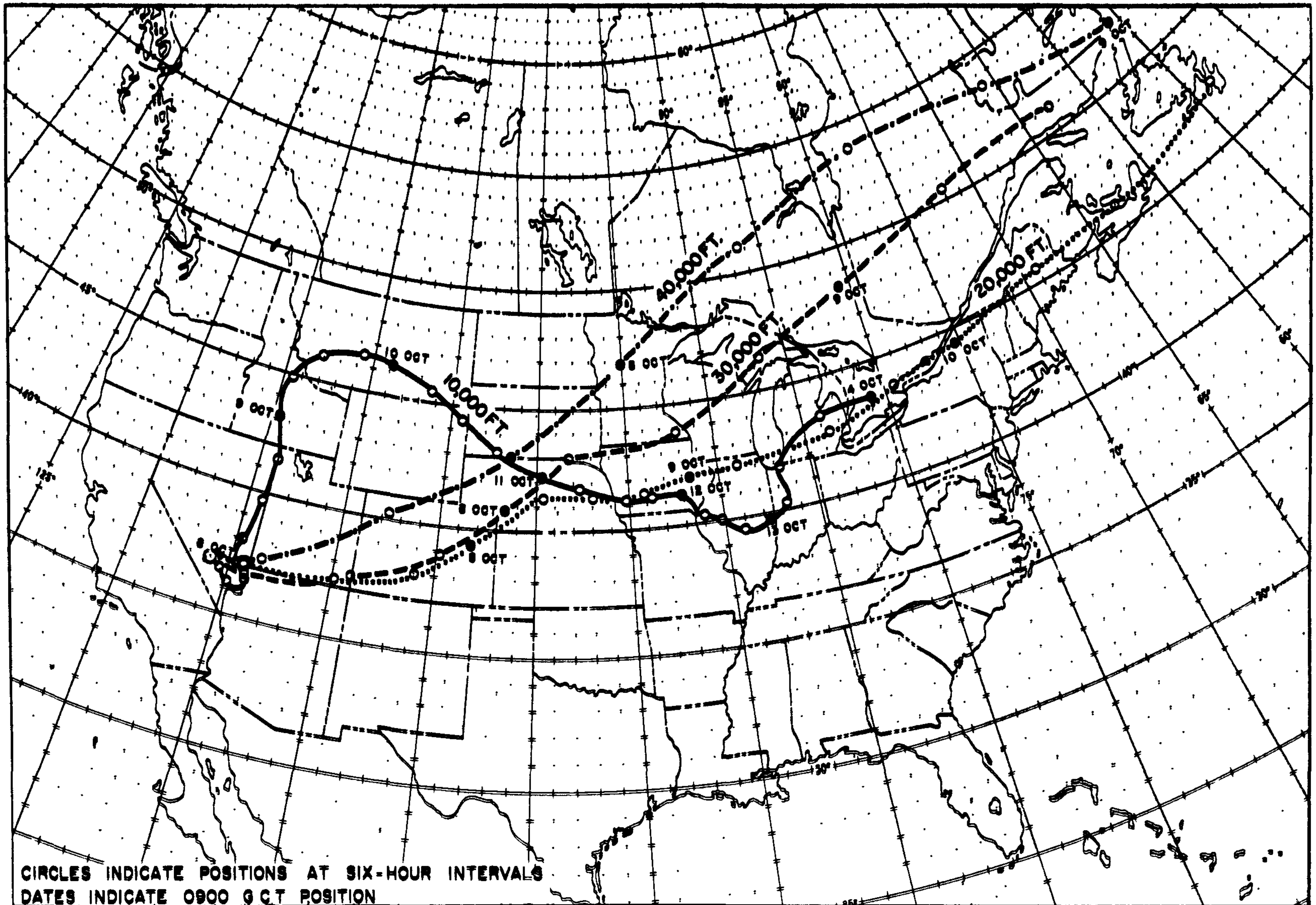
Newton, 1250 G.C.T. September 16, 1957



Whitney, 1230 G. C. T. September 23, 1957



Charleston, 1300 G. C. T. September 28, 1957



Morgan, 1300 G.C.T. October 7, 1957