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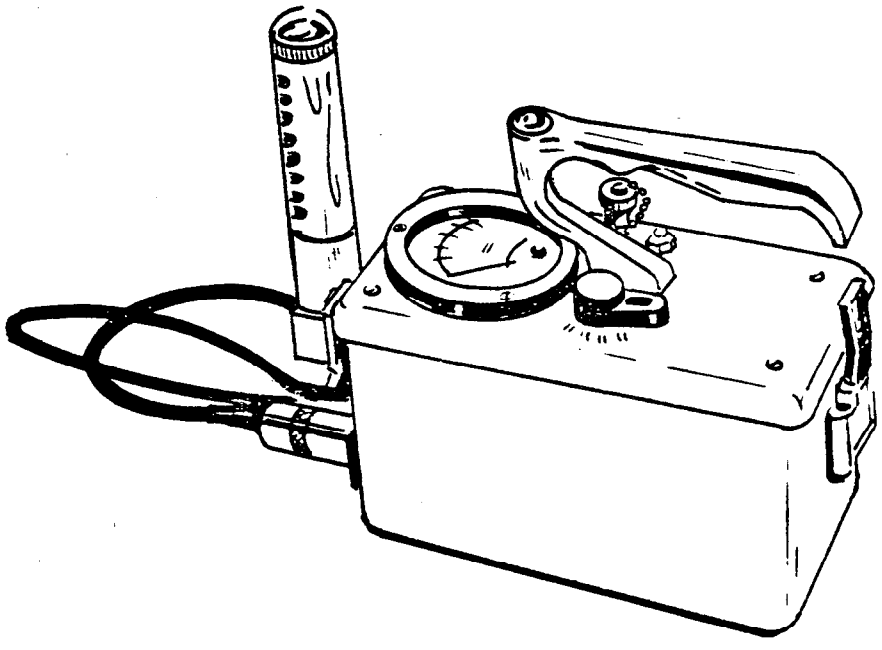
SWRHL-24r

OFF-SITE SURVEILLANCE ACTIVITIES OF THE SOUTHWESTERN RADIOLOGICAL HEALTH LABORATORY from July through December 1965

by the
Southwestern Radiological Health Laboratory
U. S. Public Health Service
Department of Health, Education, and Welfare
Las Vegas, Nevada

May 23, 1966



This surveillance performed under a Memorandum of Understanding (No. SF 54 373)
for the
U. S. ATOMIC ENERGY COMMISSION

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ABSTRACT

The Southwestern Radiological Health Laboratory of the U. S. Public Health Service performed off-site radiological surveillance for nine announced events during the period from July through December 1965. This surveillance is conducted in the public areas surrounding the Nevada Test Site under a Memorandum of Understanding with the U. S. Atomic Energy Commission. No reactor experiments were conducted during this time.

During the six month period there was no release of radioactivity which was detected off-site. Also during this period an underground test was conducted in Alaska as part of the Vela Uniform program. No radioactivity was released following this detonation.

Analysis of all sampling and surveillance performed during the six month period indicates that the safety criteria established by the Atomic Energy Commission for the off-site population were not exceeded.

TABLE OF CONTENTS

I. INTRODUCTION

During the period July through December 1965, nine announced underground nuclear tests were conducted by the U. S. Atomic Energy Commission at their Nevada Test Site as a part of Operation Flintlock. In addition, Project Longshot was conducted underground on Amchitka Island in the Aleutian Chain as part of the Vela Uniform program. The U. S. Public Health Service carried out a program of radiological surveillance of the public areas off-site for the Operational Safety Division of the AEC's Nevada Operations Office under a Memorandum of Understanding between the U. S. Atomic Energy Commission (AEC) and the U. S. Public Health Service (PHS).

The Off-Site Radiological Safety Program of the Southwestern Radiological Health Laboratory (SWRHL) conducted its program of radiological monitoring and environmental sampling in the off-site areas surrounding the restricted area enclosed within the Nevada Test Site and the Nellis Air Force Range. This overall complex of the Nevada Test Site (NTS) and the Nellis Air Force Range (NAFR) includes the Nuclear Rocket Development Station (NRDS) and the Tonopah Test Range (TTR) and for simplicity will be called the test range complex throughout this report. Although routine sampling and monitoring was done within a 300-mile radius around the test range complex, surveillance was extended as necessary to provide adequate coverage.

This report describes the methods and equipment used and summarizes the data collected during the six month period.

II. OPERATIONAL PROCEDURES

A. Ground Monitoring

Mobile monitoring teams were deployed in the off-site area before each event to locations most likely to be affected by a release of radioactive material. If a release had occurred, the teams would have conducted a ground monitoring program directed from Control Point headquarters via two-way radio communications. Ground monitoring would then continue until activity levels became too low to necessitate further monitoring.

Each monitor was equipped with an Eberline E-500B, a Precision Model 111 Standard "Scintillator", a Beckman MX-5, and a Tracerlab AN/PDR T1B. The Eberline E-500B has a range of 0 to 200 milliroentgens per hour (mR/hr) beta-gamma detection in four scales with an external halogen filled GM tube and a 0 to 2000 mR/hr range, gamma only, from an internal Anton 302 tube. The Precision Model 111 Standard "Scintillator" was used primarily for low level detection since it provides a range of 0 to 5 mR/hr in six scales. The Beckman MX-5 instrument has a range of 0 to 20 mR/hr in three scales. It is equipped with an external Geiger tube with a sliding beta shield. The Tracerlab AN/PDR T1B has a range of 0.05 to 50,000 mR/hr in five scales. This instrument employs an air ionization chamber detector, These instruments are accurate to $\pm$ 20%, and readings can be taken to two significant figures.

B. Dose Rate Recorders

To supplement the ground monitoring program, Eberline RM-11 dose rate recorders were utilized to document cloud passage at fixed locations,

thereby allowing mobile monitoring teams to continue following the release as it moved through the off-site area. These recorders utilize a Geiger tube detector and operate on 110V AC. They have a 0.01 to 100 mR/hr range and are accurate to ±20%. Gamma dose rate is recorded on a 30-hour strip chart.

C. Aerial Cloud Tracking

A PHS aerial monitoring team was available for each experiment. In the event of a radioactive release, this team, equipped with instruments identical to those used by ground monitors, tracked the effluent. Normally an Air Force U3-A aircraft is used in this tracking mission.

Aerial cloud tracking is essentially used to detect relative radiation intensities and to indicate cloud position, speed and direction. The information thus obtained is utilized to position ground monitors to insure comprehensive ground coverage and subsequently better surveillance.

D. Aerial Sampling

The aerial sampling program was performed by the Engineering Development Program of the Southwestern Radiological Health Laboratory. The program used two C-45 aircraft for cloud sampling activities. Cloud samples were collected by cryogenic, electrostatic precipitator, and mass air sampling techniques. The methods developed have resulted in measurements of cloud inventories which have been reasonably consistent with determinations made by other organizations and other methods.

E. Air Sampling

The SWRHL Air Surveillance Network operated ninety-eight stations during this six month period. The network now includes stations

operating in every state west of the Mississippi except Montana and North Dakota. Also, during October, nineteen stations were established in Alaska and the Aleutian Islands. These stations operated through October and, in some cases, into November. The air sampler used in the Air Surveillance Network is a Gelman "Tempest". The "Tempest" Air Sampler employs a Gast Model 1550 vacuum pump driven by a General Electric 1/2 hoursepower motor. The pump runs at 1440 rpm with an average flow rate of approximately 10 cfm. The sampler is equipped to use a 4" diameter Whatman 541 filter paper and an MSA charcoal cartridge. The total volume of air sampled is calculated from an average vacuum reading (which in turn indicates the average flow rate) and the total time of sampling.

F. Milk and Water Sampling

The previously established milk sampling program from both commercial dairies and private producers continued throughout the six month period. Fifty-nine sources were routinely sampled during this period, most on a monthly basis. A total of 204 samples were collected from these locations. In the event of cloud passage over a specific area, intensified sampling within the area is conducted to document changes in activity.

Water samples were collected on a routine basis, unless circumstances dictated specific source sampling. Both potable and nonpotable water supplies were sampled. During this period 218 water samples were collected from 63 sources. Most of these sources are sampled on a monthly basis.

G. Vegetation Sampling

Normally, vegetation samples are collected only in the event of a release of radioactive material. The analytical results of these samples are used to delineate the fallout pattern.

H. Film Badges

Approximately one hundred fifty residents in the off-site area wore film badge dosimeters throughout this period. These film badges were changed each month and were processed by the Radiological Sciences Department of Reynolds Electrical and Engineering Co., Inc. Approximately seventy-five station badges were also utilized to provide more complete coverage. The badge used is made of DuPont type 555 film. Dose, as determined from this film, is accurate to $\pm$50% in the 20 to 100 mR range and $\pm$10% in the 100 to 2000 mR range.

I. Public Relations

Frequent contacts with the off-site population, schools and civic groups provided the opportunity to explain the role of the Public Health Service with respect to the programs of the Atomic Energy Commission. As a result of favorable public relations, a number of off-site residents took part in the environmental sampling program; all routine air sampling stations except Las Vegas were operated by local citizens, and many people volunteered to wear film badge dosimeters.

J. Medical and Veterinarian Services

A Public Health Service medical officer was available on short notice in the event any cases of a medical nature arose as a result of the test series. No such cases were brought to the attention of the PHS.

An Army Veterinarian assigned to the NVOO, AEC, was available to the Public Health Service Off-Site Radiological Safety Program. Veterinarian services were also provided by a PHS Veterinarian. Liaison was maintained with livestock producers in the area and the program of wildlife and cattle investigation was continued.

Semi-annual slaughter of cattle from the NTS herd and the Knoll Creek and Delamar Valley herds was accomplished in cooperation with the University of Nevada. Specimens from these animals were analyzed for radionuclide content.

K. Bioenvironmental Research

Another program of the Southwestern Radiological Health Laboratory is Bioenvironmental Research. The mission of this program is, in part, to investigate the inter-relationships among the levels of radionuclide contamination of air, soil, water, vegetation and milk.

III. ANALYTICAL PROCEDURES

All air sample prefilters and charcoal cartridges were returned to the Southwestern Radiological Health Laboratory in Las Vegas for radiological analyses. Prefilters were counted for gross beta activity in a Beckman "Wide Beta" low background (6 $\pm$ 1 cpm beta) proportional system which has an efficiency of approximately 45 percent for 0.54 Mev betas. After an initial count, if no significant activity was detected, the prefilters were counted at 5 and 12 days after collection. In all other cases, prefilters were recounted a minimum of three times in the first 48 hours following collection. The computational procedure employed depends upon the assumption that a decay constant can be determined for each individual sample and that this constant can then be used to extrapolate the activity to the end of the collection period.

Each prefilter selected and all charcoal cartridges were analyzed for gamma isotopes by placing them directly on a 4"x 4" NaI(Tl) crystal coupled to a TMC Model 404C gamma pulse height analyzer viewing energies from 0 to 2 Mev.

Detection capability of the system as shown in Table 1 is an empirical estimate obtained from previous data collected under the following conditions:

a. Count time in days after fissioning as indicated by footnotes.
b. Prefilters collect unfractionated fission products resulting in a complex spectrum.
c. MSA charcoal collects gaseous fission products only (primarily iodines).
d. An eight isotope matrix is employed for computation and

isotopes other than those examined are present in amounts which are small relative to those eight.

e. Natural activity on air samples is approximately five times system background.

Table 1. Threshold detectability at time of count of several radionuclides in various samples (90% confidence level).

Sample Type	^{131}I	^{132}Te-I	^{133}I	^{135}I	^{140}Ba-La	Length of Count	Notes
Whatman No. 541	500	1000	500	1000	500	10 min.	1
(pCi)	200	--	200	--	200	10 min.	2
MSA Charcoal	200	400	200	400	200	10 min.	1
(pCi)	100	--	100	--	100	10 min.	2
3.5 liter water* (pCi/l)	20	40-50	20-30	40-50	20	40 min.	4
3.5 liter milk* (pCi/l)	20		20-30		20	40 min.	3

*Counted in 3.5 liter inverted well (Marinelli) aluminum beakers.
1 - counted at less than 3 days after fissioning.
2 - counted at 3 days or more after fissioning.
3 - with $^{137}Cs \leq 100$ pCi/l.
4 - assuming insignificant amounts of other nuclides, and all given isotopes at about detection limits to approximately 10 times the lower limit.

Although the minimum detectable levels for water samples involve the limitations listed in (d) above, the situation is usually simplified by having no background other than that of the system. For a sample containing all of the isotopes of iodine, the error term on threshold values at the 95 percent confidence level is approximately equal to $\pm$50%.

Biological discrimination will limit the number of isotopes present in a milk sample to relatively few. Under normal sampling procedures, this discrimination coupled with the short physical half life will tend

to eliminate ^{132}I and ^{135}I from the sample by the time it is counted. At the 95 percent confidence level reported values for milk are ±10 pCi/l or 10 percent at the time of count whichever is greater for a 40 minute count.

After any release of activity from the NTS, milk samples are collected from dairies (processing plants), producing dairy farms, and farms producing milk for their own consumption. Each sample is counted for 50 minutes. No attempt is made to recount samples giving low positive values. The lower limit of detection for gamma emitters in milk samples is 20 picocuries per liter (pCi/l) at the time of count, and all results below that value are reported as <20 pCi/l.

All liquid samples are counted in 3.5 liter inverted well aluminum beakers which are placed on top of a 4"x 4" crystal coupled to a 400-channel gamma pulse height analyzer. Overall detection efficiency for the 0.364 Mev photopeak of ^{131}I is 6.4 percent. A matrix technique is employed to compute the interference due to the presence of other isotopes. The input to this matrix is variable, allowing for the simultaneous determination of any eight nuclides for which detection efficiencies and interference factors have been obtained. Actual computation is performed by an IBM 1620 computer.

Water samples are analyzed for gross beta activity by slowly evaporating an aliquot to dryness in a 2" diameter stainless steel planchet and counting the beta activity in a low background counter.

IV. RESULTS

None of the nine announced detonations at the Nevada Test Site resulted in releases of radioactive effluent which was detected off-site. The underground test conducted in Alaska did not release radioactivity to the atmosphere. No reactor experiments were conducted during this period.

The only indication of positive results from sampling or monitoring during this period was in a few milk samples. Some milk samples collected north of the test range complex in early July 1965 contained ^{131}I. The activity in these samples is attributed to the Phoebus 1-A reactor experiment which was conducted on the NRDS on June 25. The results of the Phoebus experiment are discussed in detail in the "Final Report of Off-Site Surveillance for the Phoebus 1-A Experiment" (SWRHL-19r) and are summarized in "Off-Site Surveillance Activities of the Southwestern Radiological Health Laboratory from January through June 1965 (SWRHL-23r). The results of all milk sampling from July through December are listed in the Appendix.

In addition to the above mentioned milk samples, two samples collected in September and one sample collected in October contained ^{131}I. The values were on or near the detection limit for this isotope (20 pCi/l). These results cannot be attributed to any release, foreign or domestic.

Milk samples listed in the Appendix from the states of Colorado, Idaho, and Oregon are not collected routinely but are the result of activating a portion of the Standby Milk Network on a trial-run basis. This network was established to supplement the laboratory's capability

to sample milk in the event of a release of radioactivity where additional sampling is deemed necessary. Participating milk producers mail their samples to the laboratory when alerted to do so. Occasionally, as during this period, a portion of the network is activated in order to insure that the system is functioning properly.

The highest gross beta concentration on an air sample filter was 2.7 pCi/m^3 at Pahrump, Nevada in November; this value is at the level of background. No fresh fission products were found on any air sample analyzed during this period. Additionally, no fresh fission products were found in any water sample analyzed during this period. Film badges had no positive exposures which could be attributed to activities.

V. CONCLUSIONS

Results obtained through environmental radiation surveillance during this period indicate that no individual in the off-site area received an exposure, resulting from Nevada Test Site operations, which exceeded the guides established by the AEC and/or recommended by the FRC and NCRP.

APPENDIX

MILK SAMPLING RESULTS

LOCATION	DATE COL.	I131	BA140	CS137	SR89	SR90
ALAMO NEV STEWARTS DAIRY	07 02 65	2.0E1*	ND	5.5E1	5	3.
ALAMO NEV STEWARTS DAIRY	07 02 65	ND	ND	4.5E1	B	5.
ALAMO NEV STEWARTS DAIRY	07 04 65	5.0E1	ND	3.0E1	10	8.
ALAMO NEV STEWARTS DAIRY	07 05 65	ND	ND	4.0E1	B	5.
ALAMO NEV STEWARTS DAIRY	07 07 65	3.0E1	ND	4.5E1	B	9.
ALAMO NEV STEWARTS DAIRY	07 15 65	ND	ND	3.0E1	B	8.
ALAMO NEV STEWARTS DAIRY	08 05 65	ND	ND	3.0E1	B	8.
ALAMO NEV STEWARTS DAIRY	08 31 65	ND	ND	2.5E1	TOO	SOUR.
ALAMO NEV STEWARTS DAIRY	09 30 65	ND	ND	2.0E1	B	2.
ALAMO NEV STEWARTS DAIRY	11 19 65	ND	ND	2.0E1	B	6.
ALAMO NEV STEWARTS DAIRY	12 03 65	ND	ND	3.5E1	B	6.
CALIENTE NEV YOUNG RANCH	08 04 65	ND	ND	3.5E1	B	9.
CALIENTE NEV YOUNG RANCH	08 30 65	ND	ND	3.0E1	B	4.
CALIENTE NEV YOUNG RANCH	09 29 65	ND	ND	ND	B	1.
CALIENTE NEV YOUNG RANCH	11 03 65	ND	ND	1.5E1	B	4.
CALIENTE NEV YOUNG RANCH	12 07 65	ND	ND	3.5E1	B	5.
CURRANT NEV BLUE EAGLE RANCH	07 01 65	1.8E2	ND	1.3E2	10	8.
CURRANT NEV BLUE EAGLE RANCH	07 03 65	5.0E1	ND	1.0E2	B	11.
CURRANT NEV BLUE EAGLE RANCH	07 04 65	5.0E1	ND	1.1E2	25	13.
CURRANT NEV BLUE EAGLE RANCH	07 05 65	3.0E1	ND	1.2E2	25	9.
CURRANT NEV BLUE EAGLE RANCH	07 07 65	6.0E1	ND	9.0E1	B	7.
CURRANT NEV BLUE EAGLE RANCH	07 18 65	ND	ND	6.5E1	B	6.
CURRANT NEV BLUE EAGLE RANCH	09 02 65	ND	ND	1.0E1	5	5.
CURRANT NEV BLUE EAGLE RANCH	10 07 65	ND	ND	5.5E1	B	12.
CURRANT NEV BLUE EAGLE RANCH	11 18 65	ND	ND	6.5E1	B	20.
CURRANT NEV MANZONIES RANCH	07 08 65	5.0E1	ND	1.1E2	35	21.
DUCKWATER NEV HALSTEAD RANCH	07 09 65	ND	ND	2.5E1	B	9.
DUCKWATER NEV HALSTEAD RANCH	08 04 65	ND	ND	3.5E1	B	8.

*2.0E1 = $2.0 \times 10^{1} = 20$

ND = Not Detectable

B = <5

LOCATION	DATE COL.	I131	BA140	CS137	SR89	SR90
DUCKWATER NEV HALSTEAD RANCH	09 02 65	2.0E1	ND	ND	B	4.
DUCKWATER NEV HALSTEAD RANCH	10 06 65	ND	ND	ND	5	3.
DUCKWATER NEV HALSTEAD RANCH	11 17 65	ND	ND	5.5E1	B	8.
EUREKA NEV FISH CREEK RANCH	07 07 65	ND	ND	1.1E2	B	11.
EUREKA NEV FISH CREEK RANCH	09 02 65	ND	ND	1.3E2	B	7.
EUREKA NEV WILLOWS RANCH	12 01 65	ND	ND	3.5E1	B	8.
FALLON NEV CREAMLAND DAIRY	12 01 65	ND	ND	1.5E1	B	2.
FALLON NEV CREAMLAND DAIRY	12 02 65	ND	ND	2.5E1	B	7.
FALLON NEV CREAMLAND DAIRY	12 03 65	ND	ND	3.5E1	B	7.
FALLON NEV CREAMLAND DAIRY	12 04 65	ND	ND	2.0E1	NO	CHEM.
FALLON NEV CREAMLAND DAIRY	12 06 65	ND	ND	2.5E1	NO	CHEM.
FALLON NEV CREAMLAND DAIRY	12 07 65	ND	ND	2.5E1	B	4.
GENOA NEV MEADOW GOLD DAIRY	12 01 65	ND	ND	3.5E1	B	7.
GENOA NEV MEADOW GOLD DAIRY	12 03 65	ND	ND	3.0E1	NO	CHEM.
GENOA NEV MEADOW GOLD DAIRY	12 05 65	ND	ND	5.0E1	NO	CHEM.
GENOA NEV MEADOW GOLD DAIRY	12 06 65	ND	ND	2.5E1	B	7.
HIKO NEV SCHOFIELD DAIRY	07 02 65	6.0E1	ND	6.0E1	15	7.
HIKO NEV SCHOFIELD DAIRY	07 03 65	ND	ND	5.0E1	15	9.
HIKO NEV SCHOFIELD DAIRY	07 04 65	ND	ND	5.5E1	10	6.
HIKO NEV SCHOFIELD DAIRY	07 07 65	ND	ND	2.0E1	B	4.
HIKO NEV SCHOFIELD DAIRY	08 05 65	ND	ND	2.0E1	B	8.
HIKO NEV SCHOFIELD DAIRY	08 30 65	ND	ND	1.0E1	B	3.
HIKO NEV SCHOFIELD DAIRY	10 01 65	ND	ND	2.0E1	B	4.
HIKO NEV SCHOFIELD DAIRY	11 04 65	ND	ND	2.5E1	B	3.
HIKO NEV SCHOFIELD DAIRY	12 06 65	ND	ND	9.5E1	B	14.
LAS VEGAS NEV HILAND DAIRY	10 04 65	ND	ND	1.5E1	5	1.
LAS VEGAS NEV ANDERSON DAIRY	10 04 65	ND	ND	2.0E1	B	4.
LAS VEGAS NEV HINIES DAIRY	10 04 65	ND	ND	1.5E1	5	3.

LOCATION	DATE COL.	I131	BA140	CS137	SR89	SR90
LAS VEGAS NEV MG DAIRY	10 04 65	ND	ND	3.5E1	5	6.
LAS VEGAS NEV ARDEN DAIRY	10 04 65	ND	ND	3.0E1	5	16.
LATHROP WELLS NEV DANSBY RN	08 04 65	ND	ND	3.0E1	B	4.
LATHROP WELLS NEV DANSBY RN	08 25 65	ND	ND	2.0E1	B	5.
LATHROP WELLS NEV DANSBY RN	09 30 65	ND	ND	2.5E1	B	2.
LATHROP WELLS NEV DANSBY RN	10 28 65	ND	ND	ND	B	3.
LATHROP WELLS NEV DANSBY RN	12 08 65	ND	ND	3.5E1	B	3.
LOGANDALE NEV VEGAS VALLEY	12 06 65	ND	ND	4.0E1	B	5.
LUND NEVADA MCKENZIE DAIRY	07 03 65	ND	ND	4.0E1	B	8.
LUND NEVADA MCKENZIE DAIRY	07 09 65	2.0E1	ND	6.0E1	B	7.
LUND NEVADA MCKENZIE DAIRY	07 17 65	ND	ND	4.5E1	B	9.
LUND NEVADA MCKENZIE DAIRY	07 29 65	ND	ND	2.0E1	5	5.
LUND NEVADA MCKENZIE DAIRY	08 05 65	ND	ND	4.5E1	B	7.
LUND NEVADA MCKENZIE DAIRY	08 14 65	ND	ND	5.5E1	10	42.
LUND NEVADA MCKENZIE DAIRY	08 19 65	ND	ND	5.5E1	10	8.
LUND NEVADA MCKENZIE DAIRY	09 01 65	ND	ND	3.5E1	B	5.
LUND NEVADA MCKENZIE DAIRY	09 09 65	ND	ND	2.5E1	5	6.
LUND NEVADA MCKENZIE DAIRY	09 18 65	ND	ND	3.5E1	B	8.
LUND NEVADA MCKENZIE DAIRY	09 23 65	ND	ND	2.5E1	B	7.
LUND NEVADA MCKENZIE DAIRY	09 30 65	ND	ND	3.5E1	5	5.
LUND NEVADA MCKENZIE DAIRY	10 07 65	ND	ND	3.0E1	B	5.
LUND NEVADA MCKENZIE DAIRY	10 14 65	5.0E1	ND	3.0E1	B	6.
LUND NEVADA MCKENZIE DAIRY	10 22 65	ND	ND	4.0E1	B	8.
LUND NEVADA MCKENZIE DAIRY	10 30 65	ND	ND	4.5E1	B	10.
LUND NEVADA MCKENZIE DAIRY	11 05 65	ND	ND	3.0E1	B	7.
LUND NEVADA MCKENZIE DAIRY	11 13 65	ND	ND	1.5E1	B	8.
LUND NEVADA MCKENZIE DAIRY	11 24 65	ND	ND	4.5E1	B	5.
LUND NEVADA MCKENZIE DAIRY	12 04 65	ND	ND	4.0E1	B	8.

LOCATION	DATE COL.	I131	BA140	CS137	SR89	SR90
LUND NEVADA MCKENZIE DAIRY	12 11 65	ND	ND	4.5E1	5	6.
LUND NEVADA MCKENZIE DAIRY	12 17 65	ND	ND	4.0E1	B	10.
LUND NEVADA MCKENZIE DAIRY	12 24 65	ND	ND	3.0E1	5	7.
LUND NEV MCKENZIE DAIRY	12 31 65	ND	ND	2.0E1	5	4.
MESQUITE NEV HUGHES BROS DAIRY	11 02 65	ND	ND	1.5E1	B	6.
MESQUITE NEV HUGHES BROS DAIRY	12 01 65	ND	ND	4.5E1	B	9.
MOAPA NEV SEARLES DAIRY	08 05 65	ND	ND	4.0E1	B	5.
MOAPA NEV SEARLES DAIRY	08 30 65	ND	ND	3.5E1	B	3.
MOAPA NEV SEARLES DAIRY	10 01 65	ND	ND	3.5E1	SMPLE	LOST.
MOAPA NEV SEARLES DAIRY	11 04 65	ND	ND	3.0E1	B	5.
MOAPA NEV SEARLES DAIRY	12 08 65	ND	ND	4.0E1	B	4.
NYALA NEV SHARP'S RANCH	07 07 65	ND	ND	9.0E1	10	9.
NYALA NEV SHARP'S RANCH	09 29 65	ND	ND	4.0E1	B	7.
NYALA NEV SHARP'S RANCH	10 05 65	ND	ND	7.0E1	5	9.
NYALA NEV SHARP'S RANCH	12 07 65	ND	ND	8.0E1	B	11.
PIOCHE NEV HORLACHERS RN	07 07 65	ND	ND	6.5E1	10	10.
PIOCHE NEV HORLACHERS RN	08 05 65	ND	ND	3.0E1	B	7.
PIOCHE NEV HORLACHERS RN	08 29 65	ND	ND	5.0E1	B	5.
PIOCHE NEV HORLACHERS RN	09 30 65	ND	ND	6.0E1	B	5.
PIOCHE NEV HORLACHERS RN	11 03 65	ND	ND	7.0E1	B	11.
PIOCHE NEV HORLACHERS RN	12 07 65	ND	ND	8.5E1	B	14.
RENO NEV MODEL DAIRY	11 30 65	ND	ND	3.5E1	B	7.
RENO NEV MODEL DAIRY	12 01 65	ND	ND	3.5E1	B	4.
RENO NEV MODEL DAIRY	12 02 65	ND	ND	3.5E1	NO	CHEM.
RENO NEV MODEL DAIRY	12 03 65	ND	ND	2.5E1	B	5.
RENO NEV VELVET CRESCENT CRMY	12 03 65	ND	ND	2.5E1	NO	CHEM.
RENO NEV VELVET CRESCENT CRMY	12 05 65	ND	ND	1.5E1	NO	CHEM.
RENO NEV VELVET CRESCENT CRMY	12 06 65	ND	ND	3.5E1	B	7.

LOCATION	DATE COL.	I131	BA140	CS137	SR89	SR90
RENO NEV VELVET CRESCENT CRMY	12 04 65	ND	ND	3.0E1	B	5.
SPRINGDALE NEV PEACOCK RN	07 07 65	ND	ND	5.0E1	5	3.
SPRINGDALE NEV PEACOCK RN	08 25 65	ND	ND	4.5E1	B	4.
SPRINGDALE NEV PEACOCK RN	09 28 65	ND	ND	7.5E1	B	5.
SPRINGDALE NEV PEACOCK RN	12 01 65	ND	ND	3.5E1	B	3.
YERRINGTON NEV VALLEY DAIRY	12 01 65	ND	ND	5.0E1	B	6.
ALAMOSA COLO ALAMOSA MILK CO	09 29 65	ND	ND	1.5E1	5	7.
BRUSH COLO MCLAGAN BROS CRMY	09 27 65	ND	ND	3.0E1	B	9.
COLORADO SPRINGS COLO SINTON D	09 27 65	ND	ND	3.0E1	5	2.
COLORADO SPRINGS COLORADO	09 28 65	ND	ND	3.5E1	B	13.
CRAIG COLO YAMPA VALLEY DAIRY	09 28 65	ND	ND	4.5E1	B	16.
CRAIG COLO YAMPA VALLEY DAIRY	09 28 65	ND	ND	2.5E1	B	10.
CRAIG COLO YAMPA VALLEY DAIRY	09 30 65	ND	ND	4.0E1	5	19.
CRAIG COLO YAMPA VALLEY DAIRY	09 30 65	ND	ND	4.0E1	B	9.
CRAIG COLO YAMPA VALLEY DAIRY	10 02 65	ND	ND	2.5E1	5	6.
CRAIG COLO YAMPA VALLEY DAIRY	10 02 65	ND	ND	6.0E1	5	17.
CRAIG COLO YAMPA VALLEY DAIRY	10 03 65	ND	ND	4.0E1	B	17.
DELTA COLORADO ARDEN M G DAIRY	09 28 65	ND	ND	2.5E1	B	5.
GLENWOOD SPR COLO GLWD SPR CRMY	09 28 65	ND	ND	3.5E1	B	10.
GRAND JCT COLORADO CLYMER DAIRY	09 28 65	ND	ND	1.5E1	B	8.
MONTE VISTA COLO SUNRISE DAIRY	09 30 65	ND	ND	3.0E1	B	12.
SALIDA COLO MONARCH DAIRY	09 27 65	ND	ND	2.5E1	B	8.
GRANGEVILLE IDA R TERHAAR RN	09 19 65	ND	ND	4.0E1	5	24.
GRANGEVILLE IDA LEWIS STUB RN	09 19 65	ND	ND	5.0E1	5	33.
GRANGEVILLE IDA AL FREI RN	09 20 65	ND	ND	5.0E1	B	16.
GRANGEVILLE IDA FREI STUB TER	09 20 65	ND	ND	4.5E1	B	24.
ALBANY OREGON SNOW PEAK DAIRY	12 06 65	ND	ND	3.0E1	B	14.
ALBANY OREGON SNOW PEAK DAIRY	12 08 65	ND	ND	4.5E1	NO	CHEM.

LOCATION	DATE COL.	I131	BA140	CS137	SR89	SR90
ALBANY OREGON SNOW PEAK DAIRY	12 09 65	ND	ND	5.0E1	NO	CHEM.
ALBANY OREGON SNOW PEAK DAIRY	12 10 65	ND	ND	4.0E1	B	14.
ALBANY OREGON SNOW PEAK DAIRY	12 11 65	ND	ND	6.0E1	NO	CHEM.
ALBANY OREGON SNOW PEAK DAIRY	12 11 65	ND	ND	5.0E1	NO	CHEM.
ALBANY OREGON SNOW PEAK DAIRY	12 13 65	ND	ND	4.0E1	B	13.
ASTORIA OREGON DARIGOLD DAIRY	12 01 65	ND	ND	2.2E2	B	33.
BROOKINGS OREGON SEAVIEW DAIRY	12 06 65	ND	ND	6.0E1	B	30.
BROOKINGS OREGON SEAVIEW DAIRY	12 08 65	ND	ND	5.0E1	B	47.
COOS BAY OREGON BROOKMEAD DAIRY	12 02 65	ND	ND	7.0E1	B	56.
CORVALLIS OREGON O S U DAIRY	12 03 65	ND	ND	4.0E1	B	9.
CORVALLIS OREGON SUNNY BROOK D	12 01 65	ND	ND	3.0E1	B	11.
EUGENE OREGON ECHO SPRING DAIRY	12 01 65	ND	ND	3.0E1	B	10.
EUGENE OREGON ECHO SPRING DAIRY	12 02 65	ND	ND	3.0E1	NO	CHEM.
EUGENE OREGON ECHO SPRING DAIRY	12 03.65	ND	ND	5.0E1	NO	CHEM.
EUGENE OREGON ECHO SPRING DAIRY	12 04 65	ND	ND	3.0E1	NO	CHEM.
EUGENE OREGON ECHO SPRING DAIRY	12 05 65	ND	ND	3.5E1	B	10.
EUGENE OREGON ECHO SPRING DAIRY	12 06 65	ND	ND	3.5E1	NO	CHEM.
EUGENE OREGON EUGENE FARMERS CR	12 06 65	ND	ND	6.0E1	NO	CHEM.
GRANTS PASS OREGON ARDEN FARMS	11 30 65	ND	ND	3.0E1	B	9.
MEDFORD OREGON JORGENSENS DAIRY	12 01 65	ND	ND	3.0E1	B	9.
REEDSPORT OREGON REEDSPORT CRMY	11 30 65	ND	ND	3.5E1	B	12.
ROSEBURG OREGON UMPQUA DAIRY	12 01 65	ND	ND	3.5E1	B	10.
SALEM OREGON CURLYS DAIRY	12 01 65	ND	ND	5.0E1	B	15.
TILLAMOOK OREGON TILLAMOOK D	12 02 65	ND	ND	1.2E2	B	27.
GARRISON UTAH GONDERS RANCH	07 07 65	ND	ND	4.0E1	B	6.
GARRISON UTAH GONDERS RANCH	08 04 65	ND	ND	2.0E1	B	3.
GARRISON UTAH GONDERS RANCH	09 01 65	ND	ND	1.0E1	B	3.
GARRISON UTAH GONDERS RANCH	10 05 65	ND	ND	4.0E1	B	6.

LOCATION	DATE COL.	I131	BA140	CS137	SR89	SR90
GARRISON UTAH GONDERS RANCH	11 16 65	ND	ND	3.0E1	B	6.
GARRISON UTAH GONDERS RANCH	12 21 65	ND	ND	4.0E1	B	6.
NEW CASTLE UTAH NEW CASTLE D	07 01 65	ND	ND	5.0E1	B	8.
NEW CASTLE UTAH NEW CASTLE D	08 02 65	ND	ND	4.0E1	B	14.
NEW CASTLE UTAH NEW CASTLE D	08 24 65	ND	ND	3.0E1	5	4.
NEW CASTLE UTAH NEW CASTLE D	09 21 65	ND	ND	1.0E1	B	6.
NEW CASTLE UTAH NEW CASTLE D	11 10 65	ND	ND	2.5E1	B	6.
NEW CASTLE UTAH NEW CASTLE D	12 01 65	ND	ND	3.0E1	B	5.
ST GEORGE UTAH R COX DAIRY	07 02 65	ND	ND	6.5E1	B	11.
ST GEORGE UTAH R COX DAIRY	07 09 65	ND	ND	6.0E1	B	13.
ST GEORGE UTAH R COX DAIRY	07 16 65	ND	ND	4.5E1	B	8.
ST GEORGE UTAH R COX DAIRY	07 22 65	ND	ND	5.0E1	B	8.
ST GEORGE UTAH R COX DAIRY	07 29 65	ND	ND	4.5E1	B	6.
ST GEORGE UTAH R COX DAIRY	08 06 65	ND	ND	4.0E1	B	9.
ST GEORGE UTAH R COX DAIRY	08 12 65	ND	ND	6.0E1	B	12.
ST GEORGE UTAH R COX DAIRY	08 20 65	ND	ND	6.5E1	B	12.
ST GEORGE UTAH R COX DAIRY	08 27 65	ND	ND	4.5E1	B	11.
ST GEORGE UTAH R COX DAIRY	09 03 65	2.0E1	ND	4.5E1	B	8.
ST GEORGE UTAH R COX DAIRY	09 10 65	ND	ND	4.5E1	B	9.
ST GEORGE UTAH R COX DAIRY	09 17 65	ND	ND	5.0E1	B	14.
ST GEORGE UTAH R COX DAIRY	09 23 65	ND	ND	5.0E1	B	8.
ST GEORGE UTAH R COX DAIRY	09 30 65	ND	ND	3.5E1	B	6.
ST GEORGE UTAH R COX DAIRY	10 08 65	ND	ND	1.5E1	B	7.
ST GEORGE UTAH R COX DAIRY	10 15 65	ND	ND	2.5E1	B	6.
ST GEORGE UTAH R COX DAIRY	10 21 65	ND	ND	2.0E1	B	5.
ST GEORGE UTAH R COX DAIRY	10 29 65	ND	ND	3.0E1	B	8.
ST GEORGE UTAH R COX DAIRY	11 05 65	ND	ND	3.0E1	B	7.
ST GEORGE UTAH R COX DAIRY	11 12 65	ND	ND	3.0E1	B	6.

LOCATION	DATE COL.	I131	BA140	CS137	SR89	SR90
ST GEORGE UTAH R COX DAIRY	11 19 65	ND	ND	6.0E1	B	6.
ST GEORGE UTAH R COX DAIRY	11 26 65	ND	ND	1.5E1	B	7.
ST GEORGE UTAH R COX DAIRY	12 03 65	ND	ND	2.0E1	B	6.
ST GEORGE UTAH R COX DAIRY	12 10 65	ND	ND	2.5E1	B	7.
ST GEORGE UTAH R COX DAIRY	12 17 65	ND	ND	2.5E1	5	4.
ST GEORGE UTAH R COX DAIRY	12 24 65	ND	ND	2.0E1	B	6.
ST GEORGE UTAH R COX DAIRY	12 31 65	ND	ND	3.5E1	B	6.

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