[redacted]

OPERATION REDWING

A PRELIMINARY REPORT OF [redacted] (YUMA) DELETED

Submitted by Task Group 7.1

JO-270

15 October 1956

[redacted] ata as de[redacted] Energy Act of 1954. It[redacted] the disclosure of [redacted]nts in any [redacted] an [redacted]uthorised person is prohibited.

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[redacted] (YUMA)

INTRODUCTION

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The nuclear multiplication rate (alpha) was measured to compare it with predictions based on data from hydrodynamic shots previously carried out at Nevada Test Site, and on neutronic calculations normalized to critical assembly measurements.

The [redacted] was detonated as the Yuma shot on a 200 foot tower on Aomon Island, Eniwetok Atoll, at 0756:00.9 on May 28, 1956. The yield was about

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[redacted]

[redacted]

PART I

GENERAL INFORMATION

[redacted]

ENIWETOK OBSERVED WEATHER FOR 28 MAY 1956
YUMA SHOT TIME 0756M

Sea Level Pressure	1010.2 mb
Free Air Surface Temperature	81.7°F
Wet Bulb Temperature	76.9°F
Dew Point Temperature	75.0°F
Relative Humidity	80%
Surface Wind	080° at 18 kts; gusts to 20 kts
Visibility	10 Miles

CLOUDS

5/10 cumulus; bases 1500 feet; tops 5000 feet - one top 8-10,000 feet 25 miles southeast. 3/10 altocumulus; bases 18,000 feet; tops 19,000 feet (1/10 transparent). 10/10 cirrostratus; bases 30,000 feet; tops 34,000 feet (9/10 transparent).

WEATHER

Widely scattered light showers. The only shower near the shot point passed north of Eniwetok Island at H-10 minutes and was 3 miles west of Eniwetok at shot time. Thirty mile clear area approaching shot point.

STATE OF SEA

Ocean Side: Wave heights 7 feet, period 6 seconds, direction 080°.
Lagoon Side: Wave heights greater than one foot.

Pressure Millibars	Height Feet	Temperature °C	Dew Point °C
1000	280	27.0	22.5
906	3,117	20.4	17.2
850	4,930	17.8	10.5
831	5,545	16.8	07.9
814	6,135	16.0	11.8
755	8,432	12.4	09.8
700	10,300	09.8	02.5
680	11,122	08.5	-05.3
642	12,631	05.2	-02.8
635	12,959	04.8	-06.5
600	14,450	02.1	-03.1
569	15,814	-00.7	-06.7
547	16,929	-01.0	-10.6
500	19,200	-05.8	-15.2
441	22,441	-12.2	-20.5
400	24,840	-15.4	-27.5
300	31,740	-32.0	-38.6
200	40,700	-55.4	M
150	46,520	-69.3	M
100	54,240	-77.9	M
50	67,610	-63.2	M
25		-48.9	M

WINDS ALOFT

Height Feet	Direction Degrees	Speed Knots	Height Feet	Direction Degrees	Speed Knots
1,000	090	29	24,000	160	22
2,000	090	29	26,000	200	14
3,000	090	30	28,000	250	12
4,000	090	31	30,000	190	19
5,000	090	29	32,000	190	25
6,000	080	29	34,000	210	29
7,000	080	31	36,000	220	31
8,000	080	33	38,000	200	35
9,000	080	32	40,000	210	38
10,000	080	27	45,000	230	44
12,000	080	21	50,000	270	39
14,000	090	13	55,000	210	25
16,000	140	14	60,000	060	12
18,000	150	12	65,000	080	32
20,000	100	10	70,000	110	33
22,000	140	26	75,000	090	32
			80,000	100	41

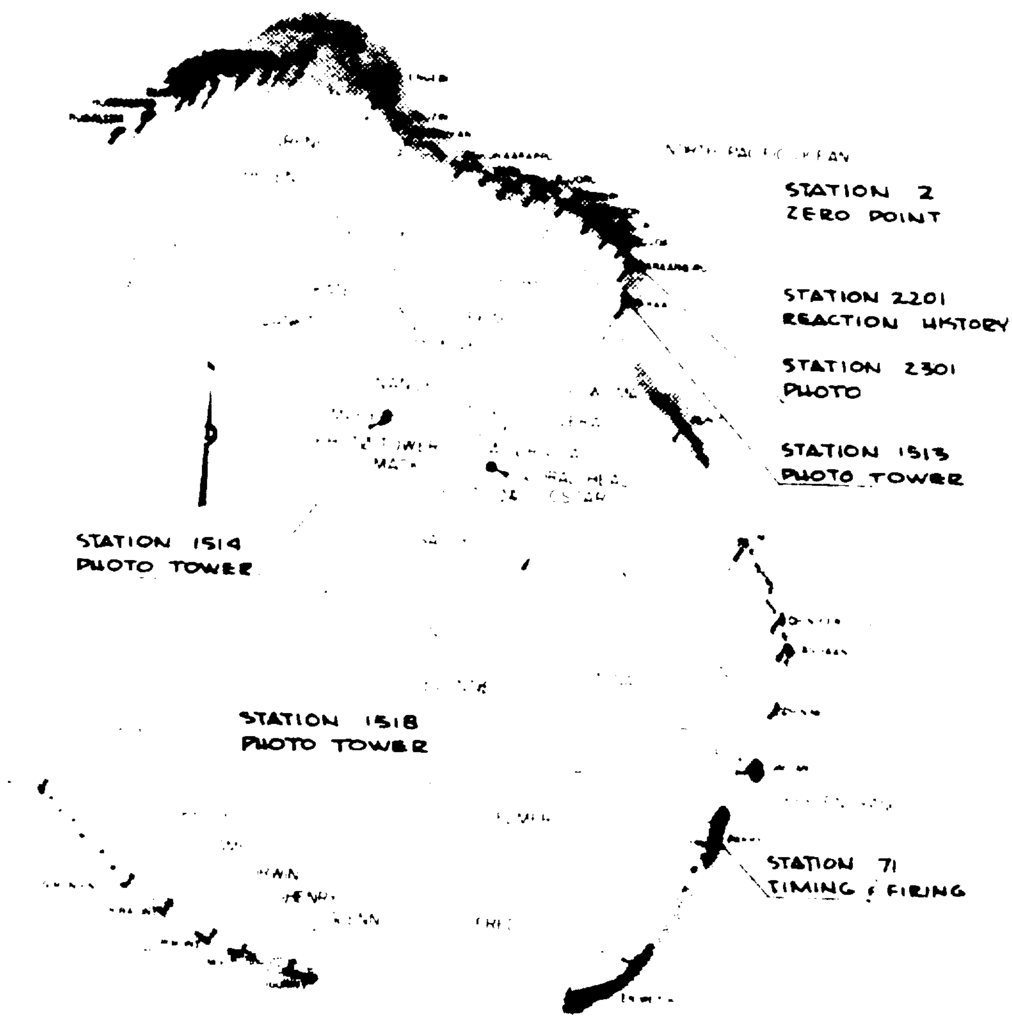

Fig. 0-1 - Eniwetok Atoll Map

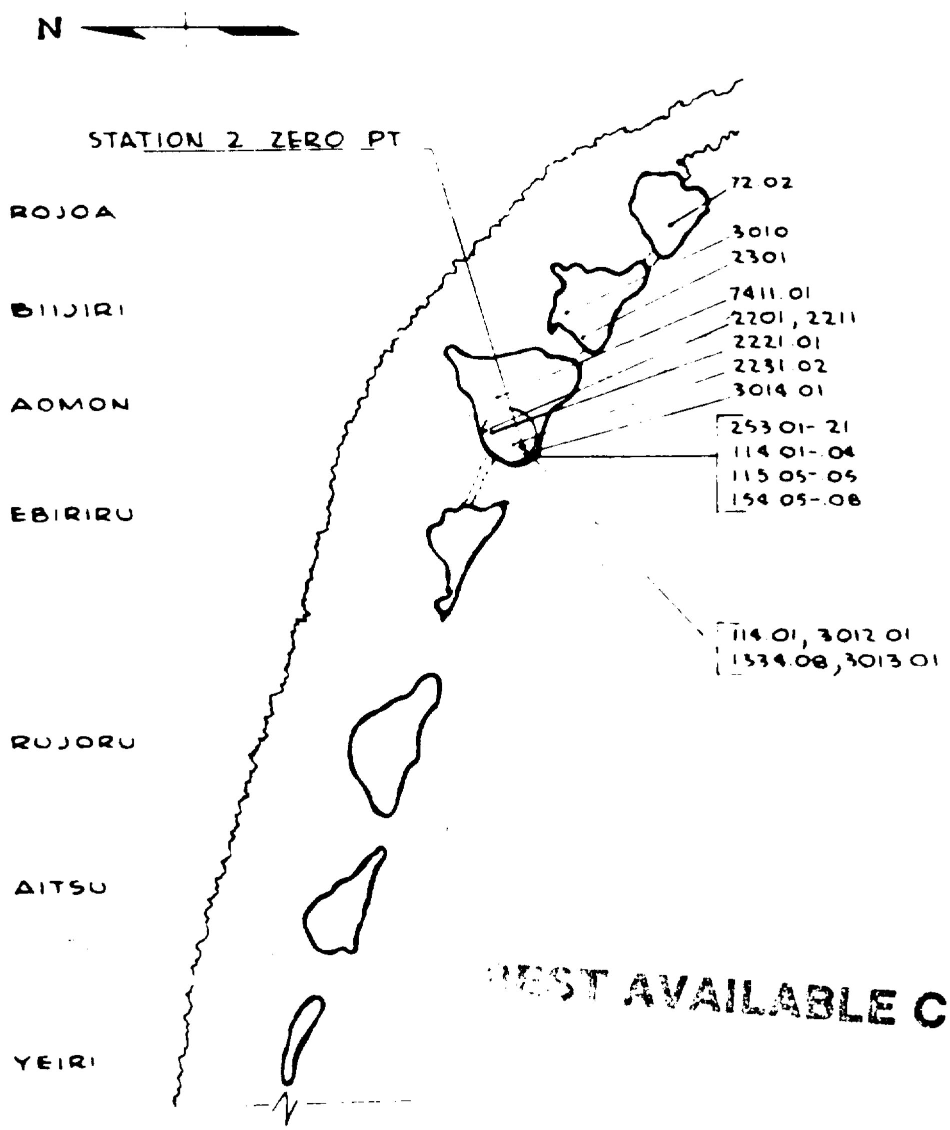

Fig. 0-2 - Scientific Stations and Zero Point

[redacted]

[redacted]

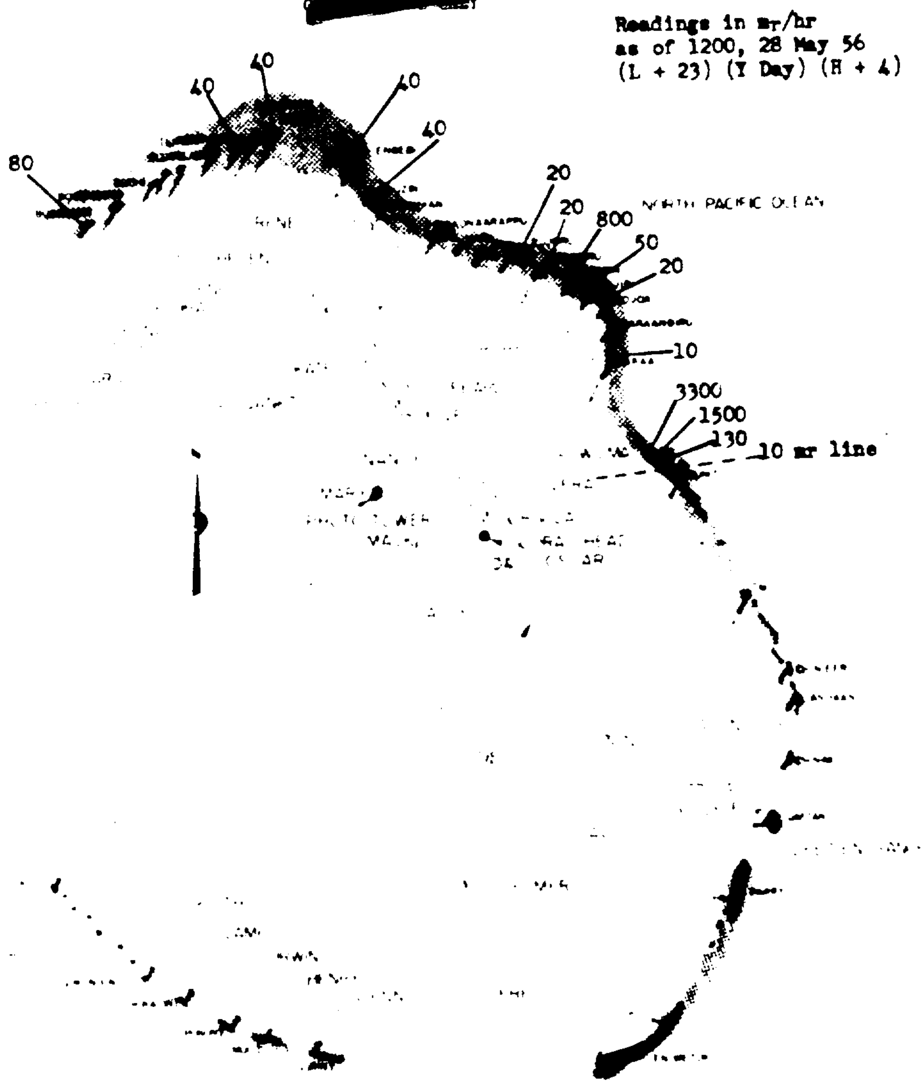

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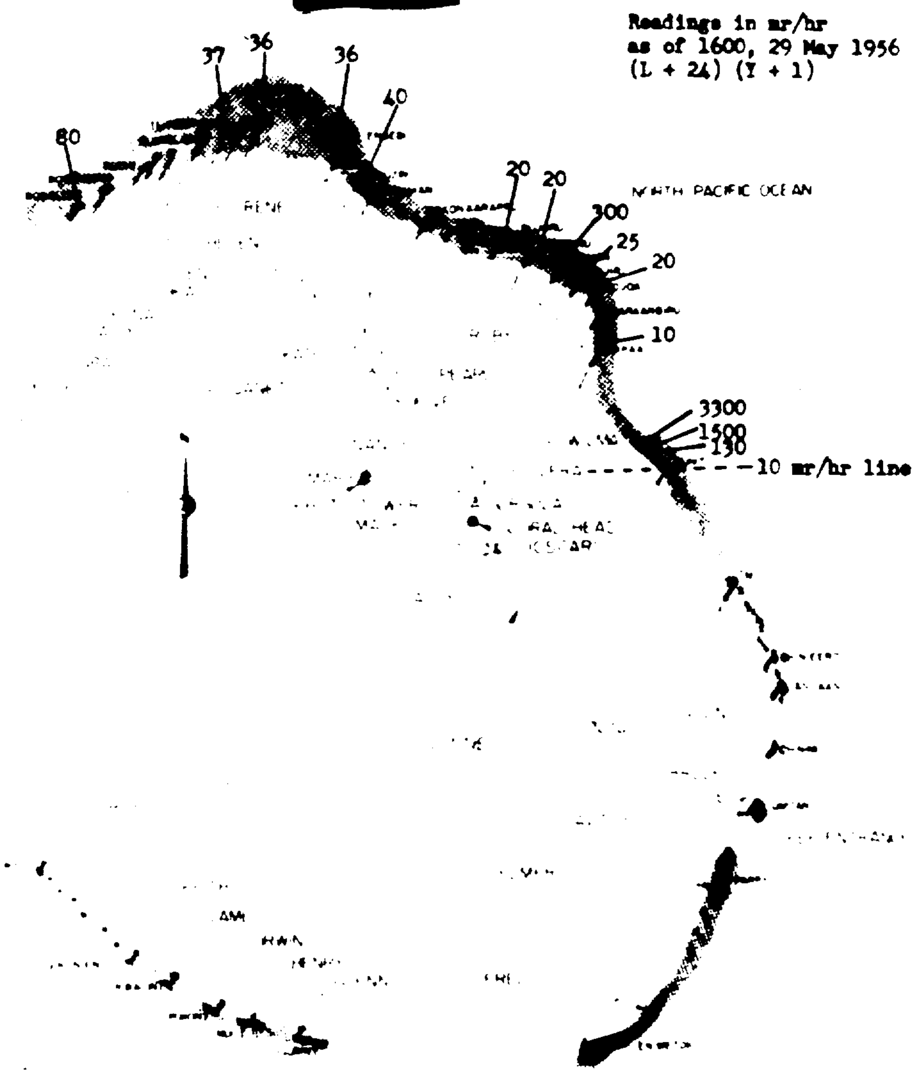
Fig. 0-3 - RadSafe Survey, D-Day

[redacted]

10

[redacted]Y

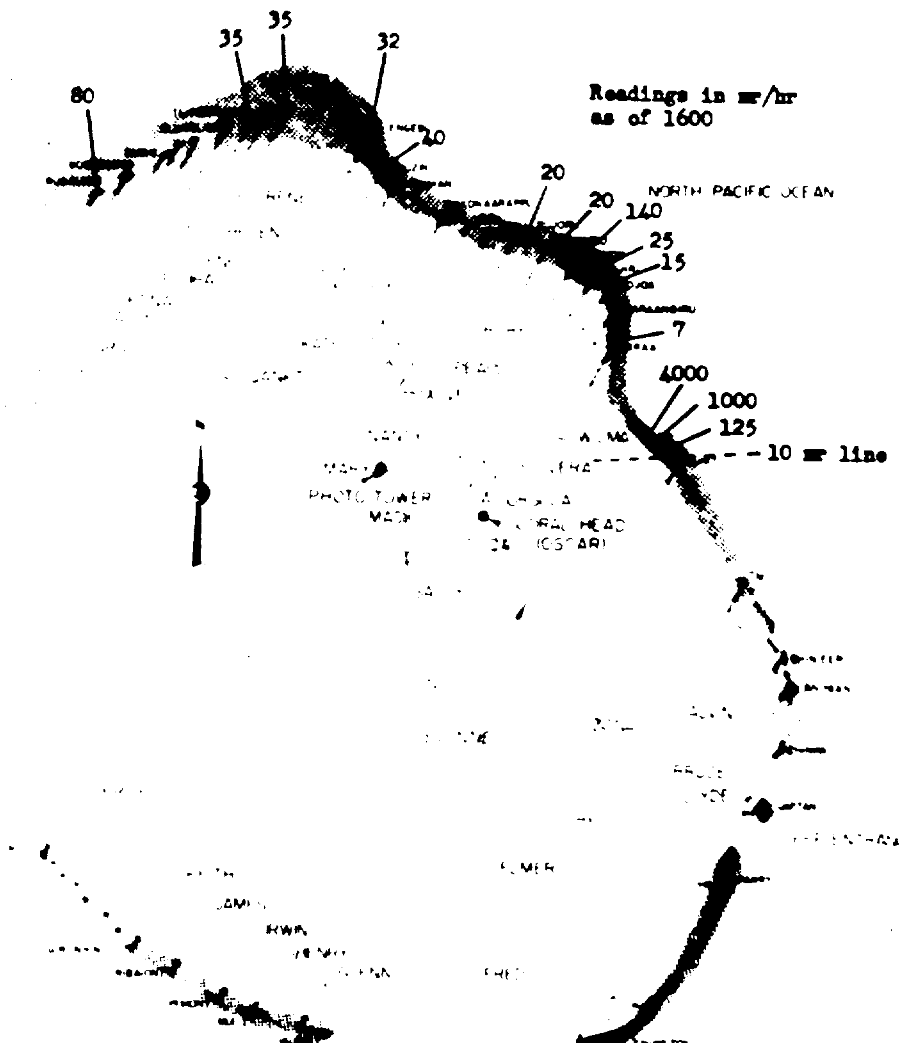


OF[redacted]LY

Fig. O-4 - RadSafe Survey, D+1

[redacted]

[redacted]



OFFICIAL [redacted]

Fig. 0-5 - RadSafeSurvey, D+2

[redacted]

PART II

TASK UNIT 3

DOD PROGRAMS

Col. K. D. Coleman
CTU-3

Program 1 -	Blast and Shock Measurements	Maj H. T. Bingham
Program 2 -	Nuclear Radiation and Effects	CDR D. C. Campbell
Program 6 -	Tests of Service Equipment and Materials	Lt Col C. W. Bankes

[redacted] (YUMA)

Project 1.1 - Basic Blast Measurements - J. J. Meszaros

OBJECTIVE

The objective of Project 1.1 in participation in [redacted] (Yuma) was to document the propagation of the blast wave from a [redacted] device.

INSTRUMENTATION

The instrumentation used was the BRL self recording pt and q gages. The pt gages were mounted flush with the surface of the ground and the q gages were mounted with the centerline of the axis 3 feet above the surface. The complete blast line which was on Aomon extended from 0 feet to 1000 feet from ground zero.

RESULTS

The observed values of peak overpressure and dynamic pressure are plotted in Fig 1.1-1. When the measured values are compared with curves taken from TM 23-200 for a [redacted] over an average surface, the [redacted] the better fit. The majority of the values plotted fall between [redacted]

The project was successful in achieving its objective and the pressure values recorded will aid in validating the HOB curves for [redacted] devices.

[redacted]

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Fig. 1.1-1 - Peak Overpressure and Dynamic Pressure Vs Distance, DELETED (Yuma)

[redacted]

[redacted] (YUMA)

Project 1.5 - Vehicle Damage Effects - R. W. McNeil

OBJECTIVE

To determine the accuracy of present damage prediction charts extended to the [redacted] region. Previous vehicle exposures to nuclear detonations have all been approximately [redacted] and larger.

TECHNIQUES

Eight vehicles, truck, 1/4 ton 4x4 Utility WWII Model MB were arranged in pairs at four stations from ground zero. The stations were 150, 250, 350, and 400 feet from ground zero. One vehicle at each station was oriented with the front end facing ground zero (face-on) while the side of the other vehicle was towards ground zero (side-on). Steel stakes were driven in the ground at each vehicle station to facilitate displacement measurements.

RESULTS

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CONCLUSIONS

Based on the limited inspection performed, the damage to the vehicles in general agrees with predicted damage levels using the formula and curves found in TM 23-200.

[redacted]

[redacted] (YUMA)

Project 2.51 - Neutron Flux Measurements and Shielding Studies -

C. W. Luke

OBJECTIVES

To measure the neutron flux and energy spectrum as a function of distance from the point of detonation of [redacted] device. Also to evaluate the angular distribution of the neutron flux about [redacted] device.

To compare the foil detector method of determining dose in rep with chemical and semi-conductor methods.

INSTRUMENTATION

In order to evaluate the angular distribution of the neutron flux for [redacted] (Yuma) shot, thr e instrument lines were required. The lines were laid as follows: One line extending along the projection on the ground of the long axis of the device, one line at 45° to this projection, and one line at 64° to this projection. It was desired that the third line be placed at 90° to the long axis of the device, however, a permanent structure along the 90° line required the use of the 64° angle.

Each instrument line consisted of a 1 inch steel cable laid along the ground. At each 100 yard interval the following detectors were placed: Au, 1 cm. or 2 cm. B^{10} shielded Pu^{239}, U^{238}, S, chemical dosimeters, germanium dosimeter, and navy DT60 glass dosimeters. Only two samples of Np^{237} were available for this shot. One sample was placed at the 200 yd. station on the 0° line and one at the 100 yd. station on the 64° line.

RESULTS

Table 2.51-1 gives the station number, slant distance to the device, and the neutrons per cm^2 as measured by each of the various detectors. Table 2.51-2 gives the station number, slant distance, and the neutron dose in rep as measured by the USAF School of Aviation Medicine's chemical dosimeters. Table 2.51-3 gives the station number, slant distance, and gamma dose for those DT60 glass dosimeters which could be read here in PPG. The remaining DT60's had to be returned to the ZI for reading due to the high dose rates. The AEC chemical dosimeter and germanium dosimeter data are not available at this time.

Fig. 2.51-1, 2, 3, and 4 are plots of neutron flux times slant distance squared vs slant distance for Pu, Np, U, and S respectively. Fig. 2.51-5 is a plot of neutron flux times slant distance vs slant distance for gold. The Np graph assumed that there is no spectral variation along the instrument line, the line being drawn parallel to the Pu and U included in the respective lines. The Np point on the 64° line has been adjusted upward to compensate for the apparent perturbation of the tower. Fig. 2.51-6 is a plot of dose in rep times slant distance squared vs slant distance as measured by the USAF chemical dosimeters and the neutron foil system.

CONCLUSIONS

The [redacted] of this device can easily be detected from the graphs. The reason for the change in slope of the 45° line is not clear.

It may be seen that the dose as measured by the chemical dosimeters is low by a factor of three to five as compared to that measured by the foil system. This discrepancy is not immediately explainable. It is anticipated that upon recalibration of both systems and comparison with AEC dosimeters this discrepancy will be resolved.

TABLE 2.51-1

MEASURED NEUTRON FLUX

DELETED

[redacted]

TABLE 2.51-4

DELETED

DELETED

Fig. 2.51-1 - Data from [redacted] Yuma)

[redacted]

DELETED

Fig. 2.51-2 - Data from [redacted] (Yuma)

DELETED

[redacted]

[redacted]

DELETED

Fig. 2.51-3 - Data from [redacted] (Yuma)

DELETED

[redacted]

24

DELETED

Fig. 2.51-4 - Data from [redacted] DELETED Yuma)

[redacted]

DELETED

Fig. 2.51-5 - Data from [redacted] (Yuma)

[redacted]

[redacted]

DELETED

Fig. 2.51-6 - Data from [redacted] (Yuma)

[redacted]

[redacted]

[redacted] (YYM)

Project 6.1 - Accurate Location of Electromagnetic Pulse Source—

F. A. Lewis

<u>OBJECTIVE</u>

To utilize the electromagnetic signal originating from nuclear weapon detonations to determine ground zero of detonation. Secondarily to obtain the yield data that is available in the bomb pulse.

<u>PROCEDURE</u>

Location of ground zero is made by use of an inverse Loran principle. The exact time the bomb pulse is received at various stations is recorded. The exact time difference in receipt of the electromagnetic pulse between two stations will be used to determine a hyperbolic curve which runs through ground zero. The point of intersection of two or more curves determines ground zero.

There are two systems being tested. One system known as the short base line or Naval System operates one net in the Hawaiian Islands and another net in California. Each net consists of one master station with slave stations connected with microwave link 50 to 60 miles on either side. The slave stations receive and automatically transmit the bomb pulse to the master station where pulse shape and time differences are analyzed. The California net has the master station located at Woodland and slave stations near Pittsburg and Marysville. The Hawaiian net has the master station located at Kona, Hawaii and the slave stations at Red Hill, Maui; and Papa, Hawaii. Each net will attempt to determine one hyperbolic line or a line of position and will not attempt an exact fix or exact location of ground zero.

The second system known as the long base line system has one net of stations in the Hawaiian area and another in the Continental U. S.

[redacted]

[redacted]

Each long base line net requires a synchronizing transmitter and receiving station located not more than 1500 miles from the transmitter. For the Hawaiian net the transmitter is located at Haiku, Oahu and receiver sites at Midway Island, Lahaina, Maui and Palmyra Island. For the Stateside net the transmitter is located at Carolina Beach, North Carolina and receiver sites at Harlingen AFB Texas, Kinross AFB Michigan, Blytheville AFB Arkansas, and Forestport, New York. Each receiver station will determine exact time of receipt of bomb pulse. From this information lines of position will be drawn and definite fixes or exact location of ground zero will be determined for each net.

Results

Short base line

Hawaii. Kona all stations received and recorded electromagnetic pulse emanating from bomb detonation. Line of position error 6.5 nautical miles. Maximum field strength [redacted]

California. Woodland net all stations received and recorded electromagnetic pulse emanating from bomb detonation. Line of position error 3 miles, maximum field strength [redacted]

Long base line

Hawaii. Lahaina net all stations received and recorded electromagnetic pulse emanating from bomb detonation. Lahaina fix error was 2360 yards. The field strength for the sky wave at Lahaina was [redacted]

Stateside. Harlingen AFB Texas net all stations received and recorded electromagnetic pulse emanating from bomb detonation.

Griffiss AFB New York received and recorded electromagnetic pulse from bomb detonation.

[redacted]

CONCLUSION

No conclusion can be made until further information is received from data reduction and interpretation.

[redacted]

[redacted] (YUMA)

Project 6.3 - Effects of Atomic Explosions on the Ionosphere - M. A. Nevn

OBJECTIVE

The objective of Project 6.3 is to obtain data on the effects of [redacted] nuclear explosions on the Ionosphere. Principally to investigate the area of absorption probably due to the high altitude radioactive particles and to study the effect of orientation relative to the earth's magnetic field on F2 layer effects.

INSTRUMENTATION

The system comprises

Two Ionosphere recorders, type C-2, operating on pulse transmission, installed in 6 ton trailer vans, one located at Rongerik Atoll and one located at Kusaie in the Caroline Islands.

One Ionosphere recorder, type C-3, operating on pulse transmission, installed in a C-97 plane based at Eniwetok Island, Eniwetok Atoll.

Detailed Description

Ionosphere recorder site (Rongerik Atoll)

site (Kusaie)

AN/CPQ-7, type C-2 Ionosphere recorder with a power output of 10 KW peak pulse alternately transmitting and receiving automatically over the range of frequencies from 1 to 25 megacycles. This equipment measures and records at vertical incidence the virtual height and critical frequencies of ionized regions of the upper atmosphere.

A 600 ohm multiple wire antenna designed and erected so that the direction of maximum intensity of radiation will be at the desired vertical angle over all of the operating frequency range from 1 to 23

[redacted]

megacycles. The transmitting and receiving antennas and the ground plane were in mutual perpendicular planes with the plane of the transmitting antenna oriented 53 degrees to the east of magnetic north.

Ionosphere recorder site (C-97 airplane)

Same as for Rongerik and Kusaie except that a C-3 Ionosphere recorder was used. This recorder is the same as the C-2 except for a few modifications and improvements.

The transmitting antenna in the C-97 was a single wire delta fastened to the lateral extremities of the tail assembly.

RESULTS

All stations operated successfully during [redacted] (Yuma) shot. There were no noticeable effects on the Ionosphere from this test.

[redacted]

[redacted]

[redacted] (YUMA)

Project 6.4 - Determination of Characteristics of Airborne Flush Mounted Antennas and Photo Tubes for Yield Determination at Extended Ground-to-Air Ranges - A. J. Waters

OBJECTIVES

To determine the effectiveness of flush mounted airborne antennas and phototubes at various ground-to-air ranges in detecting characteristic low frequency electromagnetic radiation and visible radiation, respectively.

To determine the temporal and amplitude characteristics of the low frequency electromagnetic radiation at various ground-to-air ranges.

To determine the temporal and intensity characteristics of visible radiation at various ground-to-air ranges.

To determine the effects of ambient conditions upon the satisfactory measurement of the parameters specified in the first two items.

INSTRUMENTATION

2 fiducial antennas	2 scope cameras
1 whip antenna	1 sequence camera
1 synchronizer	1 recorder
2 photoheads	

2 Dumont Scopes (1 a dual beam, 1 a single beam)

TECHNIQUE

Signal is received by antenna fed through an amplifier and then to the scope. The signal is then photographed. Photohead output is led directly to the recorder. The sequence camera photographs the blast directly for use in correlation of previous data. Distance was approximately 93 miles.

[redacted]

RESULTS

The sequence camera jammed and it will not be known if data was recorded until film is developed.

CONCLUSIONS

Depends on results of photography.

[redacted] (YUMA)

Project 6.5 - Analysis of Electromagnetic Pulse Produced by Nuclear Explosion - Charles J. Ong

OBJECTIVE

The objective of Project 6.5 is to obtain waveforms of the electromagnetic radiation for all the detonations during Operation [illegible]. This data is to be used in connection with a continuing study relating the waveforms parameters to the height and yield of the detonation.

INSTRUMENTATION

Two identical stations are used to record data, one at Eniwetok and one at Kwajalein.

The instrumentation consists of a wide-band receiver with separate outputs connected to each of the three oscilloscopes. Mounted on each oscilloscope is a Polaroid Land Camera for recording the transient display.

The wide-band receiver consists of one primary and four secondary cathode follower amplifiers. An antenna, frequency insensitive in the range of interest is fed directly into the primary cathode follower. The primary cathode follower is then connected to four individual cathode followers by a 50 ohm coaxial cable. Only three secondary followers are utilized, the fourth serving as a spare.

The number one and two cathode followers feed oscilloscopes with sweep speeds of approximately 20 microseconds per centimeter and 10 microseconds/centimeter respectively. The number three cathode follower is connected to the third oscilloscope through a 2 microsecond delay line. The third oscilloscope has a sweep speed of 1.0 microseconds/centimeter.

[redacted]

RESULTS

Table 2.51-1 gives the station number, slant distance to the device, and the neutrons per cm^2 as measured by each of the various detectors. Table 2.51-2 gives the station number, slant distance, and the neutron dose in rep as measured by the USAF School of Aviation Medicine's chemical dosimeters. Table 2.51-3 gives the station number, slant distance, and gamma dose for those DT60 glass dosimeters which could be read here in PPG. The remaining DT60's had to be returned to the ZI for reading due to the high dose rates. The AEC chemical dosimeter and germanium dosimeter data are not available at this time.

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CONCLUSIONS

The [redacted] of this device can easily be detected from the graphs. The reason for the change in slope of the 45° line is not clear.

It may be seen that the dose as measured by the chemical dosimeters is low by a factor of three to five as compared to that measured by the foil system. This discrepancy is not immediately explainable. It is anticipated that upon recalibration of both systems and comparison with AEC dosimeters this discrepancy will be resolved.

All oscilloscopes were triggered simultaneously by the DC trigger device located in the primary cathode follower and connected directly to the receiving antenna. The 2 microsecond delay line was added to permit the leading edge of the waveform to be recorded.

In order to establish a definite time relationship between the reception of the signal and the triggering of a given device such as a counter or transmitter, a time marker pip, generated by the delay trigger from one of the oscilloscopes, is fed through the 2 microsecond delay line and superimposed on the initial portion of the received waveform.

PROCEDURE

All oscilloscopes are calibrated against a known frequency standard for sweep linearity.

The cathode follower triggering system is set to trigger approximately 6db. above the noise level. The vertical deflectors of the oscilloscopes are set to receive the predicted field strength.

RESULTS

Station A: Eniwetok

Data was recorded on all oscilloscopes. The predicted field strength was [redacted] and the measured field strength was [redacted] The waveforms were good and should provide data for easy analysis.

Station B: Kwajalein

Data was recorded on all oscilloscopes. The predicted field strength was [redacted] and the measured field strength was [redacted] The waveforms showed evidence of being modulated by an unknown carrier.

PART III

TASK UNIT 1

LASL PROGRAMS

Keith Boyer
Keith Boyer
Advisory Group

Program 16 - Physics & Electronics & Reaction History — P. E. Watt

[redacted]

[redacted] (YUMA)

Project 16.3 - Electromagnetic Investigations - R. Partridge

Project 16.3 measures the time interval between the primary and secondary reactions in multi-stage devices by direct oscilloscopic recording of the electromagnetic radiation in the radio frequency range. In addition, methods of obtaining other diagnostic information from this radiation are investigated.

Equipment was operated to measure alpha, the rate of rise of the nuclear reaction. Severe radio interference was experienced, but traces were obtained at reduced sensitivity which appear to be related to alpha. More detailed readings of these traces will be required.

The time interval equipment was operated, using this device for a dry run. All channels operated correctly.

[redacted]

PART IV

TASK UNIT II

UCRL PROGRAMS

W. E. Gibbins
Dep for UCRL

Program 21 - Radiochemistry		R. H. Goeckermann
Program 22 - History of the Reaction		L. F. Wouters
Program 23 - Scientific Photography		H. B. Keller

[redacted]

[redacted] (YUMA)

Project 21.1 - Radiochemical Analysis - R. Goeckermann

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[redacted]

[redacted] (YUMA)

Project 21.2 - Sample Collection - R. Batzel

The Air Force Special Weapons Center supplied six F-84G and one B-57, as sample planes and control aircraft, respectively.

Aircraft	Time after shot - Hours	Alt. Collected - Thousand feet	Fission - One Wing	Pilot Radiation mr
032	0.30 - 1.00	6 - 7	1.75×10^{15}	
038	0.45 - 1.15	6 - 7	1.13×10^{15}	
051	1.00 - 1.10	5 - 6	0.65×10^{15}	
053	1.10 - 1.30	6.8 - 7.3	1.80×10^{15}	
046	1.20 - 1.50	7	1.94×10^{15}	
054	1.40 - 2.00	6.3 - 6.8	1.36×10^{15}	

The cloud on [redacted] (Yuma) topped at about 10,000 feet and the base was at 5,000 feet.

The samples collected were large enough for all measurements necessary. The success of the sampling was due to the cooperation and interest shown by the Air Force personnel.

Project 21.3 - Short Half-life Activities - F. Momyer

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Another phase of Project 21.3 was engaged in finding total tritium in the cloud. This was done in the following manner: Carrier amounts of heavy water, krypton and xenon were added to the collection bottles prior to the program. The collection system consisted of filters for particulate matter and collection bottles mounted on the sampling planes. Gas samples were collected at various altitudes and times following the detonation and returned to Parry for separation. Krypton, xenon, water and carbon dioxide were separated from the gas sample and molybdenum was separated from the filter sample. Krypton, xenon and molybdenum were collected to determine fissions per collection bottle. The remaining activities, C^{14} and H^3 were returned to the laboratory, as barium carbonate and water for the determination of total tritium and possibly C^{14} yield.

The fission bottle data are shown in Table 21.3-1.

TABLE 21.3-1

FISSION BOTTLE DATA

Time - 0756 - 5/28/56

Bottle	RW-Yu - FP-54	RW-Yu - FP-56	RW-Yu - FP-58
Flight	Tiger White 2	Tiger White 3	Tiger Blue 2
Altitude	6,500	5,750	6,500
Coll. Time*	+49:43-52:01	+53-58:40	+96-101:30
Net Sample Wt.	5½ oz.	14 oz.	17 oz.

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* Time of collection after shot time (minutes).

[redacted] (YUMA)

Project 22.1 - Measurement of Alpha and Boost - L. F. Wouters

EXPERIMENTAL TECHNIQUE

The gamma rays produced by the nuclear reaction were detected by fluor-photocell detectors located in a lead lined "doghouse" 890 feet from the zero point. A 27 foot lead pipe served to collimate the gamma rays onto an array of four fluors. The four fluors were positioned in tandem along the gamma path and were observed by a total of three photodiodes and four photomultiplier units. Combinations of gamma attenuators between fluors and optical attenuators between different detector units on the same fluor enabled the attainment of complete coverage from the 30th generation level to well above the peak expected gamma signal. The detector outputs were transmitted by cable to recording oscillographs located in the blockhouse where cameras provided a permanent film record of the signals.

In addition to the "doghouse" detectors a fluor-photomultiplier unit located two feet from the device in the cab enabled individual neutrons to be detected so that the initiation time might be determined.

RESULTS

The reaction history experiment was successful in measuring the high explosive transit time and the reaction rate of the [redacted] (Yuma) device.

H.E. Transit Time: The high explosive transit time was measured to be [redacted] from the X-unit pulse to the time of rise of the ENS neutron pulse.

Alpha: Preliminary reaction history results are indicated in Fig. 22.1-1 and 22.1-2. Fig. 22.1-1 is a plot of the equivalent gamma Mev per sec point source strength vs time as obtained from a combination slope-amplitude and timing-amplitude fit of the individual pieces of data. Fig. 22.1-2 is an alpha vs time curve derived from Fig. 22.1-1. The alphas obtained from individual detectors are also indicated in Fig. 22.1-2.

DELETED

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Fig. 22.1-1 - Yuma Reaction History

[redacted]

DELETED

Fig. 22.1-2 - Alpha vs Time (Yuma)

[redacted]

[redacted]

[redacted] (YUMA)

Project 22.3 - S-Unit Monitoring - C. E. Ingersoll

E. C. Woodward

The technique used for monitoring the S-unit consisted of telemetering signals from signal sources in the immediate neighborhood of the [redacted] (Yuma) device by high frequency radiofrequency methods to a receiving and recording station located on Parry. The signals were then recorded on oscillographs.

The signal sources were the load ring pulse of the X-unit and the output of a fluor - photomultiplier detector near the S-unit which measured both the S-unit output and the gamma rays from the nuclear reaction.

The oscillograph displays consisted of a raster scope display containing all signals and a linear sweep display on a 517 oscillograph which showed greater detail of the load ring pulse signal and the S-unit signal.

The results of the measurement are as follows:

Time from beginning of X-unit load ring pulse to breakaway of S-unit pulse = [redacted]

Yield of S-unit > [redacted]

Time from beginning of X-unit load ring pulse to gamma pulse breakaway = [redacted]

Δ between gamma rise and equipment cutoff = [redacted]

[redacted]

[redacted] (YUMA)

Project 23.1 - Fireball and Bhangmeter - H. Grier

D. F. Seacord B. M. Carder

FIREBALL

Two of three Parry Eastmans provided fireball records; due to the delay in detonation time one Eastman had expended its film load. Three of four Piiraai Eastmans recorded fireball growth; the fourth camera jammed.

The yield of [redacted] (Yuma) was sufficiently low as to invalidate ϕ^5 scaling; although ϕ appeared to be relatively constant this constancy occurred in the region of maximum ϕ before its normal decay to the "constant ϕ" region. The relative-scaling method has been applied using the [redacted] for comparison. Film #34207 was not used since the ϕ-t data are suspect, resulting in a monotonically-decreasing curve.

The average yield of five Eastmans and four Rapatronics is:

[redacted]

BHANGMETER

Three of four Mark 5 Bhangmeters operating at the control point gave records. Times to the first minimum were [redacted]

DELETED

[redacted]

DELETED

Fig. 23.1-1

DELETED

Fig 23.1-2

[redacted]

[redacted]

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