FINAL REPORT

FIELD TEST FT-34

ANNEX F

ANALYSIS AND RESULTS (U)

JANUARY 1969

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SNYOPSIS

A. SCOPE

This annex describes the data sources, analyses, results, conclusions and recommendations pursuant to the technical aspects of the objectives of Field Test FT-34. The objectives were:

1. To determine the extent to which the proposed method of demonstrating destruction reveals classified weapon information,

2. To evaluate the effectiveness of the tested procedures in terms of convincing the Test Inspection Force that nuclear weapons are being destroyed,

3. To evaluate the practicability and effectiveness of the proposed methods and to suggest and implement possible improvements during the test, as necessary, and,

4. To identify operational, technical, classification, safety, and security problems which arise.

Throughout this synopsis, results, conclusions and recommendations will be developed so as to reflect each of these four objectives.

B. DATA SOURCES

Data for analysis of the field operations phases of the test were obtained from the extensive pre-printed forms which inspectors filled out throughout the field test. Specially prepared forms were developed for and used at each of the four test sites and for each phase of the operation.

Data for analysis of the several post-test reviews by expert evaluators were obtained from essentially similar forms used by these evaluators.

C. RESULTS

1. Classified Information. Four levels of access were investigated during the field test. The lowest permitted only observation of weapons and materials while the highest included X-ray photographs of the weapons. Classified information was revealed to inspectors at all four levels of access with the number of exposed items increasing with access as follows, 34, 41, 60, 112. Some of the information exposed at even the lowest level of access included quite sensitive weapon design information. Classified information was revealed during all operations inspected except during a tour of the foundry and empty warehouse by inspectors at Paducah. One team of inspectors collected a very small sample of radioactive material in a previously "cleaned" work area which revealed classified information when analyzed.

2. Conviction. During the field operations inspectors were required to state whether they believed the facilities used were credible, whether weapons used were real or fake, and whether evasion had been practiced during analyses of fissionable material. Facilities, of course, were real and inspectors were convinced of their credibility. At the lowest access level, an average of 49 percent of the calls were correct; at the highest access level, an average of 81 percent of the calls were correct. The proportion of correct calls increased by a statistically significant amount between the lowest access level and the higher levels.

3. Effectiveness. For the most part, the methods for demonstrating the destruction of weapons were found to be practicable, and no significant improvements were required.

Inspectors, not being classification specialists, detected on the average only 56 percent of the classified information exposed during the test. Analysis of the major data-gathering phase of the test indicates that inspectors collected an average of 79 percent of weapons information available, including identifications of classified information where required by data forms. With the limited training available for the field test, inspectors were able to perform mass spectroscopic analyses within acceptable tolerances, but chemical analyses were not within these tolerances.

For all assay of fissile material phases of the field test, a total of 504 sample operations were performed by inspection teams. Five percent of these were incorrectly called as evaded by the inspection. 187 sample operations were subjected to evasion and four percent of these were correctly detected by inspectors. Most detections, however, were a result of equipment malfunction or slip-ups by laboratory personnel. The effectiveness of evasion improved as the test progressed, and the final team, the professional scientists, detected no evasion. There probably would always be some risk, however, that even the best prepared evasion schemes would fail and be detected.

4. Test Problems. Although no major problems arose during the field test, some of the more significant problems are summarized in the following subparagraphs.

Inspectors were unable to maintain an accurate balance between weights of weapons introduced for inspections and the weight of the resulting components and materials. The maximum weight imbalance for a batch of weapons was 3 percent of the total batch weight, but this figure is the same order as the total fissile material in the batch. Many reasons contributed to this problem--such as, inaccurate scales, different record-keeping systems by different plants, and inspectors' errors.

Inspectors' calls of fake when weapon shapes were in fact bona fide nuclear weapons indicated guesswork on the part of some inspectors.

Safety and security requirements and the requirement not to interfere with normal plant operations hampered the scheduling of operations to some extent.

Some equipment malfunction and limitations of equipment affected inspection operations slightly.

D. CONCLUSIONS

1. Classified Information. It may be possible to protect most classified information during a demonstration in a specially prepared facility if inspector access is limited to visual inspections of weapons and facilities, if some features of weapons are effectively masked, and if fissionable materials are blended. It is unlikely, however, that all information of use to a foreign government could be protected unless the inspections were quite limited. This was indicated by a post-test analysis of the value of information revealed during the field test, some of which was unclassified and available from superficial visual inspections of weapons.

2. Conviction. Inspectors' abilities to discriminate between real and fake nuclear weapons is poor at the low level of intrusion envisioned in the basic concept for the demonstrated destruction of nuclear weapons. Although the ability to detect fake weapons increases with access to weapons being destroyed, inspectors would require complete access to the weapons and would need to make laboratory examinations of some components to be absolutely convinced that the weapons were bona fide.

3. Effectiveness. The methods of demonstrating the destruction of nuclear weapons which were tested are practicable, but would vary to some extent with the access allowed inspectors.

The amount of classified information recognized by inspectors and the amount of descriptive data gathered were limited by the capabilities of inspectors and not by the inspection methods. Inspectors with general backgrounds in scientific fields can be trained in a short time to perform standard mass spectrographic analyses of fissionable materials but not chemical analyses.

4. Test Problems. None of the problems which arose during the field test affected test results significantly. Conclusions concerning these problems, however, may assist in planning further tests or treaty inspections.

In a multi-site operation wherein different scales and weight-recording systems are employed and where a great number of assemblies and components are weighed at different stages of processing, some weight errors are probable. Such errors could be reduced by minimizing and standardizing weighing operations, using accurate scales, and exercising care in calculations and in recording weights. Fissionable materials set aside for peaceful uses should be weighed separately to minimize errors and should be weighed on sensitive and accurately calibrated scales.

Inspectors' reasons for calling weapon shapes fake emphasized a lack of detailed guidelines for challenging the credibility of weapons.

Some malfunctioning of electrical and mechanical equipment for inspectors or plant operators is inevitable and can delay or preclude the completion of some operations.

E. RECOMMENDATIONS

1. If classified information is to be protected during a demonstration of the destruction of nuclear weapons a special facility should be prepared and the level of inspection access must be low. Universal tooling, handling equipment, and measuring equipment must be provided. The enrichment of uranium derived from weapons probably will have to be altered, as well as the impurities in the plutonium. Access must be limited to superficial observations of weapons, and the use of radiation measuring equipment should not be permitted during weapon examination. In addition, inspectors should not be permitted to observe nonnuclear components removed from the weapons unless the components have been processed to conceal all classified information. Facilities to be inspected must be thoroughly cleaned to preclude the gathering of micro-samples which might reveal classified information.

2. If absolute conviction concerning the weapons presented for destruction is required, then complete access must be recommended. If, however, a lesser degree of conviction is acceptable, then it is recommended that the access be based on the value to inspectors of the exposed information as developed in this annex.

3. Methods of demonstrating the destruction of nuclear weapons as envisioned in the basic concept (but in a specially prepared facility and with other measures to protect classified information) are recommended for future field tests or for a treaty inspection.

It is also recommended that inspection methods similar to those tested be used for any future test or inspection (depending on access desired) and that the inspection force be thoroughly trained by practice inspection operations.

In order to minimize both opportunities for evasion during the assay and the false alarm rate, samples of fissionable material to be transferred to peaceful uses must be analyzed in a laboratory over which inspectors have complete control.

4. Several recommendations can be made based on problems which arose during the field test.

Detailed and comprehensive guidelines should be developed for use by inspectors in determining the credibility of weapons presented for destruction.

Special emphasis should be placed on providing adequate and accurate scales and recording systems for maintaining weight balances. Standby equipment for inspections and weapons-dismantling operations should be available if tight inspection schedules must be met.

If a field test such as FT-34 is conducted again, safety and security requirements should be standardized as much as possible and the inspection operations should be given priority over other operations if it can be arranged.

If the U.S. demonstrates the destruction of weapons to foreigners, great care must be taken to clean processing facilities thoroughly to preclude the gathering of micro-samples of weapons debris which might reveal classified information.

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I. INTRODUCTION

This annex describes the analysis, results and conclusions based on and drawn from the field work and associated activities performed in Field Test FT-34, "Demonstrated Destruction of Nuclear Weapons."

The objectives of FT-34 were:

1. To determine the extent to which the proposed method of demonstrating destruction reveals classified weapon information.

2. To evaluate the effectiveness of the tested procedures in terms of convincing the Test Inspection Force that nuclear weapons are being destroyed.

3. To evaluate the practicability and effectiveness of the proposed methods and to suggest and implement possible improvements during the test, as necessary.

4. To identify operational, technical, classification, safety, and security problems which arise.

The activities of the field operations upon which the analyses of this annex are based are described in the remaining annexes to the final report for FT-34. The test was conducted by the Arms Control and Disarmament Agency, Field Operations. Technical and analytical support was provided by the Sandia Corporation of Albuquerque, New Mexico.

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II. DATA SOURCES

A. MAIN TEST OPERATIONS

1. Overall Destruction Exercise. Inspection data were recorded by the inspection teams on data forms specifically designed for each phase of the exercise as described in annex D, "Test Operations." These forms are shown in appendix F1. Data forms were designed to be self guiding during use and were filled out by the entire team rather than individuals. After completion, the forms were collated into data packages which contained data gathered by a particular team for a particular phase of the exercise (walkthrough tour, weapon shape monitoring, explosive burn, nonnuclear material disposal, fissile material assay and weight balance). Administrative data forms were used by test control personnel to (1) complete data packages, (2) describe technical or operational problems, (3) acquire test reference data, (4) debrief inspection teams, and (5) to report inspection progress to test headquarters. The administrative forms used are also shown in appendix F1.

2. Military Special Assay. Except for the requirement to detect classified information, the procedures used during the military special assay were the same as used during the overall destruction exercise fissile material assay phase. Thus the same data forms (figures F1-26 to F1-30, appendix F1) were used.

3. Laboratory Scientist Special Assay. Due to the special emphasis on evasion detection during the laboratory scientist special assay, the assay data forms from the overall destruction exercise were slightly modified for the assay. These are shown in figures F1-38 to F1-44 of appendix F1.

B. POST-TEST EXERCISES

Two post-test review exercises were conducted after the main test. The operations of these post-test exercises were described in detail in annex D, "Test Operations." This section will describe the data sources used for analysis of the post-test exercises.

1. Post-Test Classification Exercise. Evaluators with nuclear weapons experience evaluated the worth of the weapon information revealed during the overall destruction exercise of the main test. The evaluators assigned relative numerical values, in relation to an arbitrary base line, representing the worth of exposed weapon information to inspectors from the U.S.S.R. and an Nth country. The latter was defined as a nonnuclear nation with the technological capability to embark on a nuclear weapons program.

a. Part I. In Part I of the post-test conviction exercise the evaluators assigned relative values to 110 information items categorizing five areas of classified information exposed during the main test. The five categories were:

(1) External Weapon Configurations.

(2) Nuclear Materials.

(3) Implosion Systems.

(4) Thermonuclear Systems.

(5) Nonnuclear Components of the Weapons.

The complete list of the 110 information items is given in appendix F2.

b. Part II. In Part II of the post-test conviction exercise the evaluators assigned relative values to a matrix of information exposed by weapon shape and access level. Data exposed from each of six weapon shapes at each of five access levels was evaluated. The five access levels were the four from the main test plus a fifth (A_5) defined as complete access to total weapon disassembly. The six weapon shapes were:

(1) Mk 25 Genie (real).

(2) Mk 28 Ex Bomb (real).

(3) Mk 30 Warhead, Talos (real).

(4) Mk 39 Bomb (real).

(5) Mk 56 Warhead in Mk 11 R/V (real).

(6) Hawk Warhead section (fake nuclear package).

Data from the main test were presented to the evaluators for each weapon shape-access level pair. Values were recorded on the matrix form shown in figure F2-2 of appendix F2.

2. Post-Test Conviction Exercise. In the post-test conviction exercise five teams of three evaluators reviewed data from the main test on each of the nine unique weapon shapes at each of five access levels and recorded their conviction that each was real or fake. The five access levels were as in Part II of the post-test classification exercise. Each team was composed of an electrical engineer (EE), a mechanical engineer (ME) and a physicist (P) all with backgrounds in nuclear weapons research and development.

The evaluators did not actually see the weapon shapes or destruction operations. They based their conviction on review of prepared data packages which presented data from the main test for each phase of the overall destruction exercise for each weapon shape-access level pair. The data were presented on modified data forms from the main test.

The evaluators made a call of real or fake on each of the nine weapon shapes at each of the five access levels. Additionally, they noted their degree of conviction that the shape was real on a scale of 0 to 100 percent. They made both the call and the degree of conviction on two bases. First, the limited case, they based their results on knowledge limited to that directly available from the data which they reviewed. Second, the unlimited case, they based their results on both the reviewed main test data and on their prior knowledge, experience and other intangibles. Figures F1-45 and F1-46 of appendix F1 illustrate the data forms used for this.

C. TEST REFERENCE DATA

Test reference data (TRD) were those data collected before, during, and after the field test to provide baseline information against which inspection-derived data could be evaluated. TRD were collected and recorded by technical support representatives (technical contractor), test site contractor personnel, FT-34 test control personnel, and AEC classification advisors. Format for TRD collection varied according to types of data collected and individual methods deemed appropriate by the collectors. The basic method used for TRD collection was the recording of true or reference values on the appropriate test data forms.

TRD were also collected by photographic coverage of materials, facilities and activities throughout the test. Examples of this photography are shown in appendix F3. For TRD purposes, the photographs were coupled with appropriate identification markings, - often directly on the surface of the photograph.

While most TRD were developed prior to or during the test activities, some items such as the true assay of fissile material samples were only available after a test operation was completed.

D. DATA TRANSPORT

1. Data Handling During FT-34. The test data as gathere by the inspectors during the field test were processed and distributed as follows:

a. The FT-34 inspectors completed and assembled data packages for each operation at each test site and submitted the packages to the test controller.

b. The test controller reviewed the data packages for completeness and legibility, attached his comments, and submitted the packages to site Technical Support Representatives for review.

c. The Technical Support Representatives reviewed the data packages for completeness and adequacy, attached comments, and submitted the packages to AEC classification representatives for classification.

d. The classification representatives reviewed and classified each page of the data packages, added necessary comments, and submitted the packages to the Test Site Commander for reproduction and distribution.

e. The Test Site Commander reproduced each data package completely (except at Pantex where photographs were not copied) and transmitted one copy to Sandia Corporation in Albuquerque, New Mexico. The original data were transmitted to FT-34 test headquarters in Paducah, Kentucky.

f. Test Reference Data. These data were accumulated at each test site by the test controllers, technical representatives, and AEC classification representatives and were submitted to the Test Site Commander for distribution to test headquarters and to Sandia Corporation.

2. Data Retention. Original copies of all main test data are now located at the Arms Control and Disarmament Agency, Field Operations. Copies of all main test data and post-test exercise data are being retained at the Sandia Corporation of Albuquerque New Mexico.

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III. TOOLS OF ANALYSIS

A. PURPOSE

Throughout the following sections of this annex several standard tools or methods of statistical analysis will be frequently employed. This section will define and discuss the basic analysis tools used to develop the results from the test data.

B. DEFINITIONS

1. Statistical Significance. The effect of a factor on the measured performance is said to be significant at the P percent level if the difference in the performance corresponding to a change in the factor is sufficiently large that there is no more than a P percent chance that this difference was not due to the factor difference. For example, suppose that the difference in the number of correct calls on weapon shapes as the access factor changes from A_1 to A_2 is significant at the 5% level. This implies that the performance at A_1 differs from that at A_2 and there is no more than a 5% chance of this conclusion being erroneous.

The concept of statistical significance as associated with correlation is similar to that described above. If a given value for a correlation coefficient is significant at the P percent level, it can be concluded that there is in fact a nonzero correlation and there is a P percent chance that there is no correlation.

2. Analysis of Variance. The analysis of variance is a statistical technique which partitions the total variability among several measures of performance into independent parts, each of which is associated with one of the factors of the experiment. By combining this with measures of statistical significance, an estimate of the significance of each factor and factor interaction to the total performance can be made.

3. Pooled Ranking. A pooled ranking is obtained by totaling the ranks of each of the objects by judges and then

by ranking the totals. For example, assume that five objects, A, B, C, D, E, are ranked by three judges. Let the outcome be as shown in figure F-1. The pooled rank, obtained from the column headed "Total," is A, C, D, B, E, in ascending order.

	Judge			Total	Pooled Rank
	1	2	3		
A	2	1	1	4	1
B	4	5	3	12	4
C	1	2	2	5	2
D	3	4	4	11	3
E	5	3	5	13	5

FIGURE F-1. Example of Pooled Ranking

4. Kendall's Coefficient of Concordance.[1] Kendall's coefficient of concordance, W, measures the correlation between several sets of ranking of N objects. W may vary between zero (no correlation) and one (perfect correlation). A high value of W may be interpreted as meaning that the judges are applying essentially the same standard in ranking the N objects under study. For high W, the pooled ranking may serve as a standard.

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[1] Non-Parametric Statistics: For the Behavioral Sciences, Sidney Siegel, 1956, McGraw-Hill.

IV. CLASSIFICATION RESULTS

A. GENERAL

The first objective of the FT-34 field test was "to determine the extent to which the proposed method of demonstrating destruction reveals classified weapon information." Test inspectors were required to list all items of classified information which they believed were revealed throughout all phases of the field test. Additionally, AEC classification specialists at each test site monitored all inspection operations to determine what items of classified information were exposed to inspectors whether or not the inspectors detected them. Field derived data were collected and organized into an evaluation package for expert review after field operations had ended. Both the field-gathered information and the expert review evaluation data are discussed below.

B. MAIN TEST

The complete list of items of classified information exposed during the overall destruction exercise of the main test and available for detection by the inspection teams is shown in appendix F4. The list is arranged by items available at each test site for each operation and access level. The cause by which each item was exposed and, where appropriate, the weapons to which it applies are also shown.

The number of exposed items of classified information is broken out in figure F2 by access level, test site and test operation. The numbers are cumulative by access in that the number exposed at each access level includes those exposed at each prior lower level. A total of 41 items were exposed to low access inspection teams throughout all phases of the exercise while 112 items were similarly exposed to high access teams. The operations of weapon shape inspection and explosive burning at Pantex and the inspection of nonnuclear components at Paducah show an access effect with more items being exposed at higher access levels. The introduction of X-ray photographs at access level A4 during weapon shape inspection

SITE	ACCESS OPS	Number Items Available			
		Low		High	
		A1	A2	A3	A4
Pantex	Walkthru	5		5	
	Weapon Inspection	2	4	6	58
	HE Burn	4		11	
Rocky Flats	Walkthru	4		4	
	Disposal	1		1	
	Assay	1		1	
Paducah	Component Inspection	2	7	16	16
Oak Ridge	Walkthru	12		13	
	Assay	3		3	
TOTAL		34	41	60	112

FIGURE F-2. Classified Items Revealed

at Pantex caused the sharpest increase in exposure with access. One half of the items exposed to high access inspection teams resulted from these X-ray photographs. Furthermore, these items were among the most sensitive ones exposed.

A review of the individual items of exposed information indicated that some duplication existed in that the same basic information had been revealed at more than one site or operation by different means. Elimination of this duplication resulted in 60 unique items being exposed to high access inspection and 33 unique items for low access.

The type of classified information revealed during FT-34 operations varied with test site location. Basically, all classified information revealed pertained to design features associated with nuclear and thermonuclear weapons. This was emphasized in the Pantex and the Paducah operations but also carried over to the Rocky Flats and Oak Ridge operations. The major portion of classified items revealed during the field test concerned specific nuclear system design features of nuclear weapons such as nuclear components, high explosive system designs, gas boosting, and TN system designs. Minor portions of the classified information pertained to fissile material composition and nonnuclear components. Examples of specific items exposed at the lowest access level included the use of gas boosting infered from pit containers exposed during walkthrough tours at Pantex [redacted] Specific items exposed at the highest level of access included the design of the Mk 56 mechanical safing system and the radar frequencies of several weapons all exposed during the examination of X-ray photographs at Pantex.

DoE (b)(3)

C. PROTECTION OF CLASSIFIED INFORMATION

Since one of the objectives of FT-34 was to determine the amount of classified information that would be exposed during relatively normal destruction operations at the facilities, no attempt was made to hide or conceal any classified information associated with the weapons or materials. A review of the exposed information indicates that many of the items could have been protected particularly at the lower access levels. The following paragraphs indicate how this might have been done for each test site activity within the constraints imposed by the requirements for access at each of the four access levels. The number of items that would still be exposed after such concealment is broken out in figure F-3 in a similar manner as figure F-2.

1. Pantex

a. Walkthrough Tours. Four of the five revealed items could have been protected by not allowing inspectors to examine the inside of containers used for shipping pits between sites. The fifth item, the number of detonators and diameter of the Mk 25 explosive system, could have been protected by using and displaying universal adjustable tool.

b. Weapon Monitoring

(1) A1 Access. The frequency of the Hawk radar could have been protected by painting over the slot antenna. The lack of hardening for the Mk 11 R/V (containing the MK 56 Warhead) could have been protected [redacted]

(2) A2, A3 and A4 Access. Information revealed at the A2, A3 and A4 access levels resulted from the use of geiger and neutron counters and X-ray photographs. While some of the information could conceivably be protected by using extensive shielding around or in the weapons, this is not considered to be practical.

c. Explosive Burn. The four items exposed to low access teams could have been protected by more thoroughly burning or cremating the material and mixing the residue. The seven additional items exposed only to high access teams could not have been protected within the ground rules which permitted the inspection of burnables prior to burning.

2. Rocky Flats

a. Walkthrough Tours. The four items exposed to both low and high access inspectors could have been protected by closure shipping containers, the use of universal adjustable tools and the separation of guages from the machines on which they were to be used.

		Number Items Available			
SITE	ACCESS OPS	Low		High	
		A1	A2	A3	A4
Pantex	Walkthru	0		0	
	Weapon Inspection	0	2	4	56
	HE Burn	0		7	
Rocky Flats	Walkthru	0		0	
	Disposal	0		0	
	Assay	0		0	
Paducah	Component Inspection	1	6	15	15
Oak Ridge	Walkthru	0		0	
	Assay	1		1	
TOTAL		2	9	27	79

FIGURE F-3. Classified Items Revealed After Concealment Procedures

b. Material Disposal. Exposed pit weights would have been protected if inspectors had not been permitted to weigh the associated shipping containers both full and empty.

c. Assay. [redacted] This is a difficult process and the practicability of it for this environment has not been evaluated.

[illegible]

3. Paducah

a. Walkthrough Tours. No information was exposed.

b. Component Inspection.

(1) A1 Access. [redacted] The other exposed item could not be protected under the rules which permitted visual examination.

DOE (b)(3)

(2) A2, A3 and A4 Access. The information exposed at these access levels could not have been protected within ghe ground rules which required that inspectors be able to visually examine components, many of which were identifiable.

c. Material Disposal. No information was exposed.

4. Oak Ridge

a. Walkthrough Tours. All of the items of classified information which were exposed to both low and high access teams could have been protected by withholding the weights of incoming shipping containers and keeping them closed to inspectors. The additional item, classified assay of a microsample picked up by a high access teams, could have been protected by a more thorough cleaning of the facility prior to inspection.

b. Assay. [redacted]

D. EXPOSURE IN A SINGLE FACILITY

1. Concept. It is technically feasible, and probably quite desirable, to conduct an actual demonstration of the destruction of nuclear weapons in a single facility especially designed for the purpose. The use of such a facility would enhance the concealment of classified information as described in the previous section. For example, the pit shipping containers which were a source of much of the exposure at low access levels would not be required for operations within a single facility.

2. Classified Exposure. If the concealment procedures described in section C above were adopted in a single facility, then the number of classified information items exposed would be as shown in figure F-4.

	ACCESS			
	Low		High	
OPERATIONS	A1	A2	A3	A4
Walkthrough	0		0	
Weapon Inspection	0	2	4	56
HE Burn	0		7	
Assay	1		1	
Component Inspection	1	6	15	15
TOTAL	2	9	27	79

FIGURE F-4. Classified Items Revealed at a Single Facility with Concealment

The full list of these items is shown in figure F4-2 of appendix F4. [redacted] The number of items exposed during non-nuclear component inspection could be reduced to zero if the ground rules were slightly altered to permit the crushing of these components in a large hydraulic baler press. If inspectors were prohibited from examining the material to be burned prior to burning then the seven items revealed would be protected.

DOE (b)(3)

3. Single Facility Access. From the above data it can be seen that if all the previously described procedures were adopted at a single facility, a low access (A1) inspection could be conducted exposing one item of classified information, [redacted] Permissable inspection activities would include:

DOE (b)(3)

a. Walkthrough tours with geiger counters following thorough facility cleaning.

b. Weapon monitoring at the A1 level with certain external features masked.

c. Fissile material assay [redacted]

DOE (b)(3)

d. Weight balance.

e. Forced explosive burn with debris mixing.

f. Component inspection following crushing.

DOE (b)(3)

E. POST-TEST CLASSIFICATION EXERCISE

1. Part I. As described previously, the Part I information list was composed of 110 items subdivided as follows:

Category A	External Weapon Configurations	13 items
Category B	Nuclear Materials	10 items
Category C	Implosion Systems	42 items
Category D	Thermonuclear Systems	24 items
Category E	Nonnuclear Components of Weapons	21 items

The listing of Part I information is shown in figure F2-1 of appendix F2. Not all items in the listing were classified information in terms of current guidelines. Because of the inclusion of Nth country for evaluation, design information, believed to be of significance to a nonnuclear power, was included in the listing, regardless of classification. Thus, the listing was more comprehensive than the classified information revealed during the FT-34 field test in that it included unclassified but valuable design feature information on nuclear weapons in addition to classified design information.

Responses of the evaluators are listed in figures F4-3 and F4-4 of appendix F4 relative to the U.S.S.R. and Nth country responsively. A base score of 100 was established for each series of scores, however evaluators were not limited in scoring above or below this base.

a. Ranking Within Categories. The response scores of the 14 evaluators within each information category were ranked so that the relative worth of each item within that category could be determined. For these rankings, Kendall's coefficient of concordance (W) was then computed and tested for significance by a chi-square test. The values for W and χ^2 are given in figure F-5.

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		U.S.S.R.		Nth Country	
	CATEGORY	W	χ^2	W	χ^2
A.	External Weapon Config.	0.46	77.8	0.40	68.0
B.	Nuclear Materials	0.29	36.9	0.27	34.2
C.	Implosion Systems	0.35	198.9	0.45	257.1
D.	TN Systems	0.6.	195.6	0.53	169.8
E.	Nonnuclear Components	0.48	133.6	0.60	166.7

FIGURE F-5. Values of Kendall's Coefficient of Concordance (W) and the Associated Chi-Squared Value for Concordance Within the Categories

All of the values of W given in figure F-5 are significant at the P = 0.01 significance level. A pooled ranking of the responses was prepared for each category for both U.S.S.R. and Nth country responses and is shown in figures F4-5 and F4-6 of appendix F4. The similarity in rankings of information items within categories is strong for categories A, B, D, and E, while the rankings within the largest category, C, vary considerably for the U.S.S.R. and Nth country, with the exception of the highest and lowest ranking items. The large quantity of items ranked precludes an item-by-item comparison for U.S.S.R. and Nth country rankings within categories. However, some insights into the relative values of category information may be found by observation of the highest ranked and lowest ranked items within specific categories.

(1) Category A. The highest ranked items were those pertaining to external weapon materials (particularly for reentry vehicles), ballistic properties of weapons, and moments-of-inertia of weapons. These items represent information applicable to countermeasures against various nuclear weapons. The lowest ranked items for both U.S.S.R. and Nth country were those concerning means of attachment to delivery vehicles and shapes or configurations of bombs.

(2) Category B. The highest ranking items were items pertaining to the fact that [redacted] components were used in weapons and the purity of fissile materials used in various portions of nuclear weapons. The lowest ranking items concerned the use of lead, U-238, and natural uranium in weapons. This is information that has been disseminated to the public.

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(3) Category C. The highest ranking items for both U.S.S.R. and Nth country, were those pertaining to design features of implosion systems and nuclear pits. The lowest rankings were for those items which revealed (1) the fact that HE systems of different outside dimensions were used, (2) the use of a tamper material surrounding pits, and (3) [redacted] In general, the highest ranked items pertained to revelation of complete design details, while the lower ranked items involved revelation of the use of various features. DoE (b)(3)

(4) Category D. The highest ranked items for both U.S.S.R. and Nth country, pertained to design details of a complete TN weapon, [redacted] Rankings were the same for U.S.S.R. and the Nth country. The lowest ranked items were those which described types of materials used in TN weapons. DoE (b)(3)

(5) Category E. The highest ranked items for both U.S.S.R. and Nth country were those which revealed complete design details of radar fuzes, firing systems, and external neutron sources. The lowest ranked items were those concerning the use of pullout connectors on bombs and the use of energy conversion systems, environmental sensing systems, and pullout switch systems on nuclear weapons.

(6) Overall Ranking Factors. The highest ranking within categories were for items which would influence countermeasures against nuclear weapons and which would reveal design information of fission systems, TN systems, and of arming, firing, and initiation systems of weapons. Lowest ranking items tended to involve information which is publicly available and insensitive, although exceptions were found in categories C and D (fission and TN systems) where most of the items listed were sensitive and classified.

b. Rankings by Category. Ranking was performed between categories for both the U.S.S.R. and the Nth country responses. The scores of each contestant were standardized, and these standard scores were then averaged over the items in a category for each contestant. Hence, 14 means were obtained for each category, U.S.S.R., and Nth country. The ranking of the five categories for each contestant was done according to the ranks of the five category means.

The pooled rankings among the five categories are shown in figure F-6 for both the U.S.S.R. and Nth country.

	Category	U.S.S.R. Rankings	Nth Country Rankings
A.	External Weapon Config.	Fourth	Fifth
B.	Nuclear Materials	Fifth	Third
C.	Implosion Systems	Second	Second
D.	TN Systems	First	First
E.	Nonnuclear Components	Third	Fourth

FIGURE F-6. Pooled Rankings by Category

For the U.S.S.R. responses, the value of Kendall's coefficient of concordnance, W, was found to be 0.50 which is significant at the P = 0.01 significance level. For Nth country responses, W was 0.82 which is significant at the P = 0.01 level.

Theevaluators believed that revelation of TN system and implosion system information, in that order, would be most important to both U.S.S.R. and the Nth country. The order of rankings indicate that, because of its own experience with nuclear weapons, the U.S.S.R. would be least interested in obtaining information on nuclear materials and would be most interested in obtaining nuclear and nonnuclear design information from U.S. weapons to confirm its assessment of U.S. weapons and to plan countermeasures against U.S. weapons. The rankings also indicate that for an Nth country nuclear materials and nonnuclear components would be more important or informative for implementing a weapons program than would external weapon configurations. The inference here is that an Nth country would be more interested in design features, including materials, which could aid in producing a weapon of military value than in those features which pertain to configurations and delivery of existing weapons.

c. Ranking by Access Level. In addition to ranking by categories, a ranking was done by access level. Each of the 110 questions was classified according to access level; then, for each contestant, an average, based on the standard scores, was obtained for each access level. Access levels used were A1, A2, A3, A4, and A5. The access levels were those used during weapon monitoring phases of FT-34 and a higher untested access level. Access level definitions are:

A1:	External weapon configurations (dimensions, weight, c.g., case features)
A2:	Component observations through access doors; Geiger counter scanning
A3:	Neutron counter and gamma-spectrometer scanning
A4:	X-ray plate examination
A5:	(untested) Full access to weapon disassembly

The classification or positioning of each of the 110 information items into its proper access level location was done after the evaluators provided their responses to the review booklet. Therefore, the assignment of access level locations was done on a marginal basis, i.e., an information item was placed in an access level according to the lowest access level at which it would have become available. Because of this marginal method of placement, the access levels do not include the information available in lower access levels. The regrouped information represents unique rather than comulative information. The grouping of category information items by access level is shown in figures F4-7 of appendix F4.

Figure F-7 is a summary of the pooled rankings of access levels for the U.S.S.R. and the Nth country. For the U.S.S.R. Rank, the value of Kendall's coefficient of concordance (W) is 0.54 which is statistically significant at the P = 0.01 level. For the Nth country rank, the value of W is 0.88 which is statistically significant at the P = 0.01 level.

Access Level	U.S.S.R. Rankings	Nth Country Rankings
A1	4th	4th
A2	5th	5th
A3	3rd	2nd
A4	2nd	3rd
A5	1st	1st

FIGURE F-7. Pooled Rankings by Access Level

It was expected that the ranks would increase with access, and indeed access level A5 is ranked highest for both the U.S.S.R. and the Nth country. However several significant reversals of order occurred. The evaluators indicated that to both U.S.S.R. and the Nth country, the information available at access level A2 (access door observation, Geiger counter scan) would be less valuable than that at A1 (external weapon shake information). This probably reflects the fact that certain A1 level information such as fuzing, ballistic characteristics, etc., is useful for the design of countermeasures while A2 information merely confirms the presumed presence of fissile materials and staging in some weapons. The reversal of order between A3 (neutron counting and gamma spectrograph scanning) and A4 (X-ray plate examination) for the Nth country but not the U.S.S.R. reflects the interest in countermeasures by the U.S.S.R. and the need for isotopic content information by the Nth country for its early weapons program.

2. Part II. Evaluator responses to Part II information are shown in figure F4-8 or appendix F4. For Part II access level data, each higher access level included all information presented at lower access levels so that the information at each access level was cumulative. The mean scores assigned by each of 14 contestants to six shapes at four access levels (corresponding to FT-34 access levels) for the U.S.R. and Nth country are summarized in figures F-8, F-9 and F-10. An analysis of variance was performed on this data and is shown in figure F-11. The factors of evaluators, access, and weapon shape were found to be statistically significant at the 1% level. Within the fission weapon grouping, the Hawk was rated higher than the Mk 25 and Mk 30. [redacted] Within the TN weapon grouping, the Mk 56 warhead was ranked higher than the Mk 28 or the Mk 39 systems. This, too, indicates that more importance was placed on newer nuclear weapons and technology than on older weapons and technology. For the TN weapons involved, rating of importance was proportional to weapon age: the oldest weapon was ranked lowest and the newest weapon (differing technology) ranked highest.

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The large spread in mean scores for evaluators resulted from the lack of an upper bound for scoring. Although a lower bound of zero was specified (no negative scores) and a baseline value of 100 points was given, evaluators were free to use any value they chose for upper scoring limits.

The increase in access level mean scores is indicative of the increase in information made available as access levels were raised. The significant jump in means between the lower access levels and access four indicates that the evaluators believed the content of access four indicating that individual evaluators varied in their opinions of the worth of the information but agreed that the information was of high value. Only one evaluator score at the lower access levels was higher than the lowest score at access level four.

	Shape						
Access	Mk 30 F	Mk 25 F	Hawk F	Mk 39 TN	Mk 28 TN	Mk 56 TN	Means
A_1	5.9	7.5	8.5	9.4	8.1	12.4	8.6
A_2	13.0	13.2	14.9	20.8	24.5	22.1	18.1
A_3	18.9	25.0	24.4	27.7	32.7	35.4	27.4
A_4	77.3	70.4	85.2	100.0	109.3	141.1	97.2
Means	28.8	29.0	33.3	39.5	43.7	52.8	

FIGURE F-8. Two-Way Means for Access and Shape

	Access				
Evaluator	A_1	A_2	A_3	A_4	Mean
13	8.3	37.9	58.8	93.8	49.7
12	13.3	23.3	30.4	160.4	56.8
11	7.9	15.4	23.8	92.5	34.9
10	0.2	4.6	8.3	100.8	28.5
9	36.7	55.8	71.7	95.0	64.8
8	10.3	14.6	31.7	129.2	46.5
7	12.1	30.4	35.8	105.0	45.9
6	8.1	12.4	19.2	77.5	29.3
5	7.5	17.1	17.9	74.6	29.3
4	1.7	6.7	27.1	89.6	31.3
3	0.0	5.0	10.8	70.0	21.5
2	7.8	17.1	25.4	84.2	33.7
1	2.2	3.4	9.1	100.0	28.7
14	5.0	9.6	12.9	88.3	27.0
Means	8.6	18.1	27.4	97.2	

FIGURE F-9. Two-Way Means for Evaluator and Access

	Type		
Evaluator	U.S.S.R.	Nth	Mean
13	41.9	57.5	49.7
12	52.9	60.8	56.8
11	36.5	33.3	34.9
10	25.0	32.0	28.5
9	60.0	69.6	64.8
8	59.6	33.3	46.5
7	48.8	42.9	45.9
6	30.5	28.0	29.3
5	21.9	36.7	29.3
4	20.8	41.7	31.3
3	16.7	26.3	21.5
2	30.3	37.0	33.7
1	28.9	28.4	28.7
14	26.5	31.5	27.0
Means	35.7	39.9	

FIGURE F-10. Two-Way Means for Evaluator and Type

Source of Variation	Degrees of Freedom	Mean Squares	F-Ratio
Evaluator (E)	13	7,762.3	65.84**
Access (A)	3	273,056.7	127.27**
Type of recipient (U.S.S.R. or Nth country) (T)	1	2,954.3	1.82
Shape (S)	5	9,836.3	16.44**
Fission versus TN	1	37,455.8	62.60**
Other shapes	4	2,931.4	4.89**
E x A	39	2,145.5	18.20**
E x T	13	1,621.4	13.75**
E x S	65	598.3	5.07**
A x T	3	493.9	1.32
A x S	15	3,561.7	9.75**
S x T	5	523.1	1.90
E x A x T	39	375.3	3.18**
E x A x S	195	365.4	3.09**
E x S x T	65	274.8	2.33
A x S x T	15	155.7	1.32
E x A x S x T	195	117.9	
Total	671		

**Statistically significant at the P = 0.01 level.

FIGURE F-11. Analysis of Variance for Design Information Scores

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V. CONVICTION RESULTS

A. MAIN TEST

The second test objective was to evaluate effectiveness of the demonstration in convincing the inspection force that real nuclear weapons had been destroyed. Both real nuclear weapons and specially prepared fake weapons were presented for inspection and processed through destruction. Each inspection teams was required to make a call of "real" or "fake" on each weapon shape and at each access level at which the team saw the shape during the weapon shape monitoring at Pantex. Conviction was then a matter of analyzing the ability of the teams to discriminate between real and fake weapons. Conviction was determined by analyzing the number of correct calls made by a team.

The four levels of access used were denoted as A1, A2, A3 and A4. Each higher level included all information from the prior lower levels, thus access was cumulative. Low access teams performed an A1 inspection on the first weapon shape batch and an A2, including A1, on the second. High access teams performed an A3 inspection, including A1 and A2, on the first batch and an A4, including A1, A2 and A3, on the second.

1. Data. Inspection teams recorded their real or fake calls on data form CG-34-13. These calls are shown in figure F5-1 of appendix F5 for each team and access level. A summary of team calls at the highest access level reached (A2 for low access teams and A4 for high access teams is shown in figure F5-2 of appendix F5.

2. Analysis-of-Calls. The number of correct calls by teams at the four access levels was analyzed both as to the number of correct calls and as to concordance with the expected number of correct calls at each access level.

a. Correct Calls. The proportion of correct calls on weapon shapes (i.e., correct identifications by teams of real or fake) is shown in figure F-12 by access level and team size. Each entry in this figure of team size by access level is the average of two replicates, one each for the LIMA and MIKE inspection groups.

	Access Level				
Team Size	A1	A2	A3	A4	Means
2 Man	.47	.61	.61	.83	.63
4 Man	.50	.75	.89	.78	.73
Means	.48	.68	.75	.80	.68

FIGURE F-12. Proportions of Correct Calls on All Weapon Shapes by FT-34 Inspectors

An analysis of variance performed on these data indicates the difference between the number of correct calls at low and high access (i.e., A1+A2 vs. A3+A4) is statistically significant and that the difference between A1 and A2 is also statistically significant, but there is no statistically significant difference between A3 and A4. This leads to the conclusion that the number of correct calls at access level A1 is significantly less than that at A2, A3 and A4. The analysis also indicated that there is no statistically significant difference due to individual teams or team size.

The proportions of correct calls made on real weapons only and on fake weapons only are shown in figures F-13 and F-14.

Team Size	Access Level				Means
	A1	A2	A3	A4	
2 Man	.80	.80	.85	1.00	.86
4 Man	.90	1.00	1.00	.90	.95
Means	.85	.90	.92	.95	.91

FIGURE F-13. Proportion of Correct Calls on Real Weapons

Teams Size	Access Level				Means
	A1	A2	A3	A4	
2 Man	.06	.37	.31	.62	.34
4 Man	0	.43	.75	.62	.45
Means	.03	.40	.53	.62	.40

FIGURE F-14. Proportion of Correct Calls on Fake Weapons

Because of the small sample sizes, no analyses of variance were performed on the separate proportions of correct calls on real and fake weapons.

In general, the analysis of real-fake calls indicated that the ability to distinguish real from fake weapons was dependent upon access to internal weapon shape information; this ability increased significantly as access increased from visual observation of external configurations to X-ray examination of internal components. At the lowest access level used in FT-34, calls of fake against the weapon shapes were equally distributed between the real and the fake weapons. The distribution indicated that inspector distinction between real and fake was low and that conviction that real weapons were presented for destruction was also low. Successful distinction, and therefore conviction, required more information than was available at the low access levels. At access levels where distinction was most successful, the information which permitted good distinction also revealed classified information.

b. Expected Correct Calls. Since each of the fake weapon shapes was expected to be detected at a different access level, it is possible to compare the correct calls for each team against the expected number of correct calls. The expected number of correct calls was 10, 12, 14 and 16 for each team at access levels A1, A2, A3 and A4 respectively. The number of deviations from the expected are shown in figure F-15 for team size and access level with the first entry for the LIMA team and the second for MIKE.

	Access Level				
Team Size	A1	A2	A3	A4	Means
2 Man	5,0	6,0	2,6	2,0	2.6
4 Man	0,2	0,4	1,5	2,2	2.0
Means	1.8	2.5	3.5	1.5	2.3

FIGURE F-15. Deviations from Expected Calls

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In order to determine if the pattern of the correct calls was concordant with that expected by the test design, a X^2 goodness of fit test was performed. The X^2 value was significant at the P = 0.10 level. This is moderate evidence to reject the conclusion that the pattern was as expected. An analysis of variance was performed on those calls which deviated from the expected and indicated that the significant deviations were due to variations among individual teams, particularly the low access teams. This tends to confirm observations made by test controllers on the scene that low access inspectors, due to the small amount of information available to them, were almost reduced to quesswork or "hunches."

3. Reasons for Calls

Appendix F5, figure F5-3, lists the inspection calls made by each inspection team and their reasons for making fake calls. An informal review of the reasons given by teams for calls of fake indicate that many of the calls seem to be based on unsound reasoning.and are so marked in the appendix. Because these marked calls are subject to interpretation, no attempt was made to revise or validate the original inspection calls for analysis. It is believed that such validation would tend to drive the call list toward pretest expected values. A total of 58 questionable fake calls are marked in the appendix and are approximately evenly split between the LIMA and the MIKE inspection groups.

The most frequent questionable calls of fake were based upon external configuration of the weapon shapes. These calls included low density, low weight, appearance, and bad or disabled cabling. The most interesting calls of fake were those which were based upon inappropriate or makeshift handling equipment or dollies for the weapons. The carriages used, which were sufficient for display of the weapons and for movement to the disassembly area, had no bearing on the content of the weapon shapes presented. These calls serve a purpose in pointing the need for proper and consistent appearance of weapons and handling equipment for enhancement of conviction, particularly at low access where "hard" information for inspectors is scarce.

Several times the calls for a particular shape at a given access level were split between the two identical weapon shapes one real and one fake. It is believed that the shapes were sufficiently alike to provide the same data at a given access level, although it is possible that some variations could have occurred. One other possibility for explaining split calls is that the team itself was divided and the team leader elected to split calls for equitable distribution of team opinion.

The number of fake calls at the A1 level was larger than expected, particularly since half of the calls were made against real weapons. The large number of fake calls at this level indicates the lack of training in external weapon features and a lack of definition of what constituted a nuclear weapon in context of test or treaty conditions.

The largest number of fake calls was found at the A2 level. The 12 unexpected fake calls against the Mk 28-S at this access level were based primarily on lower radiation readings [redacted] as various methods of obtaining a family of yields in a given shape were covered during training. The three real weapons called fake at A2 had no access doors.

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More than half of the fake calls were made at the lower access levels where definitive information was minimized. It is important to note that no quantitative measure of correlation between conviction and distinction (correct calls) is available. The use of distinction as a substitute for conviction is based upon the premise that a group of inspectors exhibiting ability to successfully distinguish between real and fake items could transfer this ability to terms of conviction. For the FT-34 field test, inspectors were required to call a weapon shape real unless they could show reason why it was not real. Thus, every fake call for a weapon shape indicated conviction by an inspection team that the shape was not real. The lack of a requirement for inspectors to indicate why a shape was real precludes statements for positive conviction (that a shape was real). Shapes were called real by ground rule and definition as well as by default. Even though an inspection team believed a shape was fake, a lack of definitive evidence to claim fake required a call of real (default). Unfortunately, no comprehensive guidelines were available to inspectors to guide them in determining valid reasons for defining a fake shape. The training sessions at test headquarters were oriented to this task, but they could not be all inclusive. Therefore, each inspection team was forced to decide what constituted valid reasons for fake calls against the various weapon shapes.

4. Facilities. Throughout the overall destruction exercise, the inspection teams also made calls of "real" or "fake" on all inspected destruction facilities. They made no fake calls and there was no reason to expect them to do so.

B. POST-TEST CONVICTION EXERCISE

1. Data. The data generated by the post-test conviction exercise evaluators, as described previously, is shown in figures F5-4 and F5-5 of appendix F5. Since all

conviction exercise teams made completely correct calls at the A5 access level, only the first four access levels corresponding to the four access levels of the overall destruction exercise were analyzed.

2. Analysis-of-Calls. The calls of real or fake by the conviction test teams were analyzed to assess the effect of access on the number of correct calls. The type of analysis is similar to that performed on the FT-34 team calls except that there is no factor of team size. The limited and unlimited results[1] were analyzed separately. Because of ambiguity in team recording methods, some interpretation of call results was encountered. Fortunately, easy access to team members permitted clarification where necessary. If the average conviction score of a team was equal to or less than 20 percent, and the team marked the the score as real, the call was designated as fake. This designation of fake calls was assigned by test coordinators and agreed to by team members.

The proportion of correct calls on all weapon shapes for all teams is shown in figure F-16 by access level and nature of information used.

Nature of Information	Access Level				Means
	A1	A2	A3	A4	
Limited	.56	.64	.64	.78	.66
Unlimited	.60	.64	.67	.80	.68
Means	.58	.64	.66	.79	.67

FIGURE F-16. Proportion of Correct Calls on All Weapon Shapes by Post-Test Evaluators

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[1] Based respectively on information available to evaluators limited to FT-34 provided only or unlimited to include any prior knowledge of the evaluator.

This data was subjected to separate analyses of variance for the limited and unlimited cases. These analyses show that there is a statistically significant effect due to increasing access level both from low to high access and between each of the four access levels.for both limited and unlimited cases.

Figures F-17 and F-18 show the proportion of correct calls on real weapons only, out of 5 possible, and on fake weapons only, out of 4 possible, for all teams by access level and nature of information used.

Nature of Information	Access Level				Means
	A1	A2	A3	A4	
Limited	1.00	1.00	1.00	.96	.99
Unlimited	.96	.96	1.00	.96	.97
Means	.98	.98	1.00	.96	.98

FIGURE F-17. Proportion of Correct Calls on Real Weapons

Nature of Information	Access Level				Means
	A1	A2	A3	A4	
Limited	0	.20	.20	.55	.24
Unlimited	.15	.25	.25	.60	.31
Means	.08	.23	.23	.58	.28

FIGURE F-18. Proportion of Correct Calls on Fake Weapons

Due to the small sample size, no analysis of variance were performed on these data.

3. Comparison. A comparison was made of the discrimination ability of the FT-34 inspectors with that of the post-test evaluators using unlimited knowledge. This later choice is made as it seems most reasonable to expect evaluators working with data removed from the destruction site to use all knowledge at their command. The comparison of overall means of the proportion of correct calls is shown in figure F-19 for all weapon shapes, real weapons, and fake weapons.

	Weapon Shapes		
Discriminator	All Shapes	Real	Fake
FT-34 Inspector	.68	.91	.40
Post-Test Evaluators	.68	.97	.31

FIGURE F-19. Proportion of Correct Calls

The significant conclusions to be drawn from this comparison concern the rate at which incorrect calls are made. For both groups the rate of incorrect calls against fake weapons is quite high implying that, under FT-34 destruction conditions, a determined evader has a good chance of successfully passing fake weapons as real. This is especially true at low access levels. The false alarm rate (calling real weapons "fake") is 3 times as high for the FT-34 Inspectors as that of the Post-Test Evaluators (.09 vs .03). Examination of figure F-13 indicates that this difference is due to the relatively high false alarm rate of the two man FT-34 teams at the lower three access levels. If only four-man teams are considered, the average false alarm rate drops to .05.

4. Analysis-of-Conviction Percentages. As noted previously, the conviction exercise evaluators associated a percentage of conviction that the shape was real with

their calls. These conviction percentages for all teams are shown in figures F-20, F-21, F-22 and F-23 by access and profession of evaluator.

Access	Profession			Means
	EE	ME	Phys.	
A1	100.0	100.0	99.8	99.9
A2	100.0	98.8	99.8	99.5
A3	99.8	97.6	99.0	98.8
A4	97.0	97.0	97.0	97.0
Means	99.2	98.5	98.9	98.8

FIGURE F-20. Average Conviction Scores for Limited Results on Real Shapes

Access	Profession			Means
	EE	ME	Phys.	
A1	87.8	91.8	90.0	89.9
A2	70.5	76.9	73.0	73.5
A3	70.0	74.8	74.8	73.2
A4	44.5	44.9	45.3	44.9
Means	68.2	72.1	70.8	70.4

FIGURE F-21. Average Conviction Scores for Limited Results on Fake Shapes

Access	Profession			Means
	EE	ME	Phys.	
A1	63.0	68.4	75.0	68.8
A2	74.6	73.0	79.8	75.8
A3	77.6	74.8	81.6	78.0
A4	87.0	90.1	87.2	88.1
Means	75.5	76.6	80.9	77.7

FIGURE F-22. Average Conviction Scores for Un-Limited Results on Real Shapes

Access	Profession			Means
	EE	ME	Phys.	
A1	47.8	56.8	60.8	55.1
A2	45.2	50.0	52.8	49.3
A3	52.4	53.4	57.8	54.5
A4	33.8	38.5	33.5	35.3
Means	42.3	49.7	51.2	47.9

FIGURE F-23. Average Conviction Scores for Un-Limited Results on Fake Shapes

Analysis of the data from these four figures indicates that there is no practically signficant difference between the average conviction percentages for the three professions. In the limited knowledge-real weapon category, the differences between access levels are not of practical significance.

In the unlimited knowledge-real weapon category, the conviction percentage increases significantly with increased access level reflecting the increase in information about the weapons available to the evaluators. In both the limited and unlimited knowledge-fake weapon categories, the conviction percentage decreases with increased access level reflecting, in this case, the evaluators declining confidence as more information became available. The average conviction for the unlimited knowledge-fake weapon case is much lower than the corresponding limited knowledge case. This indicates the value of bringing unlimited knowledge to bear on the problem.

One interesting facet of inspection, which was observed at the A5 level, was the scoring of only 99-percent conviction, particularly by physicists, for weapons with which they were familiar. They indicated that for some primary systems, dimensions may be so critical that perturbations which need not be perceived by visual inspection measurement could cause the failure of the primary. Computer calculations and hydrodynamic verification would be necessary to verify that such a system would work sufficiently well to be declared a nuclear weapon.

5. Discrimination vs Information Value

Some comparison of the ability of inspectors to discriminate between real and fake weapons and the value of the classified information exposed can be made from test results. Figure F-24 gives this comparison. The ordinate is an average of field-test and post-test inspectors abilities to discriminate at the access levels tested and the A5 level considered only by post-test inspectors.where 100% correct calls were made. The abscissa is the average of post-test evaluators' relative values of information revealed at the different access levels normalized on the average score for the A5 level. Information from which figure F-24 is constructed is based on a small sample size, especially for the relative values of information revealed, and thus this figure should be interpreted in terms of trend rather than absolute value.

The data indicates that as the ability of inspectors to discriminate between real and fake weapons increases, so does the value of the exposed weapon information. However, the nature of these associated increases changes with access level. From access level A1 to A2 there is a marked increase in the discrimination ability with a relatively modest increase in the value of exposed information. As described in Chapter IV, the difference in discrimination between access levels A1 and A2 is statistically significant. On the other hand, the data also indicates the onset of diminishing returns from access level A3 to A4 and A5 in that the increase in discrimination is accompanied by a relatively large increase in the value of the exposed information.

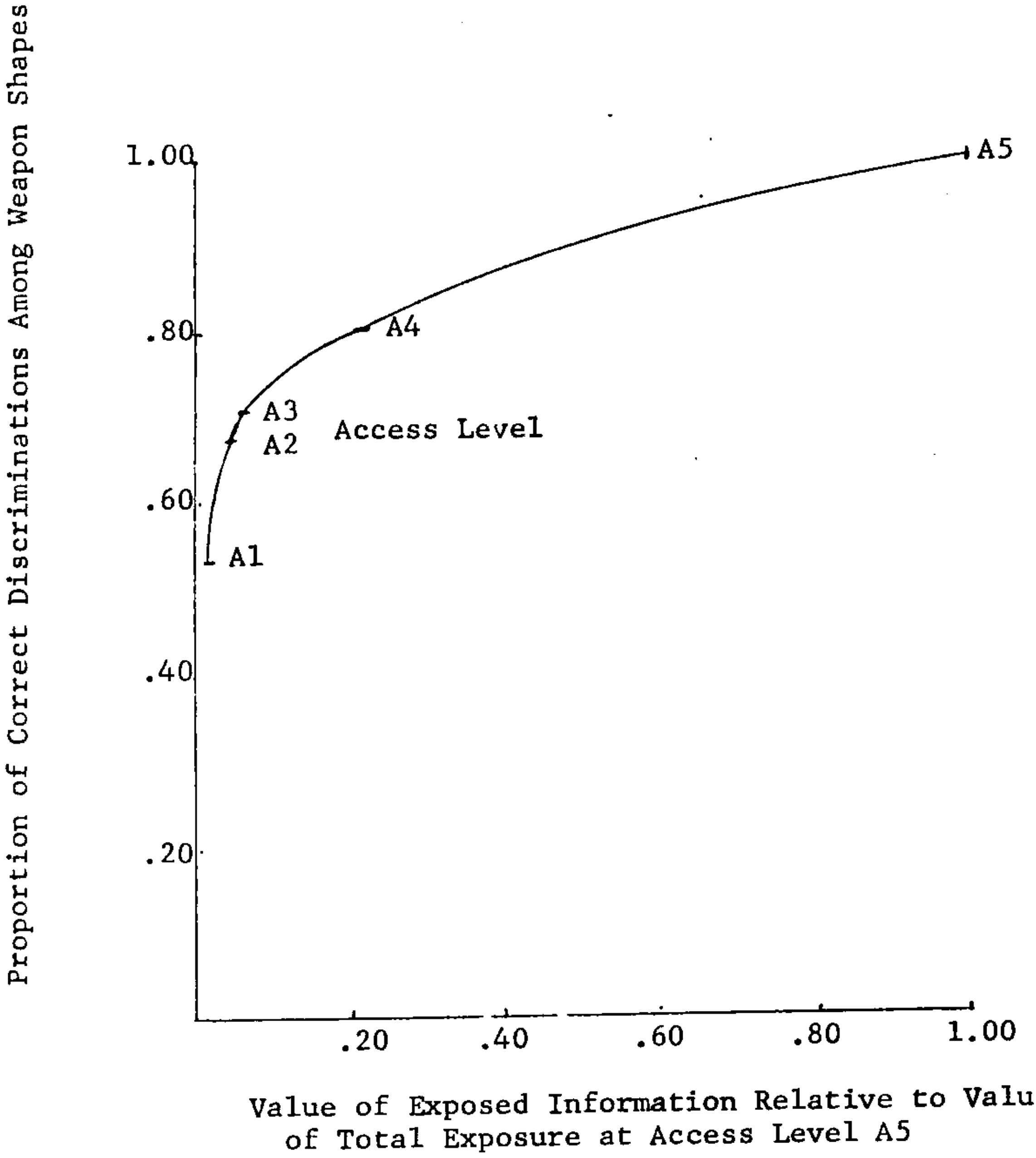

FIGURE F-24. Comparison of Discrimination and Value of Information as a Function of Access Level

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VI. EFFECTIVENESS RESULTS

The third test objective of FT-34 was to evaluate the practicality and effectiveness of the proposed methods and to suggest and implement possible improvements. The analysis of this objective primarily concerned measures of the effectiveness of inspection methods. By examining inspector performance of assigned tasks, a determination of the relative effectiveness and practicability of inspection methods can be obtained. Low inspection effectiveness indicates high complexity and possible poor comprehension of test methods or objectives. High inspection effectiveness indicates some degree of practicability of test methods and also indicates comprehension and motivation on the part of inspection personnel. Selected areas of inspection effectiveness which were used to analyze the performance of inspection personnel were (1) the detection of classified information, (2) the acquisition of test data, (3) time required to perform selected operations, (4) the maintenance of material weight balances throughout the test, (5) the performance of assay tasks, and (6) the detection of evasion during assay operations.

A. CLASSIFICATION DETECTION EFFECTIVENESS

The inspection teams did not always pick up or detect all the classified information which was exposed to them. The items actually detected were determined by a careful review of inspection teams data forms. In many cases teams detected more items than they recognized as such (e.g., photographs at high access often contained many unrecognized classified items). The number of classified items detected by each team during each phase of the overall destruction exercise is shown in figures F6-1 and F6-2 of appendix F6, and is compared in these figures with the number of exposed items. Figure F-25 shows the proportion of the items exposed actually captured or acquired for all teams by access level and team size.

Team	Access Level				
Size	A1	A2	A3	A4	Means
2-Man	.47	.45	.57	.56	.51
4-Man	.56	.56	.64	.66	.61
Means	.52	.51	.61	.61	.56

FIGURE F-25. Proportion of Exposed Classified Information Detected

Analysis of variance indicated that team size did not have significant effect on the capability to detect classifield information during monitoring operations but that a significant difference existed between low (A1+A2) and high (A3+A4) access levels. This difference indicated that high access teams, even though many more classified items were exposed to them, were able to capture a significantly greater fraction of them than did low access teams. Two specific factors may have helped to enhance this difference. First, the higher access teams used Polaroid cameras which enabled them to get pictures of many classified items even though the team did not recognize them as such. Second, test control personnel observed that morale was lower in the low access teams as they seemed to resent what they perceived to be the handicaps of low access.

B. DATA COLLECTION EFFECTIVENESS

As a measure of the effectiveness of data collection, weapon monitoring operations at Pantex were chosen as being representative of FT-34 operations. During weapon monitoring the teams were asked to report a good deal of both classified and unclassified information about each shape. This information ranged from quite simple items such as weight and dimensions to quite complex items such as the type of fuzing. As a measure of effectiveness the number of information items requested of the teams on the data collection forms was compared to the number corrected reported. This proportion is shown in figure F-26 for all teams by team size and access level.

Team Size	Access Level				Means
	A1	A2	A3	A4	
2-Man	.71	.73	.80	.80	.76
4-Man	.75	.80	.87	.81	.81
Means	.73	.76	.84	.80	.78

FIGURE F-26. Data Collection Effectiveness

An analysis of variance was performed on the data collection effectiveness results and indicated that there was a statistically significant effect due to the difference between low access (A1+A2) and high access (A3+A4). Furthermore there is a strong effect due to the differences between weapon shapes.

The mean effectiveness proportion for each shape is shown below in descending order.

Shell 8 in.	Mk 56	Mk 25	Hawk	Mk 39	Mk 57	Mk 30	Mk 28	Mk 28s
.839	.817	.809	.807	.791	.769	.767	.723	.679

For purposes of paired comparisons of the shake means, the multiple comparison technique was used. The statistic computed was $D = Qs_{\bar{x}} = .057$ where $s_{\bar{x}} = \sqrt{25.5/1600}$ and Q is the upper 5 percent point of the studentized range. This means that any two shake proportions that differ by as much as .057 are concluded to be significantly different at the 5 percent probability level. The rank order of the effectiveness proportions corresponds roughly to the quantity of information available to inspectors at the A1 level. Many of the questions asked at A1 were related to bombs and the lower effectiveness proportions for bombs indicates that information requested was not attainable at the A1 access level. Since there were fewer answerable questions about warheads and the 8-inch shell, effectiveness proportion were higher for these units than for bombs.

The differences in averages between low access (A1+A2) and high access (A3+A4) teams is believed to result from the observed higher morale of high access teams and better matching of inspection information to data form questions at high access than at low access.

C. WEIGHT BALANCE EFFECTIVENESS

1. General. Each inspection team was required to maintain a materials weight balance throughout the entire FT-34 field test. Data form CG-34-12 was used to record and summarize weight balance information, and each team was permitted to retain this form from site to site during FT-34 operations so that a running balance could be made. Weight balance information from data forms CG-34-12 is shown in figures F6-3 and F6-4 of appendix F6 for the LIMA and the MIKE inspection groups, respectively.

2. Analysis. Operational difficulties and the lack of complete test reference data precluded a meaningful analysis of the weight balance data. In theory, all material used in the field test should have been accounted for and the weight balance at the end of the test should have been zero. In practice, some error was unavoidable because of the different methods, equipment, and accuracies used in weighing material at the various test sites. No estimate for an expected or normal total weight balance error for the test circumstances is available. Extremes in residual

balance varied from 0.4 pound to 800 pounds. Both extremes were recorded by LIMA teams for batch two materials. Some of the contributions to errors, such as incorrect transcription and conversion from kilograms to pounds, were arithmetic. Weight balance error values for batch 1 (B1) and batch 2 (B2) obtained by all teams were:

	L1		L2		L3		L4	
	B1	B2	B1	B2	B1	B2	B1	B2
(lbs)	-74.2	0.4	-67.6	3.8	591	800	-78.4	11.7

	M1		M2		M3		M4	
	B3	B4	B3	B4	B3	B4	B3	B4
(lbs)	354	450	253.3	477.3	324	428	342.5	333.7

The average total weight of each batch was 26,600 lbs of which approximately [redacted] lbs was enriched uranium and [redacted] lbs was plutonium.

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Because of operational difficulties, nonstandard methods used among the test sites, and confusion in interpretation by test site personnel and inspection personnel the weight balance data are considered invalid for analysis. One of the major causes of these errors appears to have been in the smelting process at Paducah where an unknown and uncontrolled amount of non-nuclear material was lost as stock gas and particular matter. The weight balance problem during FT-34 indicates the need to have much closer control of all operations, particularly in burning, disposal and smelting operations.

D. OPERATION TIMES

As an indicator of the effectiveness of inspectors in performing inspection operations, start-stop times recorded by inspection teams were determined for the two major field test phases of weapon monitoring at Pantex and for assay at Oak Ridge. These operations were selected because they represented areas of inspection operations in which inspectors were allowed to perform inspection activities over a relatively long time period. Other inspection activities were often forced; i.e., a specific time allocation was made and the operation was terminated at the end of the allotted time. Walkthrough tours, for example, which were generally scheduled for a two-hour period, terminated at the end of the scheduled time.

1. Weapon Monitoring at Pantex

Figures F6-5 and F6-6 of appendix F6 show the time spent by LIMA and MIKE inspection teams for monitoring weapon batches at Pantex. Time used by each team to monitor each weapon shape in each batch is shown in minutes. Figure F-27 shows the average time in minutes to inspect a weapon shape for all teams by access and team size. Access in this figure is the marginal access. The times are then the times to perform tasks unique to the access level and total times for an access level are the sums of all times at corresponding lower levels plus the time for that level.

The A2 average time is low because of the limited number of shapes which had access doors. The A3 values were equipment limited as the gamma spectrographs used a large portion of the monitoring times. A time of ten minutes or 7-1/2 minutes,depending upon which gamma spectrograph was used, was required to obtain a spectral record for analysis. Often, two or three runs were used to obtain calibration data and to monitor at different locations on a given shape. Low monitor times for the A4 level indicate that, even, though monitoring may have been difficult and time consuming, the redundancy in shapes effectively caused only half the shapes in a batch to be monitored thoroughly. The other half of the batch was compared to the first half; and if the shapes appeared to be the same on X-ray plates, the second shape was examined hurriedly.

Team size had no effect on weapon monitoring times. Monitoring times were lower the second time a team inspected at any given access level than for the first time at the same access level by an average of 54 percent. This indicates that the shape familiarity obtained during first batch operations was reflected in reduced monitoring times for second batch operations.

Team Size	Access Level			
	A1	A2	A3	A4
2-Man	30	20	29	23
4-Man	23	20	39	23
Means	27	17	34	23

FIGURE F-27. Weapon Shape Inspection Time (min)

2. Assay Operation Times. Since neither low access teams at Rocky Flats or Oak Ridge nor high access teams of Rocky Flata actually performed the assey operations, only data from high access teams at Oak Ridge was applicable for analysis of operation time. Total operation times for Oak Ridge assay are presented for performer teams in figure F6-7 of appendix F6. Times include assay performance for 9 samples, eight test samples, and one standard sample. In figure F-28, average times for assay on a per sample basis are summarized. The longer times for the laboratory scientists are believed based on test observation to reflect the greater care and attention to detail used by this team and the time spent in attempting to detect evasion. The shorter average times for the Military Special Assay as compared to the Main Test Assay are similarly believed to reflect some learning or familarization with the laboratory procedures.

Analyses of variance performed on the operation times for the Main Test Assay and the Military Special Assay, indicate that the only statistically significant factor was the difference between samples during the military special assay. No reason for this is known since each sample was treated identically.

Main Test Assay	164	
2 man teams		191
4 man teams		137
Mil'y. Special Assay (2 man)	154	
Experienced teams		149
Inexp'd. teams		159
Lab. Scientist Assay (3 man)	177	
Overall Average	162	

FIGURE F-28. Assay Time per Sample at Oak Ridge (min.)

E. ASSAY EFFECTIVENESS

In order to measure the effectiveness of the performance of assay operations by the inspection teams, comparisons were made and analyzed between the team results and results obtained by the host's laboratory technicians on the same samples. This was done for Oak Ridge operations as the teams only observed the assay at Rocky Flats. Comparisons were made on the basis of the absolute value of the difference between the results obtained by the inspectors and the laboratory technicians.

Results from two phases of the assay were analyzed, chemical analysis and mass spectroscopy. Chemical analysis was used to determine the grams of uranium per gram of sample (gm U/gm). Mass spectroscopy was used to determine the proportion of the U-235 isotope in the uranium (U-235 percent). The third phase of the assay, emission spectroscopy used to determine the impurities and their approximate amounts, was not analyzed due to the high errors inherent to the operations.

1. Main Test Assay. Figures F6-10 through F6-13 of appendix F6 show the results of uranium assay for low and high access level teams of LIMA and MIKE inspection groups. In these figures, columns A and B show results obtained by FT-34 inspectors. Columns C and D show results obtained by Oak Ridge laboratory personnel who used FT-34 procedures, including evasion on the same samples.

The average differences for teams and laboratory technicians are shown in figures F-29 and F-30 for chemical analysis and mass spectroscopy by access and team size. These data were subjected to analyses of variance and none of the variables had a statiscally significant effect on either chemical analysis or mass spectroscopy.

Team Size	Access Level		Means
	Low	High	
2 man	.00092	.00068	.00080
4 man	.00046	.00103	.00075
Means	.00069	.00085	.00077

FIGURE F-29. Main Test Chemical Assay Differences in gm U/gm

Team Size	Access Level		Means
	Low	High	
2 Man	.129	.188	.158
4 Man	.125	.233	.179
Means	.127	.210	.168

FIGURE F-30. Main Test Mass Spectroscopy Differences in Percent of U-235

2. Militay Special Assay. The assay results of each team from each group of inspectors are shown in appendix F-6, in figures F6-14, F6-15, F6-16, and F6-17. These figures are in the same format as the figures for the main test assay. The average differences for teams by team composition and access are shown in figures F-31 and F-32 for chemical analysis and mass spectroscopy. These data were subjected to analyses of variance and none of the variables had a statistically significant effect on either chemical analysis or mass spectroscopy.

Team Composition	Access Level		Means
	Low	High	
Experienced	.00129	.00123	.00126
Inexperienced	.00170	.00101	.00135
Means	.00150	.00112	.00131

FIGURE F-31. Special Assay Chemical Analysis Differences in gm U/gm

Team Composition	Access Level		Means
	Low	High	
Experienced	.227	.376	.301
Inexperienced	.262	.178	.220
Means	.244	.277	.260

FIGURE F-32. Special Assay Mass Spectroscopy Differences in percent of U-235

3. Laboratory Scientist Assay. The assay results for the laboratory scientist teams are shown in figure F6-18 of appendix F6 in the same format as the previous assay results. The average difference between the laboratory scientist team and the laboratory technicians for chemical analysis was .00224 gm U/gm and .339 percent U-235 for the mass spectroscopy.

4. Comments. The accepted standard deviation for this work at Oak Ridge is 0.003 gm U/gm for chemical analysis and 0.125% for mass spectroscopy. Analysis of these differences between all FT-34 associated inspectors and the laboratory technicians indicates that for mass spectroscopy there is something more than a 5 percent chance that the variance among results is the same for both groups while for chemical analysis there is something less than a 5% chance of the two variances being the same. If the assumption is made that equal variance in results by two groups of analysts implies that both groups are equally competent, than the following conclusions may be made. All groups of FT-34 inspectors are probably as good at mass spectroscopy as the Oak Ridge technicians. On the other hand, there is a significant difference in competence between the test inspectors and the Oak Ridge technicians. From observations by test control personnel during the test, the likely cause is a lower competence by FT-34 inspectors due to the complexity of the work in chemical analysis.

F. ASSAY EVASION EFFECTIVENESS

As described in annex D, various evasions were practiced on the inspectors during laboratory operations of the overall destruction exercise, the military special assay and the laboratory scientist special assay. Inspection teams called "evasion" and gave their reasons if they believed they had detected an evasion being practiced on them. In order to be credited with a valid evasion call, the team must have specified the correct type of evasive practice.

Figure F6-19 of appendix F6 shows the evasion schedule and the number of correct calls for main test assay operations at Rocky Flats and similarly figure F6-20 for Oak Ridge. Figure F6-21 of appendix F6 shows the same information for the special assays of Oak Ridge.

Two measures were generated from this data, the detection rate and the false alarm rate. The detection rate is the proportion of the sample operations[1] subject to evasion which were correctly identified. The false alarm rate is the proportion of the sample operations which were incorrectly called as evaded. The measures are summarized in figure F-33.

Assay	Total Sample Operations	Evaded Sample Operations	Detection Rate	False Alarm Rate
Main Test, Rocky Flats	96	48	.06	0
Main Test, Oak Ridge	192	32	0	.04
Military Special Assay	192	95	.05	.08
Lab. Scientist Assay	24	12	0	0
Overall	504	187	.04	.05

FIGURE F-33. Assay Evasion Effectiveness

The amount of data developed in the test was too small to permit an analysis of variance, however it does not appear that any of the test variables (team size, composition or access) significantly affected this outcome. Observations by test control indicated that evasion detection primarily resulted from inadvertant slips by host laboratory personnel which exposed evasion. The number of detections decreased as the test progressed, possibly indicating that laboratory

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[1] One sample operation is a single unique phase of assay, such as mass spectroscopy, performed on one sample of fissile material.

personnel performing the evasions grew more skilled with practice. Eight of the 8 false alarm calls at Oak Ridge during the main test came from one team and 15 of the 16 false alarm calls during the Military Special Assay came from two teams. In each case the team in question believed they had detected evasion on one sample operation (incorrectly in two of the three cases) and then called evasion on all other samples in that operation. Their reasoning appeared to be based on "guilt by association."

4. Comments. The evasions practiced at Oak Ridge led inspectors to believe that approximately 1.5 percent more U-235 was produced than was the case. A post-test conference was held at Oak Ridge at which the test controllers, Oak Ridge Laboratory personnel and the Scientist Inspectors reviewed the evasive techniques used. This conference concluded that with practice by the laboratory technicians, evasions as high as 5 percent could be successfully practiced against FT-34 type inspectors in an FT-34 ground rule situation. Under these circumstances where inspectors do not have control of the laboratory equipment, successful detection is a matter of luck and slip-ups by the evading technicians. Consequently, the consensus of the conference was that the only way to insure against evasion and/or a high false alarm rate during assay would be to send the samples home to one's own laboratory or, if that is not practicable, to bring one's own laboratory to the site and maintain control over it.

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VII. FIELD TEST PROBLEMS

A. GENERAL

The fourth objective of the FT-34 field test was the identification of operational, technical, classification, safety, and security problems which arose during the test. This chapter will list these problems and discuss them in terms of their effects upon the test where appropriate.

Several logistical and administrative problems arose which were normal to an operation of the complexity and extent of FT-34 field operations. These problems, which pertained to such items as test scheduling, personnel transportation, and materiel transportation, were generally resolved by test site commanders or test headquarters personnel. Some problems proved irritating to inspector personnel but were of insufficient impact to affect the overall conduct of the test or to adversely affect test results.

B. OPERATIONAL AND TECHNICAL PROBLEMS

Throughout the field test, problems in operational, technical, classification, security, and safety areas were present to varying degrees. Many of these problems could have been avoided and would have to be resolved for either follow-on test activities or treaty operations. The following sections of this chapter discuss the problems encountered in each of the listed areas.

1. Pantex

a. Walkthrough Tours. Few operational problems occurred during walkthrough tours at Pantex. Inspection teams were allotted approximately 1 hour in each disassembly area; the teams were able to perform inspection tasks adequately in this time. Four-man teams were in a better position to subdivide inspection tasks than were two-man teams, but the two-man teams, while pressed, did complete assigned tasks. Many of the photographs did not provide sizing information because inspectors did not show a scale with the items photographed. Sketches produced by low access level teams were often more informative than the photographs provided by high access level teams. Dimensional estimates on sketches proved to be very good in some instances, although details shown on photographs were of great value in recording the types of items shown during inspection.

During training sessions at Test Headquarters, some information which was not to be made available to inspection personnel was released to inspectors through training notes and schedules. The material released concerned brief and unclassified descriptions of the weapon shapes to be used during inspection at Pantex. Because of this release, inspectors were aware of the types of weapons to be used at Pantex, and several inspectors looked for handling and disassembly tools associated with the weapon types listed. In particular, the fake 8-inch shell was jeopardized by this revelation. Because many of the Army inspectors were familiar with the Mk 33 nuclear round, they looked for appropriate tools for disassembly during the first walkthrough tour. The fake shell did not use Mk 33 disassembly tools; therefore, the tools were not on display at Pantex. Because Pantex had never handled the Mk 33, they did not have tools or fixtures available for display. This miscue was in effect for LIMA groups but was discovered in time to be changed for MIKE training sessions.

b. Weapon Monitoring

(1) Access Level A1. Several problems occurred during A1 monitoring at Pantex. In a few instances, the handout data forms, CG-34-04, showing scaled outlines of all the weapon types were in error. Corrections were made as soon as possible, and corrected data forms were transmitted to Pantex by technical support representatives.

Validation of weights of the weapon shapes proved to be a problem area. All weapon shapes were weighed initially by use of a load cell located outside the inspection areas. Validation of weights had to be performed on scales located within the inspection area in building 12-53. Because the scales would not cover the weight range of the Mk 39 bombs

(6000-7000 pounds), these shapes were excluded from weight verifications. One specific problem arose with the Mk 25 warhead (AIR-2A configuration). Initial weights were obtained for the missile nose section by weighing not only the missile nose but also the ring which adapted the missile nose section to a handling dolly. During verification, the missile nose was weighed without the adapter ring with the result that stated weights and verified weights disagreed by 10-20 pounds. Upon discovery of this discrepancy, Pantex personnel determined the weights of all adapter rings and re-marked the corrected weights on all the missile nose sections. The use of the adapter ring also obscured some information shown on the handout weapon shape outline; the revised data form corrected the information presented. The adapter ring was taped, and this, too, conflicted with information shown on the data form. The tape was removed and the information on the data form conformed to information available on the shape.

Incorrect weights were found on some of the Mk 57 BDU shapes. For one shape, the difference between marked weight and verified weight was 17 pounds. In this case, the unit in question was one that replaced a unit which had suffered handling damage at Pantex, this unit was removed from the test. Data from the original unit were used for the replacement unit without benefit of careful checks.

The verification scales were a continual source of problems. Although the scales had been calibrated shortly before FT-34 activities began, obvious errors in weighing were apparent throughout the exercise. The errors were first noted when several units were reweighed as part of the A1 access inspection. With a shape on the scales, the correct weight range was selected and the scale was unlocked to permit the pointer to indicate weight. The scale was relocked, then unlocked again to provide multiple readings. In many instances, the second reading varied from the first by several pounds. Differences in weights for a shape were found when the same shape was weighed at different scale ranges; these errors indicate nonlinearity in the scale range selection mechanism. The effect of the scale problem was small insofar as verified weights were concerned. A more important effect was the impact upon inspection personnel of the observed errors for values which were stated to be true. This operational problem was generally accepted by inspection personnel as unintentional; but, coming in early as it did in the program, it created some confusion and distrust in test parameters which were represented as untampered to the inspection force. It tended to create doubts as to the validity of statements concerning no intentional harassment and no evasion practiced during specific phases of the field test.

(2) Access Level A2. Problems encountered during monitoring at the A2 access level were minor. The fake Mk [redacted] on was such that [redacted] The U-238 used in the 8-inch shell was also shielded to a degree which allowed high level readings only in the background region level. The U-235, however, did indicate the presence of radioactivity. For one of the shells, Geiger counter readings were somewhat lower than for the others. No cause for this low reading is known; all shells contained the same quantities and types of radioactive materials. The case thickness on the low-reading shell was perhaps greater than that on the other shells, so that the output was better shielded. Nevertheless, two locations of radioactivity were discernible on the 8-inch shells. In general, Geiger counter reading on all the fake weapons were lower than readings on the real weapons, but this effect was not so pronounced as to provide conclusive evidence of fake weapons.

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Only three weapon types had access doors for monitoring internal components: the Mk 39, the Mk 28, and the Mk 57 BDU. In one instance, a Mk 28 fake weapon was found to have the arm-safe switch in the arm position when the radome nose was swung away from the bomb body. Pantex personnel remedied the situation as soon as it was discovered. The nose section for that particular shape had not come from war reserve stockpile.

(3) Access Level A3. During batch one monitoring for LIMA operations, one of the two available neutron counters was accidently dropped from a bench to the concrete floor of the inspection area. The instrument was repaired and recalibrated by Pantex, but its loss to inspection teams slowed the A3 inspection somewhat. The instrument was returned to the area for second batch monitoring, but its readings were erratic and subject to question. It did serve its function, however, by indicating the presence of neutrons on a go, no-go basis, although the magnitude of readings remained as a questionable item.

At the start of inspection, only one gamma spectrometer was available for FT-34 use at Pantex. During early use, the instrument ceased functioning. The cause was determined to be a cable short circuit from the probe to the monitor and the environment which was different from its normal location environment. Higher than normal temperatures were encountered in the inspection area, and the gamma-spectrometer indicated erratic output. The case was removed, and a small fan was procured to cool the electronic package of the instrument. These remedies were sufficient to permit the gamma spectrometer to be used for monitoring, although frequent calibration was necessary to check on its accuracy and drift rate. A second gamma spectrograph made available for inspection suffered no environmental difficulties. The use of two instruments resulted in speeding up the inspection process.

Pantex personnel who were available at all times during that use of the gamma spectrographs either operated or supervised the operation of the instruments. Inspectors encountered difficulty in interpreting results. In one instance, a spectrograph taken for the Mk 25, which contained plutonium, U-235 and U-238, showed in almost classic manner the contents by type in the weapon. Yet the inspection team using this spectrograph reported that no fissile material was contained in the shape. Shielded material also presented some severe problems in interpretation, particularly for the Mk 39 bomb. This weapon contained no plutonium, and no neutron count was obtained from the shape. However, the gamma spectrograph indicated a plutonium peak.

Actually, the peak shown was a result of shielding which tended to increase in effect as lower energy gamma rays were read. The instrument was trying to indicate a peak for U-238 at approximately 100 keV, but shielding so reduced the output at that energy level that the trace, starting at about the 400 keV level, dropped in amplitude. The point of inflection of the trace at the 400 keV level falsely indicated the presence of plutonium which shows a prominent gamma peak at about 385 keV. Shielding effects were noted for the Mk 39, the Mk 28, and the Mk 56 (Mk 11 R/V).

(4) Access Level A4. X-ray training for LIMA teams was less successful than desired, but corrections made for MIKE teams provided concise but useful X-ray training. Specially constructed light tables which could accommodate up to eight X-ray plates were provided by Pantex. The light tables used a coarse-grained frosted glass and internal fluorescent tubes which were not adjustable in intensity. Some sacrifice in quality was made in favor of low cost and large size, but the light tables proved to be adequate for A4 monitoring purposes. Handout sheets indicating the location of each shape with respect to the cobalt-60 source were given to each team to enable the inspectors to determine the extent of distortion and magnification of each set of X-ray plates.

One of the major problems was with the X-ray plates themselves. The X-raying of entire weapons had not been previously performed at Pantex and the techniques used, along with available equipment and facilities, were somewhat experimental. Some compromise was necessary in order to provide X-rays applicable to the test. The exposure used and the time available for X-ray of all the necessary shapes tended to emphasize the nuclear system portions of the weapons, while electromechanical components, in many instances, were often washed out and indistinguishable. The exposures did not reveal internal nuclear system design features of secondaries. The Mk 39 bomb which was, because of its size, probably the most difficult of the weapon shapes to X-ray produced somewhat marginal results in relationship to the magnification and distortion. Smaller systems provided very good X-ray plates.

The X-ray plate examination was very revealing to the inspectors, and most of the information asked for on the test data forms was obtained. One oversight was evident on the data forms, however. In access levels 2 and 3, questions were asked regarding the quantity of radioactive material in each shape. These questions were intentionally placed in the radiation monitoring access level data forms to determine whether prior knowledge on the part of inspectors would be revealed even though the monitoring methods used at these levels were not sufficient to indicate quantities of material. For the A4 access level, questions regarding location of nuclear materials were asked; however, a question concerning quantities of materials was omitted. Without the specific question being asked, no team voluntarily provided any information on quantity of uranium or plutonium in the weapon shapes. Locational information obtained by inspectors also included sizing of such items as pits and secondaries and interstage distances, but these data were not extrapolated to volumes of materials found or quantities. Sufficient information was available from the X-ray plates to enable quantities of pit materials to be found within an acceptable degree of accuracy.

c. Disposal Operations. Weight problems associated with disposal operations were discussed earlier. Minor variations were noted between tare weights marked on tote boxes and values found on the scales. During batch 1 disposal operations, the truck carrying the tote boxes to the burning area did not remain within sight of the inspectors. For a period of approximately 30 minutes the truck was not observed by either inspectors or test control personnel. It is believed that the truck driver not only took an alternate route to the burning area but also stopped en route for a break period. Remote viewing of the burning materials by means of a periscope in the control bunker and a series of mirrors adjacent to the control bunker was limited. Safety requirements dictated personnel limits within the burn area, and inspection was was performed on a shift basis. During disposal operations for batch 1 materials, some plastic parts from the Mk 39 bombs were included in the burnable materials. Because these materials did not burn successfully, they were not included in the burning process for subsequent batches but were shipped to Paducah for final disposition along with weapon cases and nonnuclear components.

d. General Problems. The many operation and technical miscues which occurred during FT-34 operations at Pantex created a morale problem among inspection personnel and resulted in unfavorable responses from the inspectors, many of whom considered it to be a hostile environment. The effect of inspection conditions at Pantex are discussed in annex E.

2. Rocky Flats

a. Walkthrough Tours (Material and Weights). Minor problems occurred during walkthrough tours at Rocky Flats. The problem areas involved the mass of equipment located in inspection areas, safety requirements which limited access and participation, tools which were not used for FT-34 activities, and requirements for constant escorting by plant personnel.

Walkthrough tour areas were located within normal production areas of the Rocky Flats plant. Areas not connected with FT-34 activities were blocked from view by dropcloths; FT-34 areas were limited to those which had a direct bearing on materials and processes used for the test. Much of the equipment exposed during walkthrough tours was superfluous to FT-34. To cover or remove this equipment and the tools associated with the equipment would have been prohibitive in time and expense, therefore, the extraneous material was left in its normal condition for plant use. The relocation of some tools, particularly within glove boxes, was noticed on second and final walkthrough tours. Plant operations precluded the return of all tools to original locations, and normal practices caused tools to be used, moved, removed, and added to the inspection area.

Safety restrictions, which applied to all FT-34 personnel, at Rocky Flats were strictly enforced. Because of the extreme health hazard associated with plutonium, FT-34 personnel were not permitted to come into contact with the material during any inspection phase of the test. The use of protective shoe coverings, smocks, and respirators and the need for alpha monitoring was a necessary irritant to inspectors; however, these requirements did not cause any more inconvenience to FT-34 personnel than to Rocky Flats personnel.

Part of the walkthrough tour of inspection at Rocky Flats was the observation of incoming materials shipped from Pantex. All materials were in pit containers. Although the inspectors had seen pit containers at Pantex, they were not certain that containers seen at Pantex were the same ones seen at Rocky Flats. The assurances and quanrantees given inspectors that no evasion or tampering with materials shipped between test sites would be permitted was, in general, meaningless. Inspectors did not observe, mark, or otherwise identify material or shipping containers at Pantex or at other test sites. They had no knowledge of what was shipped, or how it was packaged; therefore, assurances of shipping integrity were specious.

MIKE inspection teams observed and weighed the containers shipped from Pantex. As each batch of material was processed, the inspection teams weighed the empty containers (second and final walkthrough tours) to determine the quantity of weapon-derived material sent from Pantex. LIMA teams did not elect to weigh shipping containers or ask for weights to be provided. The residue material at Rocky Flats was used for weight balance information; the weight of uranium shipped to Oak Ridge was determined indirectly by subtracting the weights of plutonium and residue from the total weights determined from full and empty shipping containers.

The quantities of plutonium in each batch were within limits [redacted]

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[redacted] Evidently, the requirements for batch separation had not been communicated to the foundry personnel, and mixing of similar materials was normal to operations of this type. Inadvertent disclosure of the mixing of batch materials was made by a foundryman to inspectors. This disclosure caused some concern among the inspectors, primarily, in the area of violating assurances, although the error was generally accepted as an operational one and not as intentional harassment or evasion. [redacted]

[redacted] Mixing of batch materials had no effect on sampling or assay. The error in mixing of batch materials was corrected for MIKE inspectors.

The LIMA inspection teams were conducted on three full walkthrough tours. MIKE teams were conducted on one full walkthrough tour of the foundry and disassembly areas, but they did not elect to tour the foundry area on the second and final walkthrough tours. This deviation from test planning, which had no known effect on the test results, was agreed to by the local site commander.

b. Sampling and Assay Operations. The assay laboratory was in a condition similar to that of the disassembly area. Glove boxes contained materials, tools and equipment which were not for FT-34 use but were in use for normal laboratory operations. The laboratory did not have sufficient space or equipment to allow separation of FT-34 operations from plant operations, and routine Rocky Flats work was carried on simultaneously with FT-34 work, often within the same glove box. It was difficult for inspectors to observe an assay operation, particularly in chemical analysis, over the shoulder of a plant employee when they were uncertain about the operations being performed. Training received by FT-34 inspectors at test headquarters and at Rocky Flats was insufficient to provide complete comprehension of all assay operations and procedures. LIMA teams were trained in the general theory of assay at test headquarters and were given a cursory briefing on the use of data forms at Rocky Flats before entering the assay laboratory. Many of the LIMA inspectors were generally unfamiliar with production chemical laboratories and in particular a plutonium laboratory which makes extensive use of glove boxes. LIMA teams were not given a preassay orientation tour of the laboratory. MIKE teams were briefed on details of the Rocky Flats assay procedures and use of FT-34 data forms while at Rocky Flats. This briefing augmented training received at test headquarters. The MIKE teams were taken on an orientation tour of the assay laboratory area where laboratory procedures were demonstrated. The more intensive and comprehensive training given to MIKE inspectors served to reduce some of the assay procedure confusion that was evident with LIMA teams, although no noticeable affect on test results occurred because of these training differences.

c. General. In addition to the operational and technical problems which arose at Rocky Flats, several minor problem areas which affected inspector morale but had no other known effect on the test itself became evident. Morale problems are discussed more fully in annex E.

3. Paducah

a. On-Site Travel. Security restrictions prevented FT-34 personnel from travel between headquarters area and inspection areas by the most direct route--through the plant area. Instead, all FT-34 personnel were required to travel a perimeter road around the plant to get to the inspection areas.

b. Monitoring Operations. During weapon case and component monitoring operations, inspectors were perturbed by the lack of information regarding shipments of materials from Pantex. Some inspectors believed that weapon cases from Pantex were not used at Paducah but that similar cases were painted at Paducah and displayed for inspection. The fact that all weapon cases were not available for inspection (having been smelted) tended to reinforce this feeling, although assurances were given that Pantex material was indeed shipped to Paducah. No inspector marking or identification at Pantex was permitted for materials to be shipped to other test sites; therefore, the doubt did not disappear.

Data packages from Pantex were requested by inspectors to enable them to refresh their memories on the weapons and components seen earlier. Because the data packages had been reviewed, and commented on and contained test control and classification comments, it was not appropriate to release them to inspectors for further use. Therefore, inspectors had to rely on memory for Pantex details.

c. Weight Balance. A combination of factors presented difficulties in weight balance operations at Paducah. Material shipped from Pantex was not uniform for all batches. Plastic parts from the batch 1 Mk 39 bombs were placed on the burn pad at Pantex but were not consumed during the burning operation. These parts were accounted for in disposal operations at Pantex and were not sent to Paducah. Plastic from succeeding batches, however, was sent to Paducah along with weapon cases and components. Disassembly of smeltable portions of weapon cases and the smelting operation were performed as soon as possible after arrival of material from Pantex and before the arrival of inspectors. [redacted] The parts scheduled for smelting were the Mk 39 bomb cases, Mk 28 nose and tail section cases, and the Hawk cases. For batch 1, other materials were placed in the furnaces. These included magnesium alloy nose sections from the Talos innerbodies, weapon thermal batteries, aluminum cased components, and the steel accumulator from the Hawk. No before-or-after weights were determined for the materials smelted for batch 1; therefore, stack losses during smelting were not obtained or accounted for. Not until batch 3 did weighing produce a value for smelting stack losses. For batch 1, the Hawk accumulator bottles would not melt, and they were placed in the slag barrel along with other furnace residue. After determination of which components were mistakenly smelted during batch 1, the weights of similar components from batch 2 were obtained, and these weights were offered to the inspectors. For batch 2, components were not smelted, regardless of their aluminum content, and only those cases programmed for smelting were placed in the furnaces. Plastic parts from the Mk 39 bombs were smelted and vaporized in the furnace, but no stack losses were obtained for batch 2 smelting operations. MIKE operations profited from the errors of LIMA operations.

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For batches 3 and 4, smelted materials were those programmed according to the test design. Weights were obtained for all materials to be smelted; and residue materials, including metal ingots and slag, were weighed after smelting so that actual values of stack losses could be found and so that the values could be given to inspectors. LIMA teams and MIKE teams were not exposed to the same materials for Paducah operations; therefore, replication for these operations was lost. The materials shown within LIMA batches was inconsistent, although an attempt was made to correct batch 1 weights--not materials-by values obtained from batch 2 materials. The accuracy of these corrections could not and cannot be ascertained.

The description of materials on the weight balance data form was unclear. Definitions of the terms "residue" and "other" were not provided, and each inspection team made its own interpretation of the terms in recording its findings. This did not affect balance values, because both weights were to be subtracted from previous balances; however, it did provide a confusion factor which did not become resolved. MIKE teams were given stack loss values from smelting operations but failed to report these values in weight balance figures.

d. Disposal. A disposal of classified materials was scheduled for Paducah operations. The Paducah plant normally disposed of weapon external neutron generators by burial in a secured disposal area. Neutron generators from both batches of weapons were packaged in wooden crates and transported to the burial area under observation of inspectors. For LIMA operations, the burial turned out to be a fiasco and offered only comic relief to otherwise boring inspection routines. The high water table at the burial grounds caused the boxed components to float even after being dropped into a hole in the ground and after being covered by dirt. The crate floated to the surface a second time after more dirt was used to cover it. Finally, holes were drilled in the box so that it would sink in the burial pond. This experience reduced credibility of the disposal procedures. Bural activities for MIKE teams were without incident and benefited from LIMA experience.

4. Oak Ridge

a. Walkthrough Tours. Walkthrough tours were conducted throughout the disassembly areas and the foundry area at the Y-12 plant. Non-FT-34 areas were blocked off from inspectors and the tours were scheduled to minimize interference with normal plant operations. Time limitations for the walkthrough tours pressed low level teams to obtain data hurriedly, but the teams did acquire sufficient information to record on their data forms. Access limitations required that inspectors be escorted by the site commander, the assistant site commander, or the technical support representative and then only under the cognizance of the appropriate Y-12 supervisor for the area being toured.

Incoming materials from Pantex and Rocky Flats cause some problems because of mixed batches and late arrival. Shipments from Pantex arrived at Oak Ridge with intermixed batches evident. Batch 1 and batch 2 materials were packaged together and had to be separated at Y-12. The same was true of batch 3 and batch 4 materials. The boxes with the mixed materials had to be opened and the components separated before they were prepared for the walkthrough tour in the disassembly area. For LIMA operations, uranium from Rocky Flats did not arrive in time for the first walkthrough tour. In addition, the Rocky Flats material was labeled as "contaminated" and had to be checked by the laboratory before the material could be released to the foundry. The foundry was capable of processing only a limited amount of material on each run, and it was stated that batch materials would be isolated. Each batch, therefore, was to consist of approximately the same quantity of materials. Because of the late arrival and contamination problem with uranium from Rocky Flats, some batch 2 uranium from Pantex was added to batch 1 material to equalize the content of uranium per batch. Approximately 32 kilograms of urnaium from Rocky Flats was used in batch 2, along with the remaining batch 2 uranium from Pantex. Shipments from Pantex and Rocky Flats arrived in sufficient time for adequate separation for the MIKE operations. Weight balance information for LIMA batches 1 and 2 for uranium differed by 32 kilograms (70.4 pounds). Only a few kilograms separated the MIKE batch 3 and batch 4 recovered uranium.

As at other test sites, inspectors were unfamiliar with materials or packages which were shipped and had reservations about the validity of assurances of no tampering or evasion on shipments between plants.

b. Assay Operations, Main Test. Data forms were found to be incompatible with the actual techniques used at the Y-12 laboratory. Where applicable, Y-12 data cards were used by inspectors and stapled to the appropriate data forms. For emission spectroscopy, definitions of terms used in data collection were required to provide a basis for inspector evaluation of results. The troublesome terms were "large" and "unexpected" as applied to impurities in samples. It was explained that "large" impurities were those which would be expected to affect the chemical analysis titration for uranium content. This was defined as the presence of an impurity to the extent of 1000 parts per million (ppm) or more. Inspectors were told to disregard impurity concentrations of less than 100 ppm unless sufficient numbers of impurities in this range of concentrations totaled 1000 ppm. Expected impurities were defined as those which appear because of the material and techniques used. Examples of normally encountered or expected impurities were the large lines of uranium (because of the large uranium metal content in samples), silver (because of the use of silver in the carrier material), and carbon (because of the use of graphite electrodes). Other materials were defined as unexpected.

During the LIMA 3 team isotopic analysis phase, the mass spectrometer malfunctioned. The team was removed from the area while a repair crew checked the instrument. Repairs entailed the replacement of the vibrating reed amplifier and a panel meter. Also, a change of ion source was made because of the arcing of a fine wire in the original source. Inspectors were informed of the change of ion source. The replacement of the panel meter by one of another color led the inspectors to suspect evasion, although this change was normal for the instrument and had nothing to do with evasion.

One minor problem arose because of the scheduling of operations on a space-available basis. This type of schedule was instituted to make maximum use of the time and equipment available. Since assay phases did not have to be performed in any given order, the space-available scheduling allowed inspection teams to rotate the order of operations. The problem arose for those teams which performed (or observed) chemical analysis before performing (or observing) isotopic analysis. Isotopic analysis yielded information regarding the sample uranium content; this information was necessary to permit the weighing of appropriate quantities of dichromate for titration. Without this information, the teams starting on chemical analysis had to be told the approximate isotopic composition of each sample so that titration could be performed. The Y-12 laboratory personnel informed the teams of approximate isotopic composition and indicated that, if a different true value were found later on, the mass spectrometer corrections to titration could be made.

c. Assay Operations, Special Assay Test. The preparation of evasion materials for the special assay test presented a challenge to the Y-12 laboratory. An attempt was made to prepare an alloy of 98 percent uranium and 2 percent aluminum. It was found that such an alloy could not be formed to provide a homogeneous solution. On the seventeenth attempt, a button was formed which consisted of 98.4 percent uranium and 1.6 percent aluminum. This button, which was homogeneous, and was used for the test even though the desired 2 percent evasion could not be attained.

For the Special Assay Test, the same problem arose for teams performing chemical analysis before doing isotopic analysis as was evidenced in the main assay test. Teams in this situation were given approximate isotopic quantities so that they could proceed with titration.

d. Assay Operations - Contractor Assay Test. All equipment and techniques were normal and operable for the contractor assay test. The only problems during the contractor assay test were those created by the team members in their attempts to detect and overcome possible evasion attempts.

5. Overall Test Problems. Throughout the FT-34 field test, some data forms used were found to be ambiguous, unclear, and in error. As discrepancies were uncovered, an attempt was made to correct data forms and supply corrected forms to the field operational sites. In most instances, local solutions were implemented by test site commanders.

The only data form used daily throughout the test was the form CG-34-14 (modified to CG-34-14-1), the Daily Attitude Survey. This form was intended to serve two purposes. The first was to record and identify attitude factors for each inspector for each day of operations. It was hoped that daily analysis of these factors could provide information which could be used to avert problems associated with morale and other human factors. The second purpose was to provide some degree of inspector conviction that real nuclear weapons were presented for destruction during the test. Unfortunately, both objectives fell so far short of their goals that the survey form proved to be more of a hindrance than a help. The wrong questions were asked in the wrong manner. Daily filling out of the form became boring to the inspectors. The attitude questions were not limited to the test but were worded in such a way as to indicate inspector frustration for any number of causes. An arbitary selection was made which caused test controllers to probe into the reasons why any inspector indicated more than 50 percent frustration. Inspectors soon discovered that less explanation and paper work would be required if they kept (or indicated) a frustration level of less than 50 percent. Conviction questions were too general and did not distinguish among the various types of operations performed during the test or the types of activities performed at the different test sites. An attempt was made to correlate conviction scores for specific activities at Pantex with team real-fake calls made during weapon monitoring. No basis for correlation could be found. The validity of the daily conviction scores was questionable, and it became obvious that some inspectors were providing values which were not based upon any question activities.

One feature of the test which inspectors found objectionable was the lack of feedback information on how well they were doing. Such information could not be provided before the inspectors completed the test, and this lack of information tended to lower morale.

In many respects, the LIMA group operations served as a testing ground or pilot test for the MIKE operations. Many of the technical and operational problems which faced the LIMA teams were resolved for the MIKE teams. No quantitative value of the effect of problem solutions for MIKE can be determined. Every attempt was made to preserve the replication between the LIMA and MIKE groups, but this was not always achieved.

C. CLASSIFICATION PROBLEMS

1. General. Inspectors were required to list items of classified information which were revealed during each phase of the field test at each test site. Guidelines for the inspectors were provided in the inspection manual. These guidelines were derived from AEC classification guides current at the beginning of the test and from estimates of the types of information expected to be revealed during the test. The guidelines provided generalizations for classification of items for nuclear weapons and weapons materials but were limited to the extent that specifics for the field test should not be inadvertently disclosed. Inspection personnel were not expected to have extensive knowledge of classification. Because of this, AEC classification advisors were made available at each test site to monitor all inspection operations and to record all classified information which was available for revelation. The classification advisors also inspected each data package produced during the test and recorded those classified items found by the inspection teams. Items recorded were those called out by inspection teams - correctly or incorrectly - and also those which were revealed in the data packages but not listed as classified by the inspectors. In this manner, a list of the available classified information was formulated, along with a listing of information acquired by inspection. Several classification problem areas arose during the test and these are discussed in the following sections.

2. Pantex Classification Problems. One of the first classification problems which arose at Pantex concerned the interpretation of classified revelation of pit containers. The pit containers were on display during walkthrough tours and were visually unclassified according to current classification guides. When requested by inspectors, Pantex personnel opened the containers; [redacted]. The unopened pit containers were declared to reveal classified information for the context and location in which they were used and displayed at Pantex.

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3. Rocky Flats Classification Problems. Pit containers at Rocky Flats were subject to classification interpretation just as at Pantex. In context of the test and the location, it was determined that the pit containers revealed classified information. Few other items were revealed at Rocky Flats, so problems were minimal.

4. Paducah Classification Problems. No significant classification problems arose at Paducah for FT-34 operations. The few questionable identification problems were quickly resolved by the AEC classification advisors at the site.

5. Oak Ridge Classification Problems. No major classification problems arose at Oak Ridge.

D. SECURITY PROBLEMS

1. Training. Security restrictions were enforced throughout the FT-34 test. Security clearance information for all FT-34 personnel was verified by the test director, and it served as a basis for granting access to the AEC plants used in the test. Inspectors were afforded limited access to the plants and to information. This access was based upon the need-to-know concept and was limited to information which was judged to be necessary for the conduct of the test. Weapon design information presented during training was

limited to descriptions of nuclear and nonnuclear components of a variety of U.S. weapons, but theory of operation was intentionally omitted as being unnecessary for test purposes. Initially, weapon design information for inspectors was limited to only those weapons used during the operational phases of the test. Waivers on this restriction were granted by AEC headquarters for training information so that revelation of weapon types would not be revealed to inspection personnel before they actually saw the test weapons. Annex B discusses training restrictions in force for FT-34.

2. Operations. Security restrictions such as access limitations and escort requirements within plant areas used during test operations were enforced. Many normal plant operations which were not associated with FT-34 activities were kept from view of FT-34 personnel by the use of partitions and dropcloths.

A problem occurred during LIMA operations at Pantex. It was observed during data package review periods that inspection teams were reporting and describing weapons and design features with classified terminology such as "gas boosting," "two-stage weapon," "primary," and "secondary," yet were claiming that no classified information was revealed. The senior AEC classification advisor at Pantex was concerned that the descriptive terminology (not recognized as classified) would carry over to off-site conversations and arranged to brief the inspectors so that the terms and concepts would be properly protected. The problem was easily solved by the short briefing and the information from the briefing was used during MIKE training at test headquarters to avert reoccurrence of the problem.

E. SAFETY PROBLEMS

No major safety problems were encountered during FT-34 operations. A few incidents occurred in which some vehicle damage was sustained but no personal injuries were reported by FT-34 personnel during the test. Safety standards and practices at each test site were discussed during initial orientation for inspectors upon arrival at each site. Safety practices used during the test included the use of protective clothing for high explosive or contamination areas, separation from hazardous materials, denial of inspector weapon handling, issue of smocks and respirators in plutonium hazard areas, and full body radiation counts for a all personnel at Oak Ridge. Safety was a primary consideration for the test and every effort was made to preclude accidents or safety incidents.

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VIII. CONCLUSIONS

A. CLASSIFIED INFORMATION

1. General. Under the tested concept for the demonstrated destruction of nuclear weapons, classified information was exposed to inspectors at all access levels including the lowest level of intrusion. At the lowest level some of the exposed information was secret restricted data concerning sensitive weapon design features.

2. Facility Redesign. Much of the exposed classified information could be protected by redesign of facilities and equipment consisting of a specially constructed facility wherein universal tooling and fixtures would be used for weapons and material disassembly. Nonnuclear materials would be disposed of by rendering the material unrecognizable (e.g., complete smeltering or effective crushing), and access to unprocessed components, as permitted at Paducah, would not be permitted. Weapon surfaces would be masked to conceal features such as radar antennas that would reveal classified information. Debris from the burning of high explosive components would be thoroughly mixed prior to viewing to conceal information such as the number of detonators in one segment of explosive. [redacted]

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3. Post-Test Review. The post-test review of the value of the exposed classified information generally indicated that information concerning the design of TN and implosion (fission) systems would be most valuable to both U.S.S.R. and Nth country recipients. Within this, the value of the exposed information increased with higher access level and/or newer weapons, reflecting in both cases the greater amount of detailed information available. Below this in rank, some divergence in value to the U.S.S.R. and Nth country appeared. The review evaluators indicated that information concerning possible counter measures, as revealed by

examination of x-ray plates and nonnuclear components, would be of value. For the Nth country, the review indicated that information concerning nuclear materials as revealed by neutron counting and gamma spectrographic scanning would be of greater relative value to a developing weapons program.

B. CONVICTION

The ability of both military inspectors and post-test evaluators to discriminate between real and fake weapons was poor at the lower access levels. Access was, in both cases, the only significant variable with the proportion of correct calls increasing with access. The results showed that at the lowest access level, such as would be used in the situation described in the preceeding section, the inspection teams were often essentially guessing. The number of calls of fake on real weapons for questionable reasons by military inspectors indicates that a higher degree of inspector training is necessary to reduce the false alarm rate to that of the post-test evaluators.

The post-test evaluators were able to effect significant changes in their percentage of conviction by using the greater amount of information available at higher access levels. When they used the full range of all prior weapon knowledge, they were much less convinced of the authenticity of the weapons, particularly the fake weapons.

C. COMPARISON

A comparison of ability to discriminate among real and fake weapons to the value of exposed weapon information as a function of access level indicates that both measures increase with increasing access level. A significant increase in discrimination is accomplished between access levels A1 and A2 at a relatively modest increase in the value of exposed information. However, increases in discrimination between access levels A3, A4 and A5 are accomplished at a much higher relative increase in the value of exposed information.

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D. INSPECTION EFFECTIVENESS

1. Classification Detection Effectiveness. The inspection system tested detected an average of 47 percent of the classified items exposed when measured against the assumed 100 percent detection by classification specialists. It can be concluded that the inspection methods are effective, but that the inspectors were not adequately skilled to detect all classified information to which they were exposed. The only significant factor affecting the effectiveness was the difference between high and low access.

2. Data Collection Effectiveness. An average of 78 percent of the available and requested data describing the weapon shapes was correctly reported by the inspectors. The factors which had a statistically significant effect on this were the difference between high and low access and the differences between the weapon shapes. Lower data collection effectiveness was achieved against the relatively complex weapons such as the bombs about which a good deal of information was available.

3. Weight Balance. Problems with various techniques at the several sites prevented inspectors from maintaining accurate weight balances throughout the process. In some cases the imbalance approached a large fraction of the resultant fissile material. Tighter control of techniques and equipment than practiced in FT-34 would be required for accurate weight balances to be maintained.

4. Operation Times. Most phases of the FI-34 operations were so structured to preclude meaningful measurement of elapsed time as a useful measure. Walkthrough tours were set by schedule and no deviation was entertained. Other operations such as radiation counting and some portions of the assay were equipment determined for a goodly fraction of the operation time. During the monitoring of weapons at Pantex, team size did not affect operation times and no meaningful comparison by access level can be made. There was some indication of a reduction in time at both Pantex and Oak Ridge as some phases of the operation were repeated.

5. Assay Effectiveness. The differences between the results of the several groups of FT-34 inspectors and the Oak Ridge laboratory technicians could not be attributed to any of the test variables. Test inspectors appeared to be as competent as the laboratory technicians at mass spectroscopy, but less competent at chemical analysis.

6. Assay Evasion Effectiveness. Only 4 percent of the specific evasions were detected by teams with no apparent effect due to any of the test variables. The false alarm rate was 5 percent with some teams showing a tendency for guilt-by-association calls. The detections were primarily due to errors by the performing host laboratory technicians which tended to decrease with time. The evasive techniques tested were generally quite simple, and in the opinion of the laboratory personnel could be made much more difficult to detect. As a general conclusion, it appears to be quite easy to evade inspectors by potentially significant amounts of fissile material in a host controlled laboratory.

E. FIELD TEST PROBLEM AREAS

Weight balances of weapons versus residue were not accurate because of several factors. Accurate weights were not determined prior to and after all processing operations to identify and account for weights lost during processing. Scales were inadequate for some loads, some scales were inaccurate, and some calibrations were not reliable. Units of measurement were not always standardized, and inspectors apparently made careless errors in calculations.

Guidelines to inspectors for credible evidence that weapon shapes might be fake were not comprehensive. Inspectors' calls of fake when weapon shapes were in fact bona fide nuclear weapons indicated guesswork on the part of some inspectors. Their reasons for calling fakes erroneously may have been sufficient to suspect evasion, but they could not sucessfully sustain logical challenge.

Not enough time was available for some operations. Maximum use of the hours in some days of inspection did not necessarily result in most efficient inspection scheduling.

The need not to interrupt normal AEC production operations is recognized and was respected during the field operations. More overall time for inspection operations, and more flexibility in scheduling inspection would have resulted in a more effective field test, however.

It appears that some malfunctioning of electrical and mechanical equipment is inevitable. Lack of standby or duplicate equipment can cause delays or preclude the completion of some operations which are time-limited.

Some inspectors were not adequately skilled in interpreting gamma spectrometer readings. Inspectors were adequately trained to read normal spectrographic displays, but some were not adequately trained to interpret anomalies.

X-ray plates of weapons show a great amount of internal information of weapons. Information is not revealed, however, when heavy shielding is present and is confusing when the images of numerous components are superimposed.

Some equipment, though treated as unclassified, may reveal classified information when associated with nuclear weapons or components.

Safety and security restrictions are absolutely necessary in handling weapons materials and in protecting classified information. Planning and executing any test or inspection of demonstrating the destruction of nuclear weapons will be controlled to a great extent by these restrictions.

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IX. RECOMMENDATIONS

A. PROTECTION OF CLASSIFIED INFORMATION

If classified information is to be completely protected during a demonstrated destruction of nuclear weapons to foreign inspectors, special facilities and equipment must be prepared and access to the demonstration must be low.

1. A single processing facility should be prepared with universal tooling, handling equipment, and measuring equipment. Processing of fissionable material must also be carefully controlled.

a. [redacted]

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b. [redacted]

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c. Prior to any access by inspectors to areas where fissionable material is processed, great care must be taken in cleaning those areas so that small samples of material which may reveal classified microsamples by inspectors could be inconspicuous to host escorts. For example, dust containing a sample might adhere to shoes or clothing.

2. Once a single facility is prepared, access by inspectors should be limited to:

a. Facility walkthrough tours;

b. Weapon monitoring of mixed batches of weapons with visual access only to external features of weapons and with weapons features, which may reveal classified information, masked;

c. [redacted]

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d. Monitoring of burning of high explosives with no visual access to components prior to burning and with mixing of residue on the burn pad after burning;

e. Maintaining incoming versus outgoing records of weapons and bulk; and

f. Nonnuclear components to be disposed of with thorough smelting or crushing of all components and no access to unprocessed components.

This restrictive access is required not only to protect information that is classified because of its own nature but to preclude inferences of classified information by inspectors. For example, some ancillary equipment associated with nuclear weapons may be unclassified when considered alone, but may reveal classified aspects of nuclear designs when associated directly with weapons.

3. If it were necessary to compromise a limited amount of classified information during a demonstration of the destruction of nuclear weapons in order to raise the associated degree of conviction, priorities of value of revealed information to the inspectors should be considered and access to the demonstration should be modified accordingly. Analysis of the classified information exposed during the field test indicated the following categories of information would be of ascending importance to the U.S.S.R. or to an Nth country (defined as one with the technological capability to design nuclear weapons but not now doing so).

a. <u>U.S.S.R.</u>

(1) Location of nuclear materials.

(2) External features of weapons.

(3) Identification and locations of fissionable material isotopes.

(4) Details of fission system design.

(5) Details of thermonuclear system design.

b. Nth Country

(1) Location of nuclear materials.

(2) External features of weapons.

(3) Details of fission system design.

(4) Identification and locations of fissionable material isotopes.

(5) Details of thermonuclear system design.

B. CONVICTION OF THE DEMONSTRATION

If a high degree of inspector conviction that the weapons whose destruction is being witnessed are indeed bona fide is required, then a high degree of access to the destruction must be recommended. In effect, complete access to all facilities, weapons, and destruction products will be required. Unfortunately, a requirement for a high degree of conviction contrasts directly with a requirement to protect classified information. Under the circumstances described above for the complete protection of classified information, conviction, as measured by the ability to discriminate between real and fake weapons, might not significantly exceed 50 percent (i.e., simple guessing).

C. TEST AND DEMONSTRATION METHODS

Based on the results of the several measures of inspection effectiveness applied to the FT-34 operations, some recommendations can be made for future operations.

Improvements by inspectors as they gained experience, emphasizes the desirability of practice inspections. It is recommended that, once the inspection force has been selected, enough practice inspections be conducted to train inspectors thoroughly in the techniques of inspection and the collection and recording of data. Critiques of operations should be held and improvements implemented. Sufficient time should be allotted for practice sessions so that (1) all test reference data can be obtained; (2) inspection and destruction procedures can be checked thoroughly; (3) equipment can be checked for proper operation in the test environment; (4) data acquisition, handling, transmission, and analysis can be practiced; (5) administrative functions can be checked; and (6) safety, security, and classification problems can be recognized and corrected.

It is recommended that weight balances of weapons presented for destruction versus materials resulting from the disassembled weapons be accurately maintained. The purpose of maintaining a weight balance would be a check on other inspection activities (e.g., facility surveillance) to assure that no material or components of weapons were being withheld for possible future use in the fabrication of other weapons. Accurate and tested balances, capable of weighing even the heaviest items handled, should be made available to inspectors. Weight standards for calibration should also be provided. The weighing of fissionable materials, while included in the weight balance, should also be treated as a separate matter. Sensitive laboratory scales should be used to determine the amount of fissionable material transferred to peaceful uses.

Although the test showed that inspectors with general scientific and technical backgrounds can be trained to perform some portions of standard analyses, it is recommended that highly qualified personnel be used for this purpose. The uncertainties of the composition of fissionable material compounds and alloys of a foreign country, unforeseen problems with laboratory equipment, discussions with expert representatives of the foreign country, etc., may present problems to a nonprofessional inspector and jeopardize an inspection.

In order to minimize evasion possibilities during assay of fissionable materials, inspectors must be permitted to have complete control over equipment and materials. It is recommended that inspection teams have their own laboratories or that samples to be analyzed be returned to U.S. government-controlled laboratories for analysis. For an inspection in a foreign country, the former would be preferred to prevent delays to inspectors in determining the quality of materials being held for transfer to peaceful uses.

D. TEST OPERATION PROBLEMS

As a result of technical, operational, safety and security problems identified during the test, the following recommendations are made.

1. Detailed and comprehensive guidelines should be developed for use by inspectors in determining the credibility of weapons presented for destruction. This, of course, should be related directly to the degree of access afforded inspectors.

2. If a field test such as FT-34 is planned in the future, arrangements should be made if at all possible to give inspection operations priority. The requirement to tailor inspection operations not to interfere with higher priority operations inevitably leads to scheduling problems and concessions which affect the efficiency of the test.

3. Standby equipment should always be made available for inspection or destruction operations if a tight schedule must be followed. Capabilities and limitations of equipment and information provided by equipment (such as x-rays) should be thoroughly determined and understood.

4. During any test inspection or treaty inspection of the demonstrated destruction of nuclear weapons, time and resources must be provided to cope with inherent safety and security requirements. A great amount of confusion can

be caused by differing security and safety systems. For efficient test or inspection operations these systems should be streamlined and standardized. Unnecessary restrictions to properly cleared and qualified personnel should be avoided.

APPENDIX F1

INSPECTION FORMS

~~SECRET~~ UNCLASSIFIED

CG-34-01

CLOUD GAP 34 - INSPECTOR FORM

TEAM:	ACCESS:	LOCATION:	DATE:
SIZE:	BATCH/SHAPE: n/a	OPERATION: Walkthrough	
TEST CONTROLLER:		START TIME:	STOP TIME:
EXAMINED BY:		CLASSIFICATION REVIEW BY:	

The purpose of this walkthrough is to determine just how much and what kinds of information regarding weapons and nuclear capability can be obtained under such circumstances. Your tasks are to:

1. On a separate sheet(s), list and sketch or photograph the standard types of equipment in the test area—such as overhead cranes, machine tools and monitoring equipment. Estimate the use and capacity of each item of equipment.

2. List, describe and sketch or photograph all special type fixtures. Give your analysis of weapon information by association.

3. List, describe and sketch or photograph any other information about the facility that may be of a classified or revealing nature.

4. Describe any aspect of the facility which indicates that some of the devices being processed are not real.

5. Describe any aspect of the facility which indicates that "fissile" material has been hidden.

*6. (Access A_3 and A_4 ONLY). Monitor the test area with radiation monitoring equipment to ensure that no "fissile" material is hidden.
   - a. Describe or sketch areas and degree of monitoring.
   - b. Describe any reading suggestive of hidden radioactive material.

*7. (Access A_3 and A_4 ONLY.) Measure or photograph special equipment and/or fixtures and place dimensions on previously prepared sketches.

8. Attach appropriate sheets and fill in TEST STOP TIME.

---

* Access A_3 and A_4 ONLY.

FIGURE F1-1. Data Form CG-34-01

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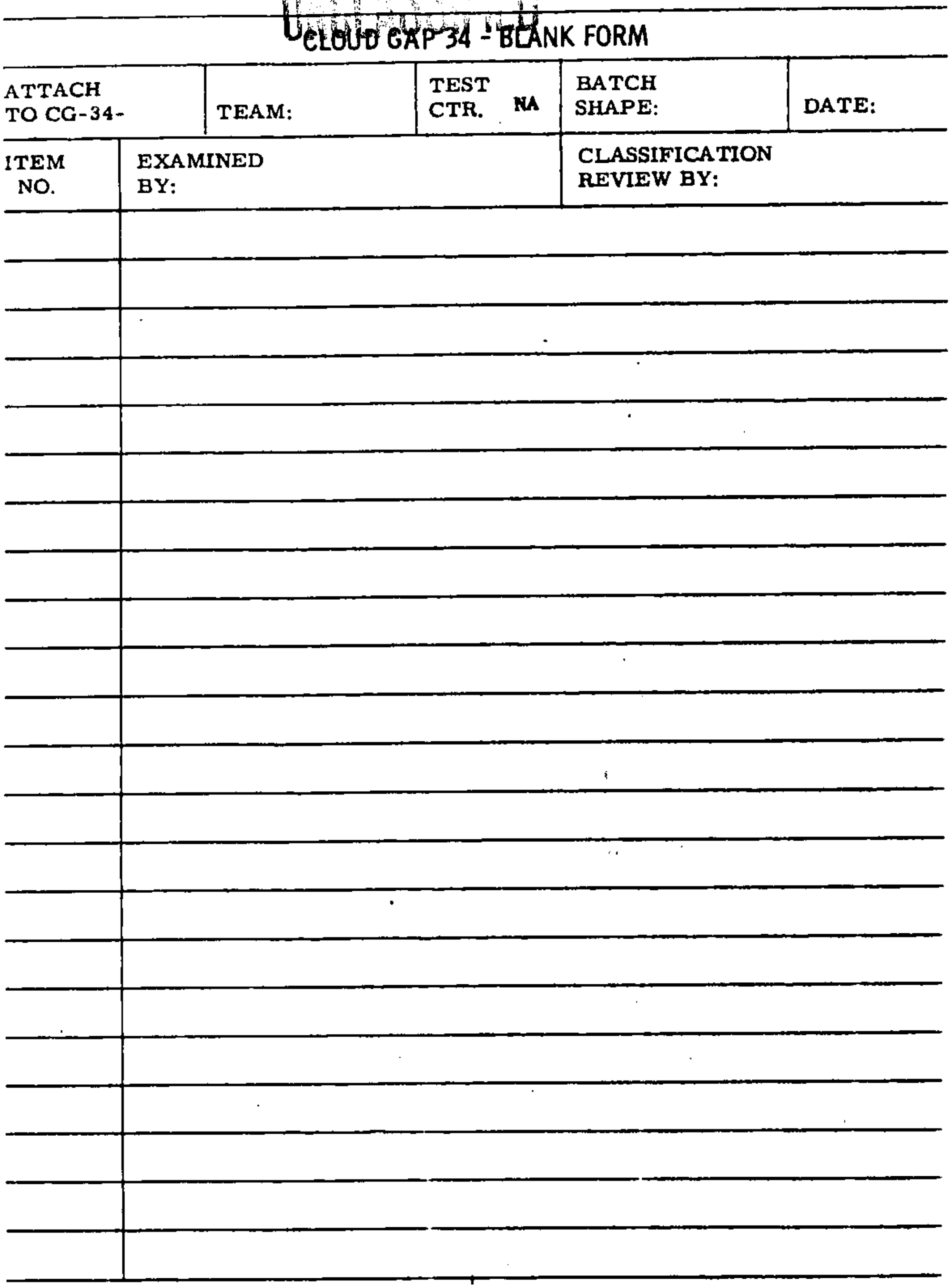
UNCLASSIFIED

CG-34-02



CLOUD GAP 34 - BLANK FORM

ATTACH TO CG-34-	TEAM:	TEST CTR. NA	BATCH SHAPE:	DATE:

ITEM NO.	EXAMINED BY:	CLASSIFICATION REVIEW BY:

CG-34-02

FIGURE F1-2. Data Form CG-34-02

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UNCLASSIFIED

CLOUD GAP 34 - GRAPH FORM

ATTACH TO CG-34-	TEAM:	TEST CTR.	BATCH SHAPE:	DATE:

EXAMINED BY:	CLASSIFICATION REVIEW BY:

FIGURE F1-3. Data Form CG-34-03

UNCLASSIFIED

SECRET

CG-34-04

CLOUD GAP 34 - WEAPON SHAPE NO.

ATTACH TO CG-34- TEAM: TEST CTR. BATCH SHAPE: DATE:

EXAMINED BY: CLASSIFICATION REVIEW BY:

STA. NO.															

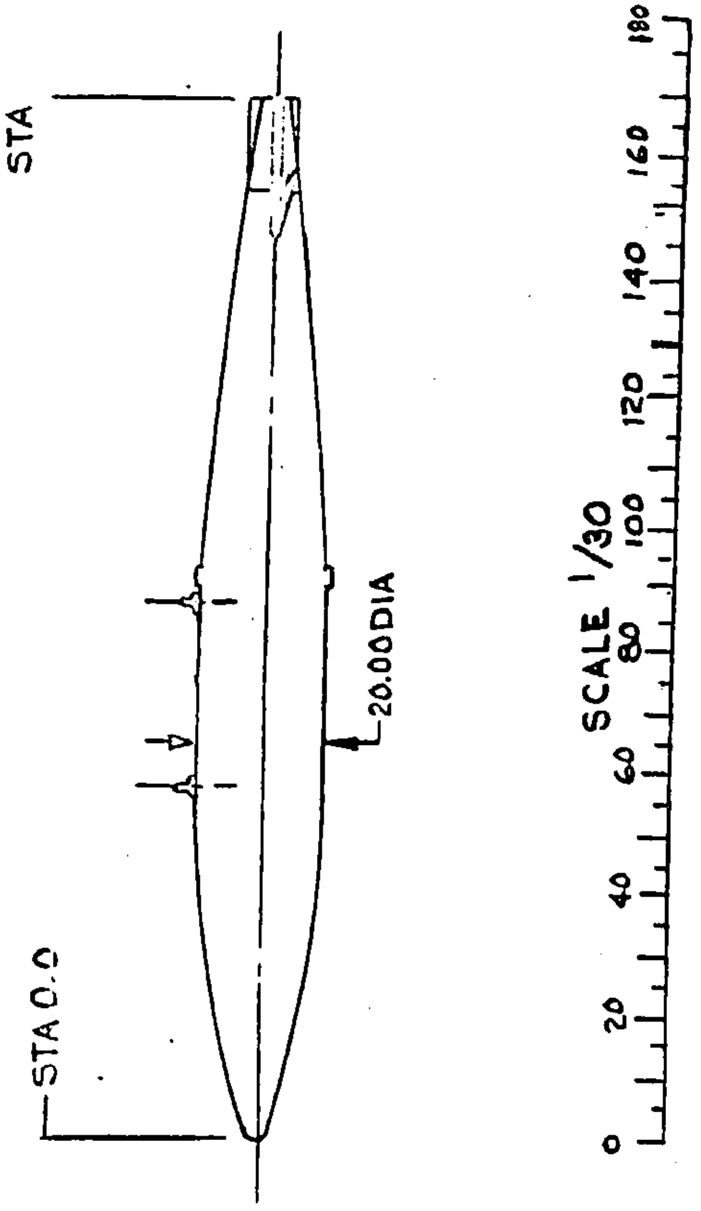

FIGURE F1-4. Data Form CG-34-04

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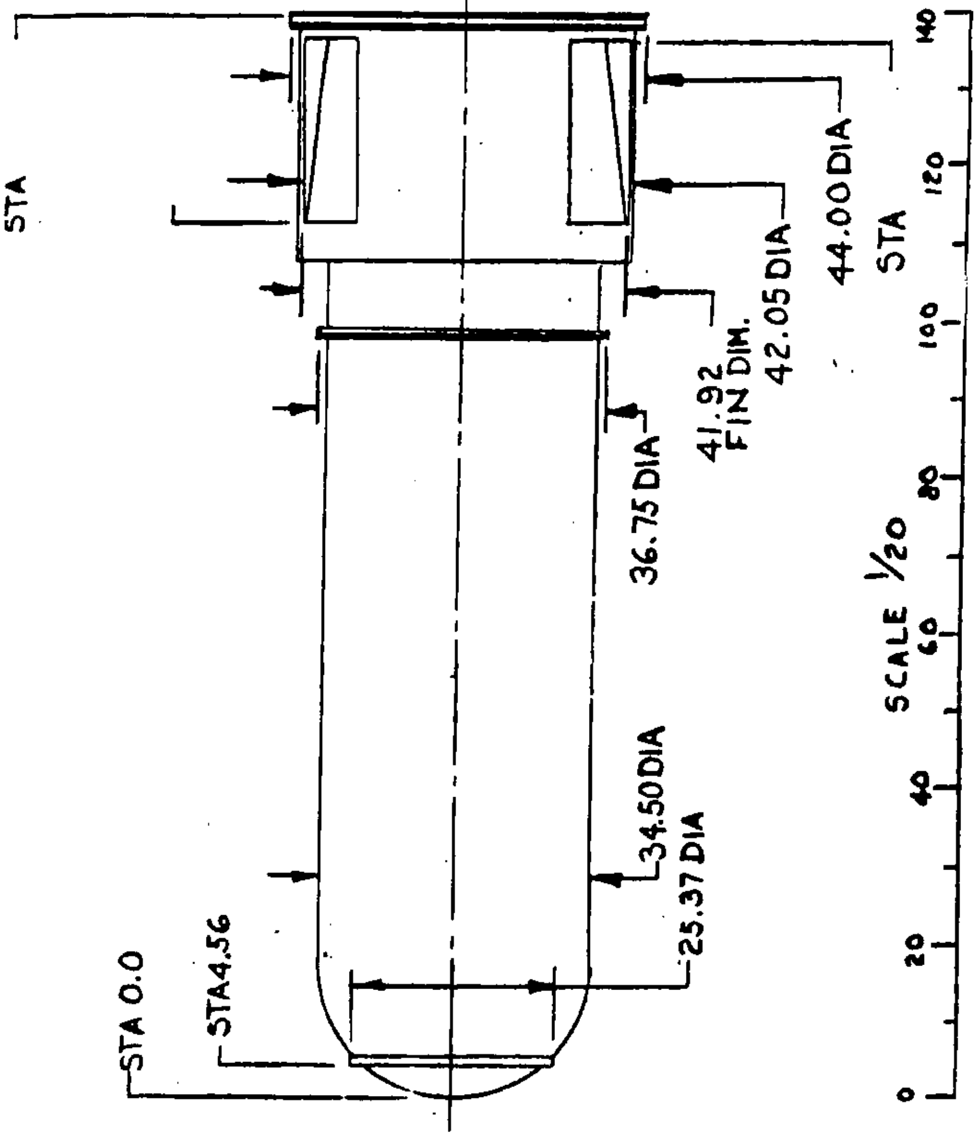
CG-34-04

CLOUD GAP 34 - WEAPON SHAPE NO.

ATTACH TO CG-34- **TEAM:** **TEST CTR.** **BATCH SHAPE:** **DATE:**

EXAMINED BY: **CLASSIFICATION REVIEW BY:**



STA. NO.

Note: A form CG-34-04 was furnished for each type of weapon configuration examined.

CG-34-04

FIGURE F1-5. Data Form CG-34-04 (cont)

UNCLASSIFIED

CG-34-05

CLOUD GAP 34 - INSPECTOR FORM

TEAM:
ACCESS:
LOCATION: Pantex
DATE:
SIZE:
BATCH/SHAPE: ALL
OPERATION: Weapon Inspection Checklist
TEST CONTROLLER:
START TIME: n/a
STOP TIME: n/a
EXAMINED BY:
CLASSIFICATION REVIEW BY:

Use checklist to ensure that all steps have been completed for each shape. Identify the operation (e. g., Geiger Counter Inspection, etc.), below. Maintain this form until all steps in that operation are complete for all shapes; then turn the form into the Test Controller.

OPERATION PERFORMED: ____________

BATCH NO. ________

Shape No.	Order Examined	Shape Description	Shape Examined	Sketch Complete	Measures Complete	Data Forms Comp.	Backup Complete	Data Pack to T.C.			
1											
2											
3											
4											
5											
6											
7											
8											
9											
10											
11											
12											
13											
14											
15											
16											
17											
18											

FIGURE F1-6. Data Form CG-34-05

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CG-34-06

CLOUD GAP 34 - INSPECTOR FORM

TEAM:	ACCESS: A1	LOCATION: Pantex	DATE:
SIZE:	BATCH/SHAPE:	OPERATION: Weapon Introduction	
TEST CONTROLLER:		START TIME:	STOP TIME:
EXAMINED BY:		CLASSIFICATION REVIEW BY:	

1. Complete this form for each weapon monitored. Use the Weapon Inspection Checklist (CG-34-05) to ensure that all shapes are reviewed.

2. Attach the appropriate Weapon Shape handout sketch (CG-34-04), and change or add to the sketch as necessary to amplify answers to the following questions.

3. Measure or estimate each of the following physical characteristics:

	Answer	Comment
a. Weapon weight (pounds)		
b. Diameter (inches)		
c. Length (inches) show on sketch		
d. Estimate volume (cubic feet)		
e. Estimate density (pounds/cubic foot)		

4. Do the physical characteristics reveal any classified information? (Explain "yes" or "?" on blank form.) Yes ? No

5. Measure, estimate, or evaluate each of the following ballistic features:

	Answer	Comment
a. Center of gravity (station, inches)		
b. Length/diameter ratio (bomb/shell)		
c. Length/diameter ratio (warhead)		
d. Does the unit have fins?	Yes ? No	
e. Is there an ablation/heat shield?	Yes ? No	
f. Does it have a ballistic shape?	Yes ? No	
g. Probable laydown capability	Yes ? No	
h. Retarded delivery capability	Yes ? No	
i. Depth bomb capability?	Yes ? No	

CG-34-06

FIGURE F1-7. Data Form CG-34-06

UNCLASSIFIED

CG-34-06
Continued

CG-34-06	TEAM:	BATCH/SHAPE:	DATE:

6. Do the ballistic features (#5) reveal any classified information? (Explain "yes" or "?" on blank form.) Yes ? No

7. Evaluate the following interconnection and structural features:

		Answer	Comment
a.	Are there means to connect unit to a delivery vehicle? (Show in sketch)	Yes ? No	
b.	Are electrical connections evident?	Yes ? No	
c.	Are pullout plugs evident?	Yes ? No	
d.	Are station breaks evident?	Yes ? No	
e.	Are rivet patterns noticeable?	Yes ? No	
f.	Does the unit have access doors?	Yes ? No	
g.	Does unit appear structurally sound?	Yes ? No	
h.	Is unit mounted on handling dolly?	Yes ? No	

8. Do the above characteristics (#7) reveal any classified information? (Explain "yes" or "?" on blank form.) Yes ? No

9. Does the unit have any of the following firing and fuzing features?

		Answer	Comment
a.	Radome?	Yes ? No	
b.	Baro-ports?	Yes ? No	
c.	Hydrostat ports?	Yes ? No	
d.	Strike and enable access plug?	Yes ? No	
e.	Other: ______	Yes ? No	

10. Do the above characteristics (#9) reveal any classified information? (Explain "yes" or "?" on blank form.) Yes ? No

11. Overall, does the unit appear to be a nuclear weapon? (Explain a "?" or "no" answer on the blank form.) Yes ? No

12. On blank form, state your opinion of the type of weapon (bomb, warhead, or projectile) and its intended use. Spellout differences of opinion among team members. When completed, fill in STOP TIME on first page.

CG-34-06
Continued

FIGURE F1-7. Data Form CG-34-06 (cont)

UNCLASSIFIED

CG-34-07

CLOUD GAP 34 - INSPECTOR FORM

TEAM:	ACCESS: A_2	LOCATION: Pantex	DATE:
SIZE:	BATCH/SHAPE:	OPERATION: Geiger Counter Inspection	
TEST CONTROLLER:		START TIME:	STOP TIME:
EXAMINED BY:		CLASSIFICATION REVIEW BY:	

1. Complete this form for each weapon (shape) monitored. In this inspection, you will survey the weapon with a geiger counter.

2. Attach the appropriate Weapon Shape handout sketch (CG-34-04), and show areas of maximum activity and relative readings.

3. Is radioactive material present? (Answer here and show readings or reason for "?" on sketch.) Yes ? No

4. Can you determine what the radioactive isotope is? (If "yes," list below:

   Isotope(s) = ________________

5. Does the radioactivity appear to be in a credible location? (If "no" or "?", explain on sketch.) Yes ? No

6. From your evaluation of radioactivity, does the unit appear to be a nuclear weapon? (Explain "no" or "?" on sketch.) Yes ? No

7. Attach appropriate sheets to this form, and fill in STOP TIME above.

FIGURE F1-8. Data Form CG-34-07

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UNCLASSIFIED

CG-34-08

CLOUD GAP 34 - INSPECTOR FORM

TEAM:	ACCESS: A_3	LOCATION: Pantex	DATE:
SIZE:	BATCH/SHAPE:	OPERATION: Neutron, Gamma Spectroscopy	
TEST CONTROLLER:		START TIME:	STOP TIME:
EXAMINED BY:		CLASSIFICATION REVIEW BY:	

1. Complete this form for each weapon (shape) monitored. Attach appropriate Weapon Shape handout sketch (CG-34-04), and refer to below.

2. Take neutron counter readings in areas where radioactivity was detected with the geiger counter (see CG-34-07).

3. Are neutrons being emitted? (If "yes," show area of maximum activity on sketch.) Yes ? No

4. Can you determine the type or location of active materials? (If "yes," identify type and location on sketch.) Yes ? No

5. Take gamma spectroscope readings in the same areas (#2 above). Indicate on sketch where each probe was located. Label each plot from the X-Y plotter and attach to this form.

6. Are there any indications of the amount of fissile material in the unit? (If "yes," estimate amount present, by type.) Yes ? No

   Type fissile material: ________ ________ ________

   Amount of material: ______ ______ ______

7. Does any of the above reveal classified information? (If "yes," explain on blank form.) Yes ? No

8. From these findings, does the unit appear to be a nuclear weapon? (Explain "no" or "?" on blank form.) Yes ? No

9. Attach appropriate sheets to this form, and fill in STOP TIME above.

FIGURE F1-9. Data Form CG-34-08

UNCLASSIFIED

CLOUD GAP 34 - INSPECTOR FORM

TEAM:	ACCESS: A_2	LOCATION: Pantex	DATE:
SIZE:	BATCH/SHAPE:	OPERATION: Access Door Evaluation	
TEST CONTROLLER:		START TIME:	STOP TIME:
EXAMINED BY:		CLASSIFICATION REVIEW BY:	

1. Complete this form for each weapon (shape) monitored. Attach the appropriate Weapon Shape handout sketch (CG-34-04), and add to or refer to below.

2. With access doors open. Can you identify any of the following behind the doors?

			Comment/Door Number
a.	Timers	Yes ? No	________
b.	Radars	Yes ? No	________
c.	Baros	Yes ? No	________
d.	Contact switches	Yes ? No	________
e.	Crush switches	Yes ? No	________
f.	Hydrostat switches	Yes ? No	________
g.	Arm-safe switches	Yes ? No	________
h.	Environmental switches	Yes ? No	________
i.	Accelerometer switches	Yes ? No	________
j.	Safe-separation switches	Yes ? No	________
k.	Nuclear system	Yes ? No	________

3. Do above characteristics (#2) reveal any classified information? (Explain "yes" or "?" on blank form.) Yes ? No

4. List any other revealing information on blank form. Does any of this reveal classified information? Yes ? No

5. From behind the access doors, does the unit appear to be a nuclear weapon? (Explain "no" or "?" on blank form.) Yes ? No

6. Attach appropriate sheets and fill in STOP TIME above.

FIGURE F1-10. Data Form CG-34-09

UNCLASSIFIED

~~SECRET~~

CG-34-10

CLOUD GAP 34 - INSPECTOR FORM

TEAM:
ACCESS: A4
LOCATION: Pantex
DATE:
SIZE:
BATCH/SHAPE:
OPERATION: Analysis of X-Ray Plates
TEST CONTROLLER:
START TIME:
STOP TIME:
EXAMINED BY:
CLASSIFICATION REVIEW BY:

1. Complete this form for each weapon (shape) monitored. Attach appropriate Weapon Shape handout sketch (CG-34-04) and refer to below.

2. How many X-ray plates were given to you for this shape? Ans._____

3. From these plates, can you determine the size and location of fissile material? (If "yes," show on sketch.) Yes ? No

4. If more than one location, can you determine spatial relationships? (If "yes," show in inches on sketch.) n/a Yes ? No

5. Can you determine the number of detonators? (Write in "no" or the number of detonators.) Ans._____

6. Can you determine size and location of high explosives? (If "yes," illustrate on sketch.) Yes ? No

7. Is there an antenna present? (If "yes," show location, configuration, and frequency on sketch, or new sketch.) Yes ? No

8. Do major components appear to have subcomponents inside? Yes ? No

9. Are subcomponent configurations realistic? (If "no," explain on sketch or blank form.) Yes ? No

10. Circle the type(s) of power supply determined to be in the unit:
    a. Batteries
    b. Explosive or pyrotechnic
    c. Other: ______________
    d. Unknown or can't determine

11. Circle the type(s) of external initiation determined to be in the unit:
    a. Explosives
    b. Electronic
    c. Other: ______________
    d. Unknown or can't determine

CG-34-10

FIGURE F1-11. Data Form CG-34-10

UNCLASSIFIED

CG-34-10
Continued

CG-34-10	TEAM:	BATCH/SHAPE:	DATE:

12. Circle the type(s) of firing set determined to be in the unit from the X-ray film:
    - a. Rotary-chopper
    - b. Ferromagnetic
    - c. Ferroelectric
    - d. Capacitor bank
    - e. Explosive plane wave generator
    - f. Transfer method, spark gap
    - g. Transfer method, relay
    - h. Converters
    - i. Inverters
    - j. Condensers
    - k. Choke coils
    - l. Unknown or can't determine

13. Circle the type(s) of arming and safing system determined to be in the unit:
    - a. Arm-safe switches
    - b. Environmental switches
    - c. Accelerometer switches
    - d. Baros
    - e. Safe-separation switches
    - f. Timers
    - g. Integrating accelerometers
    - h. Mechanical safing component
    - i. Unknown or can't determine

14. Circle the use options and equipment determined to be in the unit:
    - a. Air Option
        - (1) Timer
        - (2) Radar
        - (3) Baros
    - b. Surface Option
        - (1) Contact crystals
        - (2) Crush switch
        - (3) Timer
    - c. Underwater Option
        - (1) Hydrostats
        - (2) Timer
    - d. None, can't determine

15. Does the X-ray film reveal any classified information? (If "yes," list and discuss on blank form.) Yes ? No

16. From X-ray film analysis, does the unit appear to be a nuclear weapon? (Explain "no" or "?" on blank form.) Yes ? No

17. Spell out any differences of opinion among team members on blank form; attach appropriate sheets to the present form, and fill in STOP TIME.

CG-34-10
Continued

FIGURE F1-11. Data Form CG-34-10 (cont)

CLOUD GAP 34 - INSPECTOR FORM

TEAM:	ACCESS:	LOCATION:	DATE:
SIZE:	BATCH/SHAPE:	OPERATION: Material Disposal	
TEST CONTROLLER:		START TIME:	STOP TIME:
EXAMINED BY:		CLASSIFICATION REVIEW BY:	

1. Type of material being disposed (HE, Residue, etc.): ____________

2. Record amount of material disposed (pounds less tare): ____________

3. Did you escort material to the burning/burial site? Yes ? No

4. Did you physically view material during disposal? (If "yes," describe what you saw on blank form.) Yes ? No

5. Can you identify the material disposed of? Yes ? No
    - a. List type ________ ________ ________
    - b. Estimate amount: ________ ________ ________

6. Describe burning/burial characteristics of the material on blank form. (e.g., type and color smoke and flame, depth, etc.)

7. Were any other materials burned with the HE or buried with the residue? (If "yes," explain on blank form.) Yes ? No

8. Did you physically view the burning/burial site after disposal? (If "yes," describe remains on blank form.) Yes ? No

9. Did the material disposed of seem to fully represent the weapons monitored? (If "no," explain on blank form.) Yes ? No

10. Do you feel that any evasion was practiced? (If "yes," explain on blank form.) Yes ? No

11. Was any NEW classified information revealed in disposal? (If "yes," explain on blank form.) Yes ? No

12. Attach appropriate sheets and fill in STOP TIME above.

CG-34-11

FIGURE F1-12. Data Form CG-34-11

CG-34-12

CLOUD GAP 34 - INSPECTOR FORM

TEAM:

ACCESS:

LOCATION: ALL

DATE:

SIZE:

BATCH/SHAPE: ALL

OPERATION: Weight Balance Worksheet

TEST CONTROLLER:

START TIME: n/a

STOP TIME: n/a

EXAMINED BY:

CLASSIFICATION REVIEW BY:

Shape Number	Weight Pounds	Batch Weight Accounted For by:	Accountable Weight Increments			
			Tare	Gross	Net	Balance
1						
2		Pantex, Original Total:				
3		Pantex, Burnables:				
4		Pantex, Other Loss:				
5						
6		Rocky Flats, Pu^{239} Ingots:				
7		Rocky Flats, Residue:				
8		Rocky Flats, Other Loss:				
9						
10		Paducah, Metal Ingots:				
11		Paducah, Residue:				
12		Paducah, Other Loss:				
13						
14		Oak Ridge, U^{235} Ingots:				
15		Oak Ridge, Residue:				
16		Oak Ridge, Other Loss:				
17						
18		Loss or Balance Unaccountable:				
Total:						

CG-34-12

FIGURE F1-13. Data Form CG-34-12

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CLOUD GAP 34 - ASSESSMENT SUMMARY FORM

TEAM:

ACCESS: ALL

LOCATION:

DATE:

SIZE:

BATCH/SHAPE: ALL

OPERATION:

TEST CONTROLLER:

START TIME: n/a

STOP TIME: n/a

EXAMINED BY:

CLASSIFICATION REVIEW BY:

Batch Shape	Real	Fake	Reason for Fake or Other Comment

CG-34-13

FIGURE F1-14. Data Form CG-34-13

UNCLASSIFIED

CG-34-14-1

CLOUD GAP 34 - INSPECTOR FORM

TEAM:
ACCESS:
LOCATION:
DATE:
INSPECTOR:
OPERATION: Daily Attitude Survey
TEST CONTROLLER:
START TIME: n/a
STOP TIME: n/a
EXAMINED BY:
CLASSIFICATION REVIEW BY:

Each inspector will complete this form at the end of each inspection day. Estimate the direction and degree of conviction by entering a single probability value in each answer blank, based on the scale below. Your first impression is usually reliable.

Conviction Scale:	0%	10	20	30	40	50	60	70	80	90	100%
	No, absolutely					Unsure					Absolutely Yes

1. Did you fully understand the operations performed today? Ans. ______ %
2. Did you fully understand what was expected of you? Ans. ______ %
3. Do you feel satisfied with your own performance today? Ans. ______ %
4. Were you resentful or frustrated by any event today? Ans. ______ %
5. Do you feel the team's results were complete and accurate? Ans. ______ %
6. Do you feel test objectives and procedures are sound? Ans. ______ %
7. Do you feel the tests will satisfy those objectives? Ans. ______ %

Regarding the 36 weapons being monitored throughout this test program, to what degree do you now feel that:

8. At least some of those 36 are or were real weapons? Ans. ______ %
9. Most of those 36 are or were real weapons? Ans. ______ %
10. All 36 are or were real weapons? Ans. ______ %

If this were a Russian facility on Russian Soil, under these same circumstances, would you feel that:

11. At least some of those same 36 are or were real weapons? Ans. ______ %
12. Most of those 36 are or were real weapons? Ans. ______ %
13. All 36 are or were real weapons? Ans. ______ %

CG-34-14-1

FIGURE F1-15. Data Form CG-34-14-1

UNCLASSIFIED

CLOUD GAP 34 - INSPECTOR FORM

TEAM:
ACCESS:
LOCATION:
DATE:
SIZE:
BATCH/SHAPE: ALL
OPERATION: Assay Sample Checklist
TEST CONTROLLER:
START TIME: n/a
STOP TIME: n/a
EXAMINED BY:
CLASSIFICATION REVIEW BY:

Use checklist to ensure that all steps have been completed for each sample. Identify the operation (e. g. , Chemical Analysis) below. Maintain this form until all steps in that operation are complete for all samples; then turn the form into the Test Controller.

OPERATION PERFORMED: ____________________

Batch No.	Sample No.	Color Code	Plate or Crucible	Weight	Ingot No.	Preparation Complete	Operation Complete	Data Forms Complete	Backup Complete	Data Pack to T.C.			

FIGURE F1-16. Data Form CG-34-15

CG-34-16

CLOUD GAP 34 - INSPECTOR FORM

TEAM:	ACCESS:	LOCATION: Rocky Flats	DATE:
SIZE:	BATCH/SHAPE:	OPERATION: Emission Spectroscopy	
TEST CONTROLLER:		START TIME:	STOP TIME:
EXAMINED BY:		CLASSIFICATION REVIEW BY:	

Method ________ Date ________ Analysis By ________ Read By ________ Approved ________ Micro g/g ☐ mg/l ☐ Plate No. ________

	Sample No.	Ag	Al	B	Ba	Be	Bi	Ca	Cd	Co	Cr	Cu	Fe	Ga	In	CARD NO.
1																3
2																3
3																3
4																3
5																3
6																3
7																3
8																3
9																3

	Sample No.	K	La	Li	Mg	Mn	Mo	Na	Nb	Ni	P	Pb	Pd	Sb	Si	CARD NO.
1																4
2																4
3																4
4																4
5																4
6																4
7																4
8																4
9																4

	Sample No.	Sn	Sr	Ta	Th	Ti	U	V	W	Zn	Zr	g/g				CARD NO.
1																5
2																5
3																5
4																5
5																5
6																5
7																5
8																5
9																5
	1-8	9-13	14-18	19-23	24-28	29-33	34-38	39-43	44-48	49-53	54-58	59-63	64-68	69-73	74-78	80

Any classified information revealed? (If "yes," explain below) Yes ? No

Was sample biased/evaded in any way? (If "yes," explain below) Yes ? No

CG-34-16

FIGURE F1-17. Data Form CG-34-16

UNCLASSIFIED

CG-34-17

CLOUD GAP 34 - INSPECTOR FORM

TEAM:	ACCESS:	LOCATION: Rocky Flats	DATE:
SIZE:	BATCH/SHAPE:	OPERATION: Chemical Analysis Preparation	
TEST CONTROLLER:		START TIME:	STOP TIME:
EXAMINED BY:		CLASSIFICATION REVIEW BY:	

1. Titrant Standardization:
   - a. Weight ____
   - b. Ml Ceric Sulfate ____
   - c. Blank ____
   - d. Net Millileters ____
   - e. Norm. Ceric Sulfate ____
   - f. Equiv. Weight: ____
   - g. Purity: ____

			Aliquant #1	Aliquant #2	Average
2.	Plutonium Sample	a. Weight:			
		b. Ml Ceric Sulfate:			
		c. Blank:			
		d. Net Millileters:			
		e. Milliequiv. Wt.			
		f. Pu in g/g:			
3.	Iron Sample	a. Weight:			
		b. Optical Density:			
		c. Blank:			
		d. Net Optical Den.:			
		e. Factor:			
		f. Fe in ppm:			
		g. Pu Equivalent:			
4.	Uranium Sample	a. Weight:			
		b. Flourescence Units:			
		c. Factor:			
		d. U in ppm:			
		e. Pu Equivalent:			
			Corrected Pu in g/g:		

CG-34-17

FIGURE F1-18. Data Form CG-34-17

UNCLASSIFIED

UNCLASSIFIED

CG-34-19

CLOUD GAP 34 - INSPECTOR FORM

TEAM:	ACCESS:	LOCATION: Rocky Flats	DATE:
SIZE:	BATCH/SHAPE:	OPERATION: Sample Mass Spectroscopy	
TEST CONTROLLER:		START TIME:	STOP TIME:
EXAMINED BY:		CLASSIFICATION REVIEW BY:	

Identify sample by: ________ Batch # ________ Sample # ________ Color Code ________ Crucible # ________ Weight ________

Sample Scan No.	Plutonium Mass Number Ratio 238	239	240	241	242	240/239	240/239 Average
1.							
2.							
3.							
4.							
5.							
6.							
7.							
8.							
9.							
10.							
11.							
12.							
TOTALS:							
÷ 239 =							
M.D. =	+	+	+	+	=	1.__________Total B	
x M.D. =						Atomic Percent	
÷ Tot B =							
Mass =	238. 0495	239. 0521	240. 0539	241. 0567	242. 0587		
x Mass =	+	+	+	+	=	__________Total C	
÷ Tot C =						Weight Percent	

Any classified information revealed? (If "yes," explain below) Yes ? No

Was sample biased/evaded in any way? (If "yes," explain below) Yes ? No

CG-34-19

FIGURE F-19. Data Form CG-34-19

UNCLASSIFIED

CG-34-20

CLOUD GAP 34 - INSPECTOR FORM

TEAM:	ACCESS:	LOCATION: Rocky Flats	DATE:
SIZE:	BATCH/SHAPE:	OPERATION: Plutonium Assay Summary	
TEST CONTROLLER:		START TIME:	STOP TIME:
EXAMINED BY:		CLASSIFICATION REVIEW BY:	

Identification								
Batch	Sample	% Pu^{240}	% Pu^{239}	Wt/Pu^{239} Ingot	Number Ingots	Weight Pu^{239}	Other Weight	Total Weight
				TOTALS:				

1. Enter total weights into Weight Balance Worksheet (CG-34-12) Chk______

2. Was any classified information revealed by this assay? Yes ? No
(If "yes," say where recorded: ____________________)

3. Do you feel that evasion was practiced in this assay? Yes ? No
(If "yes," say where explained: ____________________)

CG-34-20

FIGURE F1-20. Data Form CG-34-20

UNCLASSIFIED

CG-34-21

CLOUD GAP 34 - INSPECTOR FORM

TEAM:
ACCESS: A1
LOCATION: Paducah
DATE:
SIZE:
BATCH/SHAPE:
OPERATION: Ingot and Residue Review
TEST CONTROLLER:
START TIME:
STOP TIME:
EXAMINED BY:
CLASSIFICATION REVIEW BY:

1. Inspect the metal ingots presented, and determine the following:
    - a. Type of Ingot: ____________ ____________ ____________
    - b. Number Per Type: ____________ ____________ ____________
    - c. Weight Per Type: ____________ ____________ ____________

2. Do these ingots seem to fully represent the weapon shapes monitored? (Explain "no" or "?" on blank form.) Yes ? No

3. Inspect the residue containers, and determine the following:
    - a. Type of Residue: ____________ ____________ ____________
    - b. Containers/Type: ____________ ____________ ____________
    - c. Weight Per Type: ____________ ____________ ____________

4. Does this residue seem to fully represent the weapon shapes monitored? (Explain "no" or "?" on blank form.) Yes ? No

5. Inspect covered cases. Can you associate these with weapon shapes monitored? (Explain on blank form.) Yes ? No

6. Is any pertinent information revealed by disconnection seams or other characteristics? (Explain on blank form.) Yes ? No

7. Do covered cases seem to fully represent the weapon shapes monitored? (Explain "no" or "?" on blank form.) Yes ? No

8. Was any NEW classified information revealed by any of the above? (If "yes," explain on blank form.) Yes ? No

9. Do the above materials appear to represent nuclear weapons? (Explain "no" or "?" on blank form.) Yes ? No

10. Attach appropriate sheets and fill in STOP TIME above.

CG-34-21

FIGURE F1-21. Data Form CG-34-21

CG-34-22

CLOUD GAP 34 - INSPECTOR FORM

TEAM:	ACCESS: A2	LOCATION: Paducah	DATE:
SIZE:	BATCH/SHAPE:	OPERATION: Casing and Component Review	
TEST CONTROLLER:		START TIME:	STOP TIME:
EXAMINED BY:		CLASSIFICATION REVIEW BY:	

1. Inspect uncovered weapon casings and opened boxes of components from a distance. DO NOT TOUCH CASINGS OR COMPONENTS. Answer the following for each shape by placing "Y" for yes, "N" for no, or a ? in the appropriate box:

	BATCH/SHAPE NUMBERS																	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
a. Is the shape represented?																		
b. Is the shape recognizable?																		
c. More than one type metal seen?																		
d. Laminar structure visible?																		
e. Any components visible?																		
f. Any internal features visible?																		
*g. NEW classified info. revealed?																		
*h. Is case credible as a weapon?																		

(*Explain on blank form.)

2. Examine open boxes of components. Can any component be identified in detail? (If "yes," complete a Component Description Form, CG-34-25, for each such component.) Yes ? No

3. Do the components seem to be credible portions of nuclear weapons? (Explain "no," on blank form.) Yes ? No

4. Do the components seem to fully represent the weapons being monitored? (If "no," explain on blank form.) Yes ? No

5. Did this examination reveal any NEW classified information? (If "yes," explain on blank form.) Yes ? No

6. Does all material examined seem to represent real nuclear weapons? (If "no," explain in detail on blank form.) Yes ? No

7. Attach all appropriate sheets and fill in STOP TIME above.

CONFIDENTIAL RD when blank.

CG-34-22

FIGURE F1-22. Data Form CG-34-22

CLOUD GAP 34 - INSPECTOR FORM

TEAM:	ACCESS: A_3	LOCATION: Paducah	DATE:
SIZE:	BATCH/SHAPE:	OPERATION: Weapon Case Examination	
TEST CONTROLLER:		START TIME:	STOP TIME
EXAMINED BY:		CLASSIFICATION REVIEW BY:	

1. Examine and complete this form for <u>each weapon case</u> identified. You may <u>handle</u> the case in any practical manner.

2. What is the batch/<u>shape number</u> of the case examined? (attach and refer to a shape sketch for the following.) Answer ________

3. Is the shape <u>recognizable</u> and acceptable as one you saw at Pantex? (If "no," explain on sketch.) Yes ? No

4. Can you determine what the <u>case is made of</u>? (If "yes," show metals and locations on sketch.) Yes ? No

5. Is any <u>laminar structure</u> visible or probable? (If "yes," show location and function on sketch.) Yes ? No

6. Are any internal <u>seams or compartments</u> identifiable? (If "yes," show locations and functions on sketch.) Yes ? No

7. Are any significant <u>components</u> still attached? (If "yes," complete and attach component description forms.) Yes ? No

8. Do internal features give any additional clues as to the optional <u>uses and capabilities</u> of the weapon? (If "yes," explain in detail on a blank form.) Yes ? No

9. Did this examination reveal any NEW <u>classified information</u>? (If "yes," explain in detail on blank form.) Yes ? No

10. Does this case appear to represent a <u>real nuclear weapon</u>? (If "no," explain in detail on blank form.) Yes ? No

11. Attach appropriate sheets and fill in STOP TIME above.

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FIGURE F1-23. Data Form CG-34-23

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CG-34-24

CLOUD GAP 34 - INSPECTOR FORM

TEAM: | ACCESS: A4 | LOCATION: Paducah | DATE:
SIZE: | BATCH/SHAPE: | OPERATION: Component Examinations
TEST CONTROLLER: | START TIME: | STOP TIME:
EXAMINED BY: | CLASSIFICATION REVIEW BY:

1. Examine whatever components seem appropriate. You may handle the components in any practical manner, take whatever measurements seem useful, and take photographs to illustrate your points.

2. For each component examined in detail, complete and attach a Component Description Form (CG-34-25).

3. Can you associate any of the components with any of the weapon shapes monitored? (If "yes," explain on Component Description or a blank form.) Yes ? No

4. Can you associate any one group of components to reveal the nature of a particular fuzing or firing system, etc.? (If "yes," describe the system on a blank form; identify significant features, functions, and capabilities; and illustrate with sketches or photographs.) Yes ? No

5. In summary, were ALL the components examined acceptable as credible portions of nuclear weapons? (If "no," explain exceptions on Component Description Forms.) Yes ? No

6. Did examination of any component reveal NEW classified information? (If "yes," ensure that this is explained on the appropriate Component Description Form.) Yes ? No

7. Taken as a whole, do these components seem to fully represent the weapon shapes being monitored? (If "no," explain in detail on an attached blank form.) Yes ? No

8. Does this examination suggest that one or more of the initial shapes was not a real weapon? Yes ? No

9. If #8 is answered "yes," can you identify which shape(s) are probably fakes? (If "yes," explain on blank form.) Yes ? No

10. Attach appropriate sheets and fill in STOP TIME above.

CG-34-24

FIGURE F1-24. Data Form CG-34-24

CG-34-25

CLOUD GAP 34 - INSPECTOR FORM

TEAM:	ACCESS:	LOCATION: Paducah	DATE:
SIZE:	BATCH/SHAPE:	OPERATION: Detailed Component Description	
TEST CONTROLLER:		START TIME:	STOP TIME:
EXAMINED BY:		CLASSIFICATION REVIEW BY:	
Ref. CG-34-			

1. Apparent Function: ______________________

2. Identifying Number(s): ______________ Size: ____ x ____ x ____ Wt: ______

3. Can you associate component with a weapon? Ans. "no" or shape Nr. ________

4. Is component a credible portion of a nuclear weapon? (If "no," explain below, on sketch, or on blank form.) Yes ? No

5. Does component reveal any classified information? (If "yes," explain below, on sketch, or on blank form.) Yes ? No

6. Describe component below or on attached sketch. Pay particular attention to electrical connections, mechanical features, materials used, functions, capabilities, and limitations.

7. When complete, fill in STOP TIME above and attach to appropriate form.

CG-34-25

FIGURE F1-25. Data Form CG-34-25

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CG-34-26

CLOUD GAP 34 - INSPECTOR FORM

TEAM:	ACCESS:	LOCATION: Oak Ridge	DATE:
SIZE:	BATCH/SHAPE:	OPERATION: Isotopic Analysis	
TEST CONTROLLER:		START TIME:	STOP TIME:
EXAMINED BY:		CLASSIFICATION REVIEW BY:	

1. Select sample and identify: ______ Batch # ______ Sample # ______ Color Code ______ Wt. U_3O_8 (10 mg)

2. Sample preparation:
   - a. Add 1 ml nitric acid Chk ______
   - b. Dissolve and heat-load filament Chk ______
   - c. Color code tag filament Chk ______
   - d. Insert prepared filament and evacuate Chk ______

3. Isotopic Analysis:	U_{234}	U_{235}	U_{236}	U_{238}
a. Galvanometer Readings:				
b. Galvanometer Ave. (Net):				
c. Galvanometer Zero:				
d. Interp. (Net - Zero):				
e. MV Ohms (correct 0.037)				
f. Σ (Interp. x Ohms):				

4. Calculation:

a. Start Time:	U_{234}	U_{235}	U_{236}	U_{238}	
b. Ratio:		1.0			Total
c. Weighted Ratio:		0.235			
d. Weighted Percent:					
e. STOP Time:					

NOTE: Attach Bristol Chart.

5. Did this analysis reveal any Classified information? (If "yes," explain on blank form.) Yes ? No

6. Do you believe the results were biased in any way? (If "yes," show which, how, and how much on blank form.) Yes ? No

CG-34-26

FIGURE F1-26. Data Form CG-34-26

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CG-34-27

CLOUD GAP 34 - INSPECTOR FORM

TEAM:	ACCESS:	LOCATION: Oak Ridge	DATE:
SIZE:	BATCH/SHAPE:	OPERATION: Chemical Analysis	
TEST CONTROLLER:		START TIME:	STOP TIME:
EXAMINED BY:		CLASSIFICATION REVIEW BY:	

1. Clean and degrease samples (chk ____).

2. Weigh U-metal 5 gm/sample (chk ____)

3. Calibration:
   a. Record calibration time: START: ____________ STOP: ____________
   b. Weigh primary standard dichromate (K): ____________ gms
   c. Volume ferrous ammonium sulphate used (T): ____________ ml
   d. Grams dichromate equiv. to 1 ml soup (K/T): ____________ gms

4. Fume: Add HCL and perchloric acid. Fume and rinse (chk ____).

5. Titration:
   a. Record titration time: START: ____________ STOP ____________
   b. Weigh dichromate to nearest 0. 1 mg. and titrate:

Sample Number	U-Metal Wt. gms	$K_2CR_2O_7$ Wt. gms	Volume Titer (ml)	gU/g Sample Uncorrected	gU/g Sample Corrected	Color Code
Standard						

6. Was any classified information revealed in the above? (If "yes," explain on blank form.) Yes ? No

7. Do you believe the results were biased in any way? (If "yes," show which, how, and how much on blank form.) Yes ? No

8. Attach appropriate sheets and fill in STOP TIME above.

CG-34-27

FIGURE F1-27. Data Form CG-34-27

UNCLASSIFIED

CG-34-28

CLOUD GAP 34 - INSPECTOR FORM

TEAM:	ACCESS: ALL	LOCATION: Oak Ridge	DATE:
SIZE:	BATCH/SHAPE:	OPERATION: Spectroscopy Sample Preparation	
TEST CONTROLLER:		START TIME:	STOP TIME:
EXAMINED BY:		CLASSIFICATION REVIEW BY:	

1. Prepare samples:	Check	Comment
a. Heat and cool samples in muffle furnace		
b. Mix samples from cooled crucibles		
c. Weigh 300. 0 mg oxide per sample		
d. Weigh 85. 0 mg carrier per sample		
e. Mix for three minutes		
f. 50. 0 mg mixture		
g. Charge and dry electrodes		

2. Enter sample identification below:

Batch	Sample #	Color Code	Crucible #	Weight U_3O_8 + Carrier

3. Was any classified information revealed in the above? (If "yes," explain under comments or on blank form.) Yes ? No

4. Do you believe that the samples were biased in any way? (If "yes," show which, how, and how much above or on blank form.) Yes ? No

5. Attach appropriate sheets and fill in STOP time above.

CG-34-28

FIGURE F1-28. Data Form CG-34-28

UNCLASSIFIED

CG-34-29

CLOUD GAP 34 - INSPECTOR FORM

TEAM:

ACCESS:

LOCATION: Oak Ridge

DATE:

SIZE:

BATCH/SHAPE:

OPERATION: Emission Spectroscopy

TEST CONTROLLER:

START TIME:

STOP TIME:

EXAMINED BY:

CLASSIFICATION REVIEW BY:

1. Preparation:
   - a. Insert unexposed plates in camera Chk ____
   - b. Set and load spectrograph Chk ____
   - c. Expose plates Chk ____
   - d. Observe plate development Chk ____
   - e. Record large unexpected inpurities only Chk ____

Plate No.	Materiel Type	Crucible No.	Sample No.	Element (1)	Est. ppm (1)	Element (2)	Est. ppm (2)

(cont)

Sample No.	Element (3)	Est. ppm (3)	Element (4)	Est. ppm (4)	Element (5)	Est. ppm (5)	Element (6)	Est. ppm (6)

2. Classified information revealed? (Explain on blank form.) Yes ? No

3. Were results biased in any way? (Explain on blank form.) Yes ? No

CG-34-29

FIGURE F1-29. Data Form CG-34-29

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CLOUD GAP 34 - INSPECTOR FORM

TEAM:

ACCESS:

LOCATION: Oak Ridge

DATE:

SIZE:

BATCH/SHAPE:

OPERATION: Uranium Assay Summary

TEST CONTROLLER:

START TIME:

STOP TIME:

EXAMINED BY:

CLASSIFICATION REVIEW BY:

Identification		% U_{238}	% U_{235}	Wt/U_{235} Ingot	Number Ingots	Weight U_{235}	Other Weight	Total Weight
Batch	Sample							
				TOTALS:				

1. Enter total weights into Weight Balance Worksheet (CG-34-12) Chk ______

2. Was any classified information revealed by this assay? Yes ? No
(If "yes," say where recorded: ______________________)

3. Do you feel that evasion was practiced in this assay? Yes ? No
(If "yes," say where explained: ______________________)

CG-34-30

FIGURE F1-30. Data Form CG-34-30

UNCLASSIFIED

SECRET

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CG-34-41

CLOUD GAP 34 - TEST CONTROL FORM

TEAM:
ACCESS:
LOCATION:
DATE:
SIZE:
BATCH/SHAPE:
OPERATION: Operation Monitoring
TEST CONTROLLER:
START TIME:
STOP TIME:
EXAMINED BY:
CLASSIFICATION REVIEW BY:

1. Complete this form for each major operation (for each Inspector Form).
2. Follow team activities on the same form that they use.
3. Enter notes on inspector form to show degree of evasion, impurity, etc.
4. Write additional notes and comments on attached blank form:
    a. List questions the inspectors are asking, and answers given.
    b. Record deviations from normal procedures, unusual circumstances, etc.
    c. Record any problems inspectors have with data sheets, procedures, etc.
    d. Identify classified information or evasions detected.
5. Record progress and time accounting in chart below:

See Note	Operation, Step, Event, or Delay	Time Occur	% Done	Proced Fol'd	TM-Wk Good	Data Prob	Class Info.	Evasion Detect
				Y ? N	Y ? N	Y ? N	Y ? N	Y ? N
				Y ? N	Y ? N	Y ? N	Y ? N	Y ? N
				Y ? N	Y ? N	Y ? N	Y ? N	Y ? N
				Y ? N	Y ? N	Y ? N	Y ? N	Y ? N
				Y ? N	Y ? N	Y ? N	Y ? N	Y ? N
				Y ? N	Y ? N	Y ? N	Y ? N	Y ? N
				Y ? N	Y ? N	Y ? N	Y ? N	Y ? N
				Y ? N	Y ? N	Y ? N	Y ? N	Y ? N
				Y ? N	Y ? N	Y ? N	Y ? N	Y ? N
				Y ? N	Y ? N	Y ? N	Y ? N	Y ? N
				Y ? N	Y ? N	Y ? N	Y ? N	Y ? N
				Y ? N	Y ? N	Y ? N	Y ? N	Y ? N
				Y ? N	Y ? N	Y ? N	Y ? N	Y ? N
				Y ? N	Y ? N	Y ? N	Y ? N	Y ? N
				Y ? N	Y ? N	Y ? N	Y ? N	Y ? N
				Y ? N	Y ? N	Y ? N	Y ? N	Y ? N
				Y ? N	Y ? N	Y ? N	Y ? N	Y ? N
				Y ? N	Y ? N	Y ? N	Y ? N	Y ? N

CG-34-41

FIGURE F1-31. Test Control Form CG-34-41

UNCLASSIFIED

CG-34-42

CLOUD GAP 34 - TEST CONTROL FORM

TEAM: | ACCESS: | LOCATION: | DATE:

SIZE: | BATCH/SHAPE: | OPERATION: Deviation/Problem Report

TEST CONTROLLER: | START TIME: n/a | STOP TIME: n/a

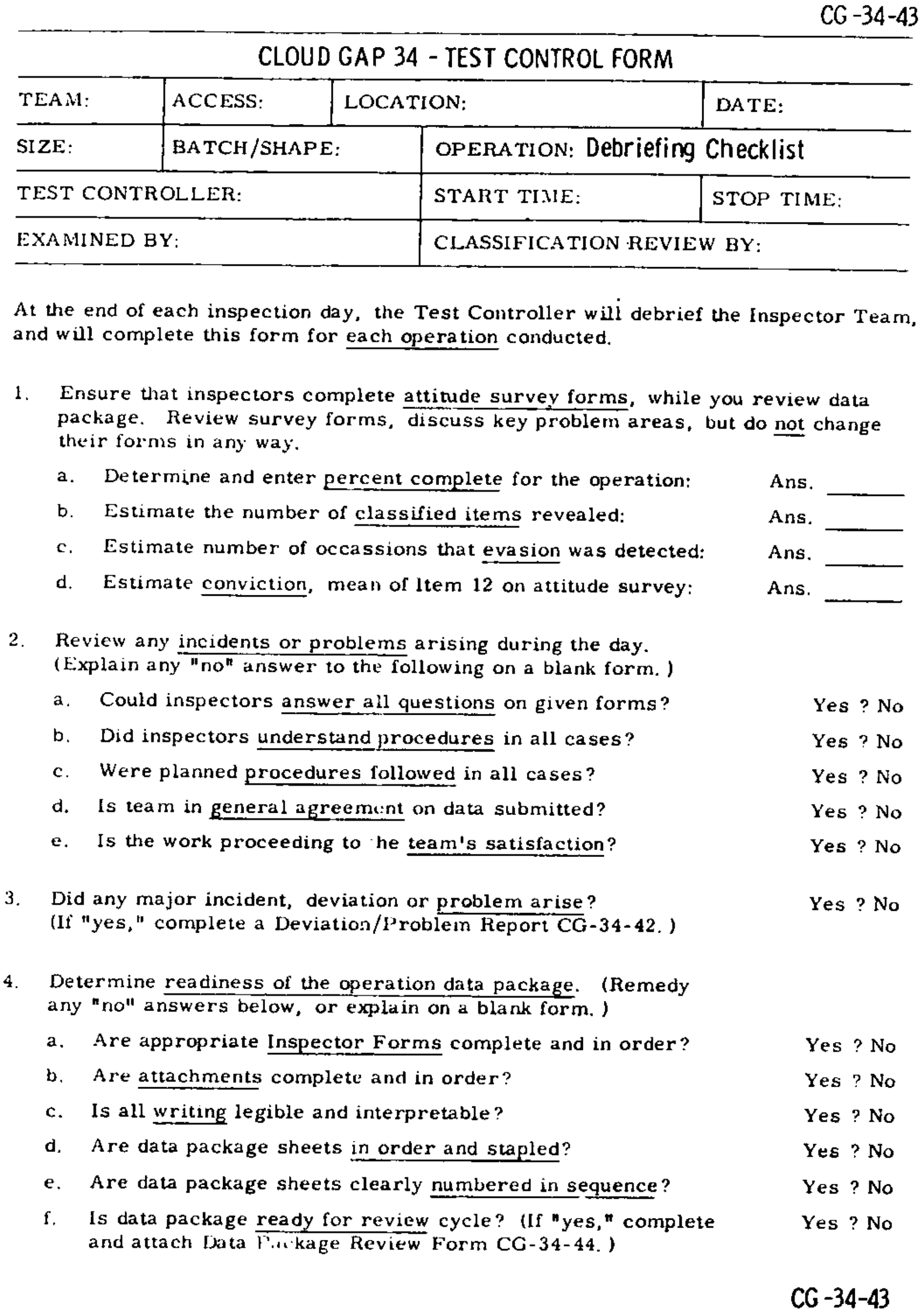
EXAMINED BY: | CLASSIFICATION REVIEW BY:

Test Controllers will complete this form for each deviation or problem that may change test procedures or results. Submit completed form to report problem, and attach copy to appropriate data package for incorporation into evaluations and analyses. Use supplementary blank forms as necessary.

Check Nature of Problem	Describe Problem in Detail:
__ Accident, injury, illness __ Data form or document __ Equipment malfunction __ Facility support __ Supply deficiency __ Test reference data __ Transport or shipping __ Weapon monitored __ Weather conditions __ Other:	
Check Effects of Problem	**Describe Effects in Detail:**
__ Data loss __ Delay of data or test __ Incomplete data __ Incomplete operation __ Personnel change __ Procedure change __ Reference data change __ Safety hazard __ Security hazard __ Other:	
Check Action Taken/Needed	**Describe Action Taken/Needed in Detail:**
__ For record only __ Management decision __ Postponement __ Replacement __ Test design change __ Test results change __ Other:	

CG-34-42

FIGURE F1-32. Test Control Form CG-34-42



CG-34-43

CLOUD GAP 34 - TEST CONTROL FORM

TEAM:	ACCESS:	LOCATION:	DATE:
SIZE:	BATCH/SHAPE:	OPERATION: Debriefing Checklist	
TEST CONTROLLER:		START TIME:	STOP TIME:
EXAMINED BY:		CLASSIFICATION REVIEW BY:	

At the end of each inspection day, the Test Controller will debrief the Inspector Team, and will complete this form for each operation conducted.

1. Ensure that inspectors complete attitude survey forms, while you review data package. Review survey forms, discuss key problem areas, but do not change their forms in any way.
   - a. Determine and enter percent complete for the operation: Ans. ______
   - b. Estimate the number of classified items revealed: Ans. ______
   - c. Estimate number of occassions that evasion was detected: Ans. ______
   - d. Estimate conviction, mean of Item 12 on attitude survey: Ans. ______

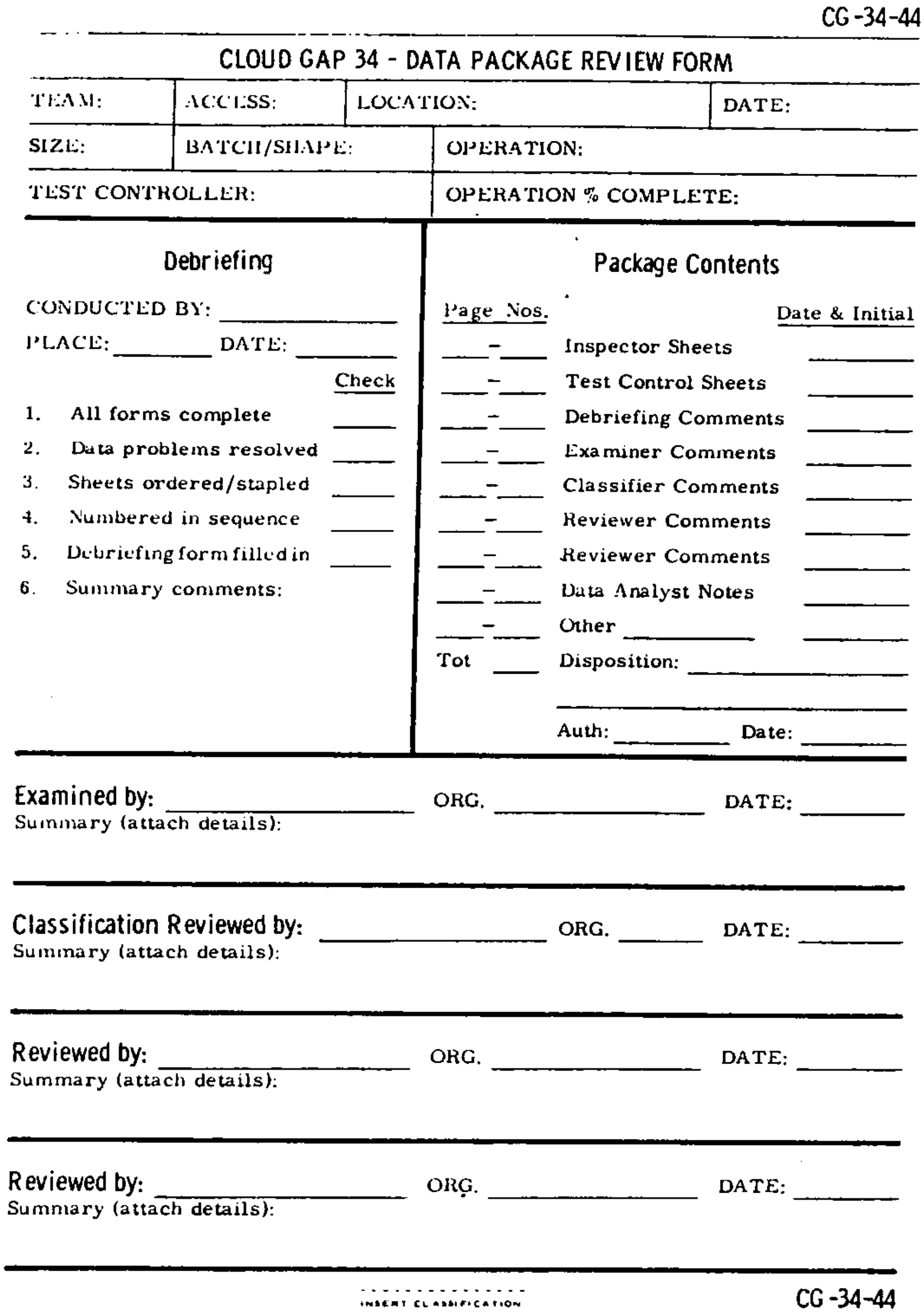
2. Review any incidents or problems arising during the day. (Explain any "no" answer to the following on a blank form.)
   - a. Could inspectors answer all questions on given forms? Yes ? No
   - b. Did inspectors understand procedures in all cases? Yes ? No
   - c. Were planned procedures followed in all cases? Yes ? No
   - d. Is team in general agreement on data submitted? Yes ? No
   - e. Is the work proceeding to the team's satisfaction? Yes ? No

3. Did any major incident, deviation or problem arise? (If "yes," complete a Deviation/Problem Report CG-34-42.) Yes ? No

4. Determine readiness of the operation data package. (Remedy any "no" answers below, or explain on a blank form.)
   - a. Are appropriate Inspector Forms complete and in order? Yes ? No
   - b. Are attachments complete and in order? Yes ? No
   - c. Is all writing legible and interpretable? Yes ? No
   - d. Are data package sheets in order and stapled? Yes ? No
   - e. Are data package sheets clearly numbered in sequence? Yes ? No
   - f. Is data package ready for review cycle? (If "yes," complete and attach Data Package Review Form CG-34-44.) Yes ? No

CG-34-43

FIGURE F1-33. Test Control Form CG-34-43



CG-34-44

CLOUD GAP 34 - DATA PACKAGE REVIEW FORM

TEAM:	ACCESS:	LOCATION:	DATE:
SIZE:	BATCH/SHAPE:	OPERATION:	
TEST CONTROLLER:		OPERATION % COMPLETE:	

Debriefing

CONDUCTED BY: ____________

PLACE: ________ DATE: ________

	Check
1. All forms complete	____
2. Data problems resolved	____
3. Sheets ordered/stapled	____
4. Numbered in sequence	____
5. Debriefing form filled in	____
6. Summary comments:	

Package Contents

Page Nos.		Date & Initial
___-___	Inspector Sheets	____
___-___	Test Control Sheets	____
___-___	Debriefing Comments	____
___-___	Examiner Comments	____
___-___	Classifier Comments	____
___-___	Reviewer Comments	____
___-___	Reviewer Comments	____
___-___	Data Analyst Notes	____
___-___	Other ______	____
Tot ___	Disposition: ________	

Auth: ______ Date: ______

Examined by: __________ ORG. ________ DATE: ______
Summary (attach details):

Classification Reviewed by: __________ ORG. ______ DATE: ______
Summary (attach details):

Reviewed by: __________ ORG. ________ DATE: ______
Summary (attach details):

Reviewed by: __________ ORG. ________ DATE: ______
Summary (attach details):

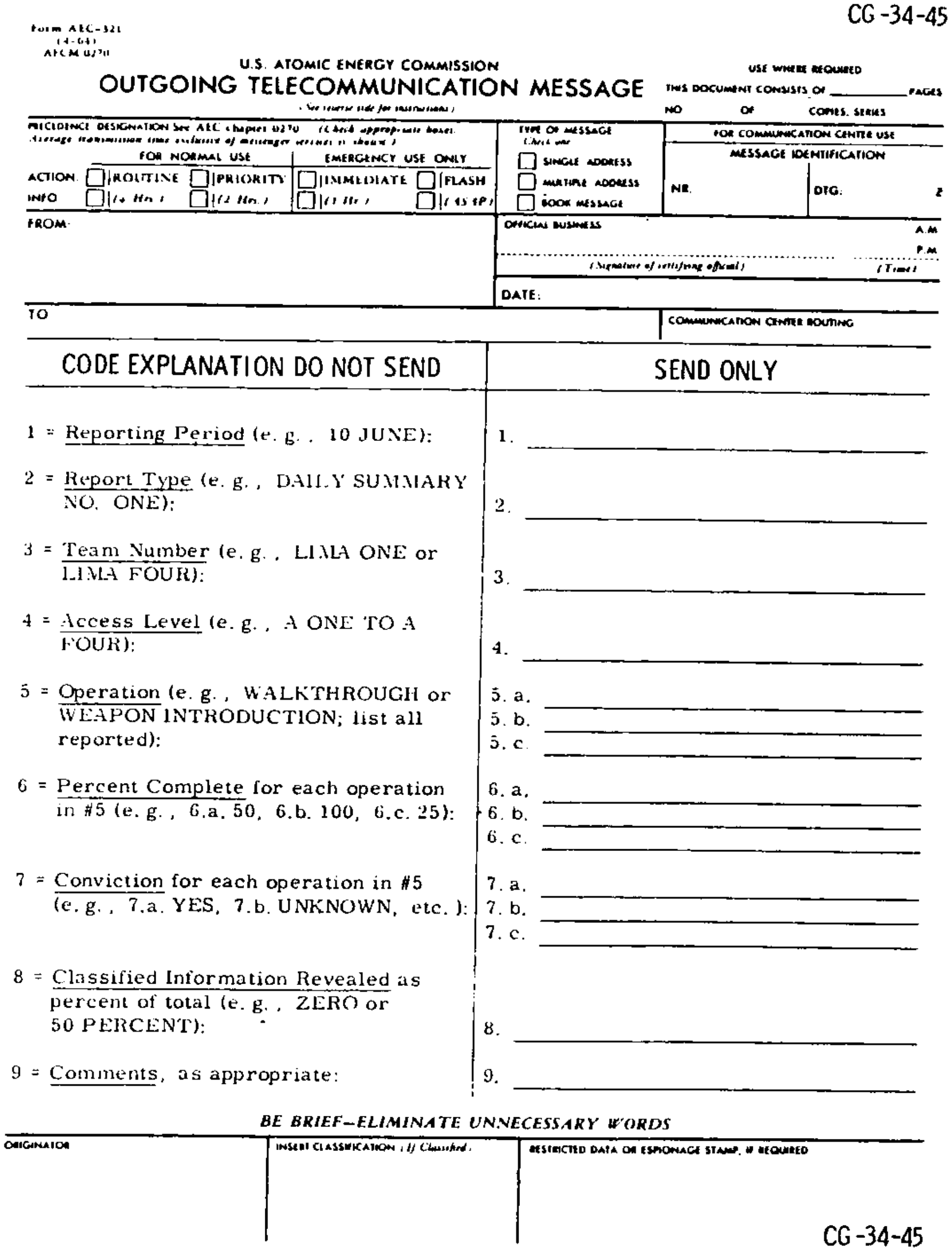
INSERT CLASSIFICATION

CG-34-44

FIGURE F1-34. Data Package Review Form CG-34-44

UNCLASSIFIED

UNCLASSIFIED



CG-34-45

Form AEC-321
(4-64)
AECM 0270

U.S. ATOMIC ENERGY COMMISSION

OUTGOING TELECOMMUNICATION MESSAGE

(See reverse side for instructions)

USE WHERE REQUIRED
THIS DOCUMENT CONSISTS OF ________ PAGES
NO OF COPIES, SERIES

PRECEDENCE DESIGNATION See AEC chapter 0270 (Check appropriate boxes. Average transmission time exclusive of messenger service is shown.)

	FOR NORMAL USE		EMERGENCY USE ONLY	
ACTION	☐ ROUTINE	☐ PRIORITY	☐ IMMEDIATE	☐ FLASH
INFO	☐ (6 Hrs.)	☐ (2 Hrs.)	☐ (1 Hr.)	☐ (15 M.)

TYPE OF MESSAGE
Check one
☐ SINGLE ADDRESS
☐ MULTIPLE ADDRESS
☐ BOOK MESSAGE

FOR COMMUNICATION CENTER USE
MESSAGE IDENTIFICATION
NR. DTG: Z

FROM:

OFFICIAL BUSINESS A.M. P.M.
(Signature of certifying official) (Time)

DATE:

TO

COMMUNICATION CENTER ROUTING

CODE EXPLANATION DO NOT SEND	SEND ONLY
1 = Reporting Period (e. g. , 10 JUNE):	1.
2 = Report Type (e. g. , DAILY SUMMARY NO. ONE):	2.
3 = Team Number (e. g. , LIMA ONE or LIMA FOUR):	3.
4 = Access Level (e. g. , A ONE TO A FOUR):	4.
5 = Operation (e. g. , WALKTHROUGH or WEAPON INTRODUCTION; list all reported):	5. a. 5. b. 5. c.
6 = Percent Complete for each operation in #5 (e. g. , 6.a. 50, 6.b. 100, 6.c. 25):	6. a. 6. b. 6. c.
7 = Conviction for each operation in #5 (e. g. , 7.a. YES, 7.b. UNKNOWN, etc.):	7. a. 7. b. 7. c.
8 = Classified Information Revealed as percent of total (e. g. , ZERO or 50 PERCENT):	8.
9 = Comments, as appropriate:	9.

BE BRIEF—ELIMINATE UNNECESSARY WORDS

ORIGINATOR | INSERT CLASSIFICATION (If Classified) | RESTRICTED DATA OR ESPIONAGE STAMP, IF REQUIRED

CG-34-45

FIGURE F1-35. Outgoing Message Form CG-34-45

UNCLASSIFIED

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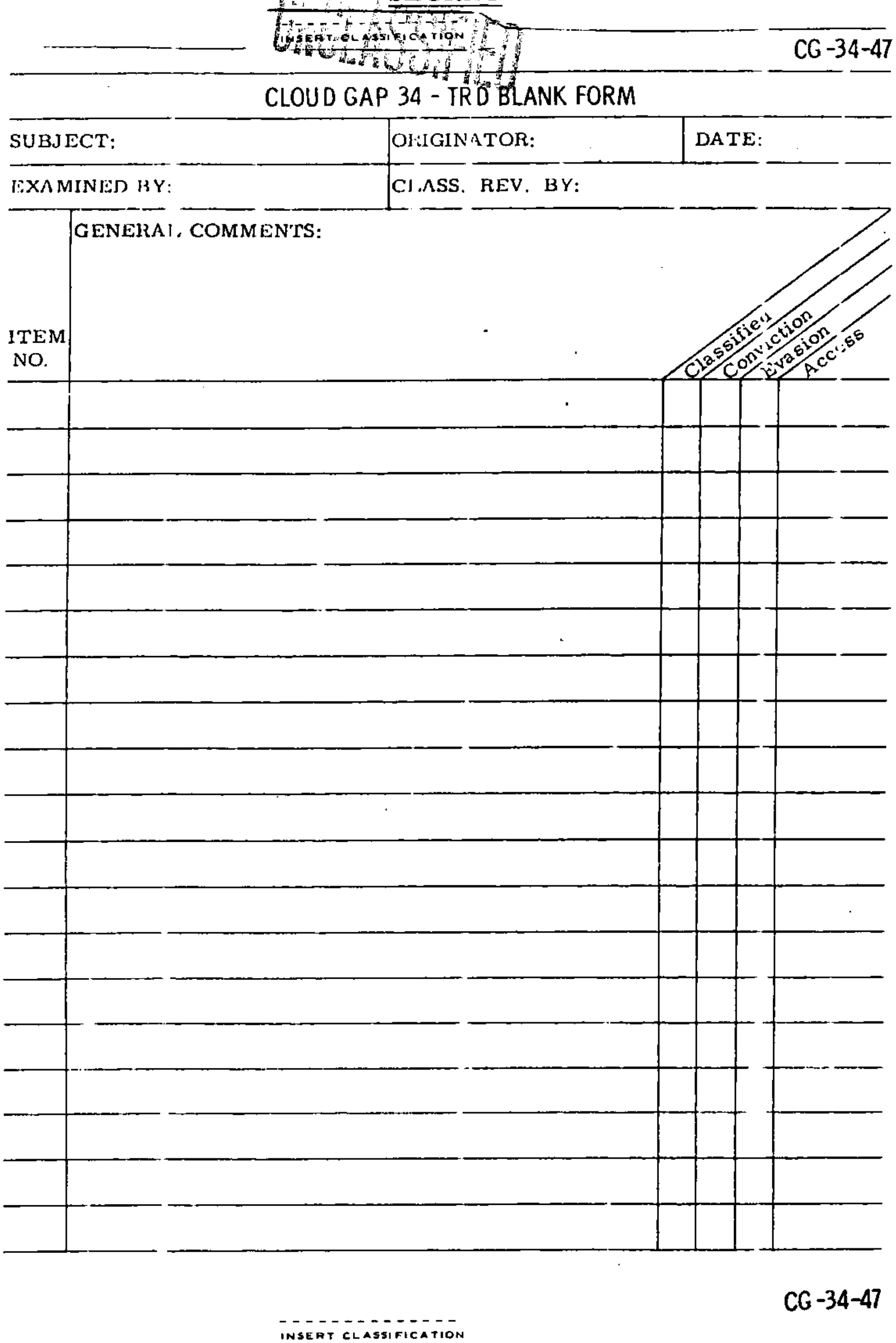
UNCLASSIFIED



CG-34-47

INSERT CLASSIFICATION

CLOUD GAP 34 - TRD BLANK FORM

SUBJECT:

ORIGINATOR:

DATE:

EXAMINED BY:

CLASS. REV. BY:

ITEM NO.	GENERAL COMMENTS:	Classified	Conviction	Evasion	Access

CG-34-47

INSERT CLASSIFICATION

FIGURE F1-36. Test Reference Data Form CG-34-47

UNCLASSIFIED

UNCLASSIFIED

INSERT CLASSIFICATION

CG-34-48

CLOUD GAP 34 - TEST REFERENCE DATA (TRD)

TYPE TRD: EQUIPMENT REFERENCE DATA	SITE:
SUBJECT:	LAYOUT LOCATION:
ORIGINATOR:	ORIG. ORG.:
EXAMINED BY:	CLASS. REV. BY:

The purpose of test reference data is to exhaustively define items of information which are classified and/or lead to or support conviction that weapons destroyed in this test are real weapons.

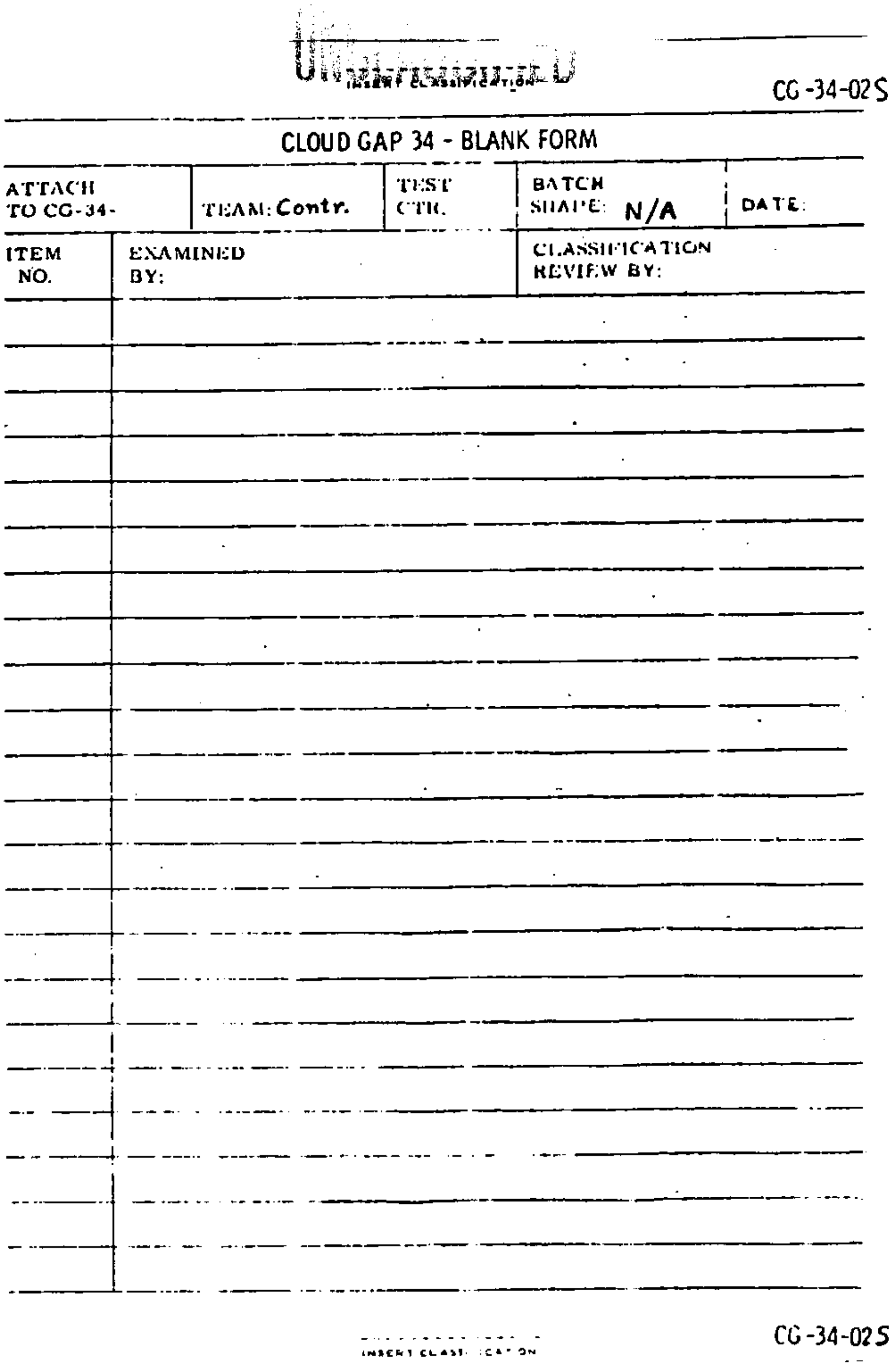
1. Equipment Description:
   - a. Manufacturer or local designation:
   - b. Model number or other identification:
   - c. Descriptive manual No.: Attached? Yes ? No
   - d. Operator manual No.: Attached? Yes ? No
   - e. Other or DR associated SOP: Attached? Yes ? No
2. How is equipment used for or exposed in Cloud Gap 34?
   - a. Basic function(s):
   - b. Operation used in: Access Level:
   - c. Estimated time of use or exposure per access level:
   - d. Restrictions or limitations:
3. Would examination of this equipment reveal classified information? (If "yes," list and identify all items of such information on attached TRD Blank Form, CG-34 51, and show lowest access level at which revealed.) Yes ? No
4. Would features of this equipment tend to convince inspectors that real weapons are being destroyed? (If "yes," identify such features on TRD Blank Form, and show lowest effected access level.) Yes ? No
5. Would any features indicate that evasion is being practiced? (If "yes," identify such features on TRD Blank form and show lowest effected access level.) Yes ? No
6. Attach and number appropriate sheets.

CG-34-48

INSERT CLASSIFICATION

FIGURE F1-37. Test Reference Data Form CG-34-48

UNCLASSIFIED



UNCLASSIFIED

INSERT CLASSIFICATION

CG-34-02S

CLOUD GAP 34 - BLANK FORM

ATTACH TO CG-34-

TEAM: Contr.

TEST CTR.

BATCH SHAPE: N/A

DATE:

ITEM NO.	EXAMINED BY:	CLASSIFICATION REVIEW BY:

INSERT CLASSIFICATION

CG-34-02S

FIGURE F1-38. Contractor Assay Data Form 02S

CLOUD GAP 34 - INSPECTOR FORM

ATTACH TO CG-34-

TEAM: Contr.

TEST CTR.

BATCH SHAPE: N/A

DATE:

EXAMINED BY:

CLASSIFICATION REVIEW BY:

OPERATION: Potential Evasion Listings

List all possible sources of evasion which you believe could be used during any phase of this analysis. Evasion is an process which would lead to erroneous results (make it appear that most fissile material is present than that actually available).

ITEM NO.	

INSERT CLASSIFICATION

CG-34-02-S1

FIGURE F1-39. Contractor Assay Data Form 02-S1

UNCLASSIFIED

UNCLASSIFIED

INSERT CLASSIFICATION

CLOUD GAP 34 - INSPECTOR FORM

ATTACH TO CG-34-	TEAM: Contr.	TEST CTR.	BATCH SHAPE: N/A	DATE:
EXAMINED BY:			CLASSIFICATION REVIEW BY:	

OPERATION: Evasion Calls

List any and all evasion which you detect during any phase of the analysis.

ITEM NO.	

INSERT CLASSIFICATION

CG-34-02-S2

FIGURE F1-40. Contractor Assay Data Form 02-S2

UNCLASSIFIED

CG-34-26-S

CLOUD GAP 34 - INSPECTOR FORM

TEAM: Contr.	ACCESS: High	LOCATION: Oak Ridge	DATE:
SIZE: 3	BATCH/SHAPE: N/A	OPERATION: Isotopic Analysis	
TEST CONTROLLER:		START TIME:	STOP TIME:
EXAMINED BY:		CLASSIFICATION REVIEW BY:	

1. Select sample and identify: Sample # Color Code

2. Sample preparation:
   - a. Add 1 ml nitric acid Chk ______
   - b. Dissolve and heat-load filament Chk ______
   - c. Color code tag filament Chk ______
   - d. Insert prepared filament and evacuate Chk ______

3. Isotopic Analysis:

	U_{234}	U_{235}	U_{236}	U_{238}
a. Galvanometer Readings:				
b. Galvanometer Ave. (Net):				
c. Galvanometer Zero				
d. Intero. (Net - Zero)				
e. MV Ohms				
f. Σ (Interp. x Ohms):				
g. Oxygen Correction	☒	☒		☒

4. Calculation:

	U_{234}	U_{235}	U_{236}	U_{238}	Total
a. Start Time:					
b. Ratio:					
c. Weighted Ratio:					
d. Weighted Percent:					

e. STOP Time:

NOTE: Attach Bristol Chart.

5. Do you believe evasion was practiced in any way? Yes ? No

6. Fill in STOP TIME above.

FIGURE F1-41. Contractor Assay Data Form 26-S

UNCLASSIFIED

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CG-34-27-S

CLOUD GAP 34 - INSPECTOR FORM

TEAM: Contr. | ACCESS: High | LOCATION: Oak Ridge | DATE:
SIZE: 3 | BATCH/SHAPE: N/A | OPERATION: Chemical Analysis
TEST CONTROLLER: | START TIME: | STOP TIME:
EXAMINED BY: | CLASSIFICATION REVIEW BY:

1. Weigh U-metal 5 gm/sample (chk _____)

2. Calibration for Oxide Standard:
   a. Record calibration time: START: _____ STOP: _______
   b. Weight of oxide: ______________________ gms
   c. Weigh primary standard dichromate (K): _______ gms
   d. Volume ferrous ammonium sulphate used (T): ___ ml
   e. Grams dichromate equiv. to 1 ml soup (K/T): ___ gms

4. Fume: Add HCl and perchloric acid. Fume and rinse (chk _____).

5. Titration:
   a. Record titration time: START: ______ STOP: _______
   b. Weigh dichromate to nearest 0.1 mg and titrate:

Sample Number	U-Oxide Wt. gms	$K_2Cr_2O_7$ Wt. gms	Volume Titer (ml)	gU/g Sample Uncorrected	gU/g Sample Corrected	Color Code
Metal Standard						

Yes ? No

6. Do you believe evasion was practiced in any way?

7. Attach appropriate sheets and fill in STOP TIME above.

FIGURE F1-42. Contractor Assay Data Form 27-S

CG-34-28-S

CLOUD GAP 34 - INSPECTOR FORM

TEAM:

ACCESS: High

LOCATION: Oak Ridge

DATE:

SIZE: 3

BATCH/SHAPE: N/A

OPERATION: Spectroscopy Sample Preparation

TEST CONTROLLER:

START TIME:

STOP TIME:

EXAMINED BY:

CLASSIFICATION REVIEW BY:

	Check	Comments
1. Prepare samples:		
a. Heat and cool samples in muffle furnace		
b. Mix samples from cooled crucibles (1 min)		
c. Extract 10 mg per sample for mass spec		
d. Weigh 300.0 mg oxide per sample		
e. Weigh 85.0 mg carrier per sample		
f. Mix for three minutes		
g. 53.0 mg mixture		
h. Charge and dry electrodes		

2. Enter sample identification below:

	Sample #	Color Code	Crucible #
Std.			
Std.			

3. Do you believe that evasion was practiced in any way? Yes ? No

4. Attach appropriate sheets and fill in STOP TIME above.

FIGURE F1-43. Contractor Assay Data Form 28-S

UNCLASSIFIED

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UNCLASSIFIED

CG-34-29-S

CLOUD GAP 34 - INSPECTOR FORM

TEAM: Contr. ACCESS: High LOCATION: Oak Ridge DATE:

SIZE: 3 BATCH/SHAPE: N/A OPERATION: Emission Spectroscopy

TEST CONTROLLER: START TIME: STOP TIME:

EXAMINED BY: CLASSIFICATION REVIEW BY:

1. a. Insert unexposed plates in camera Chk ____
   b. Set and load spectrograph Chk ____
   c. Expose plates Chk ____
   d. Develop plates Chk ____
   e. Record large impurities only Chk ____

Crucible No.	Sample No.	Element (1)	Est. ppm (1)	Element (2)	Est. ppm (2)
	Std.				

(cont)

Sample No.	Element (3)	Est. ppm (3)	Element (4)	Est. ppm (4)	Element (5)	Est. ppm (5)	Element (6)	Est. ppm (6)
Std.								

2. Was evasion practiced in any way? (Explain on blank form.) Yes ? No

FIGURE F1-44. Contractor Assay Data Form 29-S

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Form 1

SUMMARY WEAPON SHAPE CALL LIST

Could be real: 0% 50 100%

TEAM: __________ ACCESS A- __________ DATE: __________

Shape	Real	Fake	Reasons For Fake Call	Initials: Individual Conviction		
A						
B						
C						
D						
E						
F						
G						
H						
I						

Use "X" to indicate one team call per shape. For each team call, indicate each team member's degree of conviction that the shape could be a nuclear weapon, by inserting a number between 0% and 100% into the column headed by the individual's initials.

FIGURE F1-45. Conviction Test Form 1, Limited Chart

Form 2

SUMMARY WEAPON SHAPE CALL LIST

Is real: 0% 50 100%

TEAM: __________ ACCESS A- __________ DATE: __________

Shape	Real	Fake	Reasons For Fake Call	Initials: Individual Conviction		
A						
B						
C						
D						
E						
F						
G						
H						
I						

Use "X" to indicate one team call per shape. For each team call, indicate each team member's degree of conviction that the shape is a nuclear weapon, by inserting a number between 0% and 100% into the column headed by the individual's initials.

FIGURE [illegible]. Conviction Test Form 2, Unlimited Chart

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APPENDIX F2

POST-TEST CLASSIFICATION REVIEW EXERCISE INFORMATION

FIGURE F2-1. List of Nuclear Weapon Data for Evaluation

Category	Ratings	
	USSR	Nth Country
A. External weapon configurations (weight, length, c.g., structures, materials)		
1. External configuration of a re-entry vehicle		
2. External configuration of externally carried bombs		
3. External configuration of an internally carried bomb		
4. External configuration of an air defense missile warhead section		
5. External configuration of normally hidden (within delivery vehicle) air defense warhead section		
6. Structural integrity of each configuration such as case material, access doors, holes, rivet patterns, etc.		
7. Visual identification of means to attach weapon configurations to delivery vehicles such as carriage lugs, plugs, receptacles, etc.		
8. Visual identification of radome or antennas on specific weapon configurations		
9. Determination of bomb or R/V ballistic properties, center-of-pressure, weight, c.g., and other dimensions		
10. Measured moments of inertia of configurations presented for inspection		
11. Methods of delivery for shapes presented (aircraft, missile, R/V, handcarry, etc.)		
12. External materials; heat shield for R/V, structural case, etc.		
13. Guidance control on weapon shapes such as fins, electronic guidance areas		

UNCLASSIFIED

FIGURE E2-1 (cont)

Category

Ratings

USSR Nth Country

B. Nuclear Materials

1.

2.

3.

4.

5.

6.

7.

8.

9.

10.

[redacted]

DoE
(b)(3)

Category

C. Implosion Systems

1.

2.

3.

4.

[redacted]

DoE(b)(3)

UNCLASSIFIED

FIGURE F2-1 (cont)

Ratings

USSR Nth Country

5.
6.
7.
8.
9.
10.
11.
12.
13.
14.
15.
16.
17.
18.

[redacted]

DOE
(b)(3)

UNCLASSIFIED

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FIGURE F2-1 (cont)

	Ratings	
	USSR	Nth Country
19. Ratios of weapon external diameters to HE system O.D.'s		

20.
21.
22.
23.
24.
25.
26.
27.
28.
29.
30.
31.
32.
33.
34.
35.
36.

[redacted]

DOE
(b)(3)

UNCLASSIFIED

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FIGURE F2-1 (cont)

UNCL

Ratings
USSR Nth Country

37. Design features of internal initiators [redacted]

DoE (b)(3)

38. Fact that internal initiators are not used in specific weapons

39. Fact of use and complete design of external initiators (external neutron sources)

40.

DoE (b)(3)

41.

42.

Category

D. Thermonuclear (TN) Systems

1. Fact of nuclear system separation in TN weapons

2.

3.

4.

DoE (b)(3)

5.

6.

7.

8.

9.

FIGURE F2-1 (cont)

	Ratings	
	USSR	Nth Country

10.
11.
12.
13.
14.
15.
16. 100*
17.
18.
19.
20.
21.
22.
23.

[redacted]

DoE
(b)(3)

24. Complete design of a TN weapon, including primary, secondary, case, non-nuclear components, quantities and types of materials used throughout

---

*Baseline scores

FIGURE F2-1 (cont)

Category	Ratings	
	USSR	Nth Country
E. Non-Nuclear Weapon Components		
1. Fact of use of pullout connectors on bombs		
2. Function of pullout switch systems		
3. Fact of use of radar fuzing system for air burst option		
4. Design of radar fuze, including frequency, type of radar, vulnerability		
5. Fact of use of contact crystals for surface burst option		
6. Fact of use of "crush-switch" for surface burst option		
7. Fact of use of timer for laydown application		
8. Fact that safe-separation timers are used on bombs		
9. Fact that environmental sensing systems are used in nuclear weapons		
10. Fact that thermal battery power supplies are used in nuclear weapons		
11. Fact that multiple burst options are available for nuclear weapons		
12. Fact that capacitor storage units are used in nuclear weapon firing systems		
13. Complete design of firing systems, including capacitor bank, trigger circuits, energy transfer switch, load rings, and load coils to detonators		
14. Fact that low-to-high voltage conversion is used to provide energy to nuclear weapon firing systems		

FIGURE F2-1 (cont)

	Ratings	
	USSR	Nth Country
15. Complete design of firing system energy conversion systems (inverter-converter, rotary chopper, etc.)		
16. Fact that explosively actuated (one-shot) components are used in nuclear weapons		
17. Fact that external neutron sources (initiator) are used in nuclear weapons		
18. Fact that external neutron sources may be electrically or explosively actuated		
19. Complete design of external neutron [redacted]		
20. [redacted]		
21. [redacted]		

DOE (b)(3)

Evaluation Matrix

	Shape A	Shape B	Shape D	Shape E	Shape F	Shape I
A_5						
A_4				100* 100*		
A_3						
A_2						
A_1						

USSR / Nth Country

*Baseline

FIGURE F2-2. Classification Review Evaluation Matrix, Part II

UNCLASSIFIED

APPENDIX F3

SELECTED TEST REFERENCE DATA PHOTOGRAPHS

UNCLASSIFIED

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pp F3-2,3,4,5,6,7

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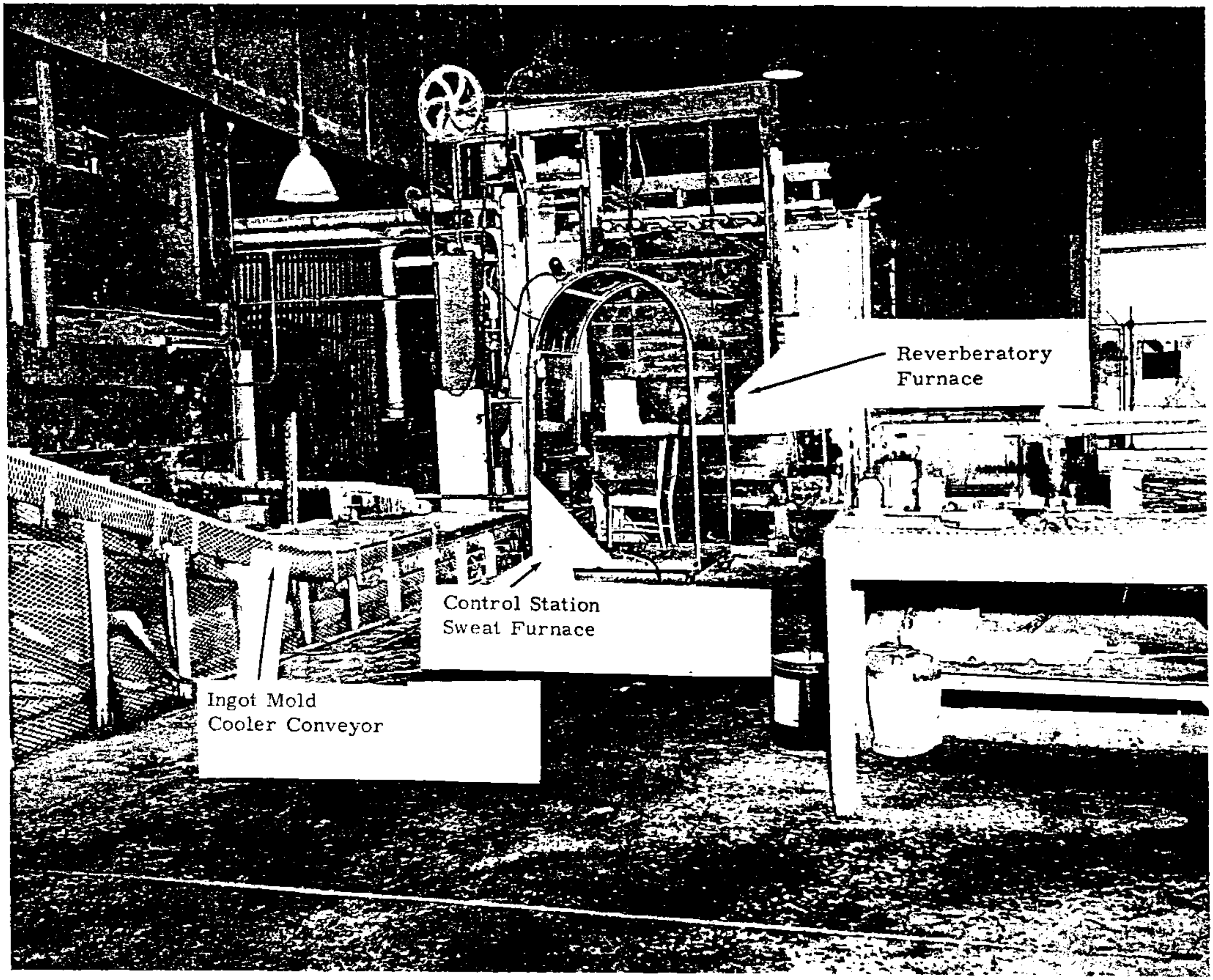

FIGURE F3-7. Foundry Area, Paducah

pp F3-9 & 10
deleted

UNCLASSIFIED

APPENDIX F4

CLASSIFIED INFORMATION DATA

The classified information available for detection during FT-34 operations was recorded by AEC classification specialists at each test site. Tabulation of all test site reports into a composite report provided the information shown in figure F4-1. Several redundancies appear in this listing; for example, the fact that gas boosting was used was available at three of the four test sites. This item of classified information is listed as available at each of the three applicable sites, because it could have been determined independently at each site. Redundant items within a test site, and particularly within a test phase operation, are carried only once as a single item of classified information. For example, the fact that gas boosting was used on several weapons (A4 monitoring at Pantex) is carried as only a single item of classified information. Listings of this sort denote the availability of a type of classified information which, once found, can be extended from one weapon to another. The importance of the item of classified information is the discovery that it exists or can be found and not in how many times it is used. Another example is in the number of detonators used on various weapons [redacted]

DoE (b)(3)

FIGURE F4-1. Classified Information Revelation During FT-34

Pantex Information

A. Walkthrough Tours - Same items available to both low and high access level teams

1.
2.
3.
4.

[redacted]

DoE (b)(3)

5. Number of detonators of particular H.E. system. (H.E. sphere handling band, P/N 025-2-40-00). (Mk 25)

B. Weapon Monitoring

Access Level A_1: External Configurations

1. Radar frequency, size of slot antenna in guidance section (Hawk)
2. Lack of hardening, Mk 11 reentry vehicle (external appearance)

Access Level A_2: Geiger Counter Scan; Open Access Door Inspection of Components

1. Location of implosion systems (Geiger counters)
2. Fact of physically separated stages (Geiger counters) (Mk 28, Mk 56, Mk 39)

pp F4-3 thru 11

deleted

FIGURE F4-3. Evaluators' Scores for U.S.S.R.

		Evaluators													
	Question	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Category A	1	1	0	0	20	5	30	10	100	10	30	10	0	0	25
	2	1	0	0	0	5	5	5	50	10	0	1	0	0	0
	3	1	0	0	0	5	0	5	70	10	0	2	0	10	10
	4	1	10	0	0	0	30	50	100	10	0	2	0	10	10
	5	10	20	0	100	5	60	40	200	10	5	5	0	10	20
	6	5	40	0	10	5	5	200	50	10	0	1	0	10	10
	7	1	0	0	10	5	10	10	100	10	0	1	0	10	10
	8	1	30	0	5	150	50	200	200	50	10	7	5	10	10
	9	10	40	0	20	5	50	200	100	50	70	15	5	25	20
	10	5	20	50	10	5	5	150	100	50	10	10	5	50	25
	11	1	10	0	20	5	10	200	200	10	0	7	0	0	10
	12	5	30	0	40	100	30	1000	2000	70	15	10	10	10	20
	13	1	20	0	15	25	40	700	300	50	5	5	0	10	10
Category B	1	75	10	20	10	5	5	200	50	0	0	5	0	0	10
	2	75	10	20	40	5	60	100	100	10	0	10	0	0	5
	3	1	10	0	10	5	5	100	20	0	10	10	0	10	5
	4	1	50	40	0	25	5	120	50	10	10	10	0	10	20
	5	1	50	80	0	25	5	200	50	10	10	10	0	10	30
	6	80	0	10	0	5	50	50	20	0	0	0	0	10	5
	7	1	0	0	0	10	70	50	50	0	0	5	0	50	10
	8	10	60	80	40	40	70	300	300	70	5	25	15	25	20
	9	75	60	80	0	0	80	200	150	20	0	25	20	0	0
	10	10	10	40	30	50	50	100	50	10	10	25	10	10	0
Category C	1	20	10	30	0	80	80	150	100	20	0	15	25	10	10
	2	10	0	10	0	75	60	100	80	20	0	10	15	10	0
	3	5	0	10	0	20	40	100	60	10	0	5	0	0	0
	4	40	50	70	80	125	100	200	100	40	0	25	25	50	25
	5	30	50	70	80	150	90	150	100	40	0	20	25	50	30
	6	90	200	100	90	75	100	200	50	20	5	65	50	100	50
	7	100	240	100	90	150	100	200	200	40	5	75	100	100	60
	8	40	20	30	0	10	40	150	50	30	10	5	15	10	25
	9	30	20	30	10	10	35	100	50	30	10	5	15	10	25
	10	20	10	30	15	10	30	100	50	30	10	5	15	10	10
	11	75	100	30	40	150	50	130	100	40	5	10	50	100	20
	12	70	200	20	5	150	30	130	70	30	0	20	100	25	40
	13	70	150	20	20	110	40	110	70	30	0	20	100	25	35
	14	70	220	40	70	150	100	130	200	40	5	20	100	25	50
	15	70	40	30	90	175	50	150	200	40	5	20	100	25	50
	16	80	40	40	0	175	30	130	100	10	10	20	100	25	25
	17	80	80	70	100	100	30	120	150	10	20	20	100	25	30
	18	85	80	20	0	100	20	100	150	10	5	20	100	25	0
	19	50	10	30	10	25	40	100	100	10	5	25	10	10	10
	20	50	30	50	40	175	50	100	50	10	5	25	25	10	25
	21	50	50	20	40	100	30	200	100	10	5	10	25	10	15
	22	70	100	20	40	100	30	300	100	10	10	25	20	50	20
	23	70	110	30	80	100	70	300	150	10	10	40	75	100	30
	24	10	10	10	10	0	50	100	50	10	5	5	25	10	0
	25	70	120	10	75	25	40	200	70	10	15	40	25	50	30

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FIGURE F4-3. Evaluators' Scores for U.S.S.R. (cont)

		Evaluators													
	Question	1	2	3	4	5	6	7	8	9	10	11	12	13	14
	26	70	60	10	10	50	50	100	30	10	20	20	50	50	20
	27	70	60	10	10	50	30	100	30	10	20	20	50	50	20
	28	5	100	10	100	50	30	100	50	10	20	100	100	100	20
	29	70	130	10	100	150	60	200	100	20	15	25	100	100	35
	30	70	80	30	40	25	50	200	200	20	10	25	100	50	20
	31	80	160	10	20	75	40	200	30	10	20	75	125	100	25
	32	70	130	0	20	5	40	200	30	10	20	75	150	100	25
	33	70	150	0	40	75	50	200	50	10	20	75	150	100	25
	34	90	180	20	80	125	60	300	70	10	23	100	150	100	30
	35	10	80	10	10	5	20	200	100	10	5	20	100	10	10
	36	50	50	0	10	5	30	150	40	20	23	10	10	10	15
	37	40	30	80	10	25	40	150	50	20	23	25	25	100	25
	38	30	60	0	15	5	30	150	40	10	23	10	10	100	15
	39	20	30	30	10	125	40	200	70	20	25	25	50	100	15
	40	20	20	80	0	10	25	200	40	10	20	10	50	10	10
	41	20	40	0	10	10	20	200	40	10	20	10	50	10	15
	42	70	40	0	10	5	30	150	60	0	5	10	50	10	15
Category D	1	10	0	0	0	75	20	100	20	60	50	20	20	10	0
	2	10	10	0	0	50	10	100	30	60	55	10	20	10	0
	3	10	10	0	0	50	10	100	30	10	10	10	20	25	0
	4	10	40	30	100	125	90	100	30	10	100	10	40	100	10
	5	10	40	30	15	75	30	90	40	10	100	25	20	10	10
	6	10	40	40	0	50	50	100	40	20	50	50	50	50	10
	7	70	120	80	0	125	70	120	100	50	80	100	150	100	15
	8	10	60	80	0	50	60	120	150	50	50	10	50	100	10
	9	10	100	80	0	150	80	130	200	70	90	15	150	100	20
	10	20	40	0	90	25	50	130	100	50	90	20	30	100	10
	11	20	50	0	90	25	50	130	50	50	90	15	40	100	10
	12	10	10	0	0	25	30	100	20	10	5	0	40	10	0
	13	10	70	0	90	5	80	150	80	30	50	10	50	100	15
	14	10	70	80	95	110	80	120	60	30	100	10	50	50	15
	15	70	40	80	0	110	70	120	100	30	50	50	50	50	15
	16	100	100	100	100	100	100	100	100	100	100	100	100	100	100
	17	90	90	40	100	150	80	100	50	100	100	25	25	100	100
	18	60	80	80	15	125	30	130	100	70	50	20	50	100	15
	19	10	70	70	0	5	30	100	60	20	60	10	50	25	0
	20	10	70	70	15	25	90	300	70	20	100	25	40	25	10
	21	10	70	0	30	50	40	100	100	70	60	35	10	25	10
	22	90	270	100	100	175	120	300	200	70	100	500	150	1000	110
	23	90	250	100	100	175	120	300	200	70	100	500	150	1000	110
	24	90	300	100	100	175	300	1000	2000	100	120	1000	400	10000	150

FIGURE F4-3. Evaluators' Scores for U.S.S.R. (cont)

		Evaluators													
	Question	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Category E	1	1	0	0	0	25	5	50	20	10	0	1	0	0	0
	2	1	10	0	0	0	10	50	100	10	5	2	0	0	10
	3	1	10	0	10	15	70	200	20	20	1	2	20	1	0
	4	1	80	80	50	25	90	800	500	30	50	15	200	1000	50
	5	1	10	30	0	25	80	10	100	10	5	2	25	1	10
	6	1	20	30	0	25	50	10	50	10	5	2	25	10	10
	7	1	20	0	10	25	20	200	100	20	0	2	25	0	10
	8	1	20	0	10	5	30	500	100	10	0	1	25	0	10
	9	1	20	0	0	0	60	100	150	10	0	1	25	0	10
	10	1	60	0	0	5	30	200	80	10	0	1	25	10	10
	11	1	30	0	0	5	30	200	150	10	0	2	25	10	20
	12	1	10	0	5	50	40	75	50	10	0	1	25	10	0
	13	70	80	30	15	125	50	500	100	20	10	5	75	50	15
	14	1	10	0	0	5	30	75	30	10	1	2	25	0	10
	15	70	30	30	15	5	35	200	80	20	5	2	75	50	15
	16	1	60	0	0	5	10	300	30	10	0	1	25	0	10
	17	1	50	10	5	5	30	75	80	10	20	10	25	10	10
	18	1	70	30	10	5	35	125	100	10	22	10	25	10	15
	19	70	90	70	10	150	40	150	150	20	25	50	40	100	15
	20	1	20	0	10	25	30	200	80	10	10	10	25	0	15
	21	70	80	0	5	25	40	200	100	20	10	10	25	10	15

FIGURE F4-4. Evaluators' Scores for Nth Country

		Evaluators													
	Question	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Category A	1	1	0	0	10	5	20	5	10	10	70	5	0	0	15
	2	1	0	0	0	5	50	1	10	10	5	1	0	0	10
	3	1	0	0	0	5	40	1	10	10	5	2	0	10	10
	4	1	10	0	0	5	20	10	10	10	10	2	0	10	10
	5	10	20	0	100	5	25	10	10	10	25	5	0	10	20
	6	10	30	0	10	5	0	2	10	10	5	1	0	20	10
	7	1	10	0	10	5	0	5	10	10	0	1	0	10	10
	8	1	30	0	20	150	20	4	15	50	40	5	5	10	10
	9	5	30	0	10	5	35	10	15	50	100	10	5	50	20
	10	5	20	50	0	5	0	50	10	50	35	7	5	50	25
	11	1	10	0	0	5	40	25	15	10	10	5	0	0	10
	12	5	40	0	10	100	60	30	20	70	35	5	10	50	30
	13	1	30	0	15	50	40	20	15	50	25	3	0	10	10
Category B	1	75	30	80	10	75	30	75	20	10	100	15	10	0	10
	2	75	40	80	10	75	40	75	30	20	100	25	10	0	5
	3	1	30	50	30	25	80	10	20	10	100	25	10	75	5
	4	1	70	80	0	100	80	20	30	20	100	25	15	50	30
	5	1	70	80	0	100	80	40	30	20	125	25	20	50	50
	6	80	20	30	50	5	60	10	30	10	10	0	20	25	5
	7	1	20	0	20	20	80	70	30	10	0	10	5	50	30
	8	40	80	100	70	75	90	50	40	90	100	50	25	100	40
	9	75	80	100	0	0	50	50	70	40	5	50	50	0	5
	10	10	40	80	80	100	80	40	40	20	125	50	15	75	10
Category C	1	20	20	70	0	100	100	60	30	50	100	25	50	50	40
	2	10	20	50	0	80	95	50	25	50	100	20	30	10	25
	3	5	10	50	0	50	90	40	20	20	50	10	20	0	10
	4	40	70	90	60	125	90	50	30	60	50	35	60	50	75
	5	30	70	90	60	175	80	40	30	60	50	30	60	50	80
	6	90	290	100	100	150	150	70	35	50	75	95	150	1000	100
	7	100	240	100	100	150	100	70	40	60	100	95	200	1000	120
	8	40	20	80	0	100	80	20	30	50	100	10	30	100	25
	9	30	20	80	20	100	70	70	30	50	100	10	30	100	25
	10	20	30	80	30	109	80	70	30	50	100	10	30	100	15
	11	75	100	90	40	150	30	70	40	60	75	25	75	100	40
	12	70	240	80	80	200	80	80	60	50	100	50	200	100	80
	13	70	190	80	90	125	90	80	60	50	100	50	200	100	75
	14	70	250	90	100	175	100	80	70	60	100	50	200	100	90
	15	70	50	90	100	200	100	80	40	60	100	50	200	100	80
	16	80	60	90	20	200	30	70	40	50	100	50	200	100	50
	17	80	90	90	100	150	30	70	50	50	100	50	200	100	60
	18	85	90	50	5	150	20	60	40	50	100	50	200	100	0
	19	50	20	80	10	25	20	40	30	50	75	50	20	10	20
	20	50	60	90	70	200	40	60	40	50	75	50	50	100	50
	21	50	80	40	25	150	60	50	40	50	75	20	50	100	50
	22	70	130	60	70	150	70	40	40	50	75	75	100	100	40
	23	70	160	80	60	150	50	40	50	50	75	75	125	100	50
	24	10	80	30	60	50	80	40	40	50	70	10	50	25	0
	25	70.	160	50	90	100	80	60	50	50	80	75	50	100	60

FIGURE F4-4. Evaluators' Scores for Nth Country (cont)

								Evaluators							
	Question	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Category E	1	1	0	0	0	100	10	10	10	20	2	1	0	0	0
	2	1	20	0	15	25	15	10	20	20	20	2	0	0	15
	3	1	20	0	15	15	30	20	30	50	10	2	20	10	0
	4	1	60	80	50	75	40	40	40	70	80	15	100	1000	60
	5	1	20	30	0	100	40	20	30	30	60	2	25	10	10
	6	1	30	30	0	100	35	20	20	30	60	2	25	25	10
	7	1	30	0	0	50	20	30	30	40	10	2	25	10	10
	8	1	30	0	0	25	20	20	20	10	0	1	25	0	10
	9	1	40	0	10	0	25	10	30	10	0	1	25	0	10
	10	1	80	0	15	5	40	20	20	10	0	1	25	10	20
	11	1	10	0	0	5	20	30	30	10	10	2	25	10	30
	12	1	20	0	15	125	50	20	30	10	2	1	25	50	0
	13	70	120	70	45	150	60	50	80	50	40	20	75	100	30
	14	1	60	0	15	25	30	20	30	30	5	3	25	50	10
	15	70	80	60	45	150	35	40	30	40	42	4	75	100	25
	16	1	60	0	15	50	15	20	20	30	10	1	25	10	10
	17	1	70	20	25	50	60	30	30	50	80	15	25	100	10
	18	1	80	70	30	50	65	20	40	30	82	15	25	100	15
	19	70	110	90	50	150	80	40	50	50	96	70	40	1000	30
	20	1	30	0	40	100	45	30	30	20	80	10	25	0	20
	21	70	90	0	10	150	50	20	40	40	85	10	25	50	20

FIGURE F4-4. Evaluators' Scores for Nth Country (cont)

		Evaluators													
	Question	1	2	3	4	5	6	7	8	9	10	11	12	13	14
	26	70	80	20	70	100	60	40	50	50	90	50	100	100	40
	27	70	80	20	70	100	60	40	70	50	90	50	100	100	40
	28	10	220	90	100	150	100	80	90	80	100	150	200	100	60
	29	75	220	80	100	150	30	75	50	40	85	50	200	100	75
	30	70	200	90	70	150	60	40	50	40	80	50	200	100	70
	31	80	230	80	20	150	60	60	90	60	95	95	225	1000	40
	32	70	220	10	20	110	60	60	40	50	95	95	250	1000	40
	33	70	220	10	20	150	60	60	50	60	95	95	250	1000	40
	34	90	240	90	90	175	100	70	60	60	96	150	250	1000	50
	35	10	120	70	20	25	30	40	40	70	30	30	150	50	20
	36	50	40	40	10	50	60	40	50	50	96	15	20	50	15
	37	40	60	90	10	100	80	40	60	50	96	50	75	1000	40
	38	30	50	70	15	100	40	40	40	40	96	15	20	100	15
	39	20	80	80	50	150	80	60	30	70	96	50	70	100	30
	40	20	20	80	30	50	40	50	20	10	95	10	50	25	20
	41	20	50	0	40	50	10	50	20	10	95	10	50	100	30
	42	70	60	0	40	25	50	50	10	0	15	10	50	100	30
Category D	1	10	50	0	30	125	100	90	50	90	100	50	50	100	20
	2	10	80	30	50	150	50	90	70	90	100	20	50	100	0
	3	10	50	60	0	100	30	80	70	50	90	20	50	100	0
	4	10	100	80	100	150	90	80	80	90	100	20	80	100	60
	5	10	100	80	80	150	25	80	80	80	110	75	50	100	30
	6	10	100	90	95	150	50	70	70	90	90	100	100	100	30
	7	70	160	100	95	150	70	80	90	95	98	150	200	1000	40
	8	10	90	100	0	75	60	80	50	80	100	20	100	100	20
	9	10	130	100	20	175	80	80	70	90	100	30	200	1000	50
	10	20	80	40	90	100	50	80	40	70	100	35	60	100	25
	11	20	90	40	90	75	50	80	30	70	100	30	70	100	25
	12	10	60	0	40	125	70	50	30	70	90	0	70	25	0
	13	10	100	80	90	200	60	70	60	80	90	30	100	100	25
	14	10	100	90	90	140	60	70	70	80	110	40	100	100	25
	15	70	60	100	80	140	50	70	50	80	90	75	100	100	30
	16	100	100	100	100	100	100	100	100	100	100	100	100	100	100
	17	90	100	100	100	200	40	90	200	100	100	40	50	100	110
	18	60	90	100	40	150	30	80	50	120	90	40	70	100	50
	19	10	80	90	50	100	20	80	60	100	95	20	100	100	20
	20	10	80	60	90	100	50	90	70	150	100	50	20	100	30
	21	10	70	30	40	150	80	70	50	100	98	60	20	100	25
	22	90	420	100	100	200	120	200	300	150	110	5000	200	1000	125
	23	90	400	100	100	200	120	200	300	150	110	5000	200	1000	140
	24	90	500	100	100	200	200	1000	1000	300	180	10000	600	90000	150

FIGURE F4-5. Evaluators' Pooled Rankings Within Information Categories - U.S.S.R.

Category A		Category B		Category C		Category D		Category E	
Rank	Item No.	Rank	Item No.	Rank	Item No.	Rank	Item No.	Rank	Item No.
1*	12	1*	8	1*	7	1*	24	1*	4
2	9	2	9	2	34	2	23	2	19
3	10	3	10	3	6	3	22	3	13
4	8	4	5	4	29	4	16	4	21
5	5	5	4	5	14	5	9	5	15
6	13	6	2	6	23	6	17	6	18
7	1	7	1	7	15	7	7	7	20
8	11	8	7	8	30	8	18	8	17
9	6	9	3	9	4	9	14	9	11
10	4	10†	6	10	17	10	15	10	5
11	7			11	33	11	20	11	7
12	3			12	31	12	10	12	6
13†	2			13	11	13	13	13	3
				14	5	14	8	14	8
				15	22	15	11	15	10
				16	25	16	4	16	12
				17	39	17	21	17	9
				18	13	18	6	18	16
				19	32	19	5	19	14
				20	12	20	19	20	2
				21	37	21	1	21†	1
				22	16	22	2		
				23	28	23	3		
				24	20	24†	12		
				25	26				
				26	18				
				27	21				
				28	27				
				29	1				
				30	8				
				31	35				
				32	38				
				33	19				
				34	9				
				35	40				
				36	36				
				37	41				
				38	10				
				39	42				
				40	2				
				41	24				
				42†	3				

*highest rank †lowest rank

FIGURE F4-6. Evaluators' Pooled Rankings Within Information Categories - Nth Country

Category A		Category B		Category C		Category D		Category D	
Rank	Item No.	Rank	Item No.	Rank	Item No.	Rank	Item No.	Rank	Item No.
1*	12	1*	8	1*	7	1*	24	1*	19
2	9	2	10	2	34	2	23	2	13
3	10	3	5	3	14	3	22	3	4
4	8	4	9	4	28	4	16	4	15
5	13	5	4	5	15	5	7	5	21
6	5	6	2	6	6	6	17	6	18
7	11	7	1	7	12	7	9	7	17
8	1	8	3	8	13	8	4	8	20
9	6	9	6	9	31	9	6	9	5
10	4	10	7	10	17	10	14	10	6
11	3			11	33	11	5	11	14
12	7			12	29	12	18	12	7
13†	2			13	16	13	20	13	12
				14	30	14	13	14	10
				15	32	15	15	15	11
				16	25	16	2	16	16
				17	11	17	1	17	3
				18	23	18	8	18	2
				19	39	19	21	19	9
				20	20	20	10	20	6
				21	22	21	11	21†	1
				22	37	22	19		
				23	18	23	3		
				24	5	24†	12		
				25	27				
				26	4				
				27	26				
				28	21				
				29	9				
				30	1				
				31	10				
				32	8				
				33	35				
				34	36				
				35	2				
				36	38				
				37	24				
				38	42				
				39	40				
				40	41				
				41	19				
				42†	3				

*highest rank †lowest rank

FIGURE F4-7. Part I Evaluation Questions Regrouped by Access Level

Access Level 1

A. External weapon configurations (weight, length, c.g., structures, materials)

1. External configuration of a re-entry vehicle
2. External configuration of externally carried bombs
3. External configuration of an internally carried bomb
4. External configuration of an air defense missile warhead section
5. External configuration of normally hidden (within delivery vehicle) air defense warhead section
6. Structural integrity of each configuration such as case material, access doors, holes, rivet patterns, etc.
7. Visual identification of means to attach weapon configurations to delivery vehicles such as carriage lugs, plugs, receptacles, etc.
8. Visual identification of radome or antennas on specific weapon configurations
9. Determination of bomb or R/V ballistic properties, center-of-pressure, weight, c.g., and other dimensions
10. Measured moments of inertia of configurations presented for inspection
11. Methods of delivery for shapes presented (aircraft, missile, R/V, handcarry, etc.)

FIGURE F4-7. Part I Evaluation Questions Regrouped by Access Level (cont)

12. External materials: heat shield for R/V, structural case, etc.

13. Guidance control on weapon shapes such as fins, electronic guidance areas

B. Nuclear Materials

1.

2.

3.

4.

5.

6.

7.

9.

10.

3E

)(3)

E. Nonnuclear Weapon Components

1. Fact of use of pullout connectors on bombs

FIGURE F4-7. Part I Evaluation Questions Regrouped by Access Level (cont)

Access Level 2

D. Thermonuclear (TN) Systems

1. Fact of nuclear system separation in TN weapons

E. Nonnuclear Weapon Components

3. Fact of use of radar fuzing system for air burst option

7. Fact of use of timer for laydown application

8. Fact that safe separation timers are used on bombs

9. Fact that environmental sensing systems are used in nuclear weapons

10. Fact that thermal battery power supplies are used in nuclear weapons

11. Fact that multiple burst options are available for nuclear weapons

12. Fact that capacitor storage units are used in nuclear weapon firing systems

16. Fact that explosively actuated (one-shot) components are used in nuclear weapons

Access Level 3

C. Implosion Systems

31. [redacted]

DOE
(b)(3)

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FIGURE F4-8. Contestant Scores, Part II Evaluation

Evaluator: 1

Access	Shape					
	A	B	D	E	F	I
A5	110 (USSR)	120	120	120	120	110
	110 (Nth Country)	120	120	120	120	110
A4	90	110	100	100	100	100
	90	110	100	100	100	100
A3	10	10	5	15	10	5
	10	10	5	15	10	4
A2	3	5	3	5	3	4
	2	4	2	5	2	3
A1	2	5	2	2	2	3
	1	4	1	1	1	2

FIGURE F4-8. Contestant Scores, Part II Evaluation (cont)

Evaluator: 2

	Shape					
Access	A	B	D	E	F	I
A5	100	120	80	130	160	25
	110	130	95	150	200	30
A4	80	90	70	100	120	20
	90	95	80	100	140	25
A3	30	40	15	15	20	10
	40	60	20	20	25	10
A2	20	30	10	10	10	0
	20	55	15	20	15	0
A1	10	10	5	5	7	0
	15	15	10	7	10	0

FIGURE F4-8. Contestant Scores, Part II Evaluation (cont)

Evaluator: 3

Access	Shape					
	A	B	D	E	F	I
A5	60	100	80	100	100	80
	90	100	80	100	100	90
A4	20	30	40	100	100	60
	60	80	80	100	100	70
A3	10	0	0	0	0	0
	60	0	0	0	0	0
A2	0	0	0	0	0	0
	0	0	0	0	0	0
A1	0	0	0	0	0	0
	0	0	0	0	0	0

FIGURE F4-8. Contestant Scores, Part II Evaluation (cont)

Evaluator: 4

	Shape					
Access	A	B	D	E	F	I
A5	20 200	200 400	100 200	200 400	250 500	60 100
A4	20 70	60 150	20 70	100 100	125 200	60 100
A3	15 20	20 70	0 0	0 20	20 70	20 70
A2	0 0	0 20	0 0	0 20	15 20	5 0
A1	0 0	0 0	0 0	0 0	15 0	5 0

FIGURE F4-8. Contestant Scores, Part II Evaluation (cont)

Evaluator: 5

	Shape					
Access	A	B	D	E	F	I
A5	100	150	100	175	175	0
	125	200	175	200	200	0
A4	25	100	20	100	100	0
	75	150	50	100	125	50
A3	10	10	10	10	20	0
	25	50	20	10	50	0
A2	10	20	10	30	10	0
	10	50	10	35	20	0
A1	10	10	0	10	10	0
	10	10	10	10	10	0

FIGURE F4-8. Contestant Scores, Part II Evaluation (cont)

Evaluator: 6

	Shape					
Access	A	B	D	E	F	I
A5	150	200	150	250	300	200
	200	300	200	300	150	100
A4	40	80	20	100	150	90
	70	80	40	100	100	60
A3	10	15	10	20	40	15
	15	15	10	30	35	15
A2	5	15	5	12	35	10
	5	7	5	10	30	10
A1	3	10	3	10	30	5
	3	5	3	15	5	5

FIGURE F4-8. Contestant Scores, Part II Evaluation (cont)

Evaluator: 7

	Shape					
Access	A	B	D	E	F	I
A5	70	125	95	200	500	90
	80	200	90	300	200	100
A4	45	90	75	100	300	80
	60	90	80	100	150	90
A3	25	20	20	40	30	50
	25	20	35	85	30	50
A2	20	30	25	70	20	50
	10	50	20	25	25	20
A1	5	15	10	15	15	20
	10	10	5	10	10	20

FIGURE F4-8. Contestant Scores, Part II Evaluation (cont)

Evaluator: 8

	Shape					
Access	A	B	D	E	F	I
A5	300	1000	500	300	2000	700
	300	300	150	150	200	200
A4	100	200	150	100	250	150
	100	100	100	100	100	100
A3	10	40	20	30	100	50
	20	20	20	20	30	20
A2	5	5	10	10	70	30
	5	5	5	10	10	10
A1	5	5	10	10	50	20
	2	5	2	5	5	5

FIGURE F4-8. Contestant Scores, Part II Evaluation (cont)

Evaluator: 9

	Shape					
Access	A	B	D	E	F	I
A5	110 120	140 150	80 90	140 150	200 150	130 140
A4	70 80	90 100	70 80	100 100	140 140	80 90
A3	60 70	70 80	60 70	70 80	80 90	60 70
A2	50 60	50 60	40 60	50 60	60 70	50 60
A1	30 40	30 40	20 30	30 40	50 60	30 40

FIGURE F4-8. Contestant Scores, Part II Evaluation (cont)

Evaluator: 10

	Shape					
Access	A	B	D	E	F	I
A5	100	125	100	110	125	100
	125	150	125	140	150	125
A4	80	100	80	100	100	100
	100	125	100	100	125	100
A3	5	10	5	0	5	5
	10	20	10	5	15	10
A2	0	5	0	0	5	0
	5	10	5	5	15	5
A1	0	0	0	0	0	0
	0	0	0	0	2	0

FIGURE F4-8. Contestant Scores, Part II Evaluation (cont)

Evaluator: 11

	Shape					
Access	A	B	D	E	F	I
A5	150	1000	250	1000	5000	500
	1000	10000	1000	10000	10000	500
A4	70	100	70	100	150	90
	75	100	75	100	100	80
A3	25	25	20	20	35	25
	25	25	20	20	20	25
A2	15	15	15	15	20	15
	15	15	15	15	15	15
A1	7	7	7	7	15	7
	7	7	7	7	10	7

FIGURE F4-8. Contestant Scores, Part II Evaluation (cont)

Evaluator: 12

	Shape					
Access	A	B	D	E	F	I
A5	150	300	200	250	400	175
	300	400	350	375	600	200
A4	70	200	150	100	200	175
	80	200	150	100	300	200
A3	30	25	25	25	25	30
	30	25	25	50	50	25
A2	20	20	20	20	20	30
	20	30	20	30	30	20
A1	15	10	10	10	10	30
	15	10	10	10	10	20

FIGURE F4-8. Contestant Scores, Part II Evaluation (cont)

Evaluator: 13

	Shape					
Access	A	B	D	E	F	I
A5	500 1000	500 1000	500 1000	500 1000	500 1000	1000 1000
A4	75 100	100 100	75 100	100 100	100 100	75 100
A3	25 60	75 75	25 60	75 75	75 75	25 60
A2	10 50	50 50	10 50	50 50	25 50	10 50
A1	0 10	0 10	0 10	25 25	0 10	0 10

FIGURE F4-8. Contestant Scores, Part II Evaluation (cont)

Evaluator: 14

	Shape					
Access	A	B	D	E	F	I
A5	75	120	60	110	130	10
	90	130	80	115	150	25
A4	60	105	50	100	110	60
	75	125	70	100	125	80
A3	10	10	10	10	15	15
	15	15	10	15	15	15
A2	5	10	5	10	10	10
	5	15	5	15	15	10
A1	5	5	5	5	5	5
	5	5	5	5	5	5

APPENDIX F5

CONVICTION DATA

FIGURE F5-1. LIMA Teams Real-Fake Calls

Low Level Access

	LIMA 1 (two-man)				LIMA 3 (four-man)			
	First batch	Second batch				First batch	Second batch	
Weapon	A_1	A_1	A_2		Weapon	A_1	A_1	A_2
39	RR	RR	RR	Real	39	RR	RR	RR
28	RR	RR	RR		28	RR	RR	RR
56	FF	FF	FF		56	RR	RR	RR
25	RR	RR	RR		25	RR	RR	RR
30	FF	FF	FF		30	RR	RR	RR
28S	RR	RR	RR	Fake	28S	RR	RR	RR
8-inch	RR	RR	RR		8-inch	RR	RR	RR
57 BDU	RR	RR	FF		57 BDU	RR	RR	FF
Hawk	RF	FF	FF		Hawk	RR	RR	RR
No. correct	7	8	10		No. correct	10	10	12

FIGURE F5-1. LIMA Teams Real-Fake Calls (cont)

High Level Access

LIMA 2 (two-man)

Weapon	First batch			Second batch			
	A_1	A_2	A_3	A_1	A_2	A_3	A_4
39	RR	RR	RR	RR	RR	RR	RR
28	RR	RR	RR	RR	RR	RR	RR
56	RR	RR	RR	RR	RR	RR	RR
25	RR	RR	RR	RR	RR	RR	RR
30	RR	RR	RR	RR	RR	RR	RR
28S	RR	RR	RR	RR	RR	RR	RR
8-inch	RR	RR	RR	RR	RR	RR	FF
57 BDU	RR	FF	FF	RR	FF	FF	FF
Hawk	RR	RR	RR	RR	RR	RR	RR
No. correct	10	12	12	10	12	12	14

LIMA 4 (four-man)

Weapon	First batch			Second batch			
	A_1	A_2	A_3	A_1	A_2	A_3	A_4
39	RR	RR	RR	RR	RR	RR	RR
28	RR	RR	RR	RR	RR	RR	RR
56	RR	RR	RR	RR	RR	RR	RR
25	FF	FR	RR	RR	RR	RR	RR
30	RR	RR	RR	RR	RR	RR	RR
28S	RR	FF	FR	RR	FR	RR	RR
8-inch	RR	FF	FF	RR	RR	RR	FF
57 BDU	FR	FF	FF	FF	FF	FF	FF
Hawk	FF	RR	RR	RR	RR	RR	RR
No. correct	11	15	15	12	13	12	14

FIGURE F5-1. MIKE Team Real-Fake Calls (cont)

Low Level Access							
MIKE 1 (two-man)				MIKE 3 (four-man)			
	First batch	Second batch			First batch	Second batch	
Weapon	A_1	A_1	A_2	Weapon	A_1	A_1	A_2
39	RR	RR	RR	39	RR	RR	RR
28	RR	RR	RR	28	RR	RR	RR
56	RR	RR	RR	56	FF	RR	RR
25	RR	RR	RR	25	RR	RR	RR
30	RR	RR	RR	30	RR	RR	RR
28S	RR	RR	RR	28S	RR	RR	FF
8-inch	RR	RR	RR	8-inch	RR	FF	FF
57 BDU	RR	RR	FF	57 BDU	RR	RR	FF
Hawk	RR	RR	RR	Hawk	RR	RR	RR
No. correct	10	10	12	No. correct	8	12	16

FIGURE F5-1. MIKE Team Real-Fake Calls (cont)

High Level Access

MIKE 2 (two-man)

Weapon	First batch A_1	First batch A_2	First batch A_3	Second batch A_1	Second batch A_2	Second batch A_3	Second batch A_4
39	RR	RR	RR	RR	RR	FF	RR
28	RR	RR	FR	RR	RR	FR	RR
56	RR	RR	RR	RR	RR	RR	RR
25	RR	RR	FF	RR	RR	RR	RR
30	RR	RR	RR	RR	RR	RR	RR
28S	RR	FF	FR	RR	FR	RR	FF
8-inch	RR	RR	FR	RR	RR	FR	FF
57 BDU	RR	RR	FR	RR	RR	RR	FF
Hawk	RR	RR	RR	FF	RR	RR	RR
No. correct	10	12	10	12	11	8	16

MIKE 4 (four-man)

Weapon	First batch A_1	First batch A_2	First batch A_3	Second batch A_1	Second batch A_2	Second batch A_3	Second batch A_4
39	RR	RR	RR	RR	RR	RR	FF
28	RR	RR	RR	RR	RR	RR	RR
56	RR	RR	RR	RR	RR	RR	RR
25	RR	RR	RR	RR	RR	RR	RR
30	RR	RR	RR	RR	RR	RR	RR
28S	RR	FF	FF	RR	FF	FF	FF
8-inch	RR	FR	FR	RR	FR	FR	FF
57 BDU	RR	FF	FF	RR	FF	FF	FF
Hawk	RR	FF	FF	RR	RR	FF	RR
No. correct	10	17	17	10	15	17	14

FIGURE F5-2. Summary of Team Calls at Highest Access Levels

LIMA TEAMS

Shape	L_1 Low A_2	L_2 High A_4	L_3 Low A_2	L_4 High A_4	
39	RR	RR	RR	RR	Real
28	RR	RR	RR	RR	
56	FF*	RR	RR	RR	
25	RR	RR	RR	RR	
30	FF*	RR	RR	RR	
28S	RR	RR*	RR	RR*	Fake
8-inch	RR	FF	RR	FF	
57 BDU	FF	FF	FF	FF	
Hawk	FF*	RR	RR	RR	
No. correct	10	14	12	14	

MIKE TEAMS

Shape	M_1 Low A_2	M_2 High A_4	M_3 Low A_2	M_4 High A_4	
39	RR	RR	RR	FF*	Real
28	RR	RR	RR	RR	
56	RR	RR	RR	RR	
25	RR	RR	RR	RR	
30	RR	RR	RR	RR	
28S	RR	FF	FF*	FF	Fake
8-inch	RR	FF	FF*	FF	
57 BDU	FF	FF	FF	FF	
Hawk	RR	RR	RR	RR	
No. correct	12	16	16	14	

*Unexpected calls

Expected Fake Calls

A_1 - None
A_2 - 57 BDU
A_3 - 8-inch shell
A_4 - 28S

FIGURE F5-3. Reasons Given for Weapon Inspection Calls of Fake

During weapon monitoring phases of inspection of FT-34, each inspection team was required to call each weapon shape monitored at each access level "real" or "fake." When a shape was called fake, the inspection team was required to justify the call by listing reasons or evidence which indicated that the shape was fake. This appendix lists the calls made by the various teams and gives the reasons offered for fake calls; comments on the validity of the calls are also included. Part A lists calls and reasons for the FT-34 field test, and Part B lists calls and reasons for the posttest conviction exercise. Calls which are considered to be invalid are marked with an asterisk(*). Calls which are questionable or unexpected but not necessarily considered invalid are warhead with an asterisk and a question mark(*?).

A. FT-34 Weapon Calls

Team LIMA 1, Weapon Batch 1

Shape	Description	A_1 Call	Reason for Fake Call
1	Mk 28 Bomb	R	
2	Mk 11 R/V	F*	Bad heat shield, bad mounting, bad dolly
3	Mk 28 Spoof	R	
4	Mk 57 BDU	R	
5	Mk 25 Genie	R	
6	Mk 39 Bomb	R	
7	Mk 30 Talos	F*	Bad dolly, bad cables, unexplained shape
8	Mk 28 Bomb	R	
9	Mk 39 Bomb	R	
10	Mk 11 R/V	F*	Bad structure, low density, bad heat shield
11	8-inch Shell	R	
12	Mk 28 Spoof	R	
13	Hawk	R	
14	Mk 57 BDU	R	
15	Mk 25 Genie	R	
16	8-inch Shell	R	
17	Hawk	F*	Low density, weak structure, bad center of gravity, bad radar location
18	Mk 30 Talos	F*	Low density, bad L/D ratio, poor structure, bad dolly, unsafe cables.

LIMA 1, Weapon Batch 2

Shape	Description	A_1 Call	A_2 Call	Reason for Fake Call
1	Mk 39 Bomb	R	R	
2	Mk 30 Talos	F*	F*	(A_1) Poor wiring, low density, bad dolly. (A_2) Bad structure, poor cabling, bad dolly, bad mounting ring.
3	Mk 25 Genie	R	R	
4	Mk 28 Bomb	R	R	
5	Mk 57 BDU	R	F	(A_2) No internal components, poor location of radioactivity.
6	Mk 28 Spoof	R	R	
7	Mk 57 BDU	R	F	(A_2) No internal components, poor location of radioactivity.
8	Mk 39 Bomb	R	R	
9	Mk 11 R/V	F*	F*	(A_1) No cables, bad heat shield, low density. (A_2) Low density, bad heat shield, bad dolly.
10	Hawk	F*	F*	(A_1) Bad dolly, weak structure, bad center of gravity, low density, poor quality components of shape. (A_2) Radioactive readings in wrong location, amateurish appearance.
11	Mk 28 Spoof	R	R	
12	8-inch Shell	R	R	
13	Mk 11 R/V	F*	F*	(A_1) Bad heat shield, bad dolly. (A_2) Bad heat shield, bad dolly, low density.
14	8-inch Shell	R	R	
15	Hawk	F*	F*	(A_1) Weak structure, low density. (A_2) Radioactive readings in wrong location, amateurish appearance, bad radar shield, light nose shield.
16	Mk 25 Genie	R	R	
17	Mk 30 Talos	F*	F*	(A_1) Low density, bad structure, bad dolly. (A_2) Low density, weak structure, poor cabling.
18	Mk 28 Bomb	R	R	

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Team LIMA 2, Weapon Batch 1

Shape	Description	A_1 Call	A_2 Call	A_3 Call	Reason for Fake Call
1	Mk 28 Bomb	R	R	R	
2	Mk 11 R/V	R	R	R	
3	Mk 28 Spoof	R	R	R	
4	Mk 57 BDU	R	F	F	(A_2) Low radioactivity, lightweight, styrofoam packing inside. (A_3) No warhead section, emission from nose too high.
5	Mk 25 Genie	R	R	R	
6	Mk 39 Bomb	R	R	R	
7	Mk 30 Talos	R	R	R	
8	Mk 28 Bomb	R	R	R	
9	Mk 39 Bomb	R	R	R	
10	Mk 11 R/V	R	R	R	
11	8-inch Shell	R	R	R	
12	Mk 28 Spoof	R	R	R	
13	Hawk	R	R	R	
14	Mk 57 BDU	R	F	F	(A_2) Active material not in credible location, inside filled with styrofoam. (A_3) Activity too high, foam visible through access door.
15	Mk 25 Genie	R	R	R	
16	8-inch Shell	R	R	R	
17	Hawk	R	R	R	
18	Mk 28 Bomb	R	R	R	

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LIMA 2, Weapon Batch 2

Shape	Description	A_1 Call	A_2 Call	A_3 Call	A_4 Call	Reason for Fake Call
1	Mk 39 Bomb	R	R	R	R	
2	Mk 30 Talos	R	R	R	R	
3	Mk 25 Genie	R	R	R	R	
4	Mk 28 Bomb	R	R	R	R	
5	Mk 57 BDU	R	F	F	F	(A_2) Most likely warhead location stuffed with polystyrene. (A_3) Activity in wrong location and too high. (A_4) Weapon empty.
6	Mk 28 Spoof	R	R	R	R	
7	Mk 57 BDU	R	F	F	F	(A_2) Activity location not credible filled with polystyrene. (A_3) Activity in wrong location and too high. (A_4) Weapon empty.
8	Mk 39 Bomb	R	R	R	R	
9	Mk 11 R/V	R	R	R	R	
10	Hawk	R	R	R	R	
11	Mk 28 Spoof	R	R	R	R	
12	8-inch Shell	R	R	R	F	(A_4) Wrong type internal components.
13	Mk 11 R/V	R	R	R	R	
14	8-inch Shell	R	R	R	F	(A_4) Wrong type internal components.
15	Hawk	R	R	R	R	
16	Mk 25 Genie	R	R	R	R	
17	Mk 30 Talos	R	R	R	R	
18	Mk 28 Bomb	R	R	R	R	

LIMA 3, Weapon Batch 1

Shape	Description	A_1 Call	Reason for Fake Call
1	Mk 28 Bomb	R	N/A
2	Mk 11 R/V	R	
3	Mk 28 Spoof	R	
4	Mk 57 BDU	R	
5	Mk 25 Genie	R	
6	Mk 39 Bomb	R	
7	Mk 30 Talos	R	
8	Mk 28 Bomb	R	
9	Mk 39 Bomb	R	
10	Mk 11 R/V	R	
11	8-inch Shell	R	
12	Mk 28 Spoof	R	
13	Hawk	R	
14	Mk 57 BDU	R	
15	Mk 25 Genie	R	
16	8-inch Shell	R	
17	Hawk	R	
18	Mk 30 Talos	R	

LIMA 3, Weapon Batch 2

Shape	Description	A_1 Call	A_2 Call	Reason for Fake Call
1	Mk 39 Bomb	R	R	
2	Mk 30 Talos	R	R	
3	Mk 25 Genie	R	R	
4	Mk 28 Bomb	R	R	
5	Mk 57 BDU	R	F	(A_2) Center section empty, poor location of radioactivity.
6	Mk 28 Spoof	R	R	
7	Mk 57 BDU	R	R	(A_2) Center section empty, poor location of radioactivity.
8	Mk 39 Bomb	R	R	
9	Mk 11 R/V	R	R	
10	Hawk	R	R	
11	Mk 28 Spoof	R	R	
12	8-inch Shell	R	R	
13	Mk 11 R/V	R	R	
14	8-inch Shell	R	R	
15	Hawk	R	R	
16	Mk 25 Genie	R	R	
17	Mk 30 Talos	R	R	
18	Mk 28 Bomb	R	R	

LIMA 4, Weapon Batch I

Shape	Description	A_1 Call	A_2 Call	A_3 Call	Reason for Fake Call
1	Mk 28 Bomb	R	R	R	
2	Mk 11 R/V	R	R	R	
3	Mk 28 Spoof	R	F*	F*	(A_2) No radiation readings. (A_3) No radiation readings.
4	Mk 57 BDU	R	F	F	(A_2) Location of radiation not credible. (A_3) No components.
5	Mk 25 Genie	F*	F*	R	(A_1) Low density, bad location of mounting bracket, tape band on base, old dolly, shape not secured. (A_2) Incomplete weapon.
6	Mk 39 Bomb	R	R	R	
7	Mk 30 Talos	R	R	R	
8	Mk 28 Bomb	R	R	R	
9	Mk 39 Bomb	R	R	R	
10	Mk 11 R/V	R	R	R	
11	8-inch Shell	R	F	F	(A_2) Not enough radiation. (A_3) Small amount of radioactivity.
12	Mk 28 Spoof	R	F*	R	(A_2) Safety wires missing, weapon not safed, masking tape inside coaxial connector.
13	Hawk	F*	R	R	(A_1) Improbable weight/volume, electrical leads cut.
14	Mk 57 BDU	F*	F	F	(A_1) Weight ratio not correct, weight only one half of required. (A_2) No active material or components inside. (A_3) Small amount of active material, no components.
15	Mk 25 Genie	F*	R	R	(A_1) Weight not compatible with size, no safety features.
16	8-inch Shell	R	F	F	(A_2) Small amount of active material. (A_3) Small amount of active material.
17	Hawk	F*	R	R	(A_1) Improbable weight/volume, electrical leads cut.
18	Mk 30 Talos	R	R	R	

LIMA 4, Weapon Batch 2

Shape	Description	A_1 Call	A_2 Call	A_3 Call	A_4 Call	Reason for Fake Call
1	Mk 39 Bomb	R	R	R	R	
2	Mk 30 Talos	R	R	R	R	
3	Mk 25 Genie	R	R	R	R	
4	Mk 28 Bomb	R	R	R	R	
5	Mk 57 BDU	F*	F	F	F	(A_1) Not enough weight. (A_2) No mechanical or electrical components behind access door. (A_3) No electrical or mechanical components, incredible radiation location. (A_4) No nuclear material or internal components.
6	Mk 28 Spoof	R	F*	R	R	(A_2) No active material.
7	Mk 57 BDU	F*	F	F	F	(A_1) Not enough weight. (A_2) No mechanical or electrical components behind access door. (A_3) No electrical or mechanical components, incredible radiation location. (A_4) No nuclear material or internal components.
8	Mk 39 Bomb	R	R	R	R	
9	Mk 11 R/V	R	R	R	R	
10	Hawk	R	R	R	R	
11	Mk 28 Spoof	R	R	R	R	
12	8-inch Shell	R	R	R	F	(A_4) No nuclear or internal components.
13	Mk 11 R/V	R	R	R	R	
14	8-inch Shell	R	R	R	F	(A_4) No nuclear or internal components.
15	Hawk	R	R	R	R	
16	Mk :5 Genie	R	R	R	R	
17	Mk :0 Talos	R	R	R	R	
18	Mk :8 Bomb	R	R	R	R	

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MIKE 1, Weapon Batch 3

Shape	Description	A_1 Call	Reason for Fake Call
1	Mk 28 Bomb	R	N/A
2	Mk 11 R/V	R	
3	Mk 28 Spoof	R	
4	Mk 57 BDU	R	
5	Mk 25 Genie	R	
6	Mk 39 Bomb	R	
7	Mk 30 Talos	R	
8	Mk 28 Bomb	R	
9	Mk 39 Bomb	R	
10	Mk 11 R/V	R	
11	8-inch Shell	R	
12	Mk 28 Spoof	R	
13	Hawk	R	
14	Mk 57 BDU	R	
15	Mk 25 Genie	R	
16	8-inch Shell	R	
17	Hawk	R	
18	Mk 30 Talos	R	

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MIKE I, Weapon Batch 4

Shape	Description	A_1 Call	A_2 Call	Reason for Fake Call
1	Mk 39 Bomb	R	R	
2	Mk 30 Talos	R	R	
3	Mk 25 Genie	R	R	
4	Mk 28 Bomb	R	R	
5	Mk 57 BDU	R	F	(A_2) Lack of internal mechanism and lack of credible location of active material.
6	Mk 28 Spoof	R	R	
7	Mk 57 BDU	R	F	(A_2) Lack of internal mechanism and lack of credible location of active material.
8	Mk 39 Bomb	R	R	
9	Mk 11 R/V	R	R	
10	Hawk	R	R	
11	Mk 28 Spoof	R	R	
12	8-inch Shell	R	R	
13	Mk 11 R/V	R	R	
14	8-inch Shell	R	R	
15	Hawk	R	R	
16	Mk 25 Genie	R	R	
17	Mk 30 Talos	R	R	
18	Mk 28 Bomb	R	R	

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MIKE 1, Weapon Batch 3

Shape	Description	A_1 Call	Reason for Fake Call
1	Mk 28 Bomb	R	N/A
2	Mk 11 R/V	R	
3	Mk 28 Spoof	R	
4	Mk 57 BDU	R	
5	Mk 25 Genie	R	
6	Mk 39 Bomb	R	
7	Mk 30 Talos	R	
8	Mk 28 Bomb	R	
9	Mk 39 Bomb	R	
10	Mk 11 R/V	R	
11	8-inch Shell	R	
12	Mk 28 Spoof	R	
13	Hawk	R	
14	Mk 57 BDU	R	
15	Mk 25 Genie	R	
16	8-inch Shell	R	
17	Hawk	R	
18	Mk 30 Talos	R	

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MIKE I, Weapon Batch 4

Shape	Description	A_1 Call	A_2 Call	Reason for Fake Call
1	Mk 39 Bomb	R	R	
2	Mk 30 Talos	R	R	
3	Mk 25 Genie	R	R	
4	Mk 28 Bomb	R	R	
5	Mk 57 BDU	R	F	(A_2) Lack of internal mechanism and lack of credible location of active material.
6	Mk 28 Spoof	R	R	
7	Mk 57 BDU	R	F	(A_2) Lack of internal mechanism and lack of credible location of active material.
8	Mk 39 Bomb	R	R	
9	Mk 11 R/V	R	R	
10	Hawk	R	R	
11	Mk 28 Spoof	R	R	
12	8-inch Shell	R	R	
13	Mk 11 R/V	R	R	
14	8-inch Shell	R	R	
15	Hawk	R	R	
16	Mk 25 Genie	R	R	
17	Mk 30 Talos	R	R	
18	Mk 28 Bomb	R	R	

MIKE 2, Weapon Batch 3

Shape	Description	A_1 Call	A_2 Call	A_3 Call	Reason for Fake Call
1	Mk 28 Bomb	R	R	R	
2	Mk 11 R/V	R	R	R	
3	Mk 28 Spoof	R	R*	F	(A_2) Low radiation reading. (A_3) No radioactive material.
4	Mk 57 BDU	R	R	R	
5	Mk 25 Genie	R	R	F*	(A_3) Gamma spectroscope indicates bad spectrum.
6	Mk 39 Bomb	R	R	R	
7	Mk 30 Talos	R	R	R	
8	Mk 28 Bomb	R	R	F*	(A_3) Gamma spectroscope indicates no fissile material.
9	Mk 39 Bomb	R	R	R	
10	Mk 11 R/V	R	R	R	
11	8-inch Shell	R	R	R	
12	Mk 28 Spoof	R	F*	R	(A_2) Low readings on Geiger counter indicates no radioactivity.
13	Hawk	R	R	R	
14	Mk 57 BDU	R	R*?	F	(A_3) Unidentified peaks on gamma spectroscope.
15	Mk 25 Genie	R	R	F*	(A_3) Energy peaks indicate no fissile material.
16	8-inch Shell	R	R	F*	(A_3) No fissile material.
17	Hawk	R	R	R	
18	Mk 30 Talos	R	R	R	

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MIKE 2, Weapon Batch 4

Shape	Description	A_1 Call	A_2 Call	A_3 Call	A_4 Call	Reason for Fake Call
1	Mk 39 Bomb	R	R	R	R	(A_3) Gamma spectroscope not credible.
2	Mk 30 Talos	R	R	R	R	
3	Mk 25 Genie	R	R	R	R	
4	Mk 28 Bomb	R	R	F*	R	(A_3) No fissile material.
5	Mk 57 BDU	R	R*?	R*?	F	(A_4) No active material except small source.
6	Mk 28 Spoof	R	R	R	F	(A_4) Active material missing.
7	Mk 57 BDU	R	R*	R*	F	(A_4) No active material except small source.
8	Mk 39 Bomb	R	R	F*	R	(A_3) Gamma spectroscope not credible.
9	Mk 11 R/V	R	R	R	R	
10	Hawk	F*	R	R	R	(A_1) Weapon too light, low density.
11	Mk 28 Spoof	R	F*	R*?	F	(A_2) Low activity on Geiger counter. (A_4) Active material missing.
12	8-inch Shell	R	R	R*	F	(A_4) Nuclear components missing.
13	Mk 11 R/V	R	R	R	R	
14	8-inch Shell	R	R	F	F	(A_3) Doubtful if one-half of gun contains fissile material. (A_4) Nuclear components missing.
15	Hawk	F*	R	R	R	(A_1) Weapon too light, low density.
16	Mk 25 Genie	R	R	R	R	
17	Mk 30 Talos	R	R	R	R	
18	Mk 28 Bomb	R	R	R	R	

UNCLASSIFIED

MIKE [illegible], Weapon Batch 3

Shape	Description	A_1 Call	Reason for Fake Call
1	Mk 28 Bomb	R	
2	Mk 11 R/V	F*	(A_1) Due to skin material, does not seem realistic no seams, n access doors.
3	Mk 28 Spoof	R	
4	Mk 57 BDU	R	
5	Mk 25 Genie	R	
6	Mk 39 Bomb	R	
7	Mk 30 Talos	R	
8	Mk 28 Bomb	R	
9	Mk 39 Bomb	R	
10	Mk 11 R/V	F*	(A_1) Poor fabrication and workmanship, hollow sounding.
11	8-inch Shell	R	
12	Mk 28 Spoof	R	
13	Hawk	R	
14	Mk 57 BDU	R	
15	Mk 25 Genie	R	
16	8-inch Shell	R	
17	Hawk	R	
18	Mk 30 Talos	R	

MIKE 3, Weapon Batch 4

Shape	Description	A_1 Call	A_2 Call	Reason for Fake Call
1	Mk 39 Bomb	R	R	
2	Mk 30 Talos	R	R	
3	Mk 25 Genie	R	R	
4	Mk 28 Bomb	R	R	
5	Mk 57 BDU	R	F	(A_2) Hollow shape, noncredible isotope location.
6	Mk 28 Spoof	R	F*	(A_2) Condition of shape, low Geiger count.
7	Mk 57 BDU	R	F	(A_2) Hollow shape, noncredible isotope location.
8	Mk 39 Bomb	R	R	
9	Mk 11 R/V	R	R	
10	Hawk	R	R	
11	Mk 28 Spoof	R	F*	(A_2) No radioactive material, poor condition of skin.
12	8-inch Shell	F*?	F*?	(A_1) Appears to be training unit. (A_2) Low Geiger count and appearance of shape.
13	Mk 11 R/V	R	R	
14	8-inch Shell	F*	F*	(A_1) Appears to be training unit. (A_2) Low Geiger count, appearance of shape.
15	Hawk	R	R	
16	Mk 25 Genie	R	R	
17	Mk 30 Talos	R	R	
18	Mk 28 Bomb	R	R	

MIKE 4, Weapon Batch 3

Shape	Description	A_1 Call	A_2 Call	A_3 Call	Reason for Fake Call
1	Mk 28 Bomb	R	R	R	
2	Mk 11 R/V	R	R	R	
3	Mk 28 Spoof	R	F*	F	(A_2) Weak radioactivity, not credible location. (A_3) Radiation locations not credible.
4	Mk 57 BDU	R	F	F	(A_2) Radiation location not compatible with center of gravity. (A_3) Radiation location not compatible with center of gravity.
5	Mk 25 Genie	R	R	R	
6	Mk 39 Bomb	R	R	R	
7	Mk 30 Talos	R	R	R	
8	Mk 28 Bomb	R	R	R	
9	Mk 39 Bomb	R	R	R	
10	Mk 11 R/V	R	R	R	
11	8-inch Shell	R	R	R	
12	Mk 28 Spoof	R	F*	F	(A_2) Radiation too far forward of center of gravity. (A_3) Weak radioactivity and location.
13	Hawk	R	F*	F*	(A_2) Radioactivity too far off of center of gravity. (A_3) Poor position of active material, bad case.
14	Mk 57 BDU	R	F	F	(A_2) Radioactive material too far forward of center of gravity. (A_3) Location of active material unbelievable.
15	Mk 25 Genie	R	R	R	
16	8-inch Shell	R	F	F	(A_2) Lacks [redacted] (A_3) Active material in wrong position.
17	Hawk	R	F*	F*	(A_2) Radioactive material too far aft. (A_3) Position of active material, flimsy case.
18	Mk 30 Talos	R	R	R	

DOE (b)(3)

MIKE 4, Weapon Batch 4

Shape	Description	A_1 Call	A_2 Call	A_3 Call	A_4 Call	Reason for Fake Call
1	Mk 39 Bomb	R	R	R	F*	(A_4) Unable to find fissile material forward, no dense material inside HE.
2	Mk 30 Talos	R	R	R	R	
3	Mk 25 Genie	R	R	R	R	
4	Mk 28 Bomb	R	R	R	R	
5	Mk 57 BDU	R	F	F	F	(A_2) Location of radioactivity not credible. (A_3) Location of active material, large void behind access door. (A_4) No internal parts.
6	Mk 28 Spoof	R	F*?	F	F	(A_2) Location and amount of activity. (A_3) Amount and location of activity. (A_4) No reason given.
7	Mk 57 BDU	R	F	F	F	(A_2) Activity location not credible. (A_3) Unbelievable position of activity, foam block, lead weight. (A_4) All internals removed, radioactive ball inserted.
8	Mk 39 Bomb	R	R	R	F*	(A_4) Unable to find fissile material forward, no dense material inside HE.
9	Mk 11 R/V	R	R	R	R	
10	Hawk	R	R	F*	R	(A_3) Unrealistic radioactivity.

MIKE 4, Weapon Batch 4 (cont)

Shape	Description	A_1 Call	A_2 Call	A_3 Call	A_4 Call	Reason for Fake Call
11	Mk 28 Spoof	R	F*?	F	F	(A_2) Radiation weak and incredible location. (A_3) Weak indication of activity. (A_4) No reason given.
12	8-inch Shell	R	F	F	F	(A_2) Half of nuclear system missing. (A_3) Projectile missing. (A_4) No nuclear components.
13	Mk 11 R/V	R	R	R	R	
14	8-inch Shell	R	R	R	F	(A_4) No nuclear components.
15	Hawk	R	R	F*	R	(A_3) Small diameter, weak indication of radioactivity.
16	Mk 25 Genie	R	R	R	R	
17	Mk 30 Talos	R	R	R	R	
18	Mk 28 Bomb	R	R	R	R	

FIGURE F5-4. Conviction Team Calls: Limited Data Form

	A_1					A_2					A_3				
Shape	T_1	T_2	T_3	T_4	T_5	T_1	T_2	T_3	T_4	T_5	T_1	T_2	T_3	T_4	T_5
A	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
B	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
C	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
D	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
E	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
F	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
G	R	R	R	R	R	F	R	R	F	F	F	R	R	F	F
H	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
I	R	R	R	R	R	F	R	R	R	R	F	R	R	R	R

	A_4					A_5				
Shape	T_1	T_2	T_3	T_4	T_5	T_1	T_2	T_3	T_4	T_5
A	R	R	R	R	R	R	R	R	R	R
B	R	R	R	R	F	R	R	R	R	R
C	R	R	R	R	F	F	F	F	F	F
D	R	R	R	R	R	R	R	R	R	R
E	R	R	R	R	R	R	R	R	R	R
F	R	R	R	R	R	R	R	R	R	R
G	F	F	F	F	F	F	F	F	F	F
H	R	F	F	F	F	F	F	F	F	F
I	F	R	R	R	R	F	F	F	F	F

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FIGURE F5-5. Conviction Team Calls: Unlimited Data Form

	A_1					A_2					A_3				
Shape	T_1	T_2	T_3	T_4	T_5	T_1	T_2	T_3	T_4	T_5	T_1	T_2	T_3	T_4	T_5
A	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
B	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
C	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
D	R	F	R	R	R	R	F	R	R	R	R	R	R	R	R
E	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
F	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
G	F	R	R	R	F	F	F	R	F	F	F	F	R	F	F
H	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
I	F	R	R	R	R	F	R	R	R	R	F	R	R	R	R

	A_4					A_5				
Shape	T_1	T_2	T_3	T_4	T_5	T_1	T_2	T_3	T_4	T_5
A	R	R	R	R	R	R	R	R	R	R
B	R	R	R	R	F	R	R	R	R	R
C	R	R	R	F	F	F	F	F	F	F
D	R	R	R	R	R	R	R	R	R	R
E	R	R	R	R	R	R	R	R	R	R
F	R	R	R	R	R	R	R	R	R	R
G	F	F	F	F	F	F	F	F	F	F
H	F	F	F	F	F	F	F	F	F	F
I	R	R	R	R	R	F	F	F	F	F

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FIGURE F5-6. Posttest Conviction Exercise Calls

Team 1

Shape	Call (Could be)	Is	Reason for Fake Call
	Access A_1		
A (Mk 25)	R	R	
B (Mk 28)	R	R	
C (Mk 28 Fake)	R	F	Case too heavy - Paducah Data
D (Mk 30)	R	R	
E (Mk 39)	R	R	
F (Mk 56)	R	R	
G (57 BDU)	R	F	Case too heavy, Paducah Data
H (8-inch Shell)	R	R	
I (Hawk)	R	F*	Doubtful design
	Access A_2		
A	R	R	
B	R	R	
C	R	R	
D	R	R	
E	R	R	
F	R	R	
G	F	F	No components
H	R	R	
I	F*	F*	Doubtful design

Team 1

Access A_3

Shape	Call (Could be)	 Is	Reason for Fake Call
A	R	R	
B	R	R	
C	R	R	
D	R	R	
E	R	R	
F	R	R	
G	F	F	No components, bad radioactivity location
H	R	R	
I	F*	F*	Doubtful design, externals

Access A_4

Shape	Call (Could be)	 Is	Reason for Fake Call
A	R	R	
B	R	R	
C	R*	R*	
D	R	R	
E	R	R	
F	R	R	
G	F	F	Empty shape
H	F	F	No nuclear system
I	R	R	

Team 2

Access A_1

Shape	Call (Could be)	Call Is	Reason for Fake Call
A	R	R	
B	R	R	
C	R	R	
D	R	F*	Questionable configuration
E	R	R	
F	R	R	
G	R	R	
H	R	R	
I	R	R	

Access A_2

Shape	Call (Could be)	Call Is	Reason for Fake Call
A	R	R	
B	R	R	
C	R	R	
D	R	F*	Questionable configuration
E	R	R	
F	R	R	
G	R	F	Empty case
H	R	R	
I	R	R	

Team 2

Access A_3

Shape	Call (Could be)	Call Is	Reason for Fake Call
A	R	R	
B	R	R	
C	R	R	
D	R	R	
E	R	R	
F	R	R	
G	R	F	Empty case
H	R	R	
I	R	R	

Access A_4

A	R	R	
B	R	R	
C	R	R	
D	R	R	
E	R	R	
F	R	R	
G	F	F	Single Pu ball, no HE, components
H	F	F	Poor location and quality of fissile material, no assembly method.
I	R	R	

Team 3

Access A_1

Shape	Call		Reason for Fake Call
	(Could be)	Is	
A	R	R	
B	R	R	
C	R	R	
D	R	R	
E	R	R	
F	R	R	
G	R	R	
G	R	R	
H	R	R	
I	R	R	

Access A_2

A	R	R	
B	R	R	
C	R	R	
D	R	R	
E	R	R	
F	R	R	
G	R	R	
H	R	R	
I	R	R	

Team 3

Access A_3

Shape	Call (Could be)	(Is)	Reason for Fake Call
A	R	R	
B	R	R	
C	R	R	
D	R	R	
E	R	R	
F	R	R	
G	R	R	
H	R	R	
I	R	R	

Access A_4

A	R	R	
B	R	R	
C	R	R	
D	R	R	
E	R	R	
F	R	R	
G	F	F	Low fissile material, no HE, no components
H	F	F	No nuclear assembly
I	R	R	

Team 4

Access A_1

Shape	Call (Could be)	Call (Is)	Reason for Fake Cal
A	R	R	
B	R	R	
C	R	R	
D	R	R	
E	R	R	
F	R	R	
G	R	R	
H	R	R	
I	R	R	

Access A_2

A	R	R	
B	R	R	
C	R	R	
D	R	R	
E	R	R	
F	R	R	
G	F	F	Empty hatches, poor location of radioactivity
H	R	R	
I	R	R	

Team 4

Access A_3

Shape	Call		Reason for Fake Call
	(Could be)	(Is)	
A	R	R	
B	R	R	
C	R	R.	
D	R	R	
E	R	R	
F	R	R	
G	F	F	Empty hatches, poor location of radioactivity
H	R	R	
I	R	R	

Access A_4

A	R	R	
B	R	R	
C	R	F	No credible primary
D	R	R	
E	R	R	
F	R	R	
G	F	F	No internal components, HE, pit
H	F	F	No credible nuclear system
I	R	R	

Team 5

Access A_1

Shape	Call		Reason for Fake Call
	(Could be)	(Is)	
A	R	R	
B	R	R	
C	R	R	
D	R	R	
E	R	R	
F	R	R	
G	R	F	Inconsistant weight for Paducah residue
H	R	R	
I	R	R	

Access A_2

Shape	Call (Could be)	Call (Is)	Reason for Fake Call
A	R	R	
B	R	R	
C	R	R	
D	R	R	
E	R	R	
F	R	R	
G	F	F	Empty case, bad location of radioactivity
H	R	R	
I	R	R	

Team 5

Access A_3

	Call		
Shape	(Could be)	(Is)	Reason for Fake Call
A	R	R	
B	R	R	
C	R	R	
D	R	R	
E	R	R	
F	R	R	
G	F	F	Same reasons as at A_2, no HE
H	R	R	
I	R	R	

Access A_4

	Call		
Shape	(Could be)	(Is)	Reason for Fake Call
A	R	R	
B	F*	F*	Questionable configuration and weight.
C	F	F	No real primary or secondary. Differences between shapes B and C unclear.
D	R	R	
E	R	R	
F	R	R	
G	F	F	Same as A_2, A_3, no weapon components.
H	F	F	No assembly method, insufficient and improper materials.
I	R	R	

FIGURE F5-7. Conviction Test Individual Conviction Scores

This appendix presents data obtained during the post-test conviction exercises conducted at Sandia Corporation Sandia Laboratory and at Sandia Corporation Livermore Laboratory. Each inspector on each of five teams was required to indicate, on a scale of 0 to 100 percent, his conviction that each weapon shape under consideration "could be real" or indeed "is real," on the appropriate data forms used in the test. Each inspector initialled his conviction score responses so that a tabulation by skills could be made. For tabulation purposes, the use of "E" represents Electrical Engineering, "M" represents Mechanical Engineering, and "P" represents Physics.

FIGURE F5-7. Conviction Team 1 Scores (cont)

	Access														
	A_1			A_2			A_3			A_4			A_5		
Shape	E	M	P	E	M	P	E	M	P	E	M	P	E	M	P
Conviction Percentages - Could Be Real															
A	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
B	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
C	50	50	60	50	50	60	100	100	100	100	100	100	0	0	0
D	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
E	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
F	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
G	50	50	50	5	10	10	5	10	10	0	0	0	0	0	0
H	100	100	100	100	100	100	100	100	100	0	0	0	0	0	0
I	50	50	60	35	10	20	10	10	10	100	100	100	0	0	0
Conviction Percentages - Is Real															
A	75	90	75	80	90	90	90	95	95	95	100	100	100	100	100
B	100	90	100	95	90	90	95	95	95	95	100	100	100	100	100
C	10	10	50	5	10	50	75	90	90	95	95	95	0	0	0
D	80	90	100	90	95	100	95	95	100	95	100	100	100	100	100
E	90	95	100	95	95	100	95	95	100	95	100	100	100	100	100
F	90	95	100	95	95	100	95	95	100	95	100	100	100	100	100
G	10	25	25	0	10	0	0	0	0	0	0	0	0	0	0
H	90	90	90	95	95	95	95	95	100	0	0	0	0	0	0
I	20	20	20	10	10	0	5	0	0	95	90	90	0	0	0

FIGURE F5-7. Conviction Team 2 Scores (cont)

	Access														
	A_1			A_2			A_3			A_4			A_5		
Shape	E	M	P	E	M	P	E	M	P	E	M	P	E	M	P
Conviction Percentages - Could Be Real															
A	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
B	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
C	100	100	100	75	100	75	100	100	100	100	100	100	0	0	0
D	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
E	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
F	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
G	100	100	100	50	75	50	10	50	50	0	0	0	0	0	0
H	100	100	100	100	100	100	100	100	100	5	5	10	0	0	0
I	100	100	100	100	100	100	100	100	100	100	100	100	0	0	0
Conviction Percentages - Is Real															
A	50	50	50	60	75	75	75	75	75	90	95	85	95	100	95
B	70	75	80	75	75	75	75	75	75	80	95	80	95	100	95
C	15	25	25	25	50	50	50	50	50	70	75	75	0	0	0
D	20	5	25	25	5	25	75	75	75	85	95	85	95	100	95
E	60	50	50	75	75	85	50	50	65	80	95	85	95	100	95
F	90	75	90	95	75	90	95	85	95	80	90	80	95	100	95
G	80	75	85	10	25	20	5	25	10	0	0	0	0	0	0
H	75	75	75	80	75	80	80	75	85	0	0	0	0	0	0
I	40	50	50	75	75	75	80	75	80	90	95	85	0	0	0

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FIGURE F5-7. Conviction Team 3 Scores (cont)

	Access														
	A_1			A_2			A_3			A_4			A_5		
Shape	E	M	P	E	M	P	E	M	P	E	M	P	E	M	P
Conviction Percentages - Could Be Real															
A	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
B	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
C	100	100	100	100	100	100	100	100	100	100	100	100	0	0	0
D	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
E	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
F	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
G	100	100	100	60	60	60	70	60	100	10	0	0	0	0	0
H	100	100	100	100	100	100	100	100	100	80	20	50	0	0	0
I	100	100	100	100	100	100	100	100	100	60	60	90	0	0	0
Conviction Percentages - Is Real															
A	50	60	60	70	80	80	80	80	90	95	95	100	100	100	100
B	50	90	80	70	80	80	80	80	80	95	95	100	100	100	100
C	50	90	80	70	80	80	80	80	80	95	95	100	0	0	0
D	50	50	60	70	60	60	80	70	80	95	95	100	100	100	100
E	50	90	80	70	80	90	70	70	70	95	95	100	100	100	100
F	50	90	80	70	80	90	80	80	90	95	95	100	100	100	100
G	50	98	80	30	20	50	30	20	70	0	0	0	0	0	0
H	50	80	50	70	80	70	80	80	90	10	20	50	0	0	0
I	50	60	50	70	80	70	80	80	80	30	20	80	0	0	0

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FIGURE F5-7. Conviction Team 4 Scores (cont)

	Access														
	A_1			A_2			A_3			A_4			A_5		
Shape	E	M	P	E	M	P	E	M	P	E	M	P	E	M	P
	Conviction Percentages - Could Be Real														
A	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
B	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
C	100	100	100	100	100	100	100	100	100	100	100	40	0	0	0
D	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
E	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
F	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
G	100	100	100	0	0	10	0	0	0	0	0	0	0	0	0
H	100	100	100	100	100	100	100	100	100	0	0	0	0	0	0
I	100	100	100	100	100	100	100	100	100	100	100	100	0	0	0
	Conviction Percentages - Is Real														
A	50	60	80	70	70	80	70	70	80	90	90	90	99	99	99
B	50	40	70	70	60	80	70	60	80	90	95	90	99	99	99
C	50	30	70	60	60	60	70	60	80	20	10	30	0	0	0
D	50	60	80	70	60	80	70	60	80	90	95	90	99	99	99
E	50	60	80	70	80	80	70	80	80	80	80	80	99	99	99
F	50	60	80	70	75	80	70	70	80	90	90	90	99	99	95
G	50	60	80	0	0	0	0	0	0	0	0	0	0	0	0
H	50	60	80	60	80	80	70	80	80	0	0	0	0	0	0
I	50	60	80	60	70	70	70	70	70	90	95	90	0	0	0

FIGURE F5-7. Conviction Team 5 Scores (cont)

	Access														
	A_1			A_2			A_3			A_4			A_5		
Shape	E	M	P	E	M	P	E	M	P	E	M	P	E	M	P
Conviction Percentages - Could Be Real															
A	100	100	100	100	75	100	100	75	100	100	100	100	100	100	100
B	100	100	100	100	100	100	100	100	100	25	25	25	100	100	100
C	25	95	50	25	95	50	50	95	50	15	15	15	0	0	0
D	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
E	100	100	95	100	95	95	90	80	90	100	100	100	100	100	100
F	100	100	100	100	100	100	80	85	85	100	100	100	100	100	100
G	80	90	80	10	47	10	5	15	5	0	0	0	0	0	0
H	100	100	100	100	100	100	100	100	100	0	0	0	0	0	0
I	100	100	100	100	90	90	50	55	60	100	99	100	0	0	0
Conviction Percentages - Is Real															
A	70	70	75	70	70	75	70	70	75	90	95	90	95	96	91
B	70	75	75	70	75	75	70	75	75	5	5	10	90	95	91
C	50	55	51	49	60	51	50	60	60	0	0	0	0	0	0
D	70	80	60	80	80	70	90	85	80	90	95	90	95	99	95
E	70	30	70	80	30	70	60	25	51	90	50	70	99	95	90
F	70	80	75	80	80	75	70	60	75	95	86	90	99	99	95
G	25	50	25	0	10	5	0	10	0	0	0	0	0	0	0
H	70	65	75	70	75	75	78	85	80	0	0	0	0	0	0
I	70	65	75	65	35	75	50	32	50	80	80	70	0	0	0

APPENDIX F6

EFFECTIVENESS DATA

FIGURE F6-1. Proportion of Available Classified Information Acquired by LIMA Teams

	LIMA 1		LIMA 2		LIMA 3		LIMA 4	
	Captured	Available	Captured	Available	Captured	Available	Captured	Available
Pantex								
Walkthrough	5	5	4	5	5	5	5	5
Monitoring	2	4	35	58	1	4	37	58
Disposal	3	4	10	11	4	4	8	11
Total	(10)	(13)	(49)	(74)	(10)	(13)	(50)	(74)
Rocky Flats								
Walkthrough	0	4	0	4	0	4	0	4
Disposal	0	1	0	1	0	1	0	1
Assay	1	1	1	1	1	1	1	1
Total	(1)	(6)	(1)	(6)	(1)	(6)	(1)	(6)
Paducah								
Walkthrough	0	0	0	0	0	0	0	0
Monitoring	3	7	10	16	2	7	13	16
Disposal	0	0	0	0	0	0	0	0
Total	(3)	(7)	(10)	(16)	(2)	(7)	(13)	(16)
Oak Ridge								
Walkthrough	5	12	3	13	3	12	3	13
Disposal	0	0	0	0	0	0	0	0
Assay	3	3	3	3	3	3	3	3
Total	(8)	(15)	(6)	(16)	(6)	(15)	(6)	(16)
Team Total	(23)	(41)	(66)	(112)	(19)	(41)	(70)	(112)

FIGURE F6-2. Proportion of Available Classified Information Acquired by MIKE Teams

	MIKE 1		MIKE 2		MIKE 3		MIKE 4	
	Captured	Available	Captured	Available	Captured	Available	Captured	Available
Pantex								
Walkthrough	2	5	4	5	4	5	5	5
Monitoring	1	4	27	58	2	4	42	58
Disposal	1	4	9	11	2	4	9	11
Total	(4)	(13)	(40)	(74)	(8)	(13)	(56)	(74)
Rocky Flats								
Walkthrough	1	4	1	4	2	4	3	4
Disposal	0	1	0	1	0	1	0	1
Assay	1	1	1	1	1	1	1	1
Total	(2)	(6)	(2)	(6)	(3)	(6)	(4)	(6)
Paducah								
Walkthrough	0	0	0	0	0	0	0	0
Monitoring	1	7	9	16	4	7	10	16
Disposal	0	0	0	0	0	0	0	0
Total	(1)	(7)	(9)	(16)	(4)	(7)	(10)	(16)
Oak Ridge								
Walkthrough	5	12	5	13	8	12	6	13
Disposal	0	0	0	0	0	0	0	0
Assay	3	3	3	3	3	3	3	3
Total	(8)	(15)	(8)	(16)	(11)	(15)	(9)	(16)
Team Total	(15)	(41)	(59)	(112)	(26)	(41)	(79)	(112)

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FIGURE F6-5. LIMA Weapon Shape Monitoring Times

		A1				A2				A3		A4	
Device No.	Type	L1	L2	L3	L4	L1	L2	L3	L4	L2	L4	L2	L4
1	28	45	18	49	10		19		12	48			
2	56	25	25	40	20		10		11	35	20		
3	28S	60	19	23	25		32		15	25	55		
4	57	35	30	34	22		15		25	25	145		
5	25	55	35	42	30		9		14	27	75		
6	39	37	34	9	10		48		15	25	25		
7	30	38	45	57	25		8		14	25	62		
8	28	80	18	10	17		10		19	40	13		
9 9	39	45	18	47	48		17		20	29	96		
10	56	25	7	12	7		10		12	36	64		
11	8 Inch	25	7	23	5		5		14	31	64		
12	28S	30	10	22	13		4		32	24	80		
13	Hawk	20	25	54	15		5		20	21	23		
14	57	15	15	19	27		6		16	18	24		
15	25	25	15	16	15		7		12	20	49		
16	8 Inch	15	20	12	15		2		9	28	69		
17	Hawk	40	12	14	15		3		5	22	52		
18	30	40	8	24	15		3		20	20	20		
Total		645	351	507	334		213		290	499	946		
Average time per shape		35.83		28.17						27.72	52.56		
1	39	15	20	10	11	45	10	15	17	35	14	65	25
2	30	24	10	20	10	25	5	7	7	12	15	9	15
3	25	25	16	16	12	10	6	10	7	12	9	6	27
4	28	15	19	40	14	20	13	15	16	25	20	75	34
5	57	24	14	10	7	20	13	5	10	15	12	7	5
6	28S	25	11	12	19	40	13	32	17	30	21	45	19
7	57	12	7	30	18	40	20	20	13	13	22	7	17
8	39	30	7	60	21	20	13	55	21	25	35	28	45
9	56	19	15	15	10	25	13	13	10	30	32	34	29
10	Hawk	30	10	42	20	20	6	3	7	11	11	26	22
11	28S	25	14	24	14	20	9	19	14	25	19	20	7
12	8 Inch	10	10	16	6	10	8	6	4	11	30	18	26
13	56	20	6	10	5	15	8	5	13	33	30	16	11
14	8 Inch	10	10	7	9	10	6	25	5	19	16	5	20
15	Hawk	15	10	8	15	13	3	15	5	16	15	8	29
16	25	15	7	10	9	15	6	6	6	19	18	11	8
17	30	20	11	25	12	20	5	8	12	9	12	19	12
18	28	15	13	18	11	30	20	23	22	33	31	30	10
Total		349	210	373	223	395	177	282	206	373	362	429	361
Average time per shape						21.94		15.67				23.82	20.05

FIGURE F6-6. MIKE Weapon Shape Monitoring Times

			A$_1$				A$_2$				A$_3$		A$_4$	
	Device No.	Type	M$_1$	M$_2$	M$_3$	M$_4$	M$_1$	M$_2$	M$_3$	M$_4$	M$_2$	M$_4$	M$_2$	M$_4$
First Batch	1	28	20	22	8	11		24		28	50	40		
	2	56	25	13	21	28		28		13	40	40		
	3	28S	15	31	33	55		22		33	15	45		
	4	57	28	27	32	17		30		40	47	20		
	5	25	25	27	36	21		19		39	30	20		
	6	39	40	32	11	17		30		15	55	18		
	7	30	30	34	23	20		23		11	33	25		
	8	28	40	12	8	14		35		16	27	50		
	9	39	70	18	37	32		60		27	55	20		
	10	56	11	10	14	16		15		20	25	28		
	11	8 inch	13	9	6	12		12		14	22	27		
	12	28S	37	15	9	5		10		9	25	28		
	13	Hawk	10	10	11	11		15		27	20	15		
	14	57	10	18	11	13		10		15	28	11		
	15	25	9	17	12	5		15		8	13	16		
	16	8 inch	10	12	23	7		15		15	17	30		
	17	Hawk	15	25	22	4		23		23	28	26		
	18	30	20	17	9	5		17		11	19	24		
	Total		428	349	326	287		403		364	549	483		
	Average time per shape		23.78		16.11						30.50	26.83		
Second Batch	1	39	23	20	10	11	25	17	25	22	30	20	23	90
	2	30	9	9	17	10	13	15	11	10	19	13	34	5
	3	25	13	8	14	11	13	10	12	12	12	15	25	60
	4	28	28	17	25	9	14	22	22	25	25	24	63	68
	5	57	9	13	5	9	20	18	13	13	18	12	5	5
	6	28S	9	10	6	16	18	27	16	17	20	19	28	30
	7	57	10	31	10	10	30	16	14	18	35	11	2	5
	8	39	5	8	11	20	20	16	19	20	15	55	43	50
	9	56	8	13	10	24	15	19	13	12	23	20	48	55
	10	Hawk	10	7	12	19	17	26	10	10	10	12	32	40
	11	28S	7	12	7	5	33	27	8	15	16	18	20	15
	12	8 inch	12	6	4	9	15	19	12	13	13	20	5	15
	13	56	10	9	12	12	17	16	10	12	20	25	10	20
	14	8 inch	8	3	19	12	16	25	11	15	17	22	4	10
	15	Hawk	5	17	15	15	10	10	12	15	10	18	9	10
	16	25	7	6	12	8	9	8	6	10	10	19	2	10
	17	30	5	12	8	7	13	10	9	15	9	16	13	5
	18	28	8	17	6	10	15	32	14	17	22	40	33	17
	Total		186	218	202	217	313	333	237	271	324	388	399	460
	Average time per shape						17.39		13.17				22.10	25.56

FIGURE F6-7. Oak Ridge Assay-Operation Elapsed Times for Nine Samples

FT-34 main test teams	Chemical analysis	Mass spectroscopy	Sample preparation	Emission spectroscopy	Total	Per sample average
LIMA 2	410	505	754	325	1994	222
LIMA 4	230	335	340	420	1325	148
MIKE 2	265	663	360	150	1438	159
MIKE 4	175	360	485	120	1140	127
Average time per team	270	466	465	254	1474	
Average time per sample	30	52	54	28		164
Special assay teams						
LIMB b	267	501	180	285	1233	137
LIMA d	230	507	315	190	1242	138
MIKE b	270	490	375	315	1450	161
MIKE d	330	370	405	505	1610	179
Average time per team	274	467	319	324	1384	
Average time per sample	30.4	51.9	35.3	36		153.6
Contractor assay team	420	455	300	417	1592	
Average time per sample	47	51	33	46		177

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Figure F6-18 Main Test Assay Evasion Detection - Rocky Flats

			Evasion Schedule			Evasion Calls Made		
Teams	Batch	Sample identification	Chemical analysis	Emission spectroscopy	Mass spectroscopy	Chemical analysis	Emission spectroscopy	Mass spectroscopy
All LIMA Teams	1	C-1-A through D						
	1	C-3-A through D						
	2	C-2-A through D	Evaded	Evaded	Evaded		L4 Sample D	
	2	C-4-A through D	Evaded	Evaded	Evaded		L1 Sample A	
							L4 Sample D	
All MIKE Teams	3	3-1 through 4	Evaded	Evaded	Evaded			
	3	3-5 through 8	Evaded	Evaded	Evaded			
	4	4-1 through 4						
	4	4-5 through 8						

Comments: LIMA 1 called evasion correctly in the emission spectrography area. The team added estimated impurities to values obtained in chemical analysis and computed more than 100 percent of sample, thereby detecting the added impurities of the evasion attempt.

LIMA 4 called evasion correctly in emission spectroscopy. An alert inspector observed sleight-of-hand switching of carrier vials inside a glove box. This applied to two samples and the team was credited with two valid evasion calls.

FIGURE F6-19. Main Test Assay Evasion Detection - Oak Ridge

		Evasion Schedule			Evasion Calls Made		
All teams	Sample No.	Chemical analysis	Emission spectroscopy	Isotopic analysis	Chemical analysis	Emission spectroscopy	Isotopic analysis
LIMA Batch 1 MIKE Batch 3	1			Evaded		Evasion called	
	2			Evaded		Evasion called	
	3					Evasion called	
	4					Evasion called	
LIMA Batch 2 MIKE Batch 4	5			Evaded		Evasion called	
	6			Evaded		Evasion called	
	7					Evasion called	
	8					Evasion called	
	9	Standard Sample				Evasion called	

Comments: Evasion was used only in the mass spectrograph for samples 1, 2, 5, and 6. MIKE 3 called evasion for all samples, including the guaranteed standard, for emission spectroscopy. These calls were made because of minor variations in machine settings, compared to procedural callouts, and because of differences in impurity content between emission spectrograph and chemical analysis values. Reason was incorrect in both cases.

FIGURE F6-20. Special Assay Test Evasion - Oak Ridge

Sample Number		Chemical analysis	Emission spectroscopy	Mass spectroscopy	Chemical analysis	Emission spectroscopy	Mass spectroscopy
LIMA	MIKE						
3	1	Evaded	Evaded	Evaded		M_c - OX	M_a - OX
2	2	Evaded	Evaded			M_c - OX	M_a - X
4	3			Evaded[a]		M_c - X	M_a - O
1	4					M_c - X	M_a - X
6	5	Evaded	Evaded		L_a - (?)	M_c - OX	M_a - X, M_d - X
7	6	Evaded	Evaded		L_a - (?)	M_c - OX	M_a - X
5	7					M_c - X	M_a - (?) , X
8	8	Evaded	Evaded		L_a - (?)	M_c - OX	M_a - X
9	9	Standard Sample				M_c - X	M_a - X, M_d - X
		Evasion Schedule				Evasion Calls Made	

[a] Evasion was not attempted here for team L_b.

Legend:
O = Valid call; correct reason
X = Incorrect call
OX = Correct call; incorrect reason
(?) = Suspicion call, correct reason (assumed correct)