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October 17, 1957

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ATOMIC ENERGY COMMISSION

DEMONSTRATION SHOT FOR OPERATION HARDTACK

Note by the Secretary

The attached memorandum and enclosures from the Director of Military Application is circulated for the information of the Commission in connection with the briefing by the Laboratory Directors scheduled for the afternoon of Tuesday, October 22, 1957.

W. B. McCool

Secretary

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ATOMIC ENERGY COMMISSION

DEMONSTRATION SHOT FOR OPERATION HARDTACK

Report to the General Manager by the
Director of Military Application

1. The purpose of this report is to present information on the various means which are under consideration for carrying out a "demonstration shot" in Operation HARDTACK to furnish an international observer group an opportunity to observe the reduced radioactive fallout characteristic (nature) of a U. S. test.

2. The President, at a press conference on July 3, 1957, stated his intention to invite other nations to observe our ability to produce weapons with reduced fallout. The pertinent extracts from the President's statements are given in Appendix "A".

3. On September 15, 1957, the Atomic Energy Commission and the Department of Defense jointly announced a series of nuclear tests to begin in April, 1958 at the Eniwetok Proving Ground (Appendix "B"). In this announcement it was stated that:

"A United Nations agency will be invited to designate an international group to observe one of the detonations involving limited fallout and studies are under way to determine the instrumentation which will facilitate their observation without making disclosures which would compromise restricted weapon information in violation of the Atomic Energy Act of 1954."

4. The international observer group should be under the auspices of an appropriate United Nations agency in order that

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there will be only a single group to deal with rather than a number of observer groups each representing a single nation. If each nation were allowed to send its own observer group and conduct its own experiments the problems, including control of classified information, of the test organization and other government agencies would be vastly complicated. Furthermore, an observer team of the United Nations assures the best possibility of placing an unbiased judgment before the world audience. The observer group should consist primarily of a team of competent scientists and technicians as required to carry out the necessary experiments, measurements and analyses. It will probably be necessary for this team to receive a certain amount of training, prior to the demonstration shot, in the equipment and technique of the method to be used. The personnel of the observer team will either perform all or part of the actual work themselves under the general guidance and supervision of U. S. personnel, or the work will be done by U. S. personnel under close observation by the observer group.

5. Ideally, the method which is used to demonstrate the fact of reduced fallout should possess the following characteristics:

a. High credibility - the results of the demonstration should be convincing to the observer group.

b. High reliability - both the weapon and method used should give adequate assurance of success.

c. Minimum disclosure of classified information - the method should not require the disclosure of classified information, at least of the more sensitive categories. Special care must be exercised to avoid the possibility that whatever information is disclosed, when taken with information which might already be available or which might become available to other nations, might reveal information of greater sensitivity.

d. Minimum cost - the method should not be prohibitively expensive to carry out.

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e. Adequate time to prepare - there must be sufficient time before the demonstration shot to develop the method, secure agreement with the U. N. agency, work out the necessary details, and train the observer team.

f. Operational simplicity - the scientific effort and logistic support required from the test organization should not interfere with the HARDTACK program.

6. The possible methods can be grouped under two general headings -- absolute and comparative. The absolute methods involve the direct measurement on a single shot of the quantities necessary to demonstrate the fact of reduced fallout. The comparative methods require the comparison of these quantities on two shots, without the necessity for disclosing the absolute values of these quantities.

7. The first method is to show on a single clean shot that the fission yield is only a very small fraction of the total yield. The total yield can be obtained by any of the usual hydrodynamic methods -- fireball photography, time of shock arrival, or shock intensity. The fission yield can be obtained either by the usual radiochemical techniques or by measurement of the gamma radiation from the ball of fire during the first ten seconds after detonation.


8. The radiochemical method for fission yield requires that a tracer be installed on the device for bomb fraction, the cloud be sampled and the fission yield be determined by a limited amount of radiochemical analysis. U. S. scientists would monitor this part of the work of the team to prevent more detailed chemical measurements than necessary for determining the fission yield, or removal of samples for more detailed analysis at a later time (Appendix "D").

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9. The main source of gamma radiation between 5 and 10 seconds after detonation is the fission fragments since the neutrons released to air have disappeared and the contribution from activated elements is negligible at this time. Because of air displacement due to shock the recording stations should be fairly close. Several recording stations, 2000 to 5000 yards from the detonation, consisting of a fluor behind an optical collinating system, a photocell detector and a recording oscilloscope, can give the fission yield to an accuracy within a factor of 1.5 to 2, the chief source of uncertainty being in the estimate of attenuation between the source and the detector (Appendix "C").

 This method requires that the total and fission yields of the weapon be declassified and released. Knowledge of these yields and possession of long range samples for analysis by another nation would permit that nation to obtain important design information about our weapons. Methods of confusing such determinations by the addition of various materials to the fireball of the weapon are presently being investigated. The cost of this method should not be great and there is sufficient time to prepare for its use prior to the demonstration shot. This method possesses operational simplicity, although in common with all methods under consideration, fairly elaborate security and administrative procedures would have to be worked out.

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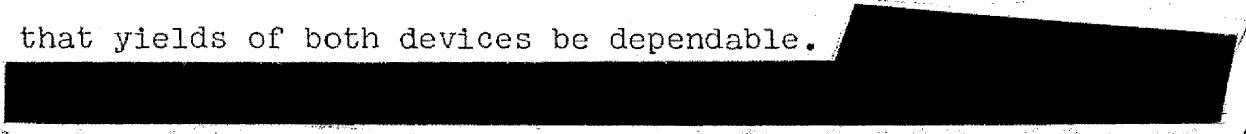
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11. The second method is to compare two shots, one clean and one conventional, of approximately the same total yield, and show that the fission yield of the clean one is many times less than the fission yield of the conventional one. In this method the fact that the total yields of the two shots are approximately the same can be determined without obtaining the absolute value of the total yield of either one. For example, using any of the hydrodynamic methods (fireball photography, time of shock arrival, or shock intensity) and placing the instrument station at a fixed but unknown distance from the zero point where both shots will be fired, it can easily be determined whether the total yields are comparable.

12. The comparison of fission yields can be made by either of two methods. One is to determine for each shot the distribution of fission product activity within the stabilized cloud. This could be done by aircraft flying through the cloud with the proper instrumentation but the reliability and credibility are low since the cloud development will differ on the two shots and the cloud penetrations cannot be duplicated. A better method is to measure the ionization of the cloud by means of instrumented rockets which telemeter their readings to ground stations. About 12 rockets per shot launched at 5 to 7 minutes after detonation (at a time before wind shear sets in) would be sufficient to obtain good coverage of the distribution in the cloud and should give reasonably accurate results. The ratio of these results would give the relative fission yields (Appendices "D" and "E").

13. This second method does not have the credibility or reliability of the first method, in which total and fission yields are measured on a single clean shot. This method also requires that yields of both devices be dependable.



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However, the comparison method does minimize the disclosure of classified information.

[REDACTED]

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6.1(a)

This method will be relatively costly; it is estimated that about one million dollars will be required for the technical program alone. If this method is to be used it will be necessary to start work on the rocket program immediately in order to complete it in time for the demonstration shot. It is estimated that a minimum of five months would be required to prepare for this type of demonstration. Although this method will place an added burden on the test organization it is felt that the Task Force can accept the added load.

14. A third method, also comparative in nature, compares fission yields on two shots by means of the surface fallout contours. Total yields would be compared as in the second method. This method depends on the general observation that the area of fallout times the intensity is proportional to the fission yield. As a matter of fact, this method would give a direct verification of the reduction in fallout. However, the credibility and reliability of this method is extremely low. The dependence of fallout on meteorological conditions which will undoubtedly be different for the two shots, and the occurrence of hotspots increase the probability that the data obtained may not prove the

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desired result. Or, if the data is favorable, the proof will not be very convincing. On past tests these same problems have given confusing data. In addition, this method would require an extensive fallout survey for which the cost would extremely high. The burden on the test organization would be quite heavy and it is doubtful if there is sufficient time to organize and prepare for such a large effort (Appendix "D").

15. It should be noted that the clean and conventional shots fired for the second and third "comparative" methods also should be proven devices, or devices for which a high degree of reliability is felt, in order to have high assurance of a successful demonstration.

16. The Bethe Panel has been asked, through Dr. Northrup, whether either or both methods one and two can be used without revealing important design information (Appendix "G"). It is anticipated that the Bethe Panel answer will be available in time for the Commission meeting on October 22, 1957. An interim reply from Dr. Carson Mark, a member of the Bethe Panel, is attached as Appendix "H". This interim reply reflects Dr. Mark's discussions at Livermore with Dr's Brown and Strut, also members of the Panel.

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APPENDIX "A"

Statement made at President's Press Conference - July 3, 1957:

Page 12 --

"Incidentally, now we are talking, and very hopefully about, about some kind of suspension of tests. But if, ever under any circumstances there is another test made, I am going to invite any country in the world that wants to come and fire its rockets in the air and see just exactly how much radio (radioactive) fallout there is from those bombs because we are not testing to make at this -- to make bigger bombs, as I have told you before. We are trying to make small bombs, clean bombs, and to develop usefulness in a peaceful world, as well as just weapons of war."

Page 19 --

Question: "Sir, would you elaborate a little more on this statement that you make that future atomic tests are going to be open to any country that wants to come to watch them?"

President: "Well, I said this -- well I don't mean to say to take the men and show them all your formulae, and all that sort of thing as to what you have done. But I said certain people have questioned the proposition that Dr. Lawrence and Dr. Teller brought to me, that eventually you could make completely clean bombs, add that even now you are 96 per cent clean, that is, you have only 4 per cent of radioactivity, radioactive fallout, that you did in the original bomb."

"I say we would be glad to ask any nation there to put its proper instruments in the air to detect whether or not their contention is true."

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APPENDIX "B"

U. S. ATOMIC ENERGY COMMISSION

DEPARTMENT OF DEFENSE

Washington 25, D. C.

No. 1163
Tel. ST 3-8000
Ext. 307

FOR IMMEDIATE RELEASE
(Sunday, September 15, 1957)

STATEMENT BY THE DEPARTMENT OF DEFENSE
AND THE ATOMIC ENERGY COMMISSION

In the absence of a safeguarded disarmament agreement, preparations are under way by the Atomic Energy Commission and the Department of Defense for a series of nuclear tests to begin in April, 1958, at the Eniwetok Proving Ground in the Pacific. The United States repeatedly has stated its willingness to suspend nuclear tests as part of a disarmament agreement. Until such an agreement is attained, continued development of nuclear weapons is essential to the defense of the United States and of the Free World.

The forthcoming series will advance the development of weapons for defense against aggression whether air-borne, missile-borne or otherwise mounted. Information on the effects of weapons will be obtained for military and civilian defense use. Test operations will be governed by the declaration made in the Bermuda Communique on March 24, 1957, of the intention of the United States "to conduct nuclear tests only in such manner as will keep world radiation from rising to more than a small fraction of the levels that might be hazardous."

An important objective of the tests will be the further development of nuclear weapons with greatly reduced radioactive fallout so that radiation hazard may be restricted to the military target. This principle was first proved in the Pacific test series of 1956.

A United Nations agency will be invited to designate an international group to observe one of the detonations involving limited fallout and studies are under way to determine the instrumentation which will facilitate their observation without making disclosures which would compromise restricted weapon information in violation of the Atomic Energy Act of 1954. Observation by news media representatives will be provided for in a manner to be announced later.

As in the past series, a control area surrounding the proving grounds will be established to safeguard air and sea traffic and will be defined well in advance of the commencement of operations.

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APPENDIX "C"

INCOMING TELETYPE

SEPT 10, 1957

FM LOS ALAMOS SCIENTIFIC LAB LOS ALAMOS NMEX
TO USAEC WASHDC
INFO ZEN/UCRL LIVERMORE CALIF

S-091A 0 102321Z

PERSONAL FOR STARBIRD, COPY TO SEWELL FROM FROMAN.
REURTT ON PROVING CLEANLINESS OF WEAPONS TO INTERNATIONAL GROUP,
ONLY REALLY CONVINCING PROOF MUST CONTAIN BELIEVABLE DATA ON
TOTAL YIELD AND ON EITHER FISSION YIELD OR THERMONUCLEAR YIELD.
A CONVINCING VALUE OF TOTAL YIELD CAN BE DETERMINED BY HYDRO-
DYNAMIC TECHNIQUES SUCH AS BALL OF FIRE, SHOCK ARRIVAL TIME, OR
SHOCK INTENSITY WITHOUT REVEALING DESIGN INFORMATION. PAST
EXPERIMENTS INDICATE THAT A CONVINCING VALUE OF THE FISSION
YIELD CAN BE MEASURED BY AN ABSOLUTE MEASUREMENT OF THE GAMMA
RADIATION FROM THE BALL OF FIRE DURING THE PERIOD FROM ONE TO
TEN SECONDS AFTER DETONATION. MAIN SOURCE OF GAMMA RADIATION
BETWEEN FIVE AND TEN SECONDS IS FISSION FRAGMENTS SINCE
NEUTRONS RELEASED TO AIR HAVE DISAPPEARED AND CONTRIBUTION
FROM ACTIVATED SODIUM ETC. IS NEGLIGIBLE AT THIS TIME. BECAUSE
OF AIR DISPLACEMENT DUE TO SHOCK, BEST ACCURACY CAN BE OBTAINED
IF RECORDING STATION IS FAIRLY CLOSE (PERHAPS BETWEEN ONE AND
TWO THOUSAND YARDS) TO TEST DEVICE. AN ACCURACY WITHIN A
FACTOR OF ONE AND ONE-HALF OR TWO SHOULD BE POSSIBLE WITH THE
CHIEF UNCERTAINTY BEING IN THE ESTIMATE OF ATTENUATION BETWEEN
SOURCE AND DETECTOR. THIS WOULD GIVE FRACTION OF BOMB ENERGY

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DUE TO FISSION TO NEARLY THE SAME ACCURACY BECAUSE ERRORS IN CALIBRATION AND IN TOTAL YIELD DETERMINATION SHOULD BE LESS. BY USING EITHER DIRECT EXPOSURE OF FILM OR A FLUOR TECHNIQUE, WE GUESS THAT A GROUP OF HALF A DOZEN SCIENTISTS AND TECHNICIANS COULD PREPARE FOR AND CARRY OUT THIS MEASUREMENT AND THE TOTAL YIELD MEASUREMENT BY WORKING TWO OR THREE MONTHS PRIOR TO TEST. ADDITIONAL EXPENSE BEYOND MAINTENANCE OF THE GROUP WOULD BE SMALL, PERHAPS A FEW THOUSAND DOLLARS FOR EQUIPMENT AND THE COST OF CONSTRUCTION OF A FEW WELLS BY HOLMES AND NARVER.

MEASUREMENT OF BOTH TOTAL YIELD AND FISSION YIELD COULD BE PERFORMED BY AN INTERNATIONAL GROUP OR BY US SCIENTISTS UNDER THEIR OBSERVATION. IF THERE IS A PROBLEM CONNECTED WITH DEDUCTIONS ABOUT DESIGN WHICH MIGHT BE MADE BY A GROUP WHICH HAS THE TOTAL AND FISSION YIELDS AND WHICH COLLECTS ITS OWN RADIOCHEMICAL SAMPLES, THESE DEDUCTIONS COULD BE CONFUSED BY PLACING QUANTITIES OF EXTRANEIOUS MATERIALS SUCH AS TUBALLOY NEAR THE BOMB.

THERE IS NO REASON TO LIMIT ABOVE OBSERVATIONS TO A CLEAN DEVICE AND, IF SIMILAR MEASUREMENTS WERE MADE ON A DIRTY OR PURE FISSION BOMB, IT WOULD PROVIDE A KIND OF CHECK ON THE ABSOLUTE CALIBRATION OF THE GAMMA DETECTORS. HOWEVER, YOU MAY NOT WISH TO ADMIT THAT WE ARE TESTING ANYTHING BUT CLEAN BOMBS AND WE BELIEVE THE JOB COULD PROBABLY BE ACCOMPLISHED ON THE BASIS OF A SINGLE TEST WITH A CLEAN DEVICE.

PRESENT PLANS FOR LASL TESTS DO NOT SEEM VERY APPROPRIATE FOR THE DEMONSTRATION BECAUSE OF THE POSITIONS OF BARGES IN THE LAGOON AND THE TYPES OF DEVICES TO BE TESTED. IN PARTICULAR, WE ARE UNHAPPY AT THOUGHT OF USING A PREVIOUSLY UNTESTED, RELATIVELY SMALL CLEAN DEVICE FOR SUCH A DEMONSTRATION BECAUSE

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IT MIGHT FAIL TO BURN WELL AND GIVE A QUITE LARGE FRACTION OF FISSION. MOREOVER, THE FRACTIONAL CLEANLINESS IS EXPECTED TO BE GREATER FOR LARGE YIELDS AND IT IS FOR LARGE YIELDS THAT CLEANLINESS IS IMPORTANT.

[REDACTED] OBVIOUSLY A DEVICE WITH A HIGH DEGREE OF CONFIDENCE IN PERFORMANCE WILL HAVE TO BE USED. GEORGE COWAN IS FAMILIAR WITH OUR DISCUSSIONS ON THIS SUBJECT AND YOU MAY WISH TO QUESTION HIM WHEN HE COMES TO WASHINGTON LATER THIS WEEK.

FOR ANOTHER POSSIBLE METHOD OF DETERMINING FISSION YIELDS WE REFER YOU TO REDWING REPORTS ITR-1352 PROGRAM 2 SUMMARY AND ITR-1320 PROJECT 2.66 INDICATING THE POSSIBILITY OF MAKING AN ABSOLUTE DETERMINATION OF THE FISSION SOURCE.

AT PRESENT LASL IS MAKING NO PREPARATIONS TO IMPLEMENT OR ASSIST IN THE SUGGESTED DEMONSTRATION.

REF THIS MESSAGE TAD-2210.

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APPENDIX "D"


INCOMING TELETYPE

SEPT 11, 1957

FM UNIV OF CALIF RADIATION LAB LIVERMORE CALIF
TO DMA USAEC WASH DC
ATTN BRIG GEN A. D. STARBIRD
INFO/LOS ALAMOS SCIENTIFIC LAB LOS ALAMOS NMEX
ATTN DAROL K. FROMAN, DIRECTORS OFFICE
S-885 57 Sept 102325Z
FROM D. C. SEWELL, SCIENTIFIC OPERATIONS DIRECTION. CIT CLN BY 57-56

WE FEEL THAT INTERNATIONAL OBSERVATION OF FALLOUT REDUCTION FROM
CLEAN BOMBS IMPLIES: TECHNICAL MEASUREMENT OF REASONABLE
PRECISION, THE CREDIBILITY OF SUCH MEASUREMENTS TO INTERNATIONAL
OBSERVERS, AND PROBABLY A FEELING OF SATISFACTION ON THE PART OF
THE OBSERVERS OVER AND ABOVE THE NECESSARY CREDIBILITY REGARDING
THE TECHNICAL MEASUREMENTS.

IN MAKING SUCH A DEMONSTRATION IT WOULD BE VERY DESIRABLE TO
HAVE A PAIR, CONSISTING OF TWO PROOF TESTED DEVICES OF NEARLY
THE SAME TOTAL YIELD BUT QUITE DIFFERENT FISSION YIELD LEVELS
TO DETONATE, MEASURE, AND COMPARE. OBVIOUSLY A LOW TOTAL YIELD
FOR EACH IS DESIRABLE.

 DOE
6/10

AT THIS TIME WE DO NOT BELIEVE THERE IS TIME, BY HARDTACK, TO
DO A GOOD ENOUGH TECHNICAL JOB TO BE USEFULLY CONVINCING. WE
BELIEVE THAT SUCH A JOB COULD BE DONE, GIVEN SUFFICIENT TIME.
THIS REQUIRES TWO STEPS. ONE, MORE TECHNICAL INVESTIGATION

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AND DEVELOPMENT BY THE UNITED STATES AHEAD OF TIME AND TWO, ADEQUATE GENERAL EDUCATION, AND THOROUGH TRAINING OF THE INTERNATIONAL OBSERVERS IN THE USE, ANALYSIS, AND FEASIBILITY OF THE TECHNIQUES INVOLVED. THE OBSERVERS SHOULD DO THE WORK THEMSELVES.

SUCH AN OBSERVER TEAM SHOULD BE CAPABLE, HAVE "LONGEVITY" AS A UNIT, AND BE RESPONSIBLE TO A CONTINUING BODY SUCH AS THE UNITED NATIONS.

AT THE PRESENT TIME THE MOST HOPEFUL TECHNIQUE IS PROBABLY THE ROCKET IONIZATION MEASUREMENTS IN THE CLOUD SUCH AS WAS INVESTIGATED BY NRDL. AT CONSIDERABLE RISK OF LACK OF CREDIBILITY, THIS TECHNIQUE MIGHT BE USED WITHOUT FURTHER DEVELOPMENT BY THE UNITED STATES. EVEN SO, WE DO NOT BELIEVE THAT THERE IS NOW TIME TO GET A PROPERLY TRAINED AND QUALIFIED INTERNATIONAL TEAM READY. IN ADDITION, WE BELIEVE THE TECHNIQUE SHOULD RECEIVE FURTHER DEVELOPMENT BY THE UNITED STATES BEFORE GOING TO INTERNATIONAL HANDS.

ANOTHER TECHNIQUE, FALLOUT MEASUREMENTS ON THE SURFACE, APPEARS UNRELIABLE AND PROBABLY UNCONVINCING SINCE IT DEPENDS UPON METEROLOGICAL CONDITIONS IN A COMPLEX WAY, AND CONDITIONS SIMILAR ENOUGH FROM SHOT TO SHOT WILL BE HARD TO FIND.

LOCAL FALLOUT MEASUREMENTS IN THE PACIFIC COULD VERY EASILY GIVE MISLEADING INFORMATION, SINCE SPOT MEASUREMENTS IS ALL ONE COULD EXPECT TO MAKE WITH EASE EITHER ON LAND OR ON THE OCEAN. WE FEEL COMPARISON OF THE REDWING SHOTS ZUNI AND TEWA (JO-269, 15 OCT 1956; JO-262, 3 OCT 1956) POINTS OUT HOW SERIOUS QUESTIONS OF CREDIBILITY COULD BE RAISED ABOUT FALLOUT MEASUREMENTS ON LAND.

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THE ONLY POSSIBILITY WHICH APPEARS TO US TO BE TECHNICALLY FEASIBLE BY HARDTACK AND CREDIBLE TO INTERNATIONAL OBSERVERS INVOLVES A RISK OF RELEASING USEFUL DATA. THIS WOULD BE THE EMPLOYMENT BY THE INTERNATIONAL TEAM OF A LIMITED AMOUNT OF THE USUAL RADIOCHEMICAL TECHNIQUES. THE TEAM WOULD DO ALL THE WORK: MEASURE AND INSTALL A BULKY (TONS) TRACER FOR BOMB FRACTION, SAMPLE THE CLOUD, MEASURE FISSION YIELD. UNITED STATES TEAM MEMBERS WOULD MONITOR THE WORK TO PREVENT MORE DETAILED CHEMICAL MEASUREMENTS AND TO PREVENT TAKING SAMPLES HOME FOR MORE DETAILED ANALYSIS. WE MENTION THIS HERE, WITHOUT RECOMMENDATION.

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APPENDIX "E"

INCOMING TELETYPE

FM UNIV OF CALIF RADIATION LAB LIVERMORE CALIF
TO DMA USAEC WASHDC

ATTN BRIG. GEN. A. D. STARBIRD

INFO USAEC SAN OAKLAND CALIF
BRADBURY/GRAVES LASL

ATTN H. A. FIDLER

S-895 57 SEPTEMBER 181835Z

FROM MARK MILLS. THIS IS IN REGARD TO INTERNATIONAL OBSERVATION
OF CLEAN BOMB TESTS.

WE STILL BELIEVE THAT PAIRED SHOTS AND ROCKET OBSERVATION
REPRESENTS THE BEST CURRENTLY AVAILABLE APPROACH.

IN CONSULTING TODAY WITH NRDL WE FIND THAT ONE COPY OF THE
PRELIMINARY DRAFT OF THE FINAL REPORT ON THIS TECHNIQUE HAS
ALREADY GONE TO YOU AND ONE TO HEADQUARTERS AFSWP. THIS REPORT
IS: PROJECT 2.61, ROCKET DETERMINATION OF ACTIVITY DISTRIBUTION
WITHIN THE STABILIZED CLOUD BY RICHARD R. SOULE AND TAKEO H.
SHIRASAWA, REPORT WT-1315, NRDL DOCUMENT CONTROL NUMBER 0016231,
DATED JULY 1, 1957. WE WOULD LIKE TO ASK YOU TO REQUEST FOR US
A COPY OF THIS PRELIMINARY FINAL DRAFT TO BE MADE AVAILABLE
PROMPTLY.

THE REPORT ESTABLISHES THE TECHNIQUE AS FEASIBLE, ALTHOUGH A
FINAL PROOF TEST EMPLOYING MORE ROCKETS PER SHOT ON SEVERAL
DEVICES WOULD BE DESIRABLE BEFORE INTERNATIONAL PARTICIPATION.



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WE SUGGEST THAT 48 ROCKETS BE ORDERED FROM COOPER, 12 TO BE FIRED IN UNITED STATES WITH INTERNATIONAL PARTICIPATION TO ESTABLISH TRAJECTORIES, 12 TO BE FIRED AT A SHOT BY U.S. TASK FORCE ALONE, AND 24 IN GROUPS OF 12 EACH BE FIRED WITH INTERNATIONAL PARTICIPATION AT EACH OF THE PAIRED CLEAN AND STANDARD CLOUD. LAUNCH TIME 5 TO 7 MINUTES IN ALL CASES TO MINIMIZE SHEAR AND ATTACHED FLARE PLUS PHOTOGRAPHY CAN BE EMPLOYED TO VERIFY ROCKETS ENTER CLOUD. COOPER STATES THAT WITH WIDE BAND TELEMETRY, GOOD SIGNALS AND AN UNAMBIGUOUS ROCKET IDENTIFICATION, ARE STRAIGHTFORWARD.



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ALTHOUGH LOW YIELD IS LESS DISTURBING TO OBSERVERS, A YIELD ABOVE ONE MEGATON SO THAT SUBSEQUENT FALLOUT IS WORLD WIDE IS MORE PERTINENT. THE CLEAN SHOT SHOULD NOT BE SO LARGE AS TO CAUSE WEATHER DELAYS OR SERIOUS LOCAL FALLOUT. A BARGE PLUS BORON CATCHER FOR ESCAPING NEUTRONS IS DESIRABLE.

DOE
6.1(a)



COOPER HAS ESTIMATED THAT IT CAN BE DONE IN TIME AND AT A COST OF ABOUT ONE MILLION DOLLARS OR LESS FOR THE TECHNICAL PROGRAM.

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THERE MAY BE ADDITIONAL COSTS IF ELABORATE SEPARATION OF INTERNATIONAL AND OTHER ACTIVITIES AT COOPER IS REQUIRED, OR IF TELE-METERING EQUIPMENT IS IMPOUNDED BY INTERNATIONAL TEAM.

INTERNATIONAL OBSERVERS MUST BE TECHNICALLY COMPETENT AND ACCEPTABLE TO UNITED STATES. THE OBSERVER TEAM MUST HAVE LONGEVITY AND BE ATTACHED TO PERMANENT INTERNATIONAL ORGANIZATION.

IF TO BE DONE IN TIME, IT IS URGENT TO GET COOPER STARTED IMMEDIATELY. SUGGEST PROGRAM THROUGH KEN STREET AT UCRL, AND COOPERATION OF NRDL BE REQUESTED THROUGH CHANNELS. A PROTOCOL AND ADMINISTRATIVE GROUP SHOULD ALSO BE STARTED TO ADMINISTER, GUARD, AND EDUCATE THE INTERNATIONAL TEAM.

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APPENDIX "F"

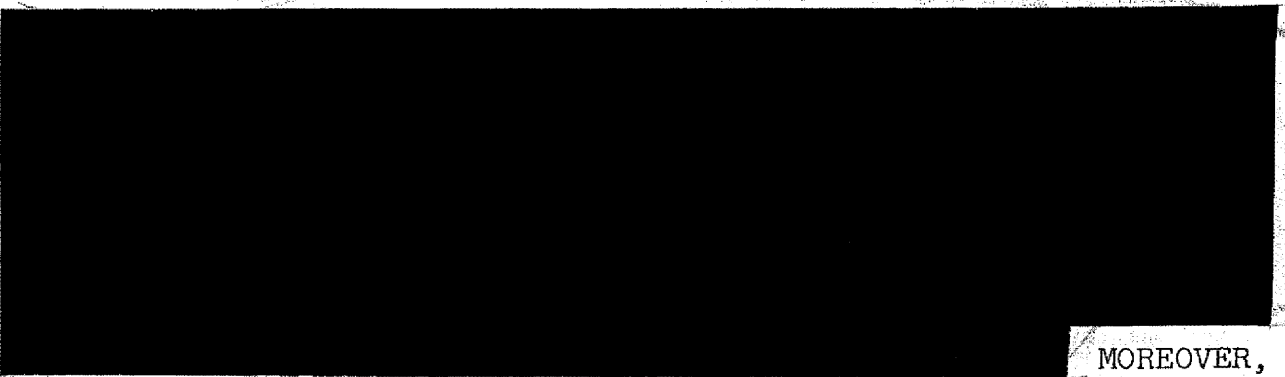
INCOMING TELETYPE

FM J DIV LASL LOS ALAMOS NMEX

TO USAEC DMA WASHDC

NR S-17 R 072337Z

TO A. D. STARBIRD FROM A. C. GRAVES AND W. E. OGLE. CITE JDO:-708.



MOREOVER,

SINCE MEGACURIE QUANTITIES OF SUCH ACTIVITIES ARE FORMED WE KNOW OF NO PRACTICAL METHOD OF CONFUSING OBSERVERS. HENCE, A LITERAL INTERPRETATION OF THE PRESIDENTS OFFER MUST RELEASE SIGNIFICANT INFORMATION. THE INFORMATION RELEASED BECOMES LESS SIGNIFICANT THE LESS QUANTITATIVELY ONE RELEASES THE RATIO OF FISSION TO TOTAL YIELD BUT THE LESS CONVINCING THE DEMONSTRATION BECOMES. IT SEEMS TO US THAT THERE ARE THREE COURSES OF ACTION. ONE, THAT WE ACCEPT THE COMPROMISE OF SIGNIFICANT INFORMATION AND DO THE BEST POSSIBLE JOB OF CONVINCING THE OBSERVER TEAM (RADIOCHEMISTRY). TWO, ACCEPT A LESSER DEGREE OF CONVICTION IN THE OBSERVER TEAM BY OFFERING A MORE QUALITATIVE METHOD, SUCH AS OBSERVATIONS WITH ROCKET OR AIRPLANE PENETRATIONS OF THE CLOUD OR FALLOUT OBSERVATIONS. AND THREE, NEGOTIATIONS AND CONVERSATIONS BETWEEN THE UNITED NATIONS AND THE UNITED STATES COULD BE PROLONGED UNTIL THE COMPLETION OF HARDTACK. THE ABOVE THREE COURSES OF ACTION ARE IN INVERSE ORDER TO OUR BEST ADVICE.

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APPENDIX "G"


JOINT MESSAGEFORM

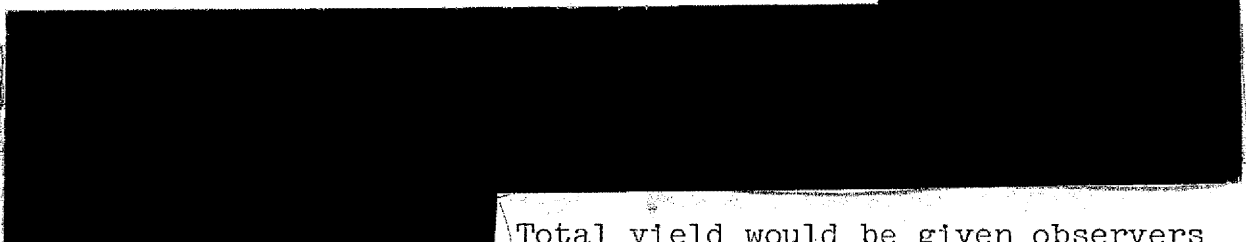

FROM: HQ USAF
AFOAT-1
WASH DC

TO: Dr. Hans A. Bethe
Cornell University
Ithaca, New York

CITE SWTD 8768

Starbird has submitted to us a question for the opinion of the Bethe Panel. The questions arise from the U.S. offer to allow foreign observers at a test of a U.S. clean weapon where they will be shown to the extent practical without revealing important nuclear design information, that the device was relatively clean. Since preparations must go forward immediately, he has asked for the earliest possible reply.

After detailed consultation it appears that there are two possible ways of fulfilling this obligation. 

 *Doc
6.1 (cc)*
 Total yield would be given observers and, so as to establish the portion of the debris analyzed, a tracer or tracers known to the observers and in known quantity would be added to the weapon. This method if it can be carried through in some way without revealing important design information would, of course, be most convincing. We would have to assume, however, that remote samples would be secured by the Soviet and analyzed.


For the second approach, two shots of a megaton or two would be fired, one of standard design and one clean. They would

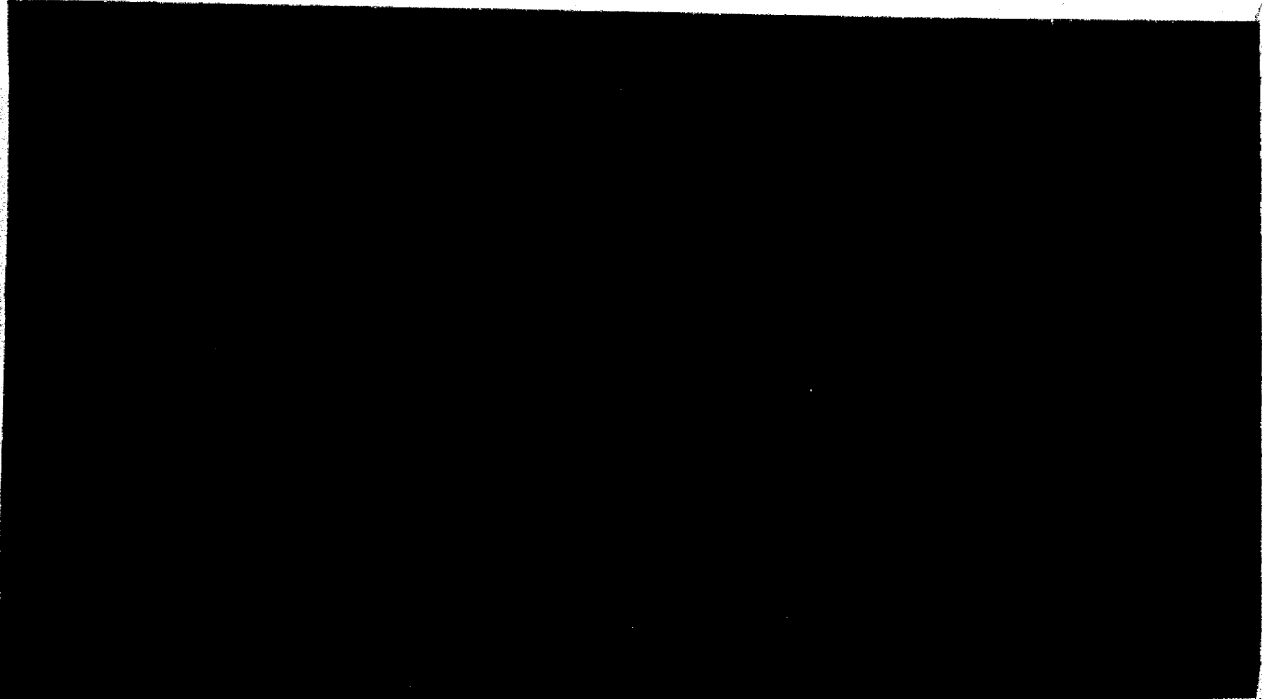
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have comparable though not necessarily equal yields. Telemetering, gamma-intensity-reading rockets would be fired through the cloud of each, and the resultant readings given to the observers. It is probably not possible to conceal from the observers the approximate yields, and again we must assume that remote samples will be taken by the Soviets and analyzed. This method would be costly, logistically difficult and less convincing.

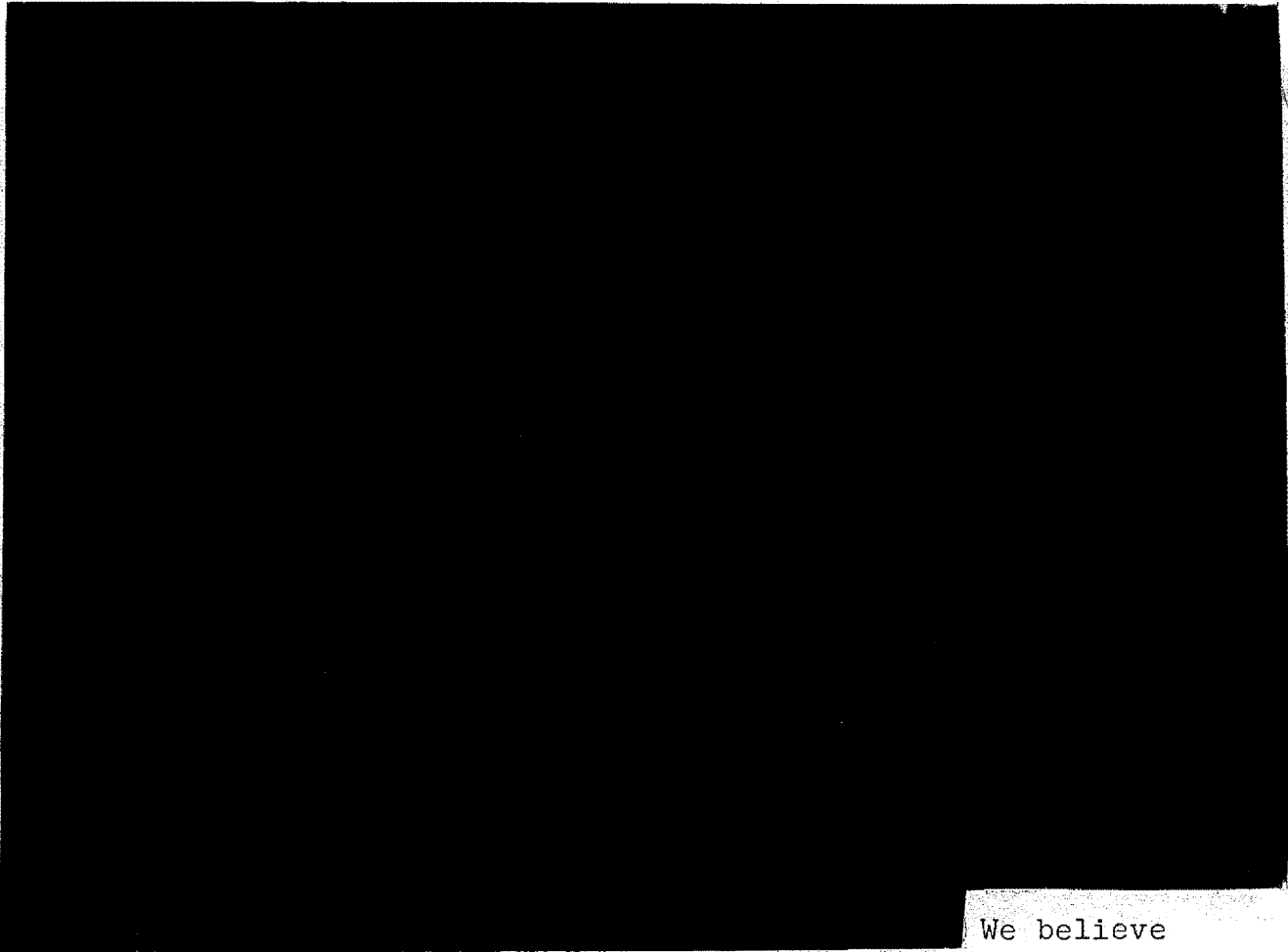
Starbird's question to the panel is "can either or both of these methods be accomplished without real danger of revealing to the Soviets important design information." In this connection, he points out the following. Before REDWING the President announced one purpose of the series as "reducing fallout."  Doe
6.16.61

Immediately after the series announcements were made that devices of greatly reduced fallout were fired. In public Congressional hearings statements were made to the effect that the way to clean-up a weapon was to reduce its fission-to-fusion ratio. In subsequent announcements the President stated that we could make weapons which were 96% clean.  Doe
6.1

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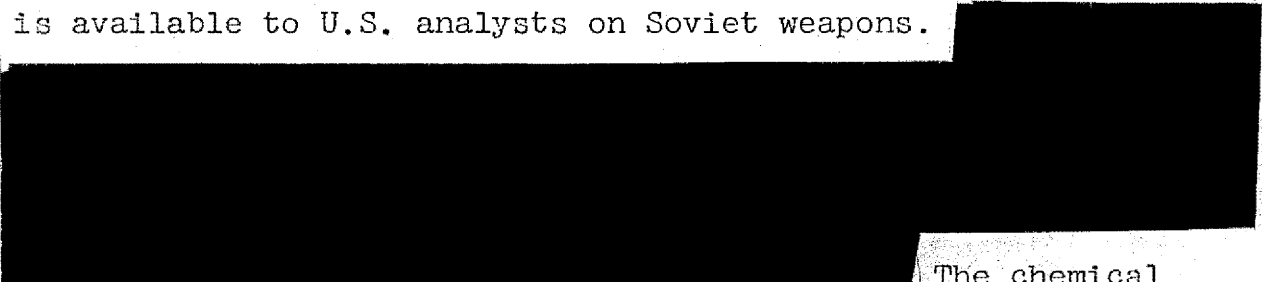
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DOE
6.16

DOE
6.16

We believe that the chemical method would give a more accurate figure for this ratio but that either method would give better accuracy than is available to U.S. analysts on Soviet weapons.



DOE
6.16

The chemical tracer proposal would appear to have some practical advantages with respect to ease of handling foreign observers at the test site.

In view of the urgency of getting an answer to this problem I have taken the liberty of sending the above request to Carson Mark at Los Alamos and to Harold Brown at Livermore. I hope to see you on Tuesday the 15th to discuss the mechanics of getting the opinions of your Committee on this problem without having a full-dress meeting. Signed D. L. Northrup

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APPENDIX "H"

INCOMING TELETYPE

OCTOBER 16, 1957

FM UNIV OF CALIF RADIATION LAB LIVERMORE, CALIF

LASL, LOS ALAMOS NMEX
ATTN: N. E. BRADBURY
DMA USAEC, WASHDC
ATTN: A. D. STARBIRD

REFERENCE: TWX SWTD 8767 NORTHRUP TO BROWN. IN OUR OPINION A DEMONSTRATION TEST CAN BE CONDUCTED SO AS TO AVOID REVEALING FURTHER IMPORTANT DESIGN INFORMATION. THIS WILL, HOWEVER, REQUIRE SOME PRECAUTIONS AND ALSO AN EFFORT TO PROVIDE CONVINCING EVIDENCE.

WE ASSUME DEMONSTRATION DEVICE WILL HAVE TO APPROXIMATE THE MAGIC NUMBER 96 PERCENT. WE ALSO BELIEVE THAT, TO BE CONVINCING, OBSERVERS WILL HAVE TO OBTAIN TOTAL AND FISSION YIELD VALUES, THE LATTER EITHER BY RADIOCHEMISTRY OR ABSOLUTE MEASUREMENT OF PAST SHOT GAMMA SOURCE. THE NEED FOR CONFIDENCE AS TO CLEANLINESS LEVEL REQUIRES SHOT OF SOME PRE-TESTED DEVICE WHICH MUST EITHER BE LIKE NAVAHO OR A REPEAT OF SOME HARDTACK MODEL.



DoE
6.1(a)

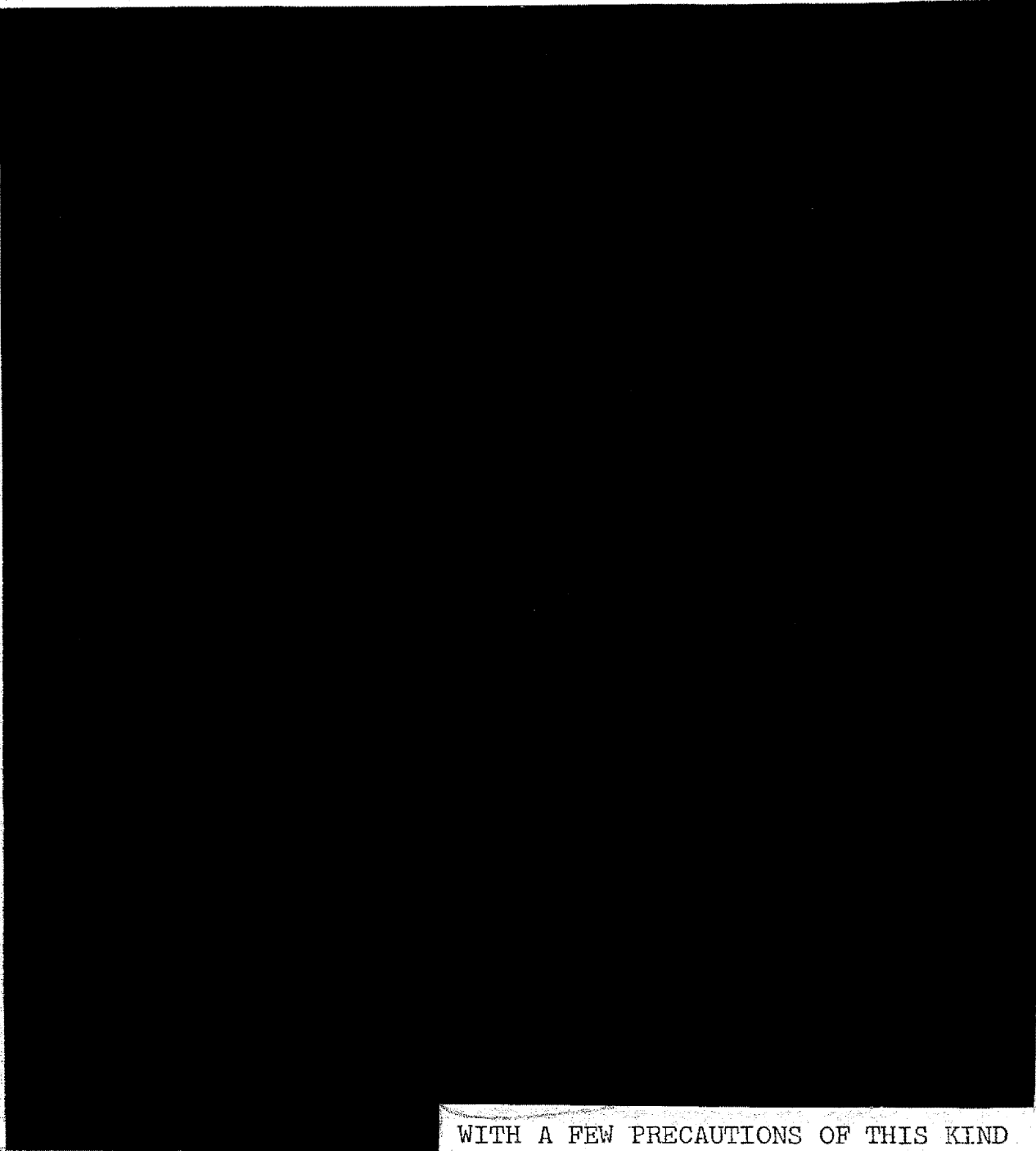
AND THIS MIGHT ITSELF BE DIFFICULT IN THE YIELD RANGE WHERE HIGH CLEANLINESS MAY BE AVAILABLE.

ABSOLUTE MEASUREMENT OF GAMMAS APPEARS LESS DIRECT AND HARDER THAN RADIOCHEMISTRY. THOUGH IT REVEALS LESS INFORMATION

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DOE
6.11

WITH A FEW PRECAUTIONS OF THIS KIND WE BELIEVE THE OBSERVERS COULD BE GIVEN CLOSE-IN SAMPLES TO DO WITH AS THEY PLEASE.

OTHER POINTS ARISE IN PROVIDING OBSERVERS FULL ASSURANCE THAT TRACER AMOUNTS ARE KNOWN ACCURATELY. THIS WOULD BE STRAIGHTFORWARD IN CONNECTION WITH A TRACER OF MANY TONS OF URANIUM SINCE NO ONE COULD SURREPTITIOUSLY INCREASE THAT SO LONG AS THEY COULD KEEP THE DEVICE UNDER SURVEILLANCE UP TO A LATE TIME. IN CASE OF TRACERS IN GRAM AMOUNTS THEY WOULD PROBABLY HAVE TO HAVE THE AMOUNTS OF THESE UNDER THEIR OWN CONTROL AND PUT THEM IN POSITION AT THE VERY LAST MOMENT. IF IT

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IS NECESSARY TO PROVIDE ASSURANCE IN THIS PARTICULAR FORM THEN AN AIRBURST WOULD PROBABLY BE RULED OUT SINCE IN THAT CASE THEY WOULD REQUIRE ACCESS TO THE BARE BOMB.

THIS REPLY THE RESULT OF DISCUSSIONS LIVERMORE BETWEEN BROWN, MARK, AND STREET.

- 25 -

Appendix "B"

DECLASSIFIED
E.O. 13526, Sec. 3.6

NW: 972006A
By DM/FR Date 7/27/05

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