FINAL REPORT

FIELD TEST FT-34

ANNEX B

INSPECTORATE AND TRAINING

JANUARY 1969

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SYNOPSIS

This annex discusses the organization and training of the inspection force employed in the FT-34 field test. The FT-34 field test was made up of three distinct parts; the FT-34 main test, the FT-34 special assay test, and the FT-34 contractor assay test. The inspection force for the FT-34 main test and the FT-34 special assay test was composed of Army, Navy, and Air Force officers. Team member assignments were made on the basis of personnel questionnaires and an interview with each inspector candidate. The FT-34 contractor assay team was composed of three civilian scientists. Summaries of pertinent background information for each inspector are included in this annex.

The training program for the inspection force consisted of formal classroom lectures given at the test headquarters and training in the use of inspection equipment given at each of the test sites.

In general, inspection personnel used in FT-34 met the selection criteria. However, the background and experience in nuclear weapons research and development possessed by FT-34 inspectors was less than desired. The source of inspection personnel was limited primarily to the military services because of cost and availability considerations. Inspection teams performed their tasks in a satisfactory manner within the framework of the FT-34 test. This level of performance was possible because of an even distribution of individuals with specialized backgrounds within teams and among teams. The overall training program provided essential information that enabled inspectors to perform assigned tasks in a satisfactory manner. However, the training program could have been made more efficient by conducting initial training for team members in specialized functions such as weapons inspection and laboratory analysis. This training should have been followed by team training in a "dry run" situation.

It is recommended that future inspectors be selected from the entire governmental laboratory complex and be organized by specialty according to the type of inspection to be performed: weapons inspection and fissile material assay inspection. An inspection team for an FT-34 type field test would consist of the following types of personnel:

1. Weapons Inspectors.

a. Nuclear Physicist. Experienced in radiation monitoring and interpretation of X-ray plates.

b. Aerodynamicist. Experienced in design and development of nuclear weapons delivery configurations.

c. Electrical or Mechanical Engineer. Experienced in design and development of electromechanical components used in arming, safing, fuzing and firing of nuclear weapons systems.

d. Nuclear Physicist. Experienced in design and development of nuclear and thermonuclear components including high explosive design.

e. Classification Specialist. Experienced in determining importance of nuclear weapon design information to a foreign country.

2. Assay Inspectors.

a. Chemist or Physicist. Experienced in chemical analysis of uranium and plutonium.

b. Chemist or Physicist. Experienced in mass spectroscopy.

c. Chemist or Physicist. Experienced in emission spectroscopy.

An inspection team for a potential treaty situation would have essentially the same composition as that recommended for a future FT-34 type test. If sampling only were required during the assay inspection then one chemist and one metallurgist could be substituted for the three assay inspectors. Weapons inspectors would include one person with a knowledge of nuclear weapons design and development information peculiar to the foreign country of interest instead of the classification specialist as recommended for a future FT-34 type test.

The inspectors selected should receive comprehensive training in the inspection procedures to be followed using weapon types and materials approximating as closely as possible, those expected to be encountered. Training should be given first by specialty and then by team in a "dry run" exercise.

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REFERENCES

The following reference materials are from the technical and operations plan annexes prepared for the conduct of FT-34.

1. Annex A. Test Design. 19 May 1967, Technical Plan Secret, Restricted Data

2. Annex D. Inspection Manual. 7 June 1967, Technical Plan. Secret, Restricted Data

3. Annex E. Equipment. 8 June 1967, Technical Plan Official Use Only

4. Annex I. Training. 6 June 1967, Operations Plan. Official Use only

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I. INTRODUCTION

A. FT-34 TEST

1. FT-34 Main Test. The FT-34 main test involved the monitoring of nuclear weapon shapes, inspection of residue material derived from weapon disassembly, assay of fissile material, and inspection of disassembly and laboratory areas pertaining to weapons and fissile material. Inspection operations for the main test were conducted at four test sites: the AEC production plants located near Amarillo, Texas (Pantex); near Golden, Colorado (Rocky Flats); near Paducah, Kentucky (Paducah plant); and at Oak Ridge, Tennessee (Y-12 plant). The main test included all operations of the demonstrated destruction of nuclear weapons described in reference 1.

Two inspection groups, designated LIMA and MIKE, participated in the main test. The sources of inspection personnel, the selection of inspectors for different inspection teams and access, and the training afforded all inspectors are discussed in detail in later chapters of this annex.

2. FT-34 Special Assay Test. In addition to the FT-34 main test inspection operations, a special test was conducted at the Y-12 plant to permit evaluation of the detectability of evasion techniques used during the assay of enriched uranium. The special assay test was conducted at the Y-12 plant laboratory at the conclusion of main test inspection activities, and the inspectors used were selected from those who participated in the main test activities. Special assay tests were conducted by both the LIMA and MIKE inspection groups.

3. FT-34 Contractor Assay Test. A third portion of the FT-34 field test operations was an independent test of evasion methods and techniques used in uranium assay. This additional special assay evasion test was conducted at the Y-12 plant laboratory after LIMA and MIKE inspection operations had been completed. Inspection personnel utilized for this assay test were obtained from the Oak Ridge National

Laboratory and the Oak Ridge Gaseous Diffusion Plant (contractors to the U.S. Atomic Energy Commission); they were selected on the basis of skills and specialties required for the various phases of assay.

B. INSPECTION TEAMS

1. Main Test Inspection Teams. The Department of Defense (DOD) provided military officers on TDY[1] status to perform inspection tasks for FT-34. Each inspection group, LIMA and MIKE, was comprised of 13 inspection personnel. The senior officer in each group was designated as chief inspector, while the remaining personnel were assigned to individual inspection teams containing either two or four members. One two-man team and one four-man team from each group were assigned high access levels for inspection and the remaining two-man team and four-man team from each group were assigned low access levels throughout the test. Team leaders were senior (ranking) officers from each inspection group. Inspection teams were required to monitor weapon shapes presented for destruction, residue from the disassembly of the weapon shapes, and disassembly areas at each plant. They also witnessed and performed assay operations on plutonium and enriched uranium derived from the weapon shapes presented. The inspectors were required to make calls of "real" or "fake" for each weapon, to note any classified information revealed throughout the test, and to detect evasion throughout the test.

2. Special Assay Inspection Teams. The inspection teams for the special assay test were selected from the inspectors used during the main test. Four two-man teams from each inspection group were selected to perform the special assay test. Two of these teams were permitted to perform all functions used in the assay (chemical analyses, mass spectroscopy, and emission spectroscopy), while the other two teams were

[1]Temporary duty.

only permitted to observe the functions performed by Y-12 laboratory personnel. Within each group of performers and observers, one team was selected on the basis of previous background in chemistry and the other team selected on the basis of little or no chemistry background.

The special assay test did not use materials which were obtained from the weapons destroyed in the FT-34 main test. Instead, special samples were made up of enriched uranium for use in the special assay test. Evasion was practiced in each area of assay. Inspectors either observed the assay being performed or performed the procedures themselves according to access afforded by test design. Inspectors were required to try to detect evasion during the special assay test and to note when evasion was detected and how the evasion was performed.

3. Contractor Assay Inspection Team. The contractor assay inspection team was composed of three scientists from the Oak Ridge scientific community (Oak Ridge National Laboratory and Oak Ridge Gaseous Diffusion Plant). These men were selected on the basis of competence in the particular skills required for the assay test. This team performed all phases of uranium assay under the same ground rules that applied to the special inspectors. In addition to the detection of evasion during the contractor assay test, team members were asked to comment on the evasion methods used, means of detecting evasion, and other potential evasion methods which could be used in assay.

C. TRAINING

1. Main Test Training. A formal training program was conducted for training inspection personnel in all aspects of the field test. The training program was conducted in two parts: training at test headquarters and on-site training at the appropriate test site locations. Both types of training are discussed in detail later in this annex.

2. Special Assay Training. No specific training was given to the FT-34 military inspectors for the special assay

test. Training given during the general training sessions for the main test covered the material necessary for the special assay test. Members of the special assay teams also had the benefit of previous participation in the main test assay using identical equipment and analytical procedures.

3. Contractor Assay Training. The members of the contractor assay team were considered to be fully qualified by background and experience to serve as inspectors without further training. Orientation of these inspectors was accomplished through oral briefings and written instructions.

II. FT-34 INSPECTORATE

A. FT-34 MAIN TEST

1. Inspection Team Structure. Two groups of inspectors, designated LIMA and MIKE, were used in FT-34. Each group was composed of four independent teams: two two-man teams and two four-man teams. One two-man team and one four-man team from each group were assigned low access levels while the remaining teams were assigned high access levels. A chief inspector was assigned to each group. The schedule of operations carried out by these teams is shown in figure B-1.

2. Source of Inspection Personnel. The source of inspection personnel for the FT-34 main test was the Department of Defense. All military inspector personnel were assigned to FT-34 on temporary duty (TDY) status for a period of 4 months.

3. Inspector Background Desired. The military services were requested to provide a total of 26 inspectors possessing qualifications as listed on the personnel requisition form included in appendix B1.

It was desired that all inspectors have a nuclear weapon background. Eight inspection team leaders were requested, four Navy and four Air Force, who possessed backgrounds in nuclear weapons research and development, maintenance or employment. Eight inspection team members were requested from the Army who had background in nuclear weapons research and development or maintenance. Ten inspection team members were requested, five Navy and five Air Force, who had backgrounds in nuclear weapons research and development and, in addition, were capable of verifying active material analysis and assay.

4. Determination of Military Inspector Backgrounds.

a. Questionnaires. A questionnaire was sent to each person nominated by the military services in order to secure data for use in making team assignments and for planning the training program. Of the persons nominated, two

LOCATION	Week of 19 Jun	Week of 26 Jun	Week of 3 Jul	Week of 10 Jul	Week of 17 Jul	Week of 24 Jul	Week of 31 Jul	Week of 7 Aug	Week of 14 Aug
Pantex			LIMA Teams	LIMA Teams	LIMA Teams		MIKE Teams	MIKE Teams	MIKE Teams
Rocky Flats						LIMA Teams	LIMA Teams		
Paducah	LIMA Teams R C&T	LIMA Teams C&T			MIKE Teams R C&T	MIKE Teams O&T		LIMA Teams	LIMA Teams
Oak Ridge									

LOCATION	Week of 21 Aug	Week of 28 Aug	Week of 4 Sep	Week of 11 Sep	Week of 18 Sep	Week of 25 Sep	Week of 2 Oct	Week of 9 Oct	Week of 16 Oct
Pantex									
Rocky Flats	MIKE Teams	MIKE Teams							
Paducah			MIKE Teams / LIMA Inspectors DB	MIKE Teams / LIMA Inspectors DB			MIKE Inspectors DB	MIKE Inspectors DB	
Oak Ridge	LIMA Teams	LIMA Teams	LIMA Special Assay *		MIKE Teams	MIKE Teams	MIKE Special Assay *		Contr. Special Assay *

R = Teams Report for Duty.
O&T = Orientation and Training.
DB = Debriefing and Report Writing.
* = Part of Special Assay Tests.

FIGURE B-1. Schedule of FT-34 Field Operations 1967 were rejected as having unsuitable backgrounds for participation in FT-34. One of these men was replaced by the parent service. The other was replaced by a person originally scheduled for test control duties but who was also well qualified to serve as an inspector. In addition, a number of substitutions were initiated by the military services. These substitutions continued until all inspectors had actually reported for duty with FT-34. Figure B-2, Summary of Questionnaire Data, shows pertinent information obtained from the questionnaires sent to each candidate. A more detailed presentation of questionnaire data is included in appendix B2.

b. Interviews. In addition to the questionnaires a brief personal interview with each inspector candidate was conducted at FT-34 test headquarters. These interviews were conducted by the Test Director, the Technical Director, and the Sandia Corporation Project Engineer or his representative. The principal purpose of these interviews was to acquire information to aid in making team assignments.

5. Inspector Backgrounds Obtained. An examination of figure B-2 shows that inspectors supplied by the Navy were predominately skilled in loading and delivery of nuclear weapons. The majority of the inspectors supplied by the Air Force were experienced in the areas of nuclear weapon effects and debris analysis. Army inspectors were generally more experienced in nuclear weapons maintenance. There was a definite lack of inspectors with experience in the design and development of nuclear weapons. The experience most closely related was that in weapon effects or debris analysis possessed by seven of the 10 Air Force inspectors. It should also be noted that background requirements for 10 inspection team members as shown on the personnel requisition form in appendix B1 included nuclear weapons research and development and capability for verifying active material analysis. Only four inspectors were supplied who met both of these requirements, AF-1, AF-6, AF-8, AF-10. This assertion must be based on a broad definition of weapons research and development to encompass work in weapons effects.

FIGURE B-2. Summary of Questionnaire Data

Designator	Rank	Age	Time in Service (years)	Nuclear Weapons Training	Academic Background	Nuclear Weapons Experience	FT-34 Weapons Familiarity
NAVY							
N-1	Ensign	25	0	None	B. S. Chemistry	None	None
N-2	Ensign	26	1	Nuclear weapons officer course	A. B. Chemistry	Nuclear weapons assembly officer	Mk 28 Mk 57 Mk 30
N-3	Lt. Cmdr.	32	10	Nuclear weapons delivery training	B. S. Agriculture	Navy delivery pilot	Mk 57
N-4	Lt.	27	4	Loading of weapons on Military A/C	B. S. Physics (Math)	Practice loading exercises	Mk 28
N-5	Lt. (j. g.)	26	4	ASW course, delivery of nuclear weapons	B. S. Metallurgy	Nuclear weapons delivery crewman	Mk 57
N-6	Lt. Cmdr.	33	10	ASW nuclear weapons course, nuclear weapons delivery	B. S. Speech	Nuclear weapons delivery pilot	Mk 57
N-7	Cmdr.	52	26	Nuclear weapons supervisor	B. S. Agriculture Engineering	Delivery pilot, nuclear weapons stockpile operations officer, nuclear weapons officer	Most U. S. nuclear weapons in stockpile
N-8	Cmdr.	47	30	Orientation, handling loading	No degree. Navy Line Officer School	Participated in nuclear weapons tests, Special Weapons Officer	Nuclear Weapons used by the Navy in the Pacific

FIGURE B-2 (Cont)

Designator	Rank	Age	Time in Service (years)	Nuclear Weapons Training	Academic Background	Nuclear Weapons Experience	FT-34 Weapons Familiarity
AIR FORCE							
AF-1	Major	36	14	None	B. S. Aero Engineering M. S. Physics	Weapons effects and debris analyst	None
AF-2	Major	37	16	None - reactor training only	B. S. Nuclear Engineering	Target information only	Mk 28
AF-3	Civilian GS-12, retired AF Major	57	20	Radiochemistry work only	B. S. Chemistry	Debris analyst	None
AF-4	Major	42	18	Electrical and mechanical maintenance of nuclear weapons, nuclear engineering	B. S. Geological Engineering B. S. Electrical Engineering M. S. Nuclear Engineering	Field maintenance of nuclear weapons, Tac. MS/S Nuclear Officer	8-inch shell Mk 39 Mk 28
AF-5	Capt.	39	13	Weapons orientation courses	B. S. Chemistry - M. S. Physical Chemistry	Debris analyst	None
AF-6	1st Lt.	27	1	None	B. S. Chemical Engineering M. S. Chemical Engineering M. S. Nuclear Engineering	Weapons effects studies only	None
AF-7	Major	46	24	Nuclear research officers courses	Associated Arts Chemistry A. B. Biochemistry	Nuclear research; no weapons experience	None
AF-8	Capt.	26	5	None	B. S. Nuclear Engineering M. S. Nuclear Engineering	Weapons effects work only	None

FIGURE B-2 (Cont)

Designator	Rank	Age	Time in Service (years)	Nuclear Weapons Training	Academic Background	Nuclear Weapons Experience	FT-34 Weapons Familiarity
AIR FORCE (cont'd.)							
AF-9	Major	42	18	Special weapons guided missile orientation	B. S. Geophysics	Air Defense Wing Officer, weapons studies	Mk 25 Mk 28 Mk 57
AF-10	Capt.	37	12	None (WOA course prior to FT-34)	B. S. Metallurgical Engineering M. S. Metallurgy	Research: weapons effects work only	None
ARMY							
A-1	Major	37	15	Extensive training in nuclear weapons and guided missile maintenance	Social Studies	Extensive experience in U. S. and overseas in nuclear weapons maintenance. Knows all U. S. Army nuclear weapons	8-inch shell
A-2	Major	37	15	Nuclear weapons disposal courses (EOD)	B. S. Education; Science (Math)	No field experience; classroom work only. Knew many U. S. nuclear weapons	8-inch shell Mk 30 plus some knowledge of other systems
A-3	Major	32	10	Nuclear weapons employment projectiles, ADM's chemistry school	B. S. Mathematics B. S. Physics	Security for nuclear weapons delivery and supply units; nuclear biological chemical weapons	8-inch shell Mk 30

FIGURE B-2 (Cont)

Designator	Rank	Age	Time in Service (years)	Nuclear Weapons Training	Academic Background	Nuclear Weapons Experience	FT-34 Weapons Familiarity
ARMY (cont'd) A-4	Major	39	19	Extensive training in Army and other Service nuclear weapons	High school	Extensive experience in field maintenance and instructions in nuclear weapons	Mk 30 Hawk 8-inch shell
A-5	Major	42	18	Employment and assembly c courses	High school	Extensive field service in nuclear weapons units in U. S. and overseas	8-inch shell Mk 30
A-6	Major	44	18	Projectile assembly, nuclear weapons officers courses, specific Army weapons training courses	B. S. Industrial Arts	Field experience in U. S. and overseas in weapons training, ordnance units. Nuclear Weapons Officer, Hq. 6th Army	8-inch shell Mk 30 Hawk
A-7	Major	37	16	Electronics and nuclear weapons courses, accident appraisal	B. S. Business Administration	Extensive field experience in Army Ordnance units in U. S. and overseas	8-inch shell Mk 30

FIGURE B-2 (Cont)

Designator	Rank	Age	Time in Service (years)	Nuclear Weapons Training	Academic Background	Nuclear Weapons Experience	FT-34 Weapons Familiarity
ARMY (cont'd)							
A-8	Capt.	29	6	EOD School, Radiation Safety, Prefix 5	B. S. General Chemistry	Nuclear weapons controller, field exercises, EOD covered "all nuclear weapons made in the U. S."	Some familiarity with all shapes

6. Team Selection Rules. Inspectors were assigned to teams according to the following rules:

a. The ranking officer from each group was designated as chief inspector.

b. The next four officers in each group in order of seniority were assigned as team leaders.

c. An inspector qualified to serve as a laboratory specialist was assigned to each team.

d. The remaining team members were assigned on a random basis. However, consideration was given to an equitable distribution of inspectors with analytical and weapons backgrounds among the teams.

7. Inspection Team Composition. Operations conducted by the LIMA teams began about 1 month before operations conducted by the MIKE teams. For this reason inspectors reported to the test headquarters in two groups of 13 men each. The inspectors available for assignment to the LIMA and MIKE teams are listed below. Figures B-3 and B-4 identify team assignments.

a. LIMA Teams. (Refer to figure B-2):

Navy:	N-1, N-2, N-3, N-7
Air Force:	AF-1, AF-2, AF-3, AF-4, AF-5
Army:	A-1, A-2, A-3, A-4

b. MIKE Teams. (Refer to figure B-2):

Navy:	N-4, N-5, N-6, N-8
Air Force:	AF-6, AF-7, AF-8, AF-9, AF-10
Army:	A-5, A-6, A-7, A-8

8. Inspector Responsibilities.

a. Chief Inspectors. Chief inspectors acted primarily as commanders of LIMA and MIKE inspection groups. They were

FIGURE B-3. LIMA Team Assignments

LIMA CHIEF INSPECTOR: N-7

Two-man, low access; LIMA-1	Team Leader: A-1 Team Member: N-1
Two-man, high access; LIMA-2	Team Leader: AF-1 Team Member: N-2
Four-man, low access; LIMA-3	Team Leader: A-2 Team Member: AF-2 Team Member: A-3 Team Member: AF-3
Four-man, high access; LIMA-4	Team Leader: AF-4 Team Member: AF-5 Team Member: A-4 Team Member: N-3

FIGURE B-4. MIKE Team Assignments

MIKE CHIEF INSPECTOR: N-8

Two-man, low access; MIKE-1	Team Leader: A-5 Team Member: AF-6
Two-man, high access; MIKE-2	Team Leader: AF-7 Team Member: A-6
Four-man, low access; MIKE-3	Team Leader: A-7 Team Member: AF-8 Team Member: A-8 Team Member: N-4
Four-man, high access; MIKE-4	Team Leader: AF-9 Team Member: N-5 Team Member: AF-10 Team Member: N-6

responsible for maintaining liaison between their teams, test site personnel, and test headquarters. The chief inspectors were responsible for seeing that inspection teams were at the test site at appropriate times and were prepared for inspection activities. They also handled military matters such as performance ratings, requests for leave, payment, and personal problems for all team members. In addition, chief inspectors were to serve as regular team inspectors in the event that a regular inspector had to leave the field test. In this connection, the chief inspectors were afforded low access level information so that if the contingency were exercised and the chief inspector had to inspect at low level, information gained at a high access level would not compromise inspection procedures and conclusions at the low level.

b. Team Leaders. Team leaders were responsible for assembling their teams at the proper times and locations, securing inspection equipment (when necessary), and assigning team members to inspection jobs such as measuring, recording data, and observing. Team leaders were responsible for providing legible records of inspection and comments and for assembling data packages for submission to test control. Because each team consisted of an even number of members, team leaders were responsible for making a final determination or interpretation of inspection calls (particularly evasion) for the team as a whole when opinions were evenly divided. Conflicting opinions, when they occurred, were recorded by team leaders.

c. Team Members. The responsibilities of inspection team members included the gathering and recording of inspection data as specified in their inspection manual. Accurate, legible reporting was required. Comments on inspection data and processes were also within the purview of all team members. Specific team members were assigned the tasks of transferring classified documents between test sites and also of transporting small items of inspection equipment (cameras, measuring devices, etc.) between test sites. All team members were responsible for reading the manuals governing inspection equipment (and processes) and test procedures.

B. FT-34 SPECIAL ASSAY TEST

1. Purpose and Source of Inspectors. In addition to the main inspection operations for FT-34, a special assay test was conducted to obtain additional data concerning the effects of evasion techniques used during the laboratory analysis of fissile materials. The materials analyzed during the special test were not materials derived from weapons during the FT-34 main test. The special assay test was conducted at Oak Ridge immediately after each main test assay inspection phase had been completed. Selected inspectors from the LIMA and the MIKE groups performed the special assay test operations.

2. Requirements. Requirements for the special assay test called for four two-man teams from each inspection group (LIMA and MIKE) to be formed as follows:

Team a: Chemical background: Observers

Team b: Chemical background: Performers

Team c: Nonchemical background: Observers

Team d: Nonchemical background: Performers

For purposes of the special assay test, it was desired that each team member understand and be capable of carrying out the laboratory procedures necessary in the analysis of uranium. It was further desired that members of teams a and b be skilled in the performance of these procedures as opposed to members of teams c and d who were considered to be unskilled.

Members of teams a and c were not permitted to perform any of the assay work but could only observe the work done by Oak Ridge Laboratory personnel. Members of teams b and d performed all analytical work themselves, although under the supervision of laboratory personnel.

3. Team Selection. The selection of candidates for the special assay teams involved (1) the screening of individual background information from questionnaires and interviews, (2) performa nce during the main test, and (3) the availability of individual inspector personnel for the special assay tests. Team assignments are shown in figures B-5 and B-6. Refer to figure B-2 for information on inspector designators.

4. Team Compatibility with Test Requirements. Figures B-5 and B-6 indicate that the requirements for team composition for the special assay test were met with two exceptions. In one instance, an inspector, AF-10, was not considered skilled in the performance of laboratory procedures. In another case an inspector, A-7, did not have an analytical background of any sort.

C. FT-34 CONTRACTOR ASSAY TEST

1. Purpose. As both a control measure and as a method to obtain extra data on the effects of assay evasion techniques, a special assay test similar to the high access portion of the LIMA and MIKE special assay test was performed at Oak Ridge after military inspectors had finished all phases of field operations for FT-34. Materials, techniques, and equipment used in this test were the same as those used by the military inspectors. Only one team, composed of contractor laboratory personnel from the Oak Ridge complex, performed during this test of assay evasion techniques.

2. Requirements and Source of Inspectors. Since only one three-man team was to be used for the contractor assay test, personnel requirements were for a specialist from each of the three basic areas of assay: wet chemistry, emission spectroscopy, and mass spectroscopy. Team member selection was limited to personnel within the Oak Ridge complex of activities. Candidates for the inspection team were recommended by personnel of the Y-12 plant analytical laboratory and were selected on the basis of competence in the particular skills required and on their availability during the testing period.

FIGURE B-5. LIMA Special Assay Test Assignments

Team	Designator	Chemistry Background
LIMA-a	AF-2[a]	Yes (Chemistry)
	N-1	Yes (Chemistry)
LIMA-b	AF-5[a]	Yes (Chemistry, Physical Chem.)
	N-2	Yes (Chemistry)
LIMA-c	AF-3[a]	No (Nuclear Engr.)
	A-3	No (Math, Physics)
LIMA-d	AF-4[a]	No (Geol., Elec. Engr., Nuc. Eng.)
	AF-1	No (Aero. Engr., Physics)

[a]Denotes Team Leader.

FIGURE B-6. MIKE Special Assay Test Assignments

Team	Designator	Chemistry Background
MIKE-a	A-8[a]	Yes (Gen. Chemistry)
	AF-6	Yes (Chemistry, Nuc. Engr.)
MIKE-b	AF-7[a]	Yes (Chemistry, Biochem.)
	AF-10	No (Metallurgy)
MIKE-c	A-7[a]	No (Bus. Admin.)
	AF-8	No (Nuc. Engr.)
MIKE-d	AF-9[a]	No (Geophysics)
	N-5	No (Metallurgy)

[a]Denotes Team Leader.

3. Contractor Assay Test Inspectors' Qualifications. Personnel chosen as inspectors for the contractor assay test were asked to submit a resume of their professional activities for background information purposes. Inspector qualifications derived from these resumes are listed below.

a. Chemist.

Position: Oak Ridge National Laboratory; Group Leader, Analytical Chemical Division.

Age: 58

Academic Background: B. A. degree in chemistry; graduate level work.

Author of numerous articles and papers concerning chemistry of uranium and associated elements.

b. Mass Spectroscopist.

Position: Oak Ridge Gaseous Diffusion Plant; Development Chemist.

Age: 43

Academic Background: B. A. degree in chemistry.

Present work includes specializing in thermal-ionization and spark source mass spectrometer methods. Author of numerous articles and publications concerning mass spectroscopy.

c. Emission Spectroscopist.

Position: Oak Ridge National Laboratory, Spectrochemistry Group Supervisor.

Age: 37

Academic Background: B. A. and M. S. degrees in chemistry; thesis: "Spectrographic Determination of Certain Rare Earths After Concentration and Separation from Uranium by Ion Exchange."

Previously at Oak Ridge Gaseous Diffusion Plant. Author of numerous papers concerning spectrochemical analysis of impurities in uranium and plutonium.

4. Training. The inspectors for the contractor assay test underwent no formal training for the test. They were carefully chosen so that the team was composed of specialists in each of the three areas of assay. There was, however, a need to inform the inspectors about the background and the purpose of the test. Therefore, a small booklet was prepared which contained background information, laboratory ground rules, instructions, and sample data forms. The instructions portion of this booklet is included in appendix B3.

D. EVALUATION OF INSPECTOR PERFORMANCE

1. Military Inspectors. The first step in an evaluation of inspector performance must be to define the role of an inspector in the FT-34 test. FT-34 was a field test of an inspection system to determine what classified information was revealed by the destruction of nuclear weapons under given conditions and to determine whether or not nuclear weapons were actually destroyed. The inspectors, organized into independent teams as previously explained, carried out well-defined procedures, recorded information gained, and evaluated this information to the best of their ability.

From the standpoint of carrying out procedures and recording information all teams performed satisfactorily. All assigned duties were accomplished within the time available. Most of the classified information available to the teams was recorded although some of this information was not recognized as being classified. Team performance in evaluating information available to determine real and fake weapon shapes was not as good as expected, particularly at the highest access level. This can be attributed in part to a lack of background in the area of nuclear weapon design and development.

All inspection teams performed their duties related to the analysis of uranium and plutonium in a satisfactory manner. Assay results for unevaded samples compared favorably with results obtained by experienced laboratory technicians. Assay results for evaded samples also compared favorably with those obtained by experienced laboratory technicians. "Correct" answers in this case are defined as those obtained without evasion being detected. The evasion schemes for fissile material samples were designed to go undetected through all laboratory analyses as opposed to the weapons inspection situation where proper application of allowed inspection procedures and correct evaluation of results should have identified a pre-determined number of fake weapons. Inspector performance in laboratory analysis cannot be judged with any degree of validity, therefore, on the basis of success in detecting evasion except to say that performance was as expected.

Team performance overall can be regarded as satisfactory although it must be recognized that inspectors with more extensive knowledge of nuclear weapon design and development could have derived more information from the data available.

2. Contractor Inspectors. The contractor assay team performed in a satisfactory manner. The evasion schemes employed against this team were identical to those employed against the special assay teams. The results obtained by the contractor inspector team were not significantly different from those obtained by the special assay teams.

3. A more detailed analysis of inspector performance relative to test results is given in annex D, "Analysis."

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III. TRAINING

A. INTRODUCTION

1. Purpose. The purpose of this chapter is to discuss the training provided to the military inspectors for FT-34 activities. Training was provided at test headquarters and also at the various test sites, in areas where headquarters training could not cover the material adequately.

The general training program content was based on the reviews of background information supplied by the pretest questionnaires from the inspector candidates. Special training in the areas of nuclear weaponry was necessary in order to provide a basic common background for all inspectors participating in the field test.

The training program was jointly established by FT-34 headquarters and the Sandia Corporation Project Engineer. Personnel from each organization participated in the training sessions.

Training sessions for both groups of inspectors, LIMA and MIKE, were held at test headquarters for approximately 2 weeks before inspection activities commenced at the first test site (Pantex) in the program.

B. REFERENCE MATERIALS

More detailed information on the FT-34 training program can be found in the annexes to the operations plan which are listed as references on page B-9. A complete list of training topics and the schedules followed can be found in reference 4.

References 1, 2, and 3 were used for training inspector personnel in the use of equipment and techniques and in describing the operations and data forms to be used at each test site for acquisition of test information. Annex A, "Test Design," was used to describe the program to the inspectors and to outline objectives of the test, although inspectors did not have access to this annex. Annex D, "Inspection

Manual," and Annex E, "Equipment," were used throughout the training program. Inspectors were issued annexes D and E to study during nonclass periods. Inspectors were permitted to take annex E with them for study outside the test site areas. Annex D study was limited to secure areas within test site locations.

C. TEST HEADQUARTERS TRAINING PROGRAM OUTLINE

1. Major Functions. Six major functions or topics were covered during the training program for FT-34 inspectors. These topics are discussed below.

a. Introductory Topics. Introductory topics included welcoming remarks by the Deputy Project Manager of Project CLOUD GAP, background information on the arms control proposals which led to FT-34, purposes and objectives of the field test, public information, and orientation on military matters. This orientation included information regarding pay, sickness, leave, transportation, housing, and general logistic support for FT-34 personnel throughout the period of test activities.

b. Classification Factors and Access Limitations. The purpose of this portion of the training program was to acquaint inspector and test site personnel with the fundamentals of classification under the Atomic Energy Act of 1954. The concept of information which is classified from time of origination until determined otherwise and the responsibility of protecting information accrued throughout the test was discussed by an AEC classification representative.

Access limitations imposed by AEC regulations were explained to the FT-34 personnel. These limitations, which were based upon the "need-to-know" concept, provided for the release of information necessary to permit the field test to be performed but excluded dissemination of extraneous information regarding weapons and facilities which were not a part of FT-34 activities. Access limitations for test sites involved screening off plant areas which did not pertain to FT-34 inspections and limiting the use of inspection areas and equipment so that normal plant operations would not be disrupted. Plant operations had priority in the event that a conflict arose between normal activities and FT-34 activities. No such conflicts arose during the test, and interference with normal plant operations at all test sites was minimal.

c. Nuclear Weapons Orientation.

(1) Weapons. A substantial portion of the training program was devoted to information regarding nuclear weapons. The purpose of this operation was to provide all inspectors with a common background on U.S. nuclear weapons and to acquaint inspectors with typical nuclear and nonnuclear portions of weapons. The approach to this orientation was to show the historical evolution of U.S. nuclear weapons from World War II types to the most recent additions of weapon types to the U.S. nuclear stockpile.

(2) Classification. This portion of training was used to acquaint the inspectors with classified items and concepts associated with the weapons and to provide rationale for the classification of those items. This was done to supplement generalized information available to the inspectors in the inspection manual and to show specific classified items as examples of the types of items to be uncovered during test inspections.

(3) Access Limitations. The access limitations mentioned above were to apply to weapons training phases as well as inspection phases of FT-34. As applied to training, access for weapon orientation was to be limited to those types of weapons actually used in the test and all others were to be excluded from discussion. This restriction proved to be unworkable because, under it, the inspectors would be supplied with information about the weapons to be inspected before weapon introduction occurred. Thus, a waiver on this limitation was requested from AEC on the grounds that it could seriously compromise inspection during the test. The waiver was granted; and, in effect, it permitted discussion of weapons not included in the test for inspection training. Test control personnel were briefed on the weapons included in the

test as well as on the other weapons used in inspector training sessions.

In keeping with the intent of the access limitation, no weapons used for inspector training were identified by Mark or Mod nomenclature. Although the inspectors were designated as having access to sigmas 1, 2, and 3 of weapon data, it was not felt necessary to divulge theory of operation of fission or TN weapons. It was sufficient for test purposes to designate materials and their locations within weapons without offering information on why particular materials and configurations were used.

(4) Coverage. During training, the following nuclear weapons and devices were presented to FT-34 inspectors:

[a]Fat Man
[a]Little Boy
[a]Mark 8
[b]Mark 9
[a]Mark 5
[a]Mark 6
[a]Mark 12
[a]Mark 7
[a]Mark 15
[a]Mark 36
[c]Mark 49
[a]Mark 53
[a]Mark 36-2
[c]Mark 31
[a]Mark 43
[b]Mark 48
[a]Mark 57
[a]Mark 61
[d]

(b)(1)
(b)(3)

[a]Bomb
[b]Shell
[c]Warheads
[d]Device

Information was presented by means of slides and viewgraphs which had nomenclature taped out. The intent of the orientation was to show chronological developments from early bombs, both implosion and gun-assembled to present weapon configurations. Basic topics for nuclear devices or weapons included:

Fission devices

Gun type
Implosion devices
[redacted]
DOE (b)(3)

TN devices

[redacted]
DOE (b)(3)

Mechanical hardening

Laydown on impact
Blast hardening

Yield variability

In addition, the following classes of weapon components were discussed:

Fuzing systems

Radars
Baros
Timers
Firing sets
Initiators - internal and external
Power supplies
Nuclear components
Case materials

Also, some discussion was given of the characteristics of working spaces and equipment compatible with requirements for handling nuclear and high explosive materials.

The fact that tritium was not considered for the demonstrated destruction of nuclear weapons was pointed out during orientation. The inspectors were informed that all gas reservoirs had been removed from those weapons in the test which utilized gas boosting.

d. Inspection Procedures. Inspection procedures and data collection techniques and forms, which were published as annex D, "Inspection Manual," were made available to inspector personnel for study. It was deemed advisable, however, to devote some training time to a review of the procedures and the use of data forms. Therefore, several sessions of training were used to review with the inspectors the data forms and procedures to be used at each test site. The use of these training sessions permitted the inspectors to become acquainted with the test procedures and to ask any questions regarding procedures and data collection. Test controllers for the various test sites participated in the sessions held for inspectors. However, they also attended sessions directed toward discussion of test control procedures and instructions.

e. Assay Instruction. Because of the emphasis on assay phases of inspection during the field test, several days of training were devoted to instructions in the techniques and equipment involved in the three major areas of material assay: wet chemistry, mass spectroscopy, and emission spectroscopy. Representatives of the AEC contractors at Rocky Flats (Dow Chemical) and Oak Ridge Y-12 (Union Carbide) provided the instruction for these sessions. The instructors were from the laboratories of the two plants, and instruction was based upon material supplied the inspectors in their equipment and inspection manuals. Assay instruction at Test Headquarters was limited to formal presentations of subject matter and was supplemented by handout material, slides, movies, and blackboard explanations. Material presented to the inspectors contained background information on the techniques used, photographs of equipment, and general operating instructions and cautions to be observed. Some equipment was used to demonstrate basic principles, but actual test equipment demonstrations were necessarily postponed until the inspectors reached the appropriate test site laboratories.

f. Other Inspection Equipment. Inspection equipment issued to all teams at Test Headquarters and carried to all test sites basically consisted of equipment such as carpenter's rules, tape measures, and Polaroid cameras. The use of these items required no formal or extensive training; however, the areas where these items of equipment were to be used for inspection required some degree of explanation. Generally, the inspection manual and the equipment manual designated which portable inspection equipment items were to be used at each test site.

There was, however, a need to provide some additional information on the plant inspection equipment to be used during weapon monitoring phases at the Pantex plant. A representative from the Pantex plant discussed the use of the Geiger counter, the neutron counter, and the gamma ray spectrograph. Facilities at Pantex for X-raying weapons were also described during these sessions. Slides and viewgraphs were used extensively during these sessions to demonstrate the types of equipment, capabilities of the equipment, and typical results from the use of the equipment against specific weapons and weapon components. Examination of and interpretive training in X-ray plate reading was deferred until on-site training at Pantex.

D. ON-SITE TRAINING

1. General. Section C, above, describes the inspector training program for training sessions held at test headquarters. Physical and practical limitations for much of the on-site plant inspection equipment precluded bringing the equipment to test headquarters for training purposes. Therefore, many specific instructions regarding techniques and equipment were postponed until the inspection teams reached the appropriate test sites where demonstrations on actual equipment could be made. The following sections comment on the training

provided at the test sites.

2. Pantex Training. Training at Pantex was directed toward the practical use of radiation monitoring equipment. The Geiger counter, portable neutron counter, and the gamma-ray spectrograph were demonstrated. Samples of radioactive materials were used for the demonstrations, and inspectors were permitted to actuate and use the monitoring equipment under the supervision of Pantex personnel. Pantex personnel were also available during inspection phases to ascertain that equipment was working properly and to provide consultation and technical assistance to the inspectors.

Training in X-ray plate reading for weapon X-rays was provided for the high access level inspectors at Pantex. Instruction consisted of two phases: the first phase dealt with generalized X-ray plate reading, the types of films and sources used, and the interpretation of densities from X-ray plate opacities; the second phase used X-ray plates from weapons to show the inspectors the type of information available for weapon batch inspection.

3. Rocky Flats Training. On-site inspector training at Rocky Flats was used to review the computational methods used in all phases of the laboratory analysis of plutonium, to acquaint the inspectors with assay equipment and procedures, and to prepare the inspectors for additional assay work at Oak Ridge. Because of the hazardous nature of plutonium,[1] inspectors at the Rocky Flats Test Site did not perform any analytical operations requiring use of glove boxes but were permitted to observe laboratory personnel perform such operations on samples of material derived from the FT-34 weapons seen at Pantex.

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[1]The body burden for Pu^{239}, or the amount that can be maintained indefinitely in an adult without producing significant body injury, is now recommended to be 0.008 microcuries which is equivalent to 0.0005 micrograms.

4. Paducah Training. Inspection procedures at Paducah required no training other than that provided during the test headquarters training sessions.

5. Oak Ridge Training. On-site inspector training at Oak Ridge Y-12 plant was directed toward additional instruction in assay techniques and equipment. The training involved tours of the laboratory areas where assay was to be performed and discussion of computational techniques for the various phases of assay. Instruction was given by laboratory personnel from the Y-12 plant. The practical approach to assay and the demonstration of actual equipment to be used were the most beneficial feature of the Y-12 on-site training.

E. COMMENTS ON THE FT-34 TRAINING PROGRAM

1. Test Headquarters Training.

a. General. This section provides comments on the overall training program from the point-of-view of FT-34 test administration. Inspector's comments are contained in section F, below. The comments here, which are directed toward the topical breakdown contained in sections C and D of this chapter, reflect opinions of the value and effectiveness of the program. Differences between LIMA and MIKE inspection groups are noted. These differences occurred because of feedback from the field and because of experience and learning during the instruction process. Changes in training generally caused the instruction to improve. The MIKE group accrued the benefits of improved training resulting from analysis of training given the LIMA group.

b. Introductory Topics. The introductory topics were covered adequately for both LIMA and MIKE inspection groups. Inspector personnel generally accepted the background information, reasons for the field test, and the assignment to participate.

An open discussion of test objectives was conducted with the MIKE group. Although these test objectives were listed in the inspection manual, the discussion enabled MIKE teams to develop a more comprehensive understanding of the test than was possible for LIMA teams before operations began.

c. Classification Factors. Inspectors were required to follow the definitions of classified information as established by AEC regulations. Each test site provided its own classification indoctrination to each inspection group.

In general, the inspectors were inexperienced in acquiring and recognizing classified information during the test. The inspectors relied almost exclusively upon the classification guidelines published in the inspection manual to identify classified items during inspection phases.

d. Nuclear Weapons Orientation. The information presented on the various nuclear weapons subjects was basic to the weapon inspection phase of the field test. It served to acquaint all inspectors with a wide variety of nuclear weapon design features. Coverage was comprehensive, and the instructor was well acquainted with his topics and was experienced in presenting similar information to other groups. The discussion of classified items supplemented the guideline information contained in the inspection manual and provided pictorial examples of many types of classified items used in the field test. Motion pictures of the burning of high explosives proved to be quite informative to the inspectors and provided data not readily available or generally known to the majority of inspector personnel. Movies of development models of weapons hardened to survive ground impact provided some weapon capability information useful in Pantex monitoring.

The slides and viewgraphs which were used extensively during these sessions provided pictorial information in a concise, orderly format. However, this type of presentation did not convey the necessary physical information of size and weight which could have been provided by full-scale, cutaway models of the same weapons. For those inspectors with limited or no weapons background, the pictures did not convey all information which would be considered desirable for inspection functions. The above comments apply not only to the nuclear portions of weapons but also to other pertinent features such as electromechanical components, cabling and connectors, and case structures.

In the same vein, too much emphasis may have been placed upon design concepts for hardening nuclear bombs for laydown applications. LIMA inspectors, in particular, appeared to direct their thinking toward all bombs being designed for laydown. If a bomb structure did not appear capable of surviving the laydown environment, serious doubt about the veracity of the shape became evident. Feedback from this facet of testing resulted in a less vigorous approach to these topics for the MIKE group training sessions.

Another deficiency in the weapons orientation training was the lack of definitive data on relative quantities of nuclear materials in the various types of weapons. Neither inspection group could, except by prior knowledge, estimate appropriate quantities of fissile material from each batch of weapons inspected. This information was presented, during training, as "large quantities" or "small quantities" of uranimum, plutonium, etc., but very few numerical values were given.

Even with the drawbacks, however, the nuclear weapons orientation training was considered to be successful. It provided necessary information without which the test procedure would have had little meaning to many of the inspectors.

e. Data Collection. Test headquarters training in the use of the inspection manual and the data forms was improved for the MIKE group as a result of field experience with LIMA. The MIKE group was given some practice training in weapon monitoring at the lowest access level. A weapon shape was made available, and a Pantex test controller was sent to test headquarters to help train the group in the use of data forms and in inspection techniques.

The data forms used for the test were modified in many instances as a result of information derived from field experience with the LIMA group. These changes were incorporated into the training given to the MIKE group.

Another factor in this area was that all information concerned with training in the use of the inspection manual was contained in the manual itself and should have been, to a large degree, self-explanatory. In this respect, the inspectors did not seem to devote sufficient time to study of the manual.

f. Assay Training. The assay training at test headquarters was, in general, adequately taught and thoroughly prepared. The fact that actual equipment could not be used or demonstrated detracted from the training to some extent. The time lag between training and use also degraded the effectiveness of the formal training, although this was partially compensated for by refresher training as part of the on-site training program.

The disparity in inspector backgrounds dictated that some of the training sessions be presented on a basic level. Because of this, inspectors with more extensive backgrounds often lost interest in the instructions.

g. Other Equipment. Training in the use of radiation monitoring equipment was marginally effective. This training suffered from some of the same problems of the assay training: lack of demonstration equipment, lack of data collection training, lack of preparation, and lack of background information on the part of inspectors. X-ray training did not cover the reading of X-ray plates, but, instead, covered only the X-ray facilities at Pantex.

Feedback from the field tended to improve equipment training for MIKE teams and allowed better and more comprehensive information to be presented.

2. On-Site Training.

a. Pantex. Training activities at Pantex concerning radiation monitoring were limited in time to a few hours during the first day of inspection operations. The Geiger counter and the portable neutron counter required very short instruction time since they were similar in usage and relatively uncomplicated. Radioactive sources for Geiger counter use were readily available. No neutron source was available for training in the use of the neutron counter.

The gamma-ray spectrograph required more training time than the other radiation monitors. Sources used for training were calibration radioactive sources rather than fissile materials found in weapons. However, the calibration sources provided a sufficient spectrum to allow adequate demonstration of operating procedures.

X-ray training for LIMA consisted of classroom work on generalized interpretation of X-ray plates under a variety of conditions of film types, source types, exposure, and targets. The classroom work proved to be too general and did not fit the inspectors' needs for specific information on weapon X-rays. Training in practical aspects of weapon X-ray plate reading was conducted by Pantex personnel using specially constructed light tables and X-ray plates from actual weapons. This phase of training provided more useful information to the inspectors than the classroom training.

X-ray training for the MIKE inspection group did not involve the classroom discussions presented to LIMA, but did cover the practical aspects of weapon X-ray plate reading. Some information was presented on the types of film used and the source of X-rays, but the most useful and informative work was at the light tables with actual weapon X-ray plates.

Some inspectors believed that the X-ray training was not sufficiently thorough. Inspectors failed to take full advantage of the fact that weapons orientation training at test headquarters revealed a great quantity of information applicable to X-ray study of weapons. The cutaway pictures indicated location, relative densities, and internal compositions of nuclear weapon parts and were directly applicable to X-ray training. Unfortunately, the inspectors categorized information according to the title under which it was presented and did not often carry over information from one category to another.

b. Rocky Flats. Laboratory training at Rocky Flats provided instruction and practice in the computational methods used for all phases of assay of plutonium. The on-site training for the LIMA inspection group was inadequate. The basic reason for this was that the training was delegated to knowledgeable but unprepared technicians.

MIKE on-site training at Rocky Flats was much improved over that provided for LIMA. MIKE inspectors were led through the processes for assay and given examples of computational methods used to obtain assay results. Also, the data forms were used to provide practice in recording data and computing results from hypothetical assay procedure outputs.

c. Paducah. No on-site training was provided at Paducah since operations there required no additional instruction.

d. Oak Ridge. On-site training at Oak Ridge was consistent for both the LIMA and the MIKE inspection groups. Inspectors were led through the assay processes by classroom instruction and were given a tour of the laboratory to inspect the various areas and equipment used. Computational methods, somewhat different from those at Rocky Flats, were also covered in the training sessions, and a data form review was also provided. Where applicable, plant data recording cards were used in lieu of the regular data forms to facilitate recording of data. Laboratory data cards were attached to the appropriate data forms for compatibility with test requirements.

F. INSPECTOR ATTITUDES TOWARD TRAINING

1. General. The debriefing questionnaires given to all inspectors at the conclusion of the field test included several questions relating to the FT-34 training program. This information is presented here to show inspector attitudes regarding the training program.

2. Inspector Evaluation of Training. For each training topic, inspectors were asked to questions: (1) Did the training seem adequate at the time it was given? (2) Did it satisfy your needs throughout the test program? Total scores are shown in figure B-7. Inspectors were also given a series of questions concerning correlation of training program content with inspection operations and the value of the training program relative to other sources of information available. These questions and total scores are presented in figure B-8.

3. Results of Inspectors' Evaluation.

a. There were significantly fewer yes responses to the second question (fill need) than to the first (adequate when given).

b. Inspectors believed that the teams either had no prior information or that the training information did not conflict in any significant way with prior knowledge.

c. The on-site training sessions were deemed to be much more helpful than the Paducah course and related training aids.

d. "Talking with fellow participants" and "knowledge gained prior to FT-34" were deemed the least helpful sources of information.

e. The LIMA teams felt the Paducah course was the least helpful source compared to on-site training, the manuals, talking, or prior knowledge.

f. Inspectors generally felt that the training information conflicted with procedures at Pantex and Rocky Flats, but only on minor points, and "not in any significant way" at either Paducah or Oak Ridge. There were a few exceptions.

FIGURE B-7. Inspector Evaluation of Training Topics

Training Topic	Inspectors Adequate Y	?	N	Inspectors Satisfied Y	?	N
CLOUD GAP public relations	21	3	0	21	2	1
Geiger counter use and operation	20	2	2	20	1	3
Spectroscopy use and operation	18	4	2	17	6	1
Weight balance accounting	20	2	2	16	2	6
Test administration and logistics	21	0	3	15	6	3
Visual inspection procedures	18	2	4	13	6	5
High explosive and waste disposal	21	3	0	15	6	3
Reviewer and classifier functions	20	3	1	15	5	4
Taking and use of photographs	20	3	1	14	6	4
Data package handling and review	19	3	2	14	6	4
Neutron counter use and operation	19	5	0	14	6	4
Test control functions/procedures	20	2	2	15	3	6
Uranium assay purposes/procedures	18	3	3	14	2	8
Inspector functions and procedures	20	3	1	11	5	8
Plutonium assay purposes/procedures	18	4	2	13	3	8
Test objectives and criteria	16	5	3	11	6	7
What to look for in walkthroughs	17	3	4	11	6	7
Design of the test program	17	4	3	10	8	6
Use and handling of data forms	19	2	3	12	3	9

FIGURE B-7. Inspector Evaluation of Training Topics (cont'd)

Training Topic	Inspectors Adequate Y	?	N	Satisfied Y	?	N
Classified information guidelines	17	2	5	10	4	10
Weapon shape and size characteristics	14	6	4	8	6	10
Weapon type and use characteristics	14	5	5	8	6	10
X-ray film interpretation	11	8	5	8	7	9
Weapon component characteristics	12	8	4	7	6	11

FIGURE B-8. Inspector Evaluation of Training Program

Operational Conflicts with Training

Did the training information conflict with any knowledge or information you had before training?

	L	M	Total
1. No, I had no prior knowledge	1	4	5
2. No, not in any significant way	11	7	18
3. Yes, but only on minor points	1	0	1
4. Yes, on a few significant points	0	1	1
5. Yes, on many significant points	0	0	0

Which of the following was the most helpful in learning test procedures?

	L	M	Total
1. The Paducah training course	0	3	3
2. On-site training sessions	10	10	20
3. Reading the manuals	1	1	2
4. Talking with fellow participants	2	0	2
5. Knowledge gained prior to CG-34	0	0	0
6. Other: work on site	0	0	0

As above, which of the following was the least helpful in learning test procedures?

	L	M	Total
1. The Paducah training course	6	1	7
2. On-site training sessions	0	0	0
3. Reading the manuals	2	3	5
4. Talking with fellow participants	2	4	6
5. Knowledge gained prior to CG-34	3	4	7

Did the operations and procedures at Pantex conflict with the training received at Paducah?

	L	M	Total
1. Not in any significant way	2	5	7
2. Yes, but only on minor points	7	5	12
3. Yes, on a few significant points	2	2	4
4. Yes, on many significant points	0	0	0
5. Yes, on many critical points	0	0	0

FIGURE B-8. Inspector Evaluation of Training Program (cont'd)

Same as above, for at Rocky Flats.	L	M	Total
1. Not in any significant way	5	4	9
2. Yes, but only on minor points	6	3	9
3. Yes, on a few significant points	1	3	4
4. Yes, on many significant points	0	2	2

Same as above, for at Paducah.

1. Not in any significant way	7	7	14
2. Yes, but only on minor points	3	3	6
3. Yes, on a few significant points	1	2	3
4. Yes, on many significant points	0	0	0
5. Yes, on many critical points	1	0	1

Same as above, for at Oak Ridge.

1. Not in any significant way	9	8	17
2. Yes, but only on minor points	2	2	4
3. Yes, on a few significant points	1	2	3
4. Yes, on many significant points	0	0	0
5. Yes, on many critical points	0	0	0

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IV. SELECTION OF FUTURE INSPECTORS

A. INTRODUCTION

The selection of future inspectors will be considered for two possible situations: FT-34 type field test operations and a treaty inspection on foreign soil. The discussion of future inspector selection will necessarily be based on results of the FT-34 field test.

B. INSPECTION SKILLS FOR FUTURE FT-34 TYPE TESTS

1. General. The selection of future inspectors should clearly be based upon both the degree and the type of information desired from the inspection process, and the inspection team composition should reflect backgrounds which directly support the areas of information desired. It is necessary to postulate the type of information desired from treaty inspections. The types of access levels used in FT-34 could serve as a basis for this postulation.

2. FT-34 Type Test Inspectors. It is clear that inspectors used in an FT-34 type field test should possess broad backgrounds in areas related to nuclear weaponry and the associated sciences related to assay of fissile material. From this proposition, a listing of generalized inspection skills can be established.

3. Inspection Skills Desired. The following denotes generalized skills desired for inspection personnel. The skills described below are those which would be attributed to an "ideal inspector" in each major category of inspection.

a. Nuclear Weaponry Skills. For an FT-34 type field test, the inspector skills required for weapon and facility monitoring should include the following:

(1) Extensive knowledge and experience in overall U.S. nuclear weapons programs.

(2) Design experience in both fission and thermonuclear weapons, including hydrodynamics and high explosive

design knowledge.

(3) Design experience or thorough knowledge of electromechanical devices used in arming, safing, fuzing, and firing of nuclear weapon systems.

(4) Experience in aerodynamics and recognition of factors influencing various methods of nuclear weapons delivery.

(5) Knowledge of the relative quantities of fissile materials used in typical nuclear weapons; capability to recognize appropriate shapes, sizes, and configurations of nuclear components and to estimate efficiencies, experience with passive radiation monitoring of nuclear weapons, and ability to interpret X-ray plates.

b. Chemistry and Analytical Skills. For an FT-34 type field test the inspector skills required for assay of fissile materials should include the following:

(1) Extensive experience in chemical analysis of uranium and plutonium.

(2) Extensive experience in mass spectroscopy, particularly in the analysis of uranium and plutonium isotopes.

(3) Extensive experience in emission spectroscopy including thorough knowledge of typical impurities, and the extent of their presence in enriched uranium and plutonium produced by various processes.

(4) Extensive knowledge of and experience with instruments associated with all phases of the assay procedure This includes design experience and the capability to recognize standard and nonstandard equipment design features.

4. Inspection Teams. It is difficult to envision individuals who would possess all the skills required in either category listed above. Rather, the skills would most likely be distributed among several individuals within

a given category. For an FT-34 type field test it would be reasonable to divide inspection functions according to inspector skills, i.e., weapon, residue, and facility monitoring would be assigned to inspectors with skills in these areas while assay of fissile material would be assigned to inspectors skilled in chemistry and analytical techniques. This partitioning would permit concurrent inspection, when applicable, and would minimize dilution of effectiveness by permitting inspectors to perform tasks within their individual skill categories.

On the basis of partitioning inspection operations, an inspection team for an FT-34 type field test could be composed of the following types of personnel:

a. Weapons, Facility, and Residue Inspectors.

(1) Nuclear Physicist. Experienced in radiation monitoring and interpretation of X-ray plates.

(2) Aerodynamicist. Experienced in design and development of nuclear weapons delivery configurations.

(3) Electrical or Mechanical Engineer. Experienced in design and development of electromechanical components used in arming, safing, fuzing and firing of nuclear weapons systems.

(4) Nuclear Physicist. Experienced in design and development of nuclear and thermonuclear components including high explosive design.

(5) Classification Specialist. Experienced in determining importance of nuclear weapon design information to a foreign country.

b. Assay Inspectors.

(1) Chemist or Physicist. Experienced in chemical analysis of uranium and plutonium.

(2) Chemist or Physicist. Experienced in mass spectroscopy.

(3) Chemist or Physicist. Experienced in emission spectroscopy.

The inspection team makeup shown above represents the basic skills outlined in section B-3 above. It is assumed that each subgroup would be directed by a leader from within each inspection category. This makeup includes only those personnel directly concerned with inspection and does not include a chief inspector or other administrative or support personnel who might be assigned for photography, sketching, or other similar work within a team.

5. Sources of Inspection Personnel. The source of inspection personnel for future FT-34 type field tests should not be limited to officers from the various military services; rather, inspector candidates should be selected from within the entire complex of governmental laboratories, both military and civilian. The skill requirements outlined above indicate the need for specialists for all phases of inspection activities. The broad spectrum of nuclear weapon and nuclear materials skills required for "ideal" inspection should lead to the acquisition of inspection personnel from a wide variety of knowledgeable and experienced people.

The objectives of any future FT-34 type field test would, in general, determine the inspection team size and composition. If, for example, a future test were designed to test or refine only one aspect of the FT-34 test, the team composition should be adjusted to the requirements under consideration. If the weapon monitoring aspects of the test were to be retested without assay, the chemistry and spectrographic inspection skills could be eliminated from inspection team requirements. Thus, the team composition listed above suggests a near-ideal inspection team for a field test patterned after FT-34.

C. INSPECTION SKILLS FOR POTENTIAL TREATY CONDITIONS

1. General. No attempt will be made to define provisions

of a potential treaty involving inspection for demonstrated destruction of nuclear weapons on foreign soil since any such definition would be beyond the scope of this report. However, certain results from the FT-34 test can be applied in planning for both future tests and potential treaty conditions. It is reasonable, therefore, to construct a basic set of conditions which could possibly be extended to a treaty situation.

2. Conditions.

a. Weapon Monitoring. It is assumed that inspection for treaty conditions would involve only low access levels for weapon and facility monitoring similar to that used in FT-34, so that weapon design features would be protected to the greatest extent possible. Two possibilities arise for inspector requirements for low access level weapon inspection. If low access level inspection were interpreted to mean "token" inspection, inspector skill levels could be adjusted to a level of counting and recording without the apparent need for highly skilled specialists for inspection duties. However intelligence information could probably be derived by highly trained inspectors even at a low access level. For this reason, highly skilled inspectors should be employed even for low access level treaty inspections.

b. Assay. Assay inspection could take any of several possible forms. The simplest form would involve only the acquisition of samples from fissile materials derived from weapons with the actual analysis being performed in a laboratory located in the inspector's home country. The other extreme for assay inspection would require on-site assay and the use of the inspector's laboratory (possibly portable) which would remain in complete control of the inspection force. The extremes represented by the above possibilities reflect a wide variation in possible assay inspection skills required. For the first case, relatively inexperienced inspection personnel could be utilized to obtain samples and maintain records and accountability. For the latter case, fully experienced personnel would be required to perform all phases of assay. Therefore, two contingencies are applicable to assay inspection under potential treaty conditions: the first would utilize relatively unskilled personnel for sample taking; the second would utilize highly skilled assay personnel who would perform all phases of assay.

c. Inspection Team Composition. From the conditions shown above, the following team composition could serve for inspection teams monitoring a treaty on foreign soil.

(1) Weapons and Facility Inspection Team.

(a) Nuclear Physicist. Experienced in radiation monitoring.

(b) Aerodynamicist. Experienced in design and development of nuclear weapons delivery configureations.

(c) Electrical or Mechanical Engineer. Experienced in design and development of electromechanical components used in arming, safing, fuzing and firing of nuclear weapons systems.

(d) Nuclear Physicist. Experienced in design and development of nuclear and thermonuclear components including high explosive design.

(e) Intelligence Specialist. Knowledgeable in nuclear weapons design and development information peculiar to the foreign power of interest.

(2) Assay Inspection Team.

(a) Contingency One - Sampling only.

Metallurgist - experienced in uranium and plutonium metallurgy.

Chemist - experienced in chemical analysis of uranium and plutonium.

(b) Contingency Two - Assay.

Chemist - experienced in chemical analysis of uranium and plutonium.

Chemist or Physicist - experienced in mass spectroscopy.

Chemist or Physicist - experienced in emission spectroscopy.

d. Limitations. The listing above for treaty inspectors does not include any administrative support personnel who could be assigned to assist inspection team members. Also, duplication of inspection personnel may be required but is not indicated here. Only the basic inspection skills believed to be applicable to inspection activities are included.

e. Source of Inspection Personnel. The source of skilled inspectors for potential treaty operations would be the same as for future FT-34 type field tests. The information in section B-5 of this chapter applies to test and to treaty conditions.

f. Related Material. A more detailed discussion of potential treaty inspection conditions and personnel is presented in the Procedures Manual associated with this report. In the Procedures Manual, a comprehensive listing of personnel, equipment, and duties expected for a treaty inspection process is presented.

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V. CONCLUSIONS

A. INSPECTORATE

1. In general, inspection personnel used in FT-34 met the selection criteria. However, the background and experience in nuclear weapons research and development possessed by FT-34 inspectors was less than desired.

2. The personnel requisitions transmitted to the military services defined inspector military backgrounds desired rather than technical disciplines. In addition optional military backgrounds not requiring the same amount or quality of training in nuclear weapons were allowed. In effect this gave the services a wide range of choices in filling the requests for personnel.

3. Inspection teams performed their tasks in a satisfactory manner within the framework of the test design. Team members tended to specialize in carrying out inspection procedures in accordance with their previous training. Thus, laboratory specialists, though entirely lacking in nuclear weapons experience, were able to perform inspection procedures at Oak Ridge and Rocky Flats laboratories in an effective manner. Those inspectors who were well acquainted with nuclear weapons yet who had no knowledge of laboratory procedures were able to perform effectively at the Pantex and Paducah test locations. The obvious conclusion is that the even distribution of individuals with specialized backgrounds within teams and among teams contributed substantially to successful performance of inspection procedures by all teams.

B. TRAINING

1. The overall training program provided information which enabled inspectors to perform assigned tasks in a satisfactory manner.

2. The diverse nature of inspector requirements made the initial training somewhat experimental in approach. The test headquarters training program was formulated to provide

refresher training for qualified inspectors who possessed extensive knowledge of nuclear weapons and good background in analytical procedures. The training was given to all inspectors, and no specialization in accordance with the many different backgrounds represented was attempted. Practical on-the-job training at each operating site provided an indispensible supplement to the classroom type training given at test headquarters.

3. The training program could have been made more effective by conducting initial training for team members in specialized functions such as weapons inspection and laboratory analysis. This would have been followed by team training in a "dry run" situation.

VI. RECOMMENDATIONS

The following recommendations are based upon the information obtained from the FT-34 field test.

A. RECOMMENDATIONS FOR FUTURE FT-34 TESTS

Recommendations for future FT-34 type tests are:

1. Inspection teams should be selected from the entire governmental laboratory (scientific) complex and be divided according to types of inspection to be performed: weapons inspection and materials assay inspection.

2. Inspection teams should be composed of members possessing the following skills:

a. Weapons Inspectors.

(1) Nuclear Physicist. Experienced in radiation monitoring and interpretation of X-ray plates.

(2) Aerodynamicist. Experienced in design and development of nuclear weapons delivery configurations.

(3) Electrical or Mechanical Engineer. Experienced in design and development of electromechanical components used in arming, safing, fuzing and firing of nuclear weapons systems.

(4) Nuclear Physicist. Experienced in design and development of nuclear and thermonuclear components including high explosive design.

(5) Classification Specialist. Experienced in determining importance of nuclear weapon design information to a foreign country.

b. Assay Inspectors.

(1) Chemist or Physicist. Experienced in chemical analysis of uranium and plutonium.

(2) Chemist or Physicist. Experienced in mass spectroscopy.

(3) Chemist or Physicist. Experienced in emission spectroscopy.

The inspection team makeup shown above represents the basic skills. It is assumed that each subgroup would be directed by a leader from within each inspection category. This makeup includes only those personnel directly concerned with inspection and does not include a chief inspector or other administrative or support personnel who might be assigned for photography, sketching, or other similar work within a team.

3. Training of inspection personnel should be thorough and cover all phases of inspection in detail.

4. Theoretical training should be supplemented by "actual use" training with all equipment and procedures to be used in the test.

5. Inspector training should be conducted by specialty, and each inspector should receive practical training in all aspects of the test requiring his specialty. Inspectors should then be trained as teams.

6. The team training program should include a "dry run" exercise to acquaint all inspectors with conditions, facilities, materials, and weapons to be encountered during the field test.

7. Inspection should be limited to as few facilities as possible so that a more realistic approach to a single facility could be realized.

B. POTENTIAL TREATY INSPECTION RECOMMENDATIONS

For potential treaty inspection, the following is recommended:

1. Inspection personnel should be selected on the same basis as for a future FT-34 type field test, particularly for weapons monitoring phases of inspection except that an intelligence specialist should be included in lieu of a classification specialist. Assay inspectors should be selected on the same basis as future FT-34 type inspectors if on-site assay is used; otherwise, lesser qualifications would suffice.

2. Training for treaty inspectors should be as thorough and comprehensive as possible and should include high access level inspection, similar to that used in FT-34, at a single facility. Training should, however, emphasize the access level specified by the treaty.

3. Training for treaty inspectors should include inspections of a variety of weapon types fabricated to resemble the weapons expected from the host nation. Assay phase training for on-site assay should include materials used by the host nation as determined by debris analysis from nuclear tests.

4. All inspection personnel should be made thoroughly familiar with all aspects of the U.S. nuclear weapons program applicable to treaty inspection. This should include knowledge of the design of U.S. nuclear weapons and delivery vehicles, of weapons production facilities, and of laboratories specializing in the assay of uranium and plutonium isotopes. This type of training would contribute to a more complete understanding of foreign weapons and may well be the best method available for attaining familiarity with such weapons.

5. Inspectors should study the language of the host nation so that direct conversation between host personnel and inspection personnel could be used if allowed.

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FINAL REPORT

FIELD TEST FT-34

ANNEX B

APPENDIX B1

REQUEST FOR TDY PERSONNEL
FOR USE IN FT-34 (U)

March 1968

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UNITED STATES ARMS CONTROL AND DISARMAMENT AGENCY

DEPARTMENT OF DEFENSE

PROJECT CLOUD GAP
1901 PENNSYLVANIA AVENUE NW.
WASHINGTON, D.C. 20452

CLG 5-34

TO: Appropriate Military Service

SUBJECT: Personnel Requirements for CG-34

Ref: CG-34 Test Plan, dated 22 August 1966

1. Forwarded herewith are the temporary duty personnel requirements for Field Test of CG-34.

2. Attention is invited to the notes at the bottom and last page of the requisition listing specific features to be noted in the TDY orders of each of the selected personnel.

3. It is requested that early action be taken on the selection of those persons required to complete the Planning Group roster. Due to the technical nature of this test it is requested that only highly qualified persons be considered to fill this requisition. This requisition will be a CLOUD GAP Working Group agenda item. The date and time of this meeting is to be announced.

4. It is further requested that names and current duty station of personnel selected be forwarded to Project CLOUD GAP, Attn: Test Director CG-34, 1901 Pennsylvania Ave., N.W. Washington D.C. 20452, as soon as determined. Orders will be handled as specified in the feature notes to the requisition.

ALVIN E. COWAN
Brigadier General, USA
Acting Project Manager

Attachment (1)
Personnel Requisition

UNCLASSIFIED
SECRET

PERSONNEL REQUISITION FORM

CG-34

Item No.	No. Req.	Grade	Service	Job Title	Duties	Specialty Code	Background Desired	Report Date	Period of Duty	Remarks
31	8*	05/04	Navy-4 and AF-4	Inspection Team Leader	Monitor weapons destruction and act as team leader.	Nuclear Weapons	Nuclear weapons R&D maintenance or employment	21 Jun 67 / 19 Jul 67	4 mos TDY	** **
32	8*	04/03	Army-8	Inspection Team Member	Monitor weapons destruction	Nuclear Weapons	Nuclear weapons R&D or maintenance	21 Jun 67 / 19 Jul 67	4 mos TDY	** **
33	10*	04/03	Navy-5 and AF-5	Inspection Team Member	Monitor weapons destruction and assay of active material	Nuclear Weapons	Nuclear weapons R&D and capable of verifying active material analysis and assay	21 Jun 67 / 19 Jul 67	4 mos TDY	** **

Total 26

The total personnel requirement for a specific job is listed in the column "No. Req." Example - Line Item No. 2 requires two persons - one provided by the Army and one provided by the Air Force.

*All personnel require a minimum security clearance of SECRET - RD; those marked with asterisk require TOP SECRET - RD.

**All teams will report initially to Test Headquarters, CG-34, 727 Joe-Clifton Drive, Paducah, Kentucky

UNCLASSIFIED
SECRET
J1-4

FINAL REPORT

FIELD TEST FT-34

ANNEX B

APPENDIX B2

INSPECTOR BACKGROUNDS (U)

March 1968

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SUMMARY OF INSPECTORS' BACKGROUNDS

LIMA TEAMS

LIMA 1

Team Leader Age 37

Rank: Major, U.S. Army; 15 years in service

Academic Background: Majored in Mathematics, History, and Political Science: Minored in Architecture, Military Science, and History. Attended University of Massachusetts, University of Mayland, and University of Southern Mississippi. No degrees obtained prior to FT-34. Assigned to Degree Completion program after FT-34 activities.

Service Nuclear Training Record: Inspector had taken the following courses:

- 7th USA WAS (ADM) (1959) - 3 weeks
- NUC. WPNS. EMPL. (1961) - 5 weeks
- Army Nuc. Wpns. Off. (1723,1724,1725) (1961) - 12 weeks
- 1723-T (1963) - 3 weeks
- 1723-T (1967) - 4 weeks

Nuclear Weapons Experience:

1957-1958:	Guided Missile Officer, Ordnance Br.	Germany
1958-1960:	Operations Officer, Ordnance Co.	Germany
1961-1963:	Chief, Special Weapons Maintenance Operational Shop	Picatinny Arsenal
1963-1964:	Battalion Operations Officer, Ordnance Br.	Germany
1964-1965:	C.O. G.M. & S.W. Ordnance Co.	Germany
1965-1966:	Operations Officer, Ammunition Brigade	Germany
1966-1967:	Nuclear Ammunition Officer	Ft. Lee, Va.

Nuclear Weapons Familiarity:

Atomic Demolition Munitions, W-7, Mk 45, Mk 54, TADM

Corporal - W-7

Honest John: W-7 and W-31

LaCrosse - W-40

8" Artillery Shell - Mk 19

SADM - W-54

155 mm nuclear shell Mk 48

Little John - Mk 45

Nike Hercules, Mk 31

Davy Crockett, Mk 54

Sergeant, Mk 52

Pershing, Mk 50

Inspector was familiar with all U.S. Army nuclear weapons and weapon systems, both fission and TN warheads.

Inspector was familiar with older type nuclear materials and radiation monitoring equipment.

Team Member: Age 25

Rank: Ensign, U. S. Navy 0 years in service

Academic Background: Westminster College, B.S. Degree

Majored in Chemistry; minored in Physics and Mathematics

Nuclear Training Record: None

Nuclear Weapons Experience: None

Nuclear Weapons Familiarity: None

This inspector was just graduated from Navy O.C.S. and came to FT-34 as his first official duty in the military service.

This inspector was classified as "analytical" for FT-34.

LIMA 2

Team Leader Age 36

Rank: Major, U.S. Air Force 14 years in service

Academic Background: B.S. Degree in Aeronautical Engineering (minor in Aerodynamics) from Parks College, St. Louis Univ. M.S. degree in Physics (minor in Mathematics) from Ohio State Univ. Other work in Physics from Univ. of California.

Nuclear Training Record: None

Nuclear Weapons Experience:

1961-1965 - Air Force Technical Applications Center

1966-1967 - Ballistic Systems Division, AFSC

Nuclear Weapons Familiarity:

No specific weapons; general information regarding physics of weapon detonations and some information on nuclear materials contents of weapons.

This inspector was classified as "analytical" for purposes of FT-34.

Team Member Age 26

Rank: Ensign, U. S. Navy Approx. 1 year in service

Academic Background: A.B. degree in Chemistry (minor in German)

from University of California 1966

Nuclear Training Record:

1966 NNWO 7 Weeks

Nuclear Weapons Experience:

Assembly Supervisor, Lake Mead Base

Nuclear Weapon Familiarity:

B-28	W-31	W-58
B-43	W-45	W-55
B-53	W-48	W-44
B-57	W-54	W-30

Inspector was familiar with above listed weapons and knew yields, arming, fuzing, and delivery capabilities.

LIMA 3

Team Leader Age 37

Rank: Major, U.S. Army 15 years in service

Academic Background: B.S. degree, Education. Majored in Science, minored in Mathematics, Univ. of Maine, 1952

Nuclear Training Record:

1957	Nuclear Weapons Disposal	6 Weeks
1963	Nuclear Weapons Disp. Refersher	2 Weeks
1962	"Prefix 5"	4 Weeks

Nuclear Weapon Experience:

School only; no field experience

Nuclear Weapon Familiarity:

Inspector was familiar with trainers on many current U.S. nuclear weapon systems. Training in rendering safe procedures also afforded information on arming and fuzing systems and other background data.

Team Member Age 37

Rank: Major, U.S. Air Force 16 years in service

Academic Background: B.S. degree in Nuclear Engineering

from Kansas State Univ. 1965

Nuclear Training Record:

No weapons training; only nuclear reactor schooling

Nuclear Weapons Experience: Yield information on specific

nuclear bombs for targeting purposes; Mk 28, Mk 36

Nuclear Weapon Familiarity:

None except that listed above; yields of Mk 28 and Mk 36 bombs

This inspector was classified as "analytical" for FT-34

Team Member Age 57

Rank: Civ. (GS-12). Retired Major, USAF 20 years in service

Academic Background: B.S. degree in Chemistry (minor in Physics).

North Dakota State Univ. 1933

Nuclear Training Record:

1949 Radiochemistry 8 Months

Nuclear Weapons Experience: None

Nuclear Weapon Familiarity: None

Inspector participated in nuclear detonation debris analysis and was classified as "analytical" for FT-34.

Team Member Age 32

Rank: Major, U.S. Army 10 years in service

Academic Background: B.S. degree in Mathematics (minor in Physics)

No. Georgia College, 1956 B. S. degree in Physics, (Minors in Math, Chemistry, Biology). U. S. Naval Postgraduate School, 1965

Nuclear Training Record:

1962	Nuc. Wpns. Employment & Rad Safety	5 Weeks
1964	NAC-30	3½ Weeks
1966	Nuclear Projectile Ass'y.	1 Week
1966	Atomic Demolitions	2 Weeks

Nuclear Weapons Experience:

1957-1959 Physical Security for V U. S. Army Corp's. Nuclear Delivery & Resupply Units

1965 - 1967 Nuclear Branch, Nuclear, Biol. Chem. Div. SCSOT

Nuclear Weapon Familiarity:

280 mm Shell Mk 19

8" artillery shell Mk 33

Honest John Mk 7, Mk 31

Demolition Munitions Mk 45, Mk 54

Inspector knew yields and delivery capabilities of weapons listed above.

LIMA 4

Team Leader Age 42

Rank: Major, U.S. Air Force 18 years in service

Academic Record: B.S. degree in Geological Engineering, Montana School of Mines, 1951; B.S. degree, Electrical Engineering, AFIT, 1957; M.S. degree in Nuclear Engineering, AFIT, 1962

Nuclear Training Record:

1952	Special Weapons Mech & Elec	3 Months
1952	Special Weapons, Nuclear	6 Months
1962	Nuclear Power Plant Course	3 Months
1962	M.S. - Nuclear Engineering	2 Years

Nuclear Weapons Experience and Familiarity

Mk 4	Mk 9
Mk 5	Mk 12
Mk 6	Mk 15/39
Mk 7	Mk 18
Mk 8	Mk 28 (WH)

Experience included training and maintenance on most of the above weapons. Inspector was classified as "analytical" for FT-34.

Team Member Age 32

Rank: Lt. Commander, U. S. Navy 10 years in service

Academic Background: B.S. degree in Agriculture,

Univ. of Nebraska, 1956

Nuclear Training Record:

1959 External Weapon Delivery 2 Weeks

Nuclear Weapons Experience:

1960-1964 Special Weapons Delivery Pilot

Nuclear Weapon Familiarity:

Mk 7 Bomb

Mk 57 Bomb

Mk 101 (W-34) Bomb

Inspector knew arming, fuzing, and yield information about the above weapons.

Team Member Age 39

Rank: Major, U.S. Army 19 years in service

Academic Background: High School only

1954	Assy Course ABE-40	8 weeks
1954	Assy Course GCE-10	4 weeks
1955	Atomic Arty Ammunition	2 weeks
1955	Assy Course GCM-19	2 weeks
1956	Nuclear Course NP-14	4 weeks
1956	Adaption Kits	2 weeks
1957	Accident Appraisal Crs. AAC-15	2 weeks
1958	Army Elec. Specialty Crs. AAE-23	8 weeks
1961	2nd Generation Training All systems (w/refersher in 1965)	10-12 weeks
1963	Nuc. Wpns. Officer Refresher	3 weeks

Nuclear Weapon Experience:

Jan. 1953 - Dec. 1953	Corporal Msl Supt.	White Sands, Ft. Bliss
Jan. 1954 - Jan. 1957	AFSWP; Spec. Wpns. Unit Trng. Gp.	Sandia Base
Jan. 1957 - Dec. 1958	Nuc. Wpns. Officer	White Sands
Dec. 1958 - June 1959	Assy Officer 9th Ord. Co. Depot Spt.	White Sands
June 1959-Nov. 1960	Assy Officer, 9th Ord. Co. 82d Ord. Bn.	USAREUR
Dec. 1960 - Mar. 1962	Shop Officer, 9th Ord. Co. 72d Ord. Bn.	USAREUR
Mar. 62 - Aug. 1962	Qual. Control Officer	USAREUR
Sept. 1962 - Sept. 1964	Spec. Wpns. Branch (Nuc. Wpns. Officer Third U.S. Army)	Ft. McPherson, Ga.

Nov. 1964 - Dec. 1964	Material Officer, 85th Ord. Brn.	Korea
Dec. 1964 - April 1965	Oprs. Officer, 65th Ord. Co. 83rd Ord. Bn.	Korea
April 1965 - Nov. 1965	Oprs. Off.	Korea
Dec. 1965 - July 1966	Nuc. Wpns. Officer, U.S. Army Msl and Munitions Center School	Redstone Arsenal
July 1966 - 1967	Opers. Officer, Directorate of unit training	Redstone Arsenal

Nuclear Weapon Familiarity:

Mk 5 Mk 6 Mk 7 Mk 12 Mk 18 Mk 30	All applications	Mk 31 Mk 40 Mk 45 8" Projectile 16" "	All applications

All control devices for ADM's

All types of nuclear materials for above.

Radars

Power Supplies

Conversion Kits

Adaption Kits

Inspector also had experience in R & D type information pertaining to arming, fuzing, yields, delivery, and nuclear safety of the weapons listed above.

Team Member Age 39

Rank: Captain, U. S. Air Force 13 years in service

Academic Background: B.S. degree in Chemistry, Michigan College of Mining and Technology, 1952; M.S. degree in Physical Chemistry, 1953, same school

Nuclear Training Record:

1965 DASA Weapons Orientation 1 Week

1966 DASA Advance d Weapons Orientation 2 Weeks

Nuclear Weapons Experience:

1956 - 1960 Air Force Technical Application Center

Nuclear Weapon Familiarity:

None, except debris analysis

This inspector was classified as "analytical" for FT-34

LIMA Chief Inspector - Age 52

Rank: Commander, U. S. Navy 26 years in service

Academic Background: B.S. degree in Agriculture (minor in Chemistry) 1938. West Virginia University. Engineering courses in Navy General Line School.

Nuclear Training Record:

1954	HATU, Atlantic Fleet	12 Weeks
1960	Nuclear Supervisor, DASA	12 Weeks

Nuclear Weapons Experience:

1954-1956	Nuclear delivery pilot and ordnance officer
1959-1961	Chief, Stockpile Operations, FC/DASA
1962-1963	Nuclear Weapons Officer, Staff, USCINCEUR
1964-1965	Team Chief, Inspector General, DASA
1966	Chief, Stockpile Management, FC/DASA

Nuclear Weapon Familiarity:

Mk 7, Mk 18, Mk 12, Mk 15 Bombs

Familiar with general field of U.S. nuclear weapons for stockpile management responsibilities.

MIKE Teams

MIKE 1

Team Leader Age 42

Rank: Major, U. S. Army 18 years in service

Academic Background: No College; High School only

Service Nuclear Training Record:

Nuc. Wpns. Employment Course	4 weeks
Little John & Rocket/Nuc. WH Assy	3 weeks
Assoc FA Officers Car	18 weeks
Nuc. Wpns. Refersher	1 week

Nuclear Weapons Experience:

1960-1961	1st How Bn, 15th Arty, 2d Inf. Div.	Ft. Benning, Ga.
1962	2d Inf. Div. Arty	Ft. Benning, (
1963	HHB, 2d Rkt/How Bn, 73d Arty	USAREUR
1963-1964	HHB, 6th Bn, 40th Arty	USAREUR
1964-1966	Hq. 3d Brigade, 3d AD	USAREUR

Nuclear Weapon Familiarity:

8" Artillery Shell (Mk 33)

Honest John (Mk 31)

Atomic Demolition Munitions (Mk 54, Mk 45, Mk 30)

Davy Crockett (Mk 54)

Inspector was familiar with nearly all aspects of U. S. Army Artillery nuclear weapons listed.

Team Member Age 27

Rank: First Lieutenant, U. S. Air Force 1 year in service

Academic Background: B.S. and M.S. degrees in Chemical Engineering from M.I.T. Additional M.S. degree in Nuclear Engineering, M.I.T. Finished schooling in 1965.

Service Nuclear Training Record: None

Nuclear Weapons Experience: Experience was limited to study of nuclear weapons effects without reference to specific U.S. nuclear weapons.

Nuclear Weapons Familiarity: None

This inspector was classified as "analytical" for FT-34

MIKE 2

Team Leader Age 46

Rank: Major, U. S. Air Force 24 years in service

Academic Background: Associate of Arts Degree, 1942; Bakersfield Jr. College - majored in Chemistry; A.B. degree, Univ. of Calif. (Berkeley), 1946, majored in Biochemistry, minored in Organic and Nuclear Chemistry. Additional work in Food Technology.

Service Nuclear Training Record:

Nuclear Research Officer (Chem) (Other training was during college work)	6 Months

Nuclear Weapons Experience:

1960-1961	Research Officer, Chem. Section	McClellan AFB Central Laboratory
1961-1966	Chief, Gas Analysis Unit, Physics Sec.	McClellan AFB, Central Laboratory
1966	Chief, Physics Section	McClellan AFB, Central Laboratory

Nuclear Weapons Familiarity: No specific weapons knowledge. Familiarity was with nuclear materials and reactions for general analysis.

Team Member   Age 44

Rank: Major, U. S. Army   18 years in service

Academic Background: B.S. degree in Industrial Arts, 1950, Colorado State University

Service Nuclear Training Record: .

Nuclear Projectile Assy	1 week
Army Nuc Wpns Officer's Course	10 weeks
7 Specific WH Training Courses	3 weeks
Refresher Training in Tactical Employment of Nuclear Weapons	1 week

Nuclear Weapons Experience:

1955-1958	Special Weapons Trng. Gp.	Sandia Base
1958-1959	525th Ord Co., 101 Ord. Bn.	USAREUR
1959-1961	Hq., 57th Ord. Gp.	USAREUR
1959-1964	Spec. Wpns. Depot	Savanna, Ill.
1965-1966	Spec. Wpns. Officer	Ft. Lewis
1966	Nuc. Wpns. Officer Hq. 6th Army	

Nuclear Weapons Familiarity:

Nuclear Artillery Shells (Mk 9, Mk 19, Mk 22)

Honest John, Corporal, ADM, Bombs (Mk 6, Mk 7)

Army Nuclear Warheads (Mk 30, Mk 31, Mk 40, Mk 50, Mk 52)

Davy Crockett (Mk 54)

MIKE 3

Team Leader Age 37

Rank: Major, U. S. Army 16 years in service

Academic Background: B.A. Degree in Business Administration, University of Nevada, 1953.

Service Nuclear Training Record:

Electronics ABE-88A	3 weeks
Nuclear NSP-33	12 weeks
Accident Appraisal AAC-7	3 weeks
Transition 9A	3 weeks

Nuclear Weapons Experience:

1956 - 1958	Nuclear Officer, Ch., Fwd Assy Sect 832nd Ord Bn	Ft. Bliss
1958 - 1959	Nuclcear Officer, 15th Ord Bn	Germany
1959 - 1961	Shop Officer, 619th Ord Co.	Germany
1961 - 1962	Opers. Off. 96th Ord. Co.	Red River Arsenal, Texas
1963 - 1964	Opns Off. C.O. 69th Ord. Co.	Italy

Nuclear Weapons Familiarity:

Nuclear Artillery Shells 8" and 280 mm (Mk 33 and Mk 19)

Army Nuclear Warheads

Nike Hercules, Honest John (Mk 7, Mk 31)

Corporal (Mk 7)

ADM's (Mk 6, Mk 7, Mk 45, Mk 54, Mk 30)

Lacrosse (Mk 40)

Davy Crockett (Mk 54)

Team Member Age 27

Rank: Lieutenant, U. S. Navy 4 years in service

Academic Background: B.S. Degree in Physics (minor in Mathematics),

Arlington State College, 1963.

Service Nuclear Training Record:

Loading of nuclear weapons on military aircraft

Nuclear Weapons Experience:

Class room instruction and practice loading of Bomb Dummy Units

Nuclear Weapons Familiarity:

BDU's for Mk 28, MK 32, and MK 53 Bombs

Inspector was classified as "analytical" for FT-34.

Team Member Age 29

Rank: Captain, U. S. Army 6 years in service

Academic Background: B.S. Degree in General Chemistry,

Morgan State College, 1960

Service Nuclear Training Record:

Prefix 5 Course	1 month
Radiation Safety Course	1 week
EOD Course, Nuclear Phase	7 weeks
Refersher Prefix 5	1 week

Nuclear Weapons Experience:

1964	Prefix 5 Course Hq. & Hq. Co., 2d Inf. Div. (Controller)	Korea
1966	EOD School	
1967	Prefix 5 Refresher	

Nuclear Weapon Familiarity:

The nuclear phase of the EOD school covered all nuclear weapons manufactured in the United States. Information included dimensions, nuclear materials, yields, arming, firing, and safing procedures.

Team Member Age 26

Rank: Captain, U. S. Air Force 5 years in service

Academic Background: B.S. Degree in Nuclear Engineering, (minor in Mech. Engr.) 1962, Lowell Technological Institute. M.S. degree in Nuclear Engineering (minor in Physics) 1964, Air Force Institute of Technology.

Service Nuclear Training Record: None

Nuclear Weapons Experience: Experience related to weapons effects but no specific nuclear weapons.

Nuclear Weapon Familiarity: None

Inspector was classified as "analytical" for FT-34

MIKE 4

Team Leader Age 42

Rank: Major, U. S. Air Force 18 years in service

Academic Background: B. S. Degree in Geophysics, 1960; Univ. of Houston. Other schooling in Petroleum Engineering at Texas A and M.

Service Nuclear Training Record:

Special Weapons - Guided Missile Orientation 1 Week

Nuclear Weapons Experience:

1954-1955	R & D Section, 4750th Air Dfns Wing	Arizona
1960-1960	Civilian Staff Scientist, Wpns. Studies	Colorado
1962-1965	Staff Scientist, Air Force Special Weapons Center	Kirtland AFB
1965-1967	Special Scientist, AFSC, Electronic System Division	Massachusetts

Nuclear Weapons Familiarity

MB-1 (Mk 25)

Polaris (Mk 47)

Mk 28, Mk 43, Mk 57, Mk 61 Bombs

Inspector was classified as "analytical" for FT-34

Team Member   Age 33

Rank: Lt. Commander, U. S. Navy   10 years in service

Academic Background: B. S. Degree in Speech (minor in Business Administration) 1957, Northwestern Univ. Other college work included Liberal Arts courses at Florida State University

Service Nuclear Training Record:

Antisubmarine Warfare Nuc. Wpns. Course

Specific U. S. Weapons Delivery (ASW)   2 weeks

Nuclear Weapons Experience:

1961-1964 ASW Nuclear Weapons Delivery Pilot

Nuclear Weapons Familiarity:

Mk 57

Mk 101 (Mk 34 WH)

Team Member Age 37

Rank: Captain, U. S. Air Force 12 years in service

Academic Background: B. S. Degree, Metallurgical Engineering, Ohio State Univ., 1954. M. S. Degree, Metallurgy (minor in ceramics), Univ. of Utah, 1963.

Service Nuclear Training Record: None

Nuclear Weapons Experience:

Air Force Weapons Laboratory, assigned to study of nuclear weapons effects. 1963 - present

Nuclear Weapons Familiarity: None

Familiar only with nuclear effects from several nuclear

devices, not specific weapons. Attached

devices, not specific weapons. Attended WOA course at Sandia Base prior to FT-34 assignment.

Team Member Age 26

Rank: Lt. (j.g.) U. S. Navy 4 years in service

Academic Background: B.S. Degree in Metallurgy (Minor in Economics)

M.I.T., 1963

Service Nuclear Training Record:

1964	ASWD Course	1 Week
1965	ASWL Course	1 Week
1966	K-00-422	1 Week

Nuclear Weapons Experience:

Delivery crewman for Navy. ASW nuclear weapons training.

Nuclear Weapons Familiarity:

Mk 57 Bomb

Mk 101 Nuclear Depth Charge (Mk 34 Warhead)

Yield, fuzing and delivery characteristics

Mike Chief Inspector - Age 47

Rank: Commander, U. S. Navy 30 Years in service

Academic Background: No degree, attended CAPE COLLEGE, CAPE GIRARDEAU, Mo. before enlisting in Navy.

Nuclear Training Record:

1954	Weapons Orientation	1 Week
1955	Weapons Handling	1 Week
1956	Weapons Loading	1 Week

Nuclear Weapons Experience:

1946 Schooling in weapons effects, participation in U.S. nuclear tests at the Pacific Proving Grounds. Controlled drone aircraft used in monitoring tests

1952-1953 Participated in Nevada Nuclear Testing Program. Controlled monitoring aircraft.

1954-1957 Special Weapons Officer for Navy Transport Wing. Supply and re-supply of CINC PAC FLEET Nuclear weapons.

Nuclear Weapon Familiarity:

External shapes and capabilities of Navy nuclear weapons used in the Pacific.

FINAL REPORT

FIELD TEST FT-34

ANNEX B

APPENDIX B3

INSTRUCTIONS FOR CONTRACTOR ASSAY AT THE Y-12 PLANT, FT-34 (U)

March 1968

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Contractor Analytical Test Operations Instructions

The purpose of this test is to determine the effectiveness of various evasion techniques during the analysis of enriched uranium samples under the ground rules stipulated. The ground rules are binding upon both the laboratory and the performers of the tests.

Your task is to perform the analysis of eight samples provided by the laboratory; the techniques and equipment of the Y-12 laboratory will be used. If you detect evasion in any area of the test, you are to call "evasion" and specify the area in which it occurred, how it was done, and on which sample. In addition we request that you study each procedure carefully as it is being carried out and list areas where you believe evasion techniques could be applied, how they could be applied, and their effect on the test. Calls of evasion are to be based upon some tangible evidence that evasion was practiced, not on just "feeling" or "hunches."

The information you provide during this test will be used in the analysis of analytical techniques for final reports on Field Test FT-34. The evasion calls and areas of potential evasion you list will plan an important role in determining procedures for use in a treaty situation. At the conclusion of your work in this test, you will be informed of the evasion techniques used in the test and asked to suggest ways in which these techniques and those potential techniques which you have listed could be neutralized. By this method, we hope to obtain data and recommendations regarding analytical evasion, and methods to overcome it, for a treaty situation.

In order to make the "contractor" analytical test as much like the regular FT-34 test as possible, ground rules for laboratory work have been formulated. These ground rules applied to the FT-34 inspectors and also apply now to this additional phase. The ground rules are listed in this booklet for your reference and use.

Ground Rules for FT-34 Oak Ridge Laboratory Work

1. Inspectors must use FT-34 equipment only.

2. Standard samples labeled with isotopic, g U/g and impurities composition will be provided each inspector team for the three analytical areas - U metal for chemical volumetric and U oxide for mass and emission spectroscopic analysis. Standard spectrographic plates for the Jarrell Ash emission spectrograph and standard weights will also be available. No evasion will be attempted on standards or on calibrations. Standards may be used at any time during the test within the limitations of allowable time with the following restrictions:

   Jarrell Ash Spectrograph - The standard must be inserted as the last sample to be arced (contamination problem). The instrument will have already been calibrated.

   Production Quantometer - The standard sample must be inserted as the last sample to be arced (contamination problem). The instrument will have already been calibrated.

   Chemical Titration - The standard sample must be titrated first to assure proper equipment calibration.

   Mass Spectrograph - The standard sample must be analyzed first to assure proper equipment calibration.

3. It is suggested that samples be analyzed in order (1 through 8); however, inspectors may analyze their samples in any order with the following restrictions:

   General - Be sure you can identify your samples. Proper color codes and sample numbers must be attached wherever possible.

   Special Analytical Exercise Emission Spectroscopic Analysis - Arc samples (1 through 4) on the Jarrell Ash Spectrograph. Arc samples (5 through 8) on the quantometer. Standards must follow samples.

Isotopic Analysis - Analyze samples 1 through 4 first, then analyze samples 5 through 8. The standard must precede samples.

4. No evasion or tampering with samples will be permitted in the following areas:

   a. FT-34 sample storage area (metal samples, oxide samples, and mass spectrometer solutions may be stored in the pigeonholes).

   b. In the muffle furnace or drying oven.

   c. In the fume area.

In order to simulate the activities of the FT-34 inspectors during this test, the same conditions used for those inspectors will apply to you. Data forms for recording answers, computations, and comments will be supplied to you as they were for the FT-34 inspectors. The use of these forms will permit some cross correlation between FT-34 inspection teams and the Oak Ridge contractor team. Specific explanation of the forms and their usage will be explained to you by your test controller.

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