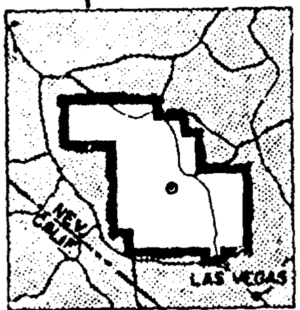
AEC Category: Health and Safety

OPERATION PLUMBBOB



NEVADA TEST SITE
MAY-OCTOBER 1957

PROJECT 38.3

MEASURING AND MONITORING TRAINING EXERCISE: FOODSTUFFS

Issuance Date: June 28, 1960

CIVIL EFFECTS TEST GROUP

NOTICE

This report is published in the interest of providing information which may prove of value to the reader in his study of effects data derived principally from nuclear weapons tests.

This document is based on information available at the time of preparation which may have subsequently been expanded and re-evaluated. Also, in preparing this report for publication, some classified material may have been removed. Users are cautioned to avoid interpretations and conclusions based on unknown or incomplete data.

PRINTED IN USA
[redacted] Available from the Office of
Technical Services, Department of Commerce,
Washington 25, D. C.

MEASURING AND MONITORING TRAINING EXERCISE: FOODSTUFFS

By

Homer J. McConnell, Raymond D. Chapman,
Alan T. Spiller, Edwin P. Laug,
Stephen E. Koelz, and Harold V. Leininger

Approved by: EDWIN P. LAUG
Director
Program 38

Approved by: ROBERT L. CORSBIE
Director
Civil Effects Test Group

Food and Drug Administration
Department of Health, Education, and Welfare
Washington, D. C.

Office of Civil and Defense Mobilization
Battle Creek, Michigan

December 1959

ABSTRACT

Project 38.3 was a field-training course conducted in areas contaminated by radioactive fallout. Information was acquired on methods of measuring and monitoring fallout with portable and laboratory equipment and on methods of decontamination from study and actual participation in the shots of Operation Plumbbob from April 29 through June 29.

Participation consisted in dry runs and actual runs under shot conditions. There were two types of runs. One consisted in the placement under fallout and later pick-up of fallout-collecting stations and -recording devices. The other consisted in the placement under fallout and later collection of foodstuffs. Each operation was followed by laboratory determinations of the amount of fallout contamination. Decontamination of the fallout-collecting stations was carried out to recover all the fallout material possible for further study. Decontamination of foodstuffs was carried out to test the feasibility of such types of operation only.

ACKNOWLEDGMENTS

Special thanks are extended to Kermit Larson, Director, Program 37, and his staff for their untiring help and support in this effort. We also thank the Denver, Los Angeles, New Orleans, and San Francisco Field Districts and the Bureau of Program Planning and Appraisal, Food and Drug Administration, Washington, D. C., for assistance given in supplying the equipment and materials used in this program.

This program was supported by a delegation of fiscal-year 1957 funds from the Federal Civil Defense Administration to the Food and Drug Administration, Department of Health, Education, and Welfare. Program personnel returned to home office on July 1, 1957, and CETG Program 37, in cooperation with the Food and Drug Administration, completed the field phase of the program

CONTENTS

ILLUSTRATIONS

ILLUSTRATIONS (Continued)

Chapter 1

INTRODUCTION

1.1 BACKGROUND

Some of the members of the group responsible for this report had been engaged earlier in making available to Food and Drug Administration officials information on civil defense problems arising from nuclear, biological, and chemical warfare. In addition to conducting numerous teaching seminars, the staff developed a manual of basic information on these subjects.[1]

It is worth emphasizing that many training and teaching problems can be materially resolved by field exercises. Therefore, when plans were made to participate in the Operation Plumbbob series to study the effect of fallout on processed foods and packaging materials[2] and on raw agricultural products,[3] a parallel program of field training that could be associated with this effort was developed.

1.2 OBJECTIVES

The objectives of this program were to secure training in (1) methods of measuring and monitoring fallout with portable and laboratory equipment and (2) practical methods of decontamination of packaged and unpackaged food exposed to fallout.

REFERENCES

1. Civil Defense Information for Food and Drug Officials, U. S. Department of Health, Education, and Welfare, Food and Drug Administration, 2nd ed., December 1956.
2. Harold V. Leininger et al., Effect of Fallout Contamination on Processed Foods, Containers, and Packaging, Project 38.1-I, Operation Plumbbob Report, WT-1496, May 1959.
3. Harold V. Leininger et al., Effect of Fallout Contamination on Raw Agricultural Products, Project 38.2, Operation Plumbbob Report, WT-1497, May 1959.

Chapter 2

TRAINING PROCEDURES

The training procedures were basically concerned with problems of fallout. Some of these were developed from the concurrent field studies mentioned in Chap. 1, but most of the substance of the actual training came from the association of the Food and Drug Administration staff with the staff of Program 37, whose wide and tested experience with fallout has long been recognized.

The training program was established within the following areas: (1) orientation; (2) mobile equipment; (3) fallout-collecting station equipment; (4) laboratory equipment; (5) dry run; (6) plotting of a fallout profile; (7) setting an actual fallout arc; (8) decontamination methods; and (9) laboratory methods.

2.1 ORIENTATION

Orientation consisted of a two-week information course in which climate, terrain, communications systems, transportation, topographical maps, and past fallout patterns were studied and discussed. Trips were taken with members of Program 37 on missions to remote off-site areas to make rechecks of fallout profiles from past tests as well as to place and recover test equipment. Particular emphasis was placed on the necessity for accurate distance measurements over desert terrain on poorly marked roads and at night.

2.2 MOBILE EQUIPMENT

The successful conduct of the field experiments would have been impossible without adequate mobility and communications. For these exercises, one-half ton trucks with two-way radios proved invaluable. Extremely helpful also was a backup station. This backup station was a special laboratory trailer that had the capability of serving as a completely independent field station in the desert (Figs. 2.1 and 2.2). Unfortunately, its effectiveness in the open desert could not be tested because of the early termination of Project 38. The mobile laboratory contained a scaler for radiological analyses and a complete chemical bench. Figures 2.3 and 2.4 show a portion of the laboratory equipment in the trailer. Adjunct equipment included a power plant, a refrigerator, air conditioning, hot and cold running water, bottled gas, and a radio transmitter and receiver tied into the camp network. Each of the trucks was supplied also with a compass, emergency tools, tow rope, battery-powered lanterns, first-aid kits, and emergency cans of gasoline and water.

2.3 FALLOUT-COLLECTING STATION EQUIPMENT

For fallout-collecting stations the following equipment, all of which was transported on the trucks, was used: (1) Fallout time indicator: this is an instrument fitted with a Geiger tube

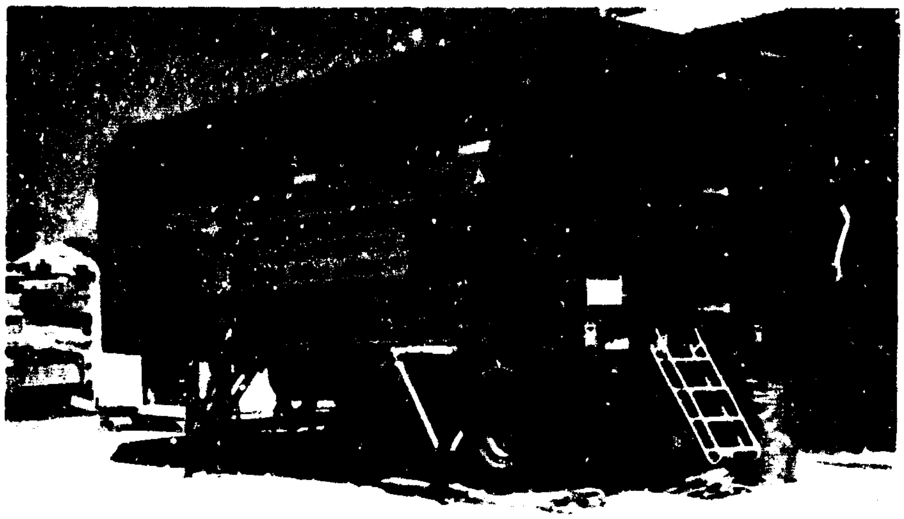


Fig. 2.1—Food and Drug Administration radiological trailer laboratory, Mercury, Nev.

Fig. 2.2—Small trucks parked near the radiological trailer laboratory partially loaded for a dry run.

Fig. 2.3—Scaler and counter in trailer laboratory.

Fig. 2.4—Muffle, scaler, and lead Geiger tube shield on one side of the laboratory trailer. Note the air-conditioning outlet in the ceiling.

sensing element electronically connected to a clock. Radiation of a set intensity causes the clock to stop, thus indicating the time of arrival of the fallout cloud. (2) Continuous background recorder: this is an ion chamber, the output of which drives a recorder that writes on a paper drum rotated by a chronometer. (3) Gummed paper collectors: these collectors were mounted, adhesive side up, on horizontal wood frames supported about 5 ft above the ground. Such devices integrate the quantity of fallout occurring at a particular station. Measurements are made with special Geiger tubes that either scan the entire surface directly or determine the radioactivity of the mineral ash after burn-off of the paper and adhesive. (4) Plastic pellets: these functioned on the same principle as the gummed paper. Plastic pellets, about the size of a small shot, are placed ½-in. deep in shallow metal pans 24 in. by 48 in. Fallout particles are trapped on the pellets or in the interstices between the pellets. The particles can be eluted with solvents and segregated by size. (5) Air collectors: these collectors function by means of air pumps that force air through paper retention filters. Since the quantity of air can be precisely metered, the amount of fallout per volume can readily determine when the radioactivity of the filter is measured. (6) Beta-gamma survey meters: for personnel protectors, as well as plotting fallout profiles, the common portable instrument in a variety of ranges and equipped with discriminating tube shield was widely used. (7) Film badges and pocket dosimeters: these were used for personal protection and personnel cumulative exposure records. In addition to this equipment, soil at the station was used. Advantage was taken of the retentive properties of soil. For this purpose an open wood or metal square frame was placed on the soil to mark off an area. Upper layers of soil therein were then skimmed, placed in containers, and transported back to the laboratory.

2.4 LABORATORY EQUIPMENT

Support for field measurements and sampling was afforded by laboratory type scalers. Instruments of this type generally require a fixed installation and accompanying laboratory equipment. The scaler used for these exercises was left at home base in the trailer; in other circumstances this vehicle could have functioned just as well while stationed off base.

2.5 THE DRY RUN

The collectors of adequate and meaningful data on fallout depended on accurate last-minute meteorological information as well as the accessibility of fallout target areas. To reach many of these areas frequently meant traversing nearly impossible terrain over roads that were poorly marked or practically nonexistent. Familiarity with the course in daylight was, therefore, very desirable since it permitted the location of suitable landmarks and the measurement of distances with the odometer of the trucks for checking against map distances. Several carefully organized dry runs were therefore executed. On these runs attempts were made to rendezvous at predetermined points or to determine the location of tentative fallout stations in relation to forecast fallout patterns over a special area. Some of the areas were from 20 to 100 miles from the site and contained as many as twenty fallout stations separated by intervals of several miles. Several runs were also made at night, in association with the staff of Program 37.

2.6 PLOTTING OF A FALLOUT PROFILE

This type exercise proved useful for evaluating the radioactivity of a given area that had been subjected to fallout. The data were obtained with beta-gamma survey meters and were also augmented by soil samples taken at frequent intervals along a particular arc. The plot of a typical fallout profile, made by taking readings every one-half mile along a 70-mile arc on a circle with a 280-mile radius, is shown in Fig. 2.5. To be noted are the "hot spots." Each value used in the plot represents the average of three individual readings, each made as the operator faced Ground Zero (GZ) and 120° to the right and left of it holding the probe waist high. Figure 2.6 shows the process of taking a soil sample. Most soil samples were taken at or near the hot spots.

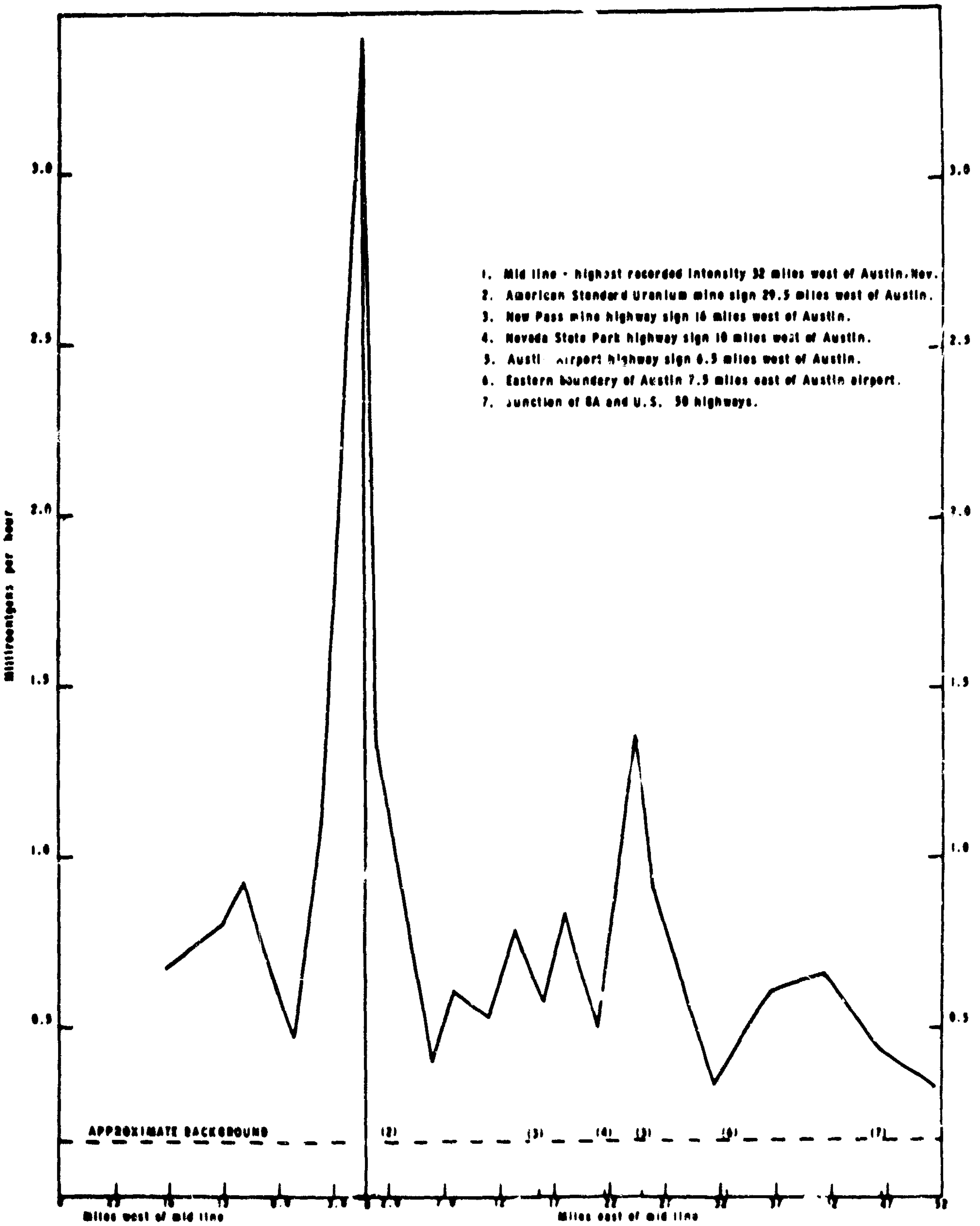


Fig. 2.6—Fallout profile made from recorded data secured following a nuclear detonation. The mid-line is the point of greatest radiological intensity.

Fig. 2.6—Taking a soil sample west of Austin, Nev., approximately 280 miles from GZ.

2.7 SETTING AN ACTUAL FALLOUT ARC

The arc set up for an actual shot ran north south, approximately 25 miles east of GZ. The arc was projected for fallout exposure. It was used for studying the effect of fallout on processed foods and packaging materials and on raw agriculture products. To place the samples and establish the required distance between stations, three teams of two men each prepared for rendezvous at specified points along the arc. Because the rough terrain and darkness required more time for the placement of the stations, the assignment was initiated about 5 hr before the predawn shot. Since last-minute weather changes necessitated adjustments in the distance between stations as well as location of the chain upon the arc, tentative locations were determined but not activated until the final fix, which occurred about 1 hr before shot time. This last-minute and vital information was obtained through a radio relay from the Control Point, effected by a plane flying high over the area.

On the basis of this information, the northernmost station was abandoned, except for the subsequent recovery of the wheat. Placement of the remaining four stations was started 8 miles southward along the arc. Placement of the last station was delayed until after shot time. However, the value of the last-minute adjustment can be readily seen. Figure 2.7 shows the locations of the stations and the amount of fallout received at each. The dotted lines radiating from GZ show the original fallout sector predicted for the arc; the solid lines show how the last-minute shift in wind moved the sector southward. The southernmost station received the largest amount of fallout. Had it been physically possible to relocate several of the northern stations to the southern end of the arc, much higher contamination of the exposed materials could have been effected. Figures 2.8, 2.9, and 2.10 show foodstuff placed ready for exposure to fallout at station 1.

Figures 2.11 and 2.12 show foodstuffs placed ready for fallout during a practice run.

2.8 DECONTAMINATION METHODS

Access to the terrain in which the exposure stations were located was gained approximately 24 hr after the shot. At this time monitoring with a portable beta-gamma survey meter indicated the following situation (see Fig. 2.7):

Station No.	Distance north from reference point (Indian Springs), miles	Radioactivity, mr/hr
1	38	0.8
2	30	1.2
3	28	1.2
4	26	2.0
5	24	13–15

For the purposes of the decontamination exercises, all foods and materials were removed from the contaminated area to an area where water was available and where the radioactivity background was not elevated. Figure 2.13 shows the recovery of bulk wheat which had been exposed to fallout.* Figures 2.14 through 2.27 show practical examples of field methods that were applied, with results given in terms of before and after beta-gamma survey readings.

2.9 LABORATORY METHODS

Experience in the handling and monitoring of fallout samples was acquired in the Program 37 laboratory at Mercury, Nev., where all preliminary fallout work was done. Plastic-pellet collectors and their plastic containers were washed with alcohol. The washing of the pellets was continued in mechanical dunking devices. All containers used for holding the pellets during the washing process were washed and rewashed in alcohol. Eventually a high percentage of the fallout particles was concentrated in the combined alcohol wash solutions. These solutions were run through a sieve. The larger fallout particles were removed from the sieve and sorted for size in a bank of screens stacked in cylinders. The fallout material from the screens was placed on filters in covered glass containers and taken to the radiation counting room. The finer particles were extracted from the alcohol solution by special filters. Filtering was continued until background intensity readings were obtained on the alcohol solution. Beta scintillation counters, gamma binary scalers, and gas proportional counters were used to determine the amount of radioactivity in the individual samples. Direct counting of the adhesive and gummed metal collectors was performed by large specially designed counting heads. A quantitative indication of the radioactive isotopes present was obtained on pulse-height analyzers. Water solubility, hydrochloric acid solubility, and magnetic separation tests were also made on the fallout material at the Mercury laboratory. All final testing was done at the laboratories of the University of California at Los Angeles.

*See reports WT-1496 and WT-1497 for details concerning methodology.

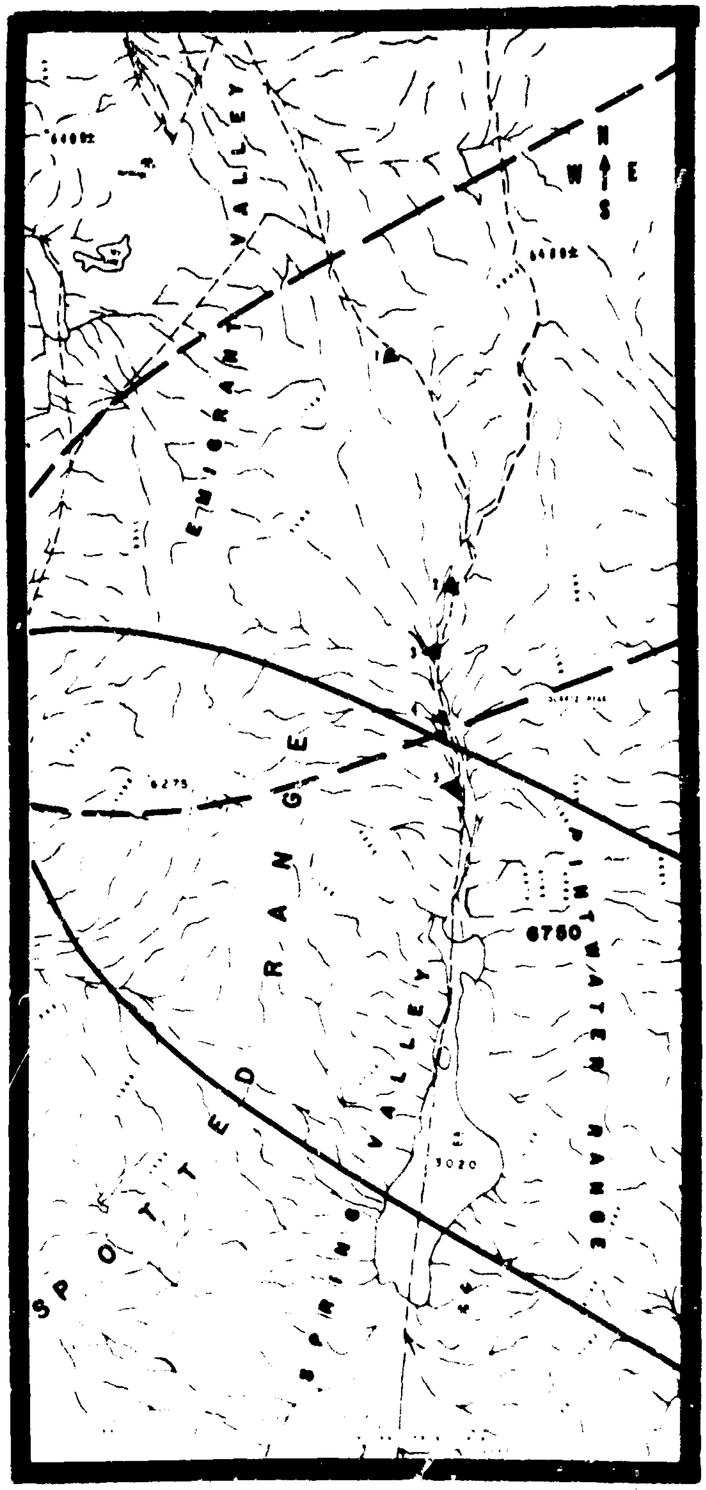


Fig. 2.7 — Diagrammatic map showing the locations of food stations and approximate locations of predicted (dotted lines) and actual (solid lines) fallout patterns. Small dotted lines indicate unimproved dirt roads in this region. Scale of miles is approximately 1 mile per quarter inch. Radioactivity at the food stations was: station 1, 0.79 μc/sq ft; station 2, 10.3 μc/sq ft; station 3, 8.6 μc/sq ft; station 4, 9.5 μc/sq ft; and station 5, 114 μc/sq ft.

Fig. 2.8—Packaged foods placed for exposure to fallout. Atomic cloud in the background.

Fig. 2.9—Packaged foods placed for exposure to fallout. The stock truck was used to haul most of the supplies for the stations.

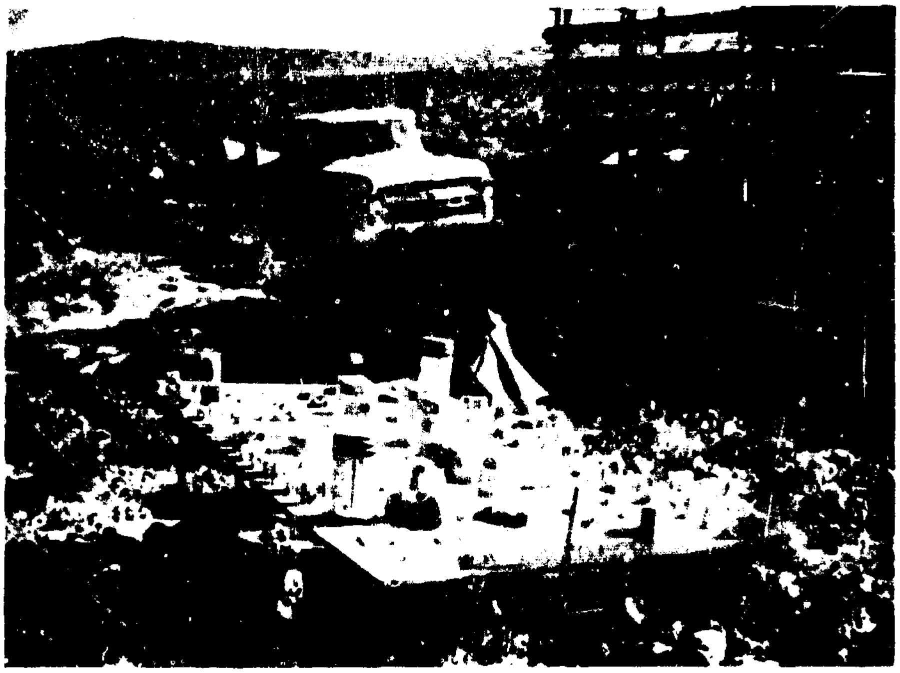


Fig. 2.10—Packaged food, bulk wheat, and trucks at food station 1.

Fig. 2.11—Dried fruit on plastic sheets on fruit-drying board ready for exposure to fallout.

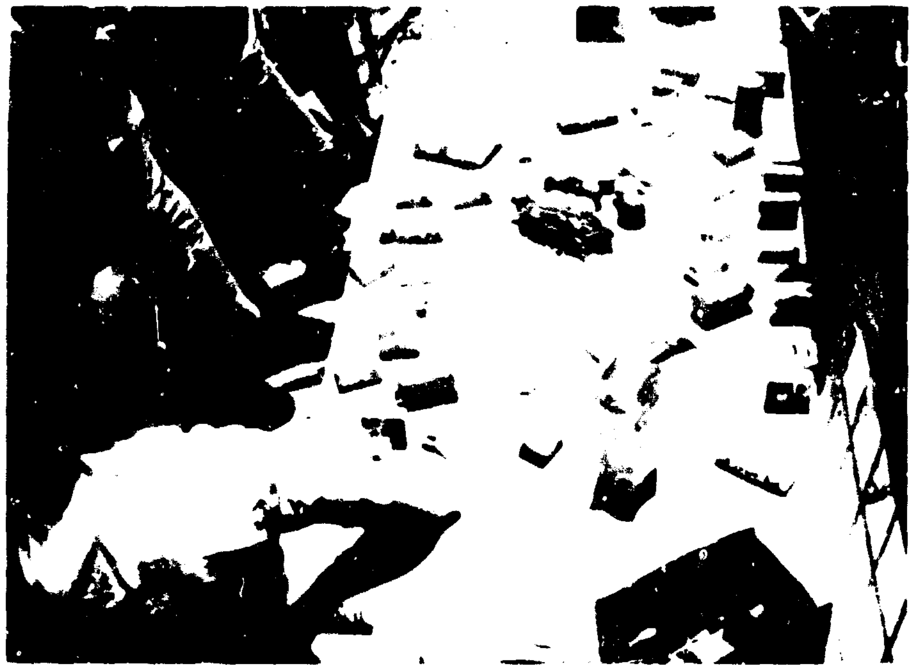


Fig. 2.12—Packaged food, milk cartons, fresh fruit, and corn in the husk. Dry-run demonstration for Air Corps officers, Mercury, Nev.

Fig. 2.13—Packaging wheat exposed to fallout for shipment to the mill. The wheat was packaged in sealed plastic bags and placed in sealed fiber cartons.

Fig. 2.14—Monitoring potatoes for radioactivity.

Fig. 2.15—Brush washing radioactive-contaminated potatoes in water. Gloves should be used if available.

Fig. 2.16—Monitoring potatoes following washing. Note change in intensity from Fig. 2.14 as the result of washing, indicating that considerable radioactive material has been removed.

Fig. 2.17—Peeling contaminated potatoes.

Fig. 2.18—Monitoring peeled potatoes. Note that the meter indicates virtually all the radioactive material was removed with the peeling.

Fig. 2.19—Monitoring sweet corn for radioactive contamination.

Fig. 2.20—Monitoring sweet corn from which the husk has been removed. Note the reduction in the meter reading, indicating that most of the radioactive material was removed with the husk.

Fig. 2.21—Monitoring paper-packaged flour for radioactive contamination.

Fig. 2.22—Monitoring paper-packaged flour for radioactive contamination. Note the higher reading in the fold. Fallout tends to fall in the folds and creases on food packages.

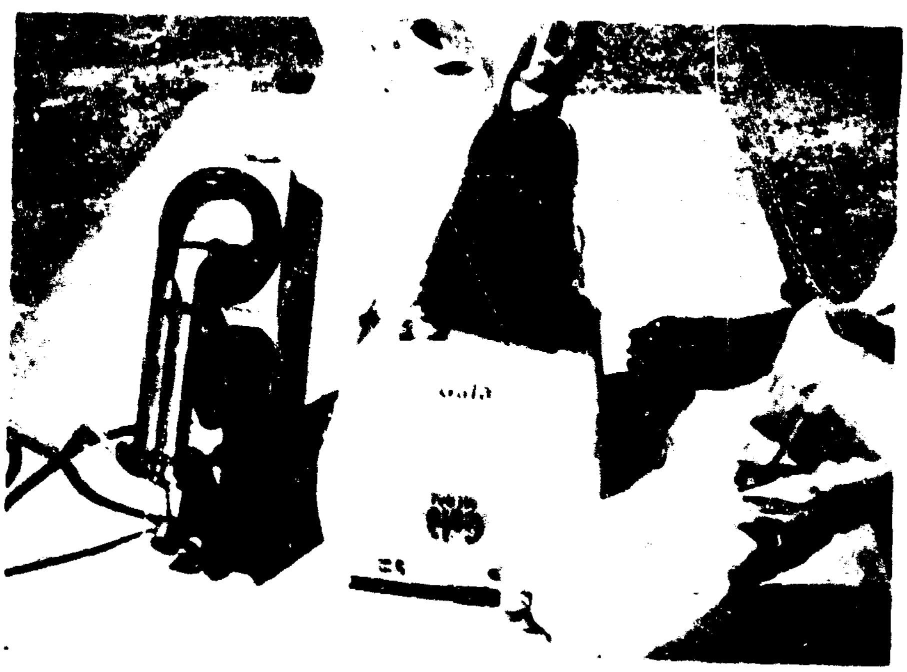


Fig. 2.23—Decontamination of the paper-packaged flour by brushing with a whisk broom.

Fig. 2.24—Making incision in brush-cleaned package of flour.

Fig. 2.25—Folding back the cut corners to form new opening for removal of the flour from the brush-cleaned bag.

Fig. 2.26—Monitoring a radioactive-contaminated Manila paper bag of food.

Fig. 2.27—Monitoring oil-soaked portion of radioactive-contaminated Manila paper bag of food. Note the meter reading indicates increased activity. Fallout is difficult to remove from oil-contaminated substances.

Chapter 3

SUMMARY

The monitoring and decontamination training program provided on-the-spot training in the use of field and laboratory monitoring equipment and practice in the decontamination of fallout-contaminated packaged and unpackaged foods.