APPENDIXES

APPENDIX NUMBER 1

GROVES-CONANT LETTER

This is the original directive of the Los Alamos Laboratory, referred to in Chapter I.

OFFICE FOR EMERGENCY MANAGEMENT
OFFICE OF SCIENTIFIC RESEARCH AND DEVELOPMENT
1530 P STREET NW.
WASHINGTON, D. C.

VANNEVAR BUSH
Director

February 25, 1943

Dr. J. R. Oppenheimer
University of California
Berkeley, California

Dear Dr. Oppenheimer:

We are addressing this letter to you as the Scientific Director of the special laboratory in New Mexico in order to confirm our many conversations on the matters of organization and responsibility. You are at liberty to show this letter to those with whom you are discussing the desirability of their joining the project with you; they of course realizing their responsibility as to secrecy, including the details of organization and personnel.

I. The laboratory will be concerned with the development and final manufacture of an instrument of war, which we may designate as Projectile S-1-T. To this end, the laboratory will be concerned with:

A. Certain experimental studies in science, engineering and ordnance; and

B. At a later date large-scale experiments involving difficult ordnance procedures and the handling of highly dangerous material.

The work of the laboratory will be divided into two periods in time: one, corresponding to the work mentioned in section A; the other, that mentioned in section B. During the first period, the laboratory will be on a strictly civilian basis, the personnel, procurement and other arrangements being carried on under a contract arranged between the War Department and the University of California. The conditions of this contract will be essentially similar to that of the usual OSRD contract. In such matters as draft deferment, the policy of the War Department and OSRD in regard to the personnel working under this contract will be practically identical. When the second division of the work is entered upon (mentioned in B), which will not be earlier than January 1, 1944, the scientific and engineering staff will be composed of commissioned officers. This is necessary because of the dangerous nature of the

work and the need for special conditions of security. It is expected that many of those employed as civilians during the first period (A) will be offered commissions and become members of the commissioned staff during the second period (B), but there is no obligation on the part of anyone employed during period A to accept a commission at the end of that time.

II. The laboratory is part of a larger project which has been placed in a special category and assigned the highest priority by the President of the United States. By his order, the Secretary of War and certain other high officials have arranged that the control of this project shall be in the hands of a Military Policy Committee, composed of Dr. Vannevar Bush, Director of OSRD, as Chairman, Major General W. D. Styer, Chief of Staff, SOS, Rear Admiral W. R. Purnell, Assistant Chief of Staff to Admiral King; Dr. James B. Conant serves as Dr. Bush's deputy and alternate on this Committee, but attends all meetings and enters into all discussions. Brigadier General L. R. Groves of the Corps of Engineers has been given over-all executive responsibility for this project, working under the direction of the Military Policy Committee. He works in close cooperation with Dr. Conant, who is Chairman of the group of scientists who were in charge of the earlier phases of some aspects of the investigation.

III. Responsibilities of the Scientific Director.

1. He will be responsible for:

a. The conduct of the scientific work so that the desired goals as outlined by the Military Policy Committee are achieved at the earliest possible dates.

b. The maintenance of secrecy by the civilian personnel under his control as well as their families.

2. He will of course be guided in his determination of policies and courses of action by the advice of his scientific staff.

3. He will keep Dr. James B. Conant and General Groves informed to such extent as is necessary for them to carry on the work which falls in their respective spheres. Dr. Conant will be available at any time for consultation on general scientific problems as well as to assist in the determination of definite scientific policies and research programs. Through Dr. Conant complete access to the scientific world is guaranteed.

IV. Responsibilities of the Commanding Officer.

1. The Commanding Officer will report directly to General Groves.

2. He will be responsible for:

a. The work and conduct of all military personnel.

b. The maintenance of suitable living conditions for civilian personnel.

c. The prevention of trespassing on the site.

d. The performance of duty by such guards as may be established within the reservation for the purpose of maintaining the secrecy precautions deemed necessary by the Scientific Director.

V. Cooperation.

The closest cooperation is of course necessary between the Commanding Officer and the Scientific Director if each is to perform his function to the maximum benefit of the work. Such a cooperative attitude now exists on the part of Dr. Conant and General Groves and has so existed since General Groves first entered the project.

Very sincerely yours,

James B. Conant

Leslie R. Groves

APPENDIX NUMBER 2

HIROSHIMA TELETYPE

Copy of teletype announcing success of Hiroshima mission received at Los Alamos from Washington office, prepared by Manley (see Chapter XIX).

Note comments by teletype operators at end. They were T/3 Flora L. Little of Jackson, Mississippi, in the Washington office and T/3 Mildred Weiss of New Orleans, Louisiana, in the Los Alamos office.

NR 137
FROM WASH LIAISON OFC WASH DC AUG 45[illegible]
TO COMMANDING OFFICER CLEAR CREEK
FIVE PARTS - TART ONE
SW
KC

FLASHED FROM THE PLANE BY PARSONS ONE FIVE MINUTES AFTER RELEASE
AND RELAYED HERE WAS THIS INFORMATION QUOTE PAREN REF EIDM WL
TO OPPENHEIMER FROM GENERAL GROVES THIS RESUME OF MSSSAGES PREPARED
BY DOCTOR HANLEY PAREN CLEAJ CUT RESULTS COMMA IN ALL RESPECTS SUCCES
FUL PD EXCEEDED TR TEST IN VISIBLE EFFECTS PD NORMAL CONDITINXXXXXX
CONDITIONS OBTAINED IN AIRCRAFT AFTER DELIVERY WAS ACCOMPLISHED PD
VISUAL ATTACK ON HIROSHIMA AT ZERO FIVE TWO THREE ONE FIVE Z WITH
ONLY ONE TENTH CLOUD COVER PD FLACK AND FIGHTERS ABSENT UNQUOTE AFTER
RTXXXX RETURN TO BASE AND GENERAL INTERROGATION FARRELL SENT THE
FOLLOWIGXXXX FOLLOWING INFORMATION QUOTE ALARGE OPENING IN CLOUD
COVER DIRECTLY OVER TARGET MADE BOMBING FAVORABLE PD EXCELLENT RECORD
REPORTED FROM FASTAX PD FILMS NOT YET PROCESSED BUT OTHER OBSERVING
[illegible]SOALSO ANTICIPATE GOOD TREXXXX RECORDS NXX PD NO APPRE
JQXO JCFA
R NIL
K HOW MANY LINES DID U GET
R 12 LINWA
PLANES ALSO ANTICIPATE COOO RCXXX RECORDS PD NO APPRECIABLE NOTICE OF
SOUND PD BRIGHT DAYLIGHT CAUSED FLASH TO BE LESS BLINDING THAN TRPXXX
TR PD A BALL OF FIRE CHANGED IN A FEW RECORDS TO PURPLE CLOUDS AND
BOILING AND UPWARD SWIRLING FLAMES PD TURN JUST COMPLETED WHEN FLASH
WAS AXXX OBSERVED PD INTENSLY BRIGHT LIGHT CONCEALED BY ALL AND RATE
OF RISE OF WHITE CLOUD FASTER THAN AT TR PD IT WAS ONE THIRD GREATER
IN DIAMETER REACHING THIRTY THOUSAND FEET IN THREE MINUTES PD MAXIMUM
ALTITUDE AT LEAST FORTY THOUSAND FEET WITH FLATTENED TOP AT THIS
LEVEL PD COMBAT AIRPLANE THREE HUNDRED SIXTY THREE MILES AWAY AT
[illegible]THOUSAND FEET OBSERVEDIT PD D
NIL ACN
OK OPR WELL JUST HAVE TO KEEP TRING AS THESE MESSAGES AR IMP
MIN PLS
OPR U STARTED THIS MSG AS PART TWO ISNT IT PART OF PART ONE
M MIN OPR I TOLD U I WO START PART TWO WHERE PART ONE NILED
IS THAT CLEAR

BUT OPR I DIDNT GET PART ONE COMPLETE

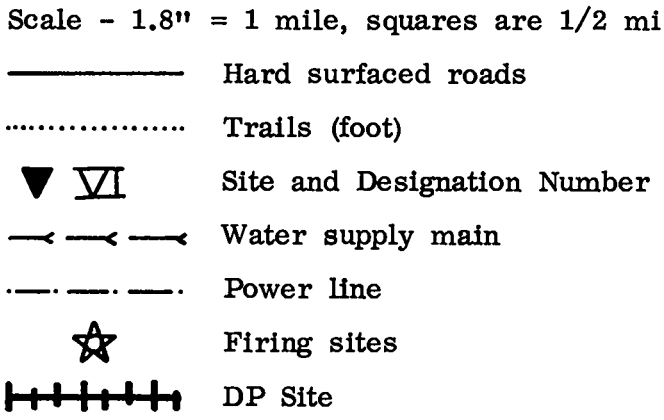
AND THE I TOLD TO U TO SA START WITH I2 LINE
AND THE 12 LINE U L O WELL I THOT U MEANT U GOT 12 OK
M THIS IS A AWFUL MESS ISNT IT IT SH SURE IS DOU THINMI WNGEFG

MIN PLS
TRY ANOTHER MACHINE MAYBE IT WILL DO VETTER
OPR IT ISNT UC MACH AND I KNOW IT IT S MINE AND THERE ISNT
A THING CAN BE DONE AS THE REPAIR MAN SAYS THERE ISNT ANYTHING WRONG
WITH IT HES BEEN HERE ALL DAY AND THIS IS AS GOOD AS IT WAILL RUN
I HAVE LOADS TO GO UXX TO U TONIGHT BUT WELL HAVE TO DO IT THIS WAY
A FEW LINES AT A TIME MIN I WANT TO TALK TO THE LT A MIN
OK
OPR ILL CALL U BACK IN A BT 10 MINUTES
OK

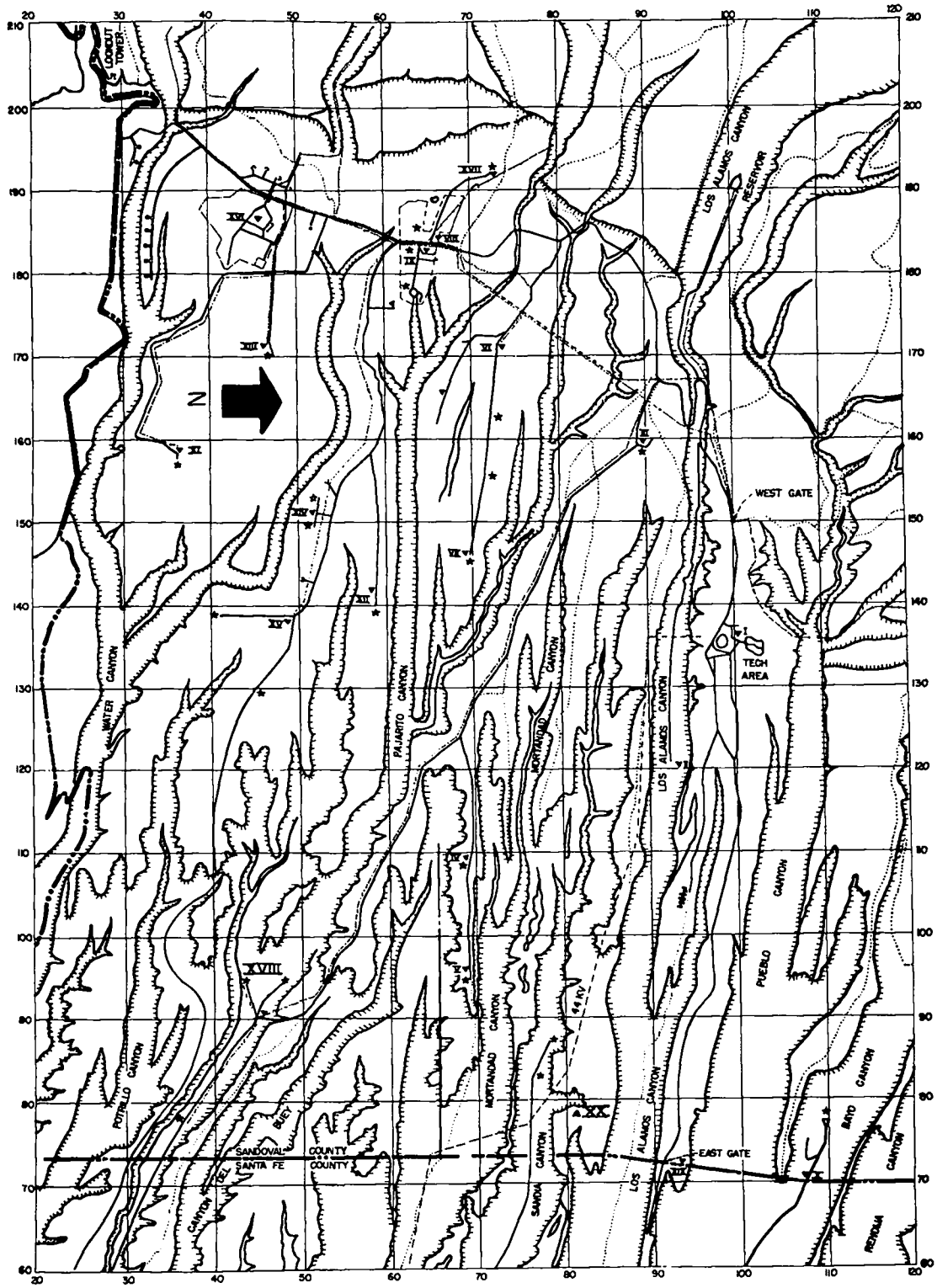
APPENDIX NUMBER 3

SITE MAP

Scale - 1.8" = 1 mile, squares are 1/2 mi. × 1/2 mi.



Number	Site	Division	NS Coordinate	EW Coordinate
I	Post Tech Area		100	135
II	Omega	G	93	121
III	S. Mesa	G	89	158
IV	Alpha	G	68	108
V	Beta	G	69	94
VI	2-Mile Mesa - upper	X	74	171
VII	2-Mile Mesa - lower	Q	69	147
VIII	Anchor Gun Site	O	65	184
IX	Anchor HE	X	65	183
X	Bayo	G	107	71
XI	K	G	38	157
XII	L	X	59	139
XIII	P	G	47	171
XIV	Q	X	52	152
XV	R	X	49	138
XVI	S	X	46	187
XVII	X	G	72	192
XVIII	Pajarito	O-X	45	91
XIX	E. Gate Lab	R	93	72
XX	Sandia	G	77	82


LOOKOUT TOWER
LOS ALAMOS RESERVOIR
CANYON
WEST GATE
TECH AREA
PAJARITO CANYON
MORTANDAD CANYON
PUEBLO CANYON
WATER CANYON
POTRILLO CANYON
SANDIA CANYON
RENDIJA CANYON
SANDOVAL COUNTY
SANTA FE COUNTY
EAST GATE
N

APPENDIX NUMBER 4

TRINITY PROJECT DETAIL LOCATION PLAN

Station	Group Leader	Symbol
Piezo Gauge	Walker	×
Sentinel (Type A)	Moon	⊛
Sentinel (Type B)	Moon	*
Geophone	Houghton	△
Paper Box Gauge	Hoogterp	⊡
Flash Bomb	Mack	◩
R 4 Ground Station	Segrè	⊠
R 4 Balloon Winch	Segrè	♀
E. D. G.	Moon	‡
Mack Slit Camera	Mack	♌
Impulse Meter	Jorgensen	◓
Condenser Gauge	Bright	◙
Excess Velocity Gauge	Barschall	⊕
Tank Range Poles	Anderson	⚠
Tank Flag Poles	Anderson	⚐
Primacord Station	Mack	☉
Metal Stake (Earth Disp)	Penney	○
Piezo Gauge Amplifier	Walker	◎
Balloon	Richards	♀
Balloon Winch	Richards	⊖
Ground Station	Richards	⊕

Roads

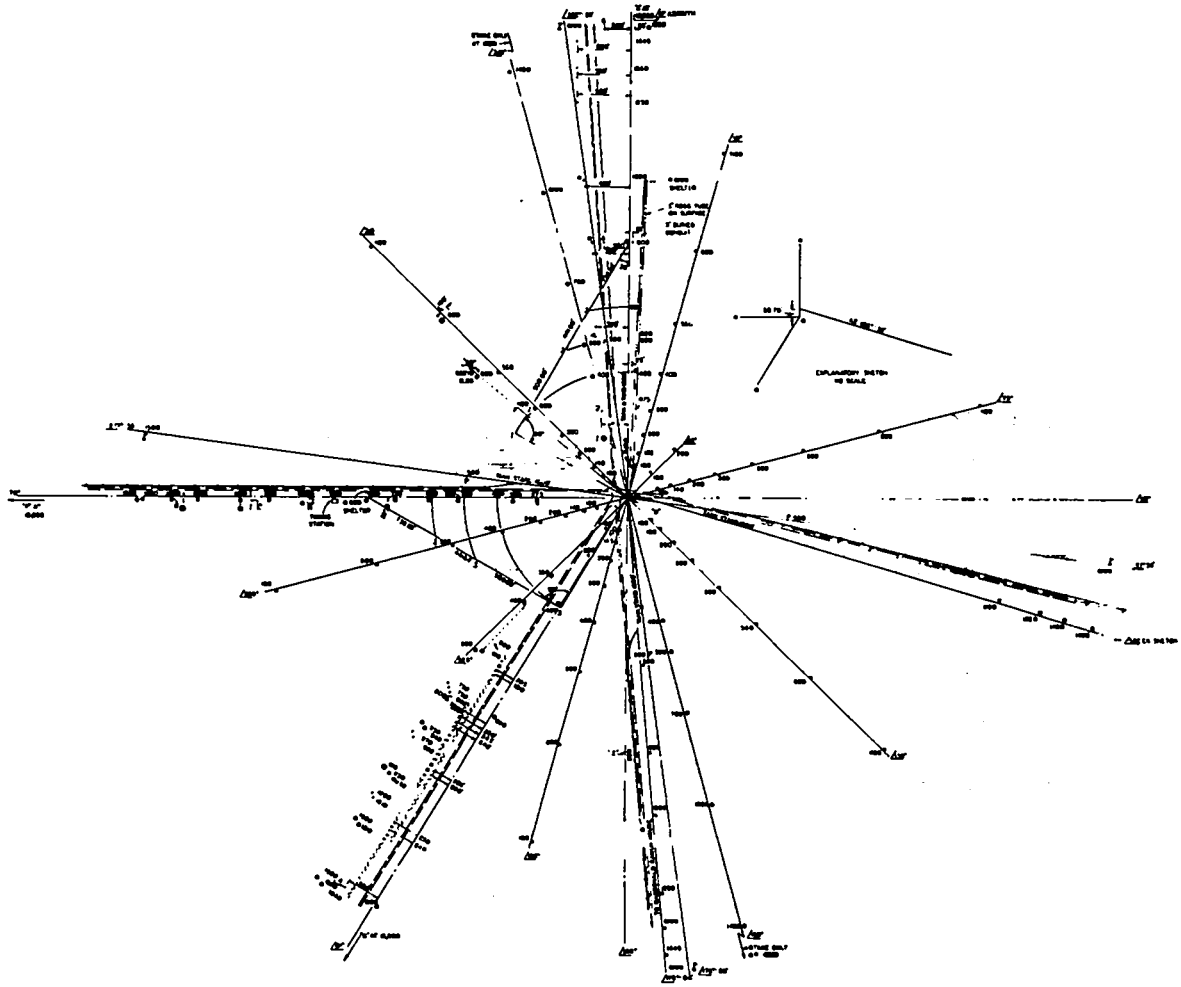
Buried Wires or Cables

Center Lines

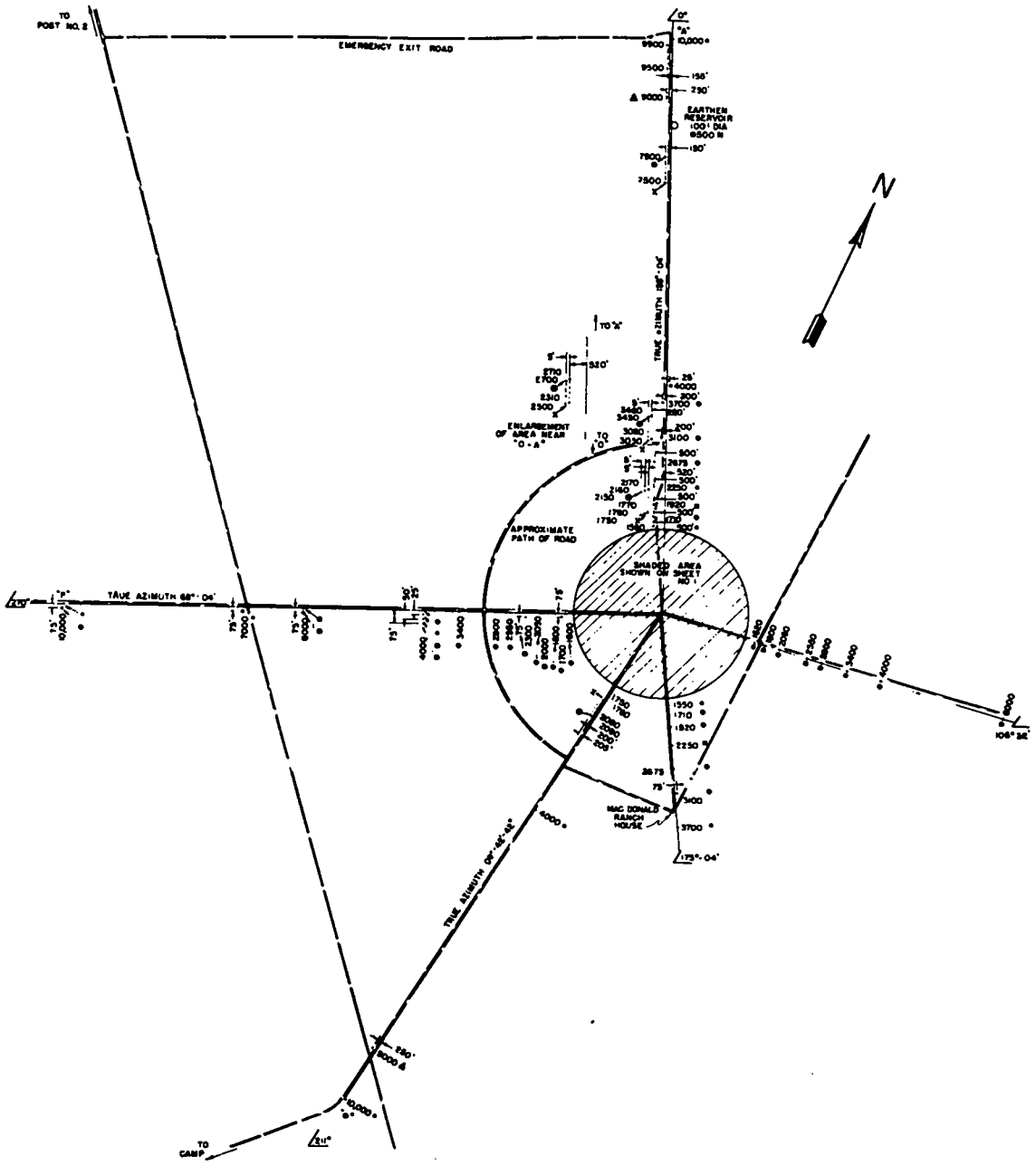
Tank Right of Way

Note: Angles are Azimuths on "OA" Line
Distances thus (800) are Radial Yards from "O"
Distances thus (75') are Offsets from L of Roads and Center Lines.

Scale: 1500 Yard circle - 1" = 300 Yards. - Sheet 1
10,000 Yards - 1" = 2750 Yards. - Sheet A



Sheet 1


TO POST NO. 2
EMERGENCY EXIT ROAD
EARTHEN RESERVOIR 100' DIA 6500 M
TRUE AZIMUTH 158° 04'
TO "A"
TO "O"
ENLARGEMENT OF AREA NEAR "O - A"
APPROXIMATE PATH OF ROAD
SHADED AREA SHOWN ON SHEET NO. 1
TRUE AZIMUTH 68° 04'
TRUE AZIMUTH 09° 48' 48"
MAC DONALD RANCH HOUSE
TO CAMP
N

Sheet A

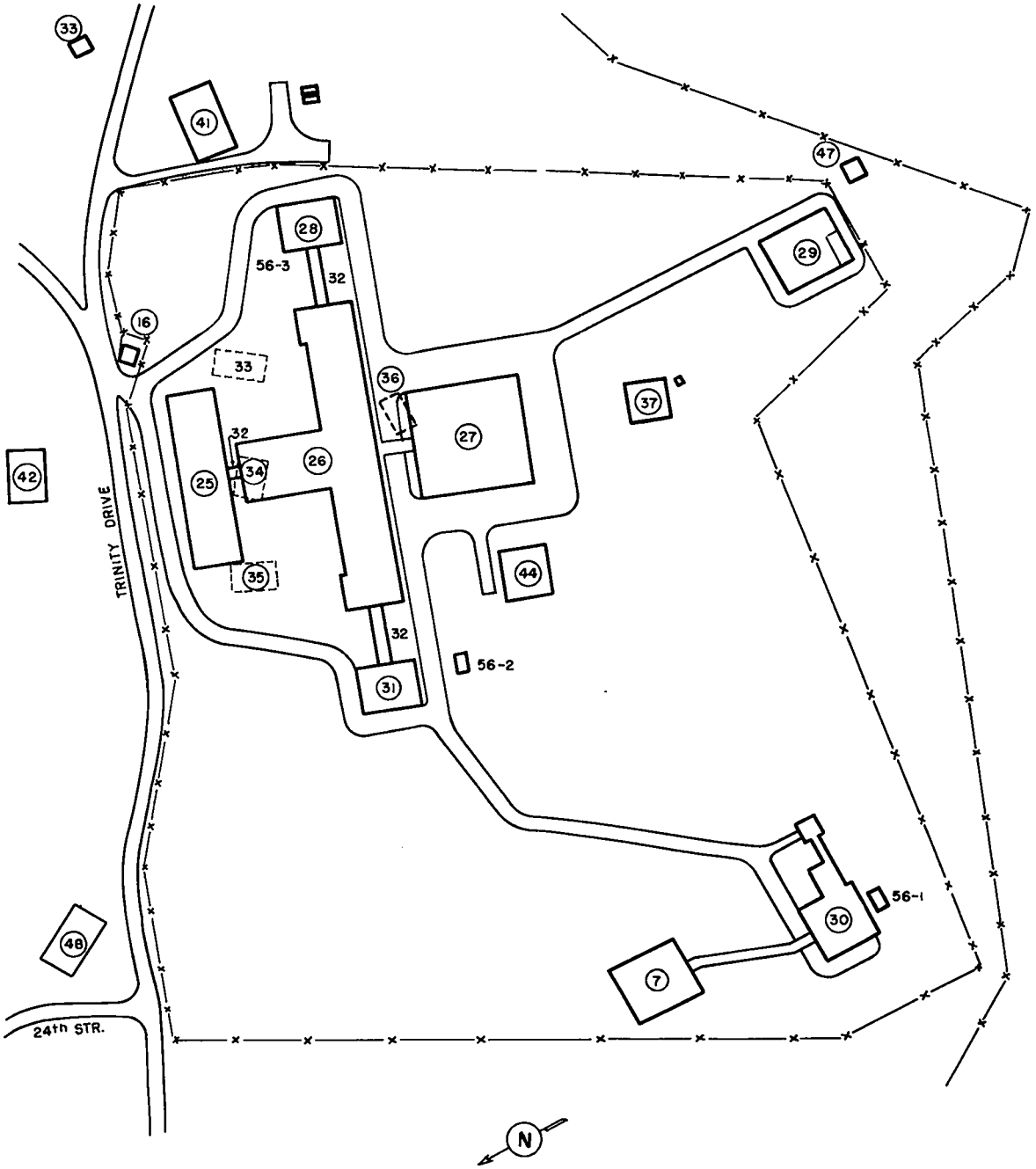
APPENDIX NUMBER 5

TECHNICAL AREA PLOT MAP

Map showing building layout of the Technical Area, as drafted in December 1942. Technical Buildings T, U, V, W, X, Y and Z were constructed as map indicates. Dashed lines show removed ranch houses.

TECHNICAL AREA AS OF DECEMBER 1942

Building No.	Designation
7	Infirmary
16	Gatehouse
25	T - Main Tech Building
26	U - Chem. and Phys. Labs
27	V - Shop (Machine)
28	W - Van de Graaff
29	Y - Cryogenics Lab
30	X - Cyclotron
31	Z - Cockcroft-Walton
32	Covered walk
33-36	Ranch houses
37	Chem. Stock
41	Warehouse
42	Icehouse
44	Boiler
47	Guard tower
48	Ranch house - PX
56	Cooling towers


33
41
47
28
56-3
32
29
16
33
36
37
32
27
42
25
34
26
TRINITY DRIVE
35
44
32
56-2
31
56-1
30
48
7
24th STR.
N

GLOSSARY OF TERMS

GLOSSARY OF TERMS

(α, n) Reaction. Any nuclear reaction in which an alpha particle (helium nucleus) is absorbed by a nucleus, with subsequent emission of a neutron.

Autocatalytic Assembly. Any method of assembling supercritical amounts of nuclear explosive, in which the initial stages of the explosion are made to assist the further assembly of the explosive. e.g., by expulsion or compression of neutron absorbers placed in the active material.

Baratol. A castable explosive mixture of barium nitrate and TNT.

Baronal. A castable explosive mixture of barium nitrate, TNT, and aluminum.

Betatron. Induction electron accelerator for generating electron beams of very great energies.

Branching Ratio. The ratio of the capture cross section to the fission cross section.

Cockcroft-Walton Accelerator. An accelerator using voltage multiplication of the rectified output of a high voltage transformer to obtain a high potential.

Composition B. A castable explosive mixture containing RDX, TNT, and wax in the proportion 60/40/1.

Critical Mass. That amount of fissionable material which, under the particular conditions, will produce fission neutrons at a rate just equal to the rate at which they are lost by absorption (without fission) or diffusion out of the mass.

Tamped Critical Mass. The critical mass when the active material is surrounded by a tamper.

Critical Radius. The radius of a spherical arrangement of fissionable material equal to one critical mass under existing conditions.

Cross Section. A quantitative measure of the probability per particle of the occurrence of a given nuclear reaction. It is defined as the number of nuclear reactions of a given type that occur, divided by the number of

target nuclei per square centimeter and by the number of incident particles.

Absorption Cross Section. The cross section for the absorption of a neutron by a given nucleus.

Capture Cross Section. The cross section for the (n, γ) reaction, in which a neutron is absorbed by a nucleus, with subsequent emission of gamma radiation.

Fission Cross Section. The cross section for the absorption of a neutron, followed by fission.

Scattering Cross Section. The cross section for the scattering of a neutron by the nuclei of some target material. Since scattering is a quantitative matter, the definition is incomplete. The differential scattering cross section is the cross section for scattering at an angle between θ and $\theta + d\theta$. The transport cross section is an average or integral scattering cross section, so defined as to give the average scattering in the forward direction:

$$\sigma_T = 2\pi \int_0^\pi (1 - \sin \theta)\ \sigma_s\ (\theta)\ \sin \theta\ d\ \theta$$

where $\sigma_s(\theta)$ is the differential scattering cross section defined above.

Cyclotron. Magnetic resonance accelerator, used in investigating atomic structures.

D(d, n) Reaction. The nuclear reaction produced by bombarding deuterons with deuterons, producing high energy neutrons.

D-D Source. The above reaction used as a source of high energy neutrons. At Los Alamos, the Cockcroft-Walton accelerator was principally used for this purpose.

Deuterium. Heavy hydrogen, D_2 or H_2^2, the hydrogen isotope of mass two.

Deuteron. A nucleus of deuterium or heavy hydrogen.

Electron Volt. An electron volt is the energy acquired by an electron falling through a potential of 1 volt. One electron volt is about 1.6×10^{-12} ergs. In thermodynamic units, 1 electron volt corresponds to a temperature of about 12,000 degrees absolute. Thus a fortieth of a volt per particle corresponds to "room temperature." Energies of this order are called "thermal." One million electron volts corresponded to a temperature of 1.2×10^{10} degrees absolute.

Fission Spectrum. The spectrum, or energy distribution, of neutrons emitted in the fission process.

Inelastic Scattering. The scattering of neutrons in which energy is lost to excitation of target nuclei.

Li(p, n) Reaction. The nuclear reaction in which neutrons are produced by bombardment of lithium by protons.

Neutron Number. The number of neutrons emitted per fission. This number is statistically variable; the expression refers therefore to the average number per fission.

(n, γ) reaction. A nuclear reaction in which a neutron is captured by a nucleus, with subsequent emission of gamma radiation.

PETN. Pentaerythritol tetranitrate.

RDX. Cyclotrimethylenetrinitramine.

Thermonuclear reaction. A mass nuclear reaction induced by thermal agitation of the reactant nuclei. The reaction is self-sustaining if the energy release is sufficient to counter-balance the energy losses that may be involved.

Tamper. A neutron reflector placed around a mass of fissionable material to decrease the neutron loss rate.

Taylor Instability. A hydrodynamical principle which states that when a light material pushes against a heavy one, the interface between them is unstable, and that when a heavy material pushes against a light one, the interface is stable.

Tritium. The hydrogen isotope of mass three. This isotope was discovered in the Cavendish Laboratory by Oliphant in 1934. It was there produced by deuterium-deuterium bombardment. Tritium is a radioactive gas with a half-life of about twenty years.

Triton. A nucleus of tritium.

Thermal Neutrons. Neutrons of thermal energy - see Electron Volt.

T-D Reaction. The nuclear reaction of tritons with deuterons.

Torpex. A castable explosive mixture of RDX, TNT, and aluminum.

Van de Graaff Generator. An accelerator using the electrostatic charge collected on a mechanically driven belt to obtain a high potential.

INDEXES

NAME INDEX[1]

[1]References are to paragraph and exhibit numbers.

SUBJECT INDEX[1]

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