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OFF-SITE SURVEILLANCE ACTIVITIES OF THE
SOUTHWESTERN RADIOLOGICAL HEALTH LABORATORY
from January through June 1965

#52 I INTRODUCTION

During the period January through June 1965, sixteen announced underground nuclear tests were conducted by the U. S. Atomic Energy Commission at their Nevada Test Site as a part of Operation Whetstone. In addition, five reactor experiments were conducted on the Nuclear Rocket Development Station. 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 over-all 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.

II OPERATIONAL AND ANALYTICAL PROCEDURES

The procedures employed by SWRHL for monitoring, sampling, and analyzing samples were reported with the surveillance activities report covering the period July through December 1964 and will not be repeated here.

III RESULTS

A. Underground tests

Three of the sixteen announced events resulted in releases of radioactive effluent which was detected in off-site populated areas. These were the Palanquin Event, a Plowshare experiment conducted on April 14, 1965, the Tee Event conducted on May 7, and the Diluted Waters Event conducted on June 16.

1. Palanquin

Project Palanquin was conducted on April 14, 1965 at 0514 hours. The maximum off-site net gamma dose rate observed was 3 mR/hr at Stone Cabin Ranch, north of the test range complex, and the maximum exposure on any film badge was 45 mR at the same location. 23,000 pCi/m³ of gross beta and 3400 pCi/m³ of ¹³¹I were the maximum concentrations of fresh fission products found on any air filter at an off-site populated location. These filters were from the sampler at Clarks Station, Nevada. The maximum concentration of ¹³¹I found in a milk sample was 11,000 pCi/l (Martin's Ranch, 35 miles SW of Eureka, Nevada) and the maximum ¹³¹I found in a water supply used for human consumption was 70 pCi/l (Stone Cabin Ranch). Selected off-site residents were brought to Las Vegas for whole body counting and the maximum measured thyroid exposure was 162 mR.

The only film badges showing positive exposures following the Palanquin Event were station badges. No personnel

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Tee?
was not
detected
in populated
location
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badges showed exposures which could be attributed to this release. Table 1 lists the station badges with positive results.

Table 1. Positive station film badge results.

| Location | Exposure Period | Dose(mR) |
|---|-----------------|----------|
| Highway 25(6.5 mi E of Warm Spgs. on Hwy 25) | 3/30/65-4/24/65 | 35* |
| Clark Station | 4/14/65-4/24/65 | 35 |
| Saulsbury Wash Road at Hwy 6(24 mi E of Tonopah on Hwy 6) | 4/14/65-4/24/65 | 30 |
| Stone Cabin Ranch | 4/14/65-4/24/65 | 30 |
| | 3/31/65-5/06/65 | 45 |
| | 3/31/65-5/06/65 | 45 |
| | 3/31/65-5/06/65 | 35 |
| | 3/31/65-5/06/65 | 25 |
| | 3/31/65-5/06/65 | 30 |

*Film badge believed to be affected by environmental damaging effects.

The air samples showing the highest concentrations of radionuclides were found along Highway 6 between Tonopah and Warm Springs, Nevada. Other samples, such as those from Boise, Idaho and Wendover, Utah contained low but perceptible changes in gross beta activity. The four samples with the highest radioiodine concentrations are shown in Table 2.

Table 2. Four air samples containing highest concentrations of radioiodines from the Palanquin Event.

| Location | Sampling Time and Date | Gross Beta pCi/m ³ | Radionuclide Analysis (pCi/m ³) | | | |
|--------------------------------|---------------------------|-------------------------------|---|------------------|------------------|------------------|
| | | | ¹³¹ I | ¹³² I | ¹³³ I | ¹³⁵ I |
| Warm Spgs. (F) | 4/14, 0600- 4/14, 1405 | 1.8E4* | 3.2E3 | 5.9E3 | 1.9E4 | 2.3E4 |
| Warm Spgs. (C) | 4/14, 0600- 4/14, 1405 | - | 5.3E2 | 2.1E2 | 3.9E3 | 8.6E3 |
| Potts (F) | 4/14, 1315- 4/15, 1250 | 3.7E3 | 5.1E2 | 5.1E2 | 1.2E3 | 6.6E2 |
| Potts (C) | 4/14, 1315- 4/15, 1250 | - | 7.2E1 | 2.9E1 | 4.0E2 | 1.6E2 |
| Clark Stn. (F) | 4/14, 0412- 4/14, 1615 | 2.3E4 | 3.4E3 | 4.0E3 | 1.0E4 | 2.2E4 |
| Clark Stn. (C) | 4/14, 0412- 4/14, 1615 | - | 6.7E2 | 3.0E2 | 6.1E3 | 9.5E3 |
| Hwy 6, 8 mi E of TTR Rd (F) | 4/14, 1115- 4/14, 1235 | 8.7E4 | 8.2E3 | 8.6E3 | 3.3E4 | 9.1E4 |
| Hwy 6, 8 mi E of TTR Rd (C) | 4/14, 1115- 4/14, 1235 | - | 4.2E3 | 1.6E3 | 3.2E4 | 7.3E4 |

*1.8E4 = 1.8x10⁴ = 18,000

F - Whatman 541 filter

C - MSA Charcoal cartridge

Gross beta and radionuclide data extrapolated to end of collection period.

A total of 100 potable and nonpotable water samples were collected for the Palanquin surveillance. A tap water sample collected on April 18, 1965 near Warm Springs, Nevada, contained 70 pCi/l of ¹³¹I. This is the highest concentration of fresh fission products found in any water sample from a water supply known to be used for human consumption.

Although it was quickly apparent that no milk supplies would be contaminated by this event to the 84,000 pCi/l level at which the Federal Radiation Council recommends protective action, the Public Health Service deemed it desirable to substitute uncontaminated milk for contaminated milk at certain locations. This was done in order to limit radiation exposure as much as possible and because the projected infant thyroid dose from radioiodine at some locations, such as Martin's Ranch (see Appendix) near Eureka, exceeded the 0.5 rad value recommended in AEC Manual, Chapter 0524, "Standards for Radiation Protection".¹ Using Table 1 in Report No. 5 of the Federal Radiation Council,² the 11,000 pCi/l of ¹³¹I at Martin's gives a projected infant thyroid dose of about one rad. Since the above mentioned protective action was instituted at the time of the peak concentration of ¹³¹I in the milk, the projected thyroid dose to infants at this location would be approximately 20 to 25% of one rad.

The eleven highest concentrations of ¹³¹I in milk, from separate locations, are listed in Table 3.

- 1 AEC Manual Chapter 0524 Standards for Radiation Protection (revised 1963). U. S. Atomic Energy Commission (1963).
- 2 Report No. 5 Background Material for the Development of Radiation Protection Standards. Staff Report of the Federal Radiation Council U. S. Government Printing Office (1964).

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report
dtd. 3/3/66

Area

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with what's
GMS

Table 3. Highest milk results following Palanquin.

| Location | Date Collected | ¹³¹ I (pCi/l) |
|---|----------------|-----------------------------|
| Eureka, Nevada Martin Ranch | 4/19/65 | 11,000 |
| Paradise Valley, Nevada Pasquale-Richard | 4/20/65 | 5,500 |
| Paradise Valley, Nevada Boggio Ranch | 4/20/65 | 4,100 |
| Ione, Nevada O'Toole Ranch | 4/17/65 | 2,700 |
| Manhattan, Nevada Pine Creek Ranch | 4/17/65 | 2,100 |
| Clarks Station, Nevada | 4/17/65 | 1,900 |
| Manhattan, Nevada Peavine Ranch | 4/16/65 | 1,800 |
| Warm Springs, Nevada Stone Cabin Ranch | 4/17/65 | 1,800 |
| Round Mountain, Nevada J-Bar Nielson Ranch | 4/16/65 | 730 |
| Battle Mountain, Nevada E L Fuller Ranch | 4/19/65 | 670 |
| Winnemucca, Nevada Amos Bros. Ranch | 4/21/65 | 590 |

2. Tee

The Tee Event, conducted on May 7, 1965, released radioactive contamination that crossed the southern border of the Nevada Test Site and passed over Highway 95 along a 15-mile sector from 11 miles east of the junction of Highway 95 and the Mercury turnoff, to 4 miles west of this junction.

Gamma dose rates above background were detected by ground monitors along Highway 95 from 4 miles west of the junction of Highway 95 and the Mercury turnoff, to 11 miles east of the junction.

Readings were low (0.04 mR/hr net gamma or below) and the cloud passage time was from approximately 1100 to 1200 hours PDT. Readings observed along this 15-mile stretch of Highway 95 were barely detectable above background.

The maximum reading of 0.04 mR/hr net gamma was observed 4 miles east of the Mercury turnoff on Highway 95 at 1108 hours.

Charcoal cartridges from eight air samplers were analyzed for specific gamma emitting isotopes as were the prefilters from the two Las Vegas stations. No fresh fission products (^{131}I , ^{132}I , ^{133}I , ^{135}I) were detected on these samples.

The maximum gross beta activity on a prefilter was 28.0 pCi/m³ taken from the sampler located 4 miles east of the Mercury turnoff on Highway 95 (unpopulated).

No milk or water samples were collected for this event.

*was
not
detected
in a
populated
off site
location!*

3. Diluted Waters

A visible cloud of radioactive effluent formed immediately after detonation of the Diluted Waters device on June 16, 1965. Collapse occurred within five minutes and sealed off further venting. Winds in the area were light and variable and the released effluent remained within ten miles of Ground Zero for over an hour. Penetration into the off-site area did not occur until approximately 1600 hours at which time the remaining effluent was moving slowly toward the northeast.

Ground monitors were operating along Highway 25 from Hiko Junction to just southeast of Queen City Summit. Two monitors were located in Penoyer Valley approximately ten miles due south of Queen City Summit.

When no readings above background were observed by 1500 hours, the ground monitors moved back to the test range complex. At 1530 hours the ground monitors encountered the effluent along the northeastern boundaries of the test range complex. Two readings of 0.02 mR/hr (net gamma) were observed. Due to the low levels encountered, the ground monitors were directed to terminate the mission.

Charcoal cartridges from air samplers operating at Alamo, Hiko and Ely, Nevada were analyzed for specific gamma emitting isotopes. No fresh fission products (^{131}I , ^{132}I , ^{133}I , ^{135}I) were detected on these cartridges. Gross beta counting of prefilters from the Air Surveillance Network showed no values in excess of normal fluctuations except for a slight rise in the gross beta

count on the filter from Nyala, Nevada. This sample, which was run from 0600 on June 16 to 0600 on June 17, contained 7.6 pCi/m³ gross beta count. Filters collected at Nyala the day before and the day following this sample showed 1.6 and 2.7 pCi/m³ gross beta.

Some of the milk samples collected after this event contained ¹³¹I. None of the shorter lived iodines (¹³²I, ¹³³I) were found in these samples.

Milk samples collected at Hiko, Nevada on June 8, 1965 and prior to cloud arrival on June 16, 1965, also contained quantities of ¹³¹I. Two events occurred prior to the Diluted Waters Event that were probably responsible for the ¹³¹I found in the milk samples collected for Diluted Waters. One event was the detonation of a nuclear device on the Chinese mainland on May 14, 1965 and the other was a test of a nuclear rocket engine at the NRDS on May 20, 1965.

The iodine isotopes found in milk samples collected subsequent to the Diluted Waters Event are probably the results of the three events and it is not possible to assess the exact contribution of any one source. Milk samples collected with positive results are listed in Table 4.

Table 4. Milk samples with positive results collected following the Diluted Waters Event.

| Location | Date Collected | Activity (pCi/l) ^{131}I |
|-----------------------|----------------|-----------------------------------|
| Alamo, Nevada | 6/17/65 | 30 |
| | 6/19/65 | 30 |
| Cherry Creek, Nev. | 6/19/65 | 40 |
| Currant, Nevada | 6/19/65 | 50 |
| Currie, Nevada | 6/19/65 | 20 |
| Duckwater, Nev. | 6/19/65 | 130 |
| Halleck, Nevada | 6/18/65 | 60 |
| Hiko, Nevada | 6/16/65 | 60 |
| | 6/17/65 | 40 |
| | 6/19/65 | 30 |
| Lund, Nevada | 6/17/65 | 20 |
| Nyala, Nevada | 6/19/65 | 80 |
| Wells, Nev. (27 mi S) | 6/19/65 | 20 |
| Wells, Nev. (1 mi E) | 6/19/65 | 60 |

B. Reactor experiments

1. Kiwi TNT

On January 12, 1965, the Kiwi Transient Nuclear Test (TNT) was conducted at 1058 hours PST at Test Cell C, located at the Nuclear Rocket Development Station, Jackass Flats, Nevada. The experiment was designed to determine the effect of rapid control drum rotation within a Kiwi reactor and the nature of the subsequent fallout. Data collected on both accounts will aid in predicting the effects of postulated Kiwi reactor accidents. Data collected following the test indicated a hot line

radiation debris.

bearing lying between 200° and 215° within 50 miles of the NRDS.

The maximum dose rate measured by a ground monitor off the test range complex was 70 mR/hr, 1.5 miles west of Lathrop Wells on Highway 95.

Film badges collected following the TNT experiment indicated no doses above the detection limit (20 mR).

A total of 74 milk samples were obtained following Kiwi TNT. The samples were collected from two ranches in the Amargosa Desert and 14 locations in southern California. The Amargosa Desert locations and fourteen California locations were sampled for approximately one week commencing on January 13. None of the 74 samples collected contained detectable quantities of fresh fission products.

Air samples from twelve stations contained fresh fission products as a result of Kiwi TNT cloud passage. Isotopic and gross beta analyses of the positive samples are given in Table 5.

2. NRX-A3

NRX-A3 Experimental Plan 4, 5, and 6 were conducted at Test Cell A, NRDS, on April 23, May 20 and May 28, 1965. The reactor was tested in an upright position so that hydrogen coolant exhausted upward along with escaping fission products. All of the three experiments yielded low levels of radioactivity off the test range complex.

Table 5. Air samples with positive results collected following the Kiwi TNT experiment, January 12, 1965.

| Location | Time On- Time Off Hrs PST | Vol- ume (m ³) | Prefilter average gross beta pCi/m ³ at end of collection | Col- lector | Gamma pulse height analyses pCi/m ³ at end of collection | | | |
|---|---------------------------------|----------------------------------|--|----------------|--|--|--|--|
| | | | | | ¹³¹ I | ¹³² I | ¹³³ I | ¹³⁵ I |
| Lathrop Wells | 1015-1240 | 45 | 4.3x10 ² | P C | ND ND | ND ND | ND ND | ND ND |
| On Hwy. 95, 1.5 mi. W. of Lathrop Wells | 1045-1220 | 34 | 2.1x10 ⁵ | P C | 6.3x10 ² 1.5x10 ² | 1.4x10 ⁴ 2.1x10 ² | 1.3x10 ⁴ 2.9x10 ² | 6.0x10 ³ 1.9x10 ³ |
| On Hwy. 95, 5 mi. W. of Lathrop Wells | 1100-1530 | 87 | 8.7 | P C | ND ND | 2.5 ND | 3.2 ND | ND ND |
| On Hwy. 29, 7 mi. S. of Lathrop Wells | 0800-1435 | 130 | 1.3x10 ³ | P C | ND ND | 1.2x10 ² 4.3 | 1.2x10 ² 3.5 | 40 18 |
| Amargosa Farm Road 3.5 mi. W. of Hwy. 29 | 0855-1610 | 166 | 1.9x10 ³ | P C | ND ND | 48 39 | 48 28 | ND 34 |
| Amargosa Farm Road 5 mi. W. of Hwy. 29 | 0735-1513 | 150 | 4.1x10 ³ | P C | ND ND | 5.1x10 ² 24 | 5.1x10 ² 23 | ND 59 |
| Amargosa Farm Road 6 mi. W. of Hwy. 29 | 0810-1440 | 125 | 7.3x10 ² | P C | NO ANALYSIS | | | |
| Amargosa Farm Road 6.5 mi. W. of Hwy. 29 | 0810-1508 | 136 | 5.7x10 ² | P C | ND ND | 61 1.3 | 61 12 | ND 7.6 |
| Amargosa Farm Road 9.3 mi. W. of Hwy. 29 | 0825-1530 | 160 | 92 | P C | ND ND | 11 1.3 | 9.5 7.3 | ND 2.3 |
| On Hwy. 29, 15.3 mi. S. of Lathrop Wells | 0845-1535 | 136 | 1.1x10 ³ | P C | ND ND | 1.2x10 ² 2.8 | 1.5x10 ² 28 | 26 15 |
| Death Valley Junction | 0650-1510 | 168 | 2.4x10 ³ | P C | ND ND | 2.5x10 ² 10 | 2.7x10 ² 8.0 | 34 34 |
| On Hwy. 190, 7.5 mi. W. of Death Valley Junction | 1310-1500 | 30 | 2.7x10 ⁴ | P C | ND ND | 3.3x10 ³ 20 | 3.1x10 ³ 5.0x10 ² | 5.3x10 ² 3.3x10 ² |

P - Prefilter

C - Charcoal cartridge

ND - Not detectable

a. NRX-A3, EP4, April 23, 1965

The reactor was tested at full power for approximately four minutes commencing at 1254 PST. Aerial tracking of the effluent from the test indicated a hot line bearing of 160° from NRDS.

Ground monitors detected cloud passage with portable instruments at Pahrump between 1500 and 1545 hours PST. Net peak dose rate during this interval was less than 0.03 mR/hr and occurred at 1530.

Air samples from several routine stations and four temporary locations were collected following EP4. Samples collected following EP4 with gross beta activity above background levels are presented in Table 6. Air samples obtained following EP4 from Beatty, Death Valley Junction and Shoshone did not indicate gross beta activity above background levels.

A milk sample and a sample of the cow's feed were obtained at Pahrump on the morning of April 24. Analysis of these two samples indicated no radioiodine.

b. NRX-A3, EP5, May 20, 1965

The reactor was tested at full power in the time interval 1032 to 1046 hours PDT. Aerial tracking of the effluent indicated a hot line bearing lying between 40° and 60° on the test range complex.

Ground monitors located on Highway 25 detected cloud passage with portable instruments. A maximum dose rate measured was 0.06 mR/hr. This measurement was made at Coyote Summit (unpopulated) at 1532 hours.

Table 6. Analysis of air samples collected following the NRX-A3, EP4, reported in pCi/m³ at end of collection.

| Location | On Time Date (PDT) | Off Time Date (PDT) | Volume (m ³) | Prefilter Gross Beta Concentration | Collector | Gamma Pulse Height Analysis | | | |
|--------------------------------------|--------------------|---------------------|--------------------------|------------------------------------|-----------|-----------------------------|------------------|------------------|------------------|
| | | | | | | ¹³¹ I | ¹³² I | ¹³³ I | ¹³⁵ I |
| Lathrop Wells | 1045, 4-23 | 1555, 4-23 | 106 | 3.1 | P C | ND | ND | ND | ND |
| | | | | | | ND | ND | ND | ND |
| Hwy. 95, 10 mi. ESE of Lathrop Wells | 1407, 4-23 | 1545, 4-23 | 17 | 34 | - | -- | -- | -- | -- |
| Hwy. 95, 17 mi. ESE of Lathrop Wells | 1350, 4-23 | 1555, 4-23 | 20 | 110 | - | -- | -- | -- | -- |
| Hwy. 95, 23 mi. ESE of Lathrop Wells | 1400, 4-23 | 1600, 4-23 | 20 | 4.7 | - | -- | -- | -- | -- |
| Hwy. 95, 25 mi. ESE of Lathrop Wells | 1404, 4-23 | 1605, 4-23 | 18 | 36 | - | -- | -- | -- | -- |
| Pahrump | 1000, 4-23 | 1120, 4-24 | 474 | 6.3 | P C | 2.4 | 2.8 | 14 | ND |
| | | | | | | 1.2 | 1.1 | 3.7 | ND |

P - Prefilter
 C - Charcoal cartridge
 ND - Not detectable
 -- Not analyzed

Air samples from several routine stations and three temporary stations were collected following EP5.

Samples collected following EP5 that contained fresh fission products are presented in Table 8. Air samples collected from Pioche, Caliente and Warm Springs Ranch did not contain fresh fission products.

Milk samples were obtained following EP5 from Pioche, Caliente, Hiko and Alamo; milk from Hiko contained radioiodine for several weeks following the experiment. Barium-140 was detected on several pasture samples collected in support of the milk sampling program. Since ^{140}Ba is generally not detected off-site from NRDS activities, it is believed that this contamination is due to another nuclear event. Furthermore, ^{131}I was contained in milk collected around May 25 from the Pasteurized Milk Network throughout the United States. Analysis of the data indicates the generalized contamination to be due to fallout from a Chinese nuclear detonation on May 14, 1965. Analysis of milk samples containing ^{131}I is presented in Table 7. Samples collected after June 25, 1965 reflected contamination due to Phoebus 1A effluent passage.

Table 7. Analysis of milk samples collected following EP5.

| Location | Date Collected | Activity (pCi/l) ^{131}I |
|-----------------|----------------|-----------------------------------|
| Schofield Dairy | 5/24/65 | 50 |
| Hiko, Nevada | 5/26/65 | 70 |
| | 5/28/65 | 50 |
| | 6/02/65 | 60 |
| | 6/08/65 | 90 |
| | 6/16/65 | 60 |
| | 6/25/65 | 30 |

Table 8. Analysis of air samples collected following the NRX-A3, EP5, reported in pCi/m³ at end of collection.

| Location | On Time Date (PDT) | Off Time Date (PDT) | Volume (m ³) | Prefilter Gross Beta Concentration | Col-lector | Gamma Pulse Height Analysis | | | |
|----------------|--------------------|---------------------|--------------------------|------------------------------------|------------|-----------------------------|-------|-------|---------------------|
| | | | | | | 131 I | 132 I | 133 I | 135 I |
| Diablo | 0655, | 0700, | 487 | 22 | P | ND | 3.3 | 0.82 | ND |
| | 5-20 | 5-21 | | | C | ND | ND | ND | ND |
| Goss Ranch | 1330, | 1600, | 45 | 76 | P | 12 | 13 | 18 | 9.3 |
| | 5-20 | 5-20 | | | C | 2.4 | ND | ND | 3.4x10 ² |
| Coyote Summit | 1326, | 1607, | 27 | 290 | P | 41 | 48 | 100 | 67 |
| | 5-20 | 5-20 | | | C | 41 | 33 | 67 | 41 |
| Hancock Summit | 1330, | 1605, | 26 | 88 | P | 15 | 15 | 30 | 17 |
| | 5-20 | 5-20 | | | C | 5.8 | ND | ND | 21 |
| Hiko | 0805, | 1700, | 201 | 41 | P | 7.0 | 7.0 | 7.0 | ND |
| | 5-20 | 5-20 | | | C | 0.95 | 1.0 | 1.7 | ND |
| Alamo | 0710, | 1700, | 203 | 38 | P | 4.6 | 5.4 | 0.94 | ND |
| | 5-20 | 5-20 | | | C | ND | ND | ND | ND |

P - Prefilter

C - Charcoal cartridge

ND - Not detectable

c. NRX-A3, EP6, May 28, 1965

The reactor was tested at intermediate power levels in the approximate time interval 1030 to 1100 hours PDT.

Aerial tracking of the effluent indicated a hot line bearing of 250° on NRDS.

Ground monitors did not detect dose rates greater than background on the test day. Monitored locations included Lathrop Wells, Beatty, and Highway 95 between these towns.

Air samples were collected from the Lathrop Wells and Beatty routine stations and from one temporary station following EP6. Of the air samples collected following EP6, only the Lathrop Wells charcoal cartridge contained radioiodine. A summary of the results is shown in Table 9.

Milk samples were obtained at two locations following EP6. Three samples from Springdale, Nevada, collected on June 3, 9, and 17 contained detectable quantities of ^{131}I . These quantities were 70, 40, and 50 pCi/l respectively.

3. Phoebus 1A

The Phoebus 1A Experiment was conducted at Test Cell C on June 25, 1965 under conditions identified as Experimental Plan 4. The nominal operating power was 1100 megawatts. The reactor was tested in an upright position so that the hydrogen coolant exhausted upward along with escaping fission products.

A ground monitor assigned to Queen City Summit (65 miles, 15° from Test Cell C) detected cloud arrival at 1615 PDT and

Table 9. Analysis of air samples collected following the NRX-A3, EP6, reported in pCi/m³ at end of collection.

| Location | On Time Date (PDT) | Off Time Date (PDT) | Volume (m ³) | Prefilter Gross Beta Concentration | Collector | Gamma Pulse Height Analysis | | | |
|-------------------------------------|--------------------|---------------------|--------------------------|------------------------------------|-----------|-----------------------------|------------------|------------------|------------------|
| | | | | | | ¹³¹ I | ¹³² I | ¹³³ I | ¹³⁵ I |
| Lathrop Wells | 0735, 5-28 | 1350, 5-28 | 117 | .51 | P | -- | -- | -- | -- |
| | | | | | C | ND | ND | ND | ND |
| | 1355, 5-28 | 0635, 5-29 | 342 | .54 | P | ND | ND | ND | ND |
| | | | | | C | 0.6 | ND | 0.7 | ND |
| Hwy. 95, 15 mi. W. of Lathrop Wells | 1055, 5-28 | 1335, 5-28 | 27 | 11 | P | ND | ND | ND | ND |
| | | | | | C | ND | ND | ND | ND |
| Beatty | 0722, 5-28 | 1353, 5-28 | 137 | .47 | P | -- | -- | -- | -- |
| | | | | | C | ND | ND | ND | ND |
| | 1353, 5-28 | 0855, 5-29 | 315 | -- | P | -- | -- | -- | -- |
| | | | | | C | ND | ND | ND | ND |

P - Prefilter
 C - Charcoal Cartridge
 ND - Not detectable
 -- Not analyzed

measured a peak dose rate of 0.065 milliroentgens per hour at 1631 hours. Dose rates above background persisted at this location and are believed to have been associated with heavy rain in the area. Monitoring of Highway 25 north and south of Queen City Summit on the evening of June 25 indicated that this location was on the hot line. Queen City Summit is unpopulated.

Charcoal cartridges collected from four air sampling locations following Phoebus 1A contained isotopes of radioiodine. The analyses are presented in Table 10. Cartridges collected from Twin Springs Ranch, Warm Springs, Clarks Station, Nyala, Carrant, Sunnyside, Caliente, and Warm Springs Ranch did not contain radioiodines. Gross beta analysis of prefilters from these locations did not indicate concentrations greater than normal background levels ($<2 \text{ pCi/m}^3$), although strontium-91 was detected on several prefilters in concentrations of approximately 1 pCi/m^3 .

Milk was sampled at several locations following the Phoebus 1A test. The positive results of the analyses are presented in Table 11. Several samples were obtained prior to the effluent passage and the data indicate that radioiodine contamination of the area northeast of the test range complex existed prior to the Phoebus effluent passage. This contamination is believed due to three prior events: (1) a Chinese mainland nuclear detonation on May 14, 1965 which introduced low levels of ^{131}I into milk supplies over much of the United States, (2) a test of the nuclear rocket NRX-A3 which was conducted at NRDS on May 20, 1965, and (3) an accidental release of fission products from the Diluted Waters Event conducted at NTS on June 16, 1965. Some contamination, however, must be attributed to the

Table 10. Analyses of air samples collected following Phoebus 1-A, EP4 in pCi/m³ at end of collection.

| Location | On Time Date (PDT) | Off Time Date (PDT) | Volume (m ³) | Prefilter Gross beta Concentration | Col- lector | Gamma pulse height analysis | | | |
|---|--------------------------|---------------------------|-----------------------------|--|----------------|--------------------------------|------------------|------------------|------------------|
| | | | | | | ¹³¹ I | ¹³² I | ¹³³ I | ¹³⁵ I |
| Queen City Summit (unpopulated) | 6/25 | 6/26 | 53 | 1.6 | P | -- | -- | -- | -- |
| | 1551 | 1145 | | | C | 7.7 | 3.6 | 22 | 15 |
| Diablo | 6/25 | 6/26 | 541 | .46 | P | -- | -- | -- | -- |
| | 0700 | 0920 | | | C | .63 | .87 | 2.1 | 1.3 |
| Alamo | 6/25 | 6/26 | 482 | 2.0 | P | 1.1 | 2.1 | 2.5 | ND |
| | 0700 | 0730 | | | C | .56 | .21 | 1.8 | 1.2 |
| Hiko | 6/25 | 6/26 | 499 | 1.4 | P | .6 | 1.4 | 1.5 | ND |
| | 0805 | 0810 | | | C | .36 | .24 | 1.0 | .34 |
| AEC Standards for Radiation Protection | | | | | | 100 | 8000 | 1000 | 4000 |

-- = gamma pulse height analysis not performed.

ND = not detectable

P = prefilter

C = charcoal cartridge

Phoebus effluent since ^{131}I levels increased and the presence of ^{133}I ($T_{1/2} = 20$ hrs) and $^{132}\text{Te-I}$ ($T_{1/2} = 77$ hrs) was noted on feed samples.

Table 11. Analysis of milk samples collected following Phoebus 1A, EP4.

| Location | Date Collected | Activity (pCi/l) ^{131}I |
|-------------------------------------|----------------|-----------------------------------|
| Stewart's Dairy Alamo, Nevada | 6/28/65 | 20 |
| | 6/29/65 | 20 |
| | 7/02/65 | 20 |
| | 7/04/65 | 50 |
| | 7/07/65 | 30 |
| Schofield Dairy Hiko, Nevada | 6/25/65* | 30 |
| | 6/26/65 | 40 |
| | 6/28/65 | 50 |
| | 7/02/65 | 60 |
| Blue Eagle Ranch Currant, Nevada | 6/28/65 | 100 |
| | 7/01/65 | 180 |
| | 7/03/65 | 50 |
| | 7/04/65 | 50 |
| | 7/05/65 | 30 |
| | 7/07/65 | 60 |
| Manzonie Ranch Currant, Nevada | 6/19/65* | 50 |
| | 6/28/65 | 20 |

*samples obtained before Phoebus effluent passage

C. Six months summary

The highest air filter results collected during the six month period were taken following the Palanquin Event and are listed in the summary of that event. During this six month period the SWRHL expanded its Air Surveillance Network from fifty-nine stations operating in January to ninety-seven stations operating in June. The network now includes stations operating in every state west of the Mississippi River except Montana and North Dakota.

Some samples of water used for human consumption collected during this period contained ^{131}I . These samples were collected following the Palanquin Event and the Phoebus reactor experiment. The values were all below 300 pCi/l, the AEC ^{radiation} protection standard for ~~individuals~~ ^{and Population Groups in uncontrolled areas,} ~~continuous exposure~~.

The highest radioiodine content found in milk during this period was at the Martin Ranch, Eureka, Nevada where a peak level of 11,000 picocuries per liter of milk was recorded on April 18 and 19, 1965 following the Palanquin Event. However, the highest value found at a farm where children were living was at the Pasquale-Richards Ranch, Paradise Valley, Nevada, where the peak level of 5500 pCi/l was recorded on April 20. This is about 1/40 of the Protective Action Guide of the Federal Radiation Council.

Approximately 4500 film badges were collected and processed from film badge stations and badged personnel in the off-site area. Only the station badges listed with the Palanquin summary showed positive exposures which could be associated with events during this period.

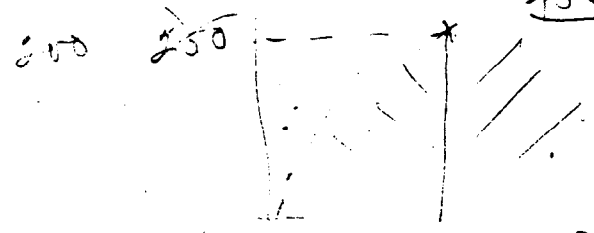
RPG?
NOT PAG

$$\frac{5}{2.50}$$

$$\frac{5500}{250000} = \sim \frac{1}{46}$$

$$\frac{5500}{194,000} = \frac{1}{35}$$

$$250,000 \rightarrow 175 \rightarrow 301$$



$$250 \text{ nCi prot} \rightarrow 1750 \text{ nCi} \rightarrow 301 \text{ OK}$$

IV. 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 the NCRP.