USDA

RADIOLOGICAL MONITORING HANDBOOK

AGRICULTURAL RESEARCH SERVICE • U. S. DEPARTMENT OF AGRICULTURE

AGRICULTURE HANDBOOK NO. 246

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USDA Radiological Monitoring Handbook

Agriculture Handbook No. 246
U. S. Department of Agriculture
July 1963

This is a correction for Part V, page 13, the first paragraph under the heading "Care of Instruments." The paragraph should read as follows:

> Instructions for maintenance of radiological instruments are found in the USDA Radiological Training Manual (page 79). Information concerning operational checks for this equipment is contained in the Office of Civil Defense Handbook for Radiological Monitors, FG-E-5.9, April 1963, pages 4 through 10.

This is a correction for Part V, page 15, items 4 through 6 in the paragraphs under the heading "Procedure When Emergency Occurs."

4. For the first 12 hours after the arrival of fallout, dose rate reports will be made at hourly intervals.

5. During the period 13 through 24 hours after the initial report of fallout occurrence, dose rate reports will be made each 3 hours, based on observations taken at 0300, 0600, 0900, 1200, 1500, 1800, 2100, and 2400 GMT. (For instance, if the last hourly reading was taken at 7:20 P.M., EST, the next or 13th report would be made at 10:00 P.M., EST, which is 0300 GMT.)

6. During the period 25 through 48 hours, dose rate reports will be made each 6 hours, based on observations taken at 0300, 0900, 1500, and 2100 GMT.

7. Dose rate reports daily after 48 hours based on observations taken at 0300 GMT.

December 1963

USDA RADIOLOGICAL MONITORING HANDBOOK

Agricultural Research Service
UNITED STATES DEPARTMENT OF AGRICULTURE

Agriculture Handbook No. 246

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PREFACE

By Executive Order of the President, the Secretary of Agriculture has been assigned certain responsibilities for preparedness for any national emergency. One of these responsibilities is, in case of a nuclear attack, the monitoring of radioactive fallout affecting agricultural and forest lands, water used for agricultural purposes, meat and poultry, commodities stored or harvestable on farms and ranches, and livestock.

Radiological monitoring includes identifying radiation, measuring its intensities, interpreting radiological data, and helping to develop defense plans that will prevent or alleviate damage and injury from excessive radiation.

This handbook provides radiological monitors of the U.S. Department of Agriculture with information, procedures, and guidance in conducting emergency monitoring services.

It should be emphasized that the levels of radiation intensity and radioactive contamination associated with fallout from nuclear weapons testing are relatively low—so low, in fact, that civil defense instruments now available for this monitoring are unable to measure accurately the resulting degree of contamination.

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USDA Radiological Monitoring Handbook

PART I.—INTRODUCTION

The President of the United States has issued Executive Orders assigning emergency preparedness functions to a number of Federal Departments and Agencies. These orders direct the departments and agencies to make plans in their areas of responsibility "designed to develop a state of readiness * * * with respect to all conditions of national emergency, including attack upon the United States."

These emergency preparedness responsibilities are to be regarded as basic functions of the agencies and are to be integrated completely with other agency programs.

Assignment of Defense Responsibilities to USDA

Executive Order 10998 states in part:

Section 1. *Scope.* The Secretary of Agriculture * * * shall prepare national emergency plans and develop preparedness programs covering * * * defense against biological warfare, chemical warfare, and radiological fallout pertaining to agricultural activities * * *

* * *

Section 4. *Cooperation with Department of Defense.* In consonance with national civil defense plans, programs, and operations of the Department of Defense, under Executive Order No. 10952, the Secretary shall:

* * *

Develop plans for a national program, direct Federal activities, and furnish technical guidance to State and local authorities concerning * * * protective measures, treatment and handling of livestock, including poultry, agricultural commodities on farms or ranches, agricultural lands, forest lands, and water for agricultural purposes, any of which have been exposed to or affected by radiation. Plans shall be developed for a national program and direction of Federal activities to assure the safety and wholesomeness and to minimize losses from * * * radiological effects, and other emergency hazards of livestock, meat and meat products, poultry and poultry products in establishments under the continuous inspection of the U.S. Department of Agriculture, and agricultural commodities and products owned by the Commodity Credit Corporation or by the Secretary.

Establishment of Radiological Monitoring Service Within USDA

In keeping with the Executive Order, the Secretary of Agriculture issued on February 7, 1963, Memorandum No. 1489, Revised, Assignment of Defense Responsibilities in USDA. In this memorandum he assigned to Agricultural Research Service (ARS) responsibility for these pre-emergency and emergency operations:

Organization and direction of a system of radiological monitoring, including (1) arrangements with OCD–DOD for the acquisition, use, and disposition of monitoring equipment; (2) training of instructors in the use of monitoring equipment and general assistance to agencies of the Department in coordinating radiological training; (3) development and formulation of guidelines for use in determining the most efficient countermeasures for production, processing, and distribution of agricultural commodities. These guidelines are the results of research studies conducted in cooperation with other Federal departments, including the Department of Defense, the Atomic Energy Commission, and the Department of Health, Education, and Welfare.

Maintaining a capability for radiological monitoring at meat slaughtering and processing plants and stockyards subject to continuous ARS inspection.

Administrative functions on behalf of the Secretary relating to radiological safety within the Department.

Three other Department agencies were assigned responsibilities for radiological monitoring in their areas: Agricultural Marketing Service (AMS), Forest Service (FS), and Soil Conservation Service (SCS). Specific responsibilities are discussed in parts VII, VIII, IX, and X.

The Department agencies shall, with the overall coordination of ARS, utilize the assistance of other Department agencies and cooperating agencies where location and capability make that practicable. For this purpose, other agencies are authorized to designate and make available for training such of their personnel as may be needed for the Department's radiological monitoring services.

All monitoring activities will be closely coordinated with activities of State and local governments.

Need for Radiological Monitoring

Radiological monitoring includes identifying damaging radiation, measuring radiation intensities, interpreting radiological data, and helping to develop plans that will prevent or alleviate damage and injury from excessive radiation.

After a nuclear attack, radiological monitoring is required in order to obtain information upon

which to base decisions and operations of defense programs concerning protection, survival, recovery, and rehabilitation, as well as appraisal, evaluation, and assessment of agricultural resources. The presence of radiation, its intensity, and hazardous effects may be determined only by the proper use of monitoring instruments. Without this capability, there would be little or no factual information upon which to base any required action. Trained radiological defense monitors are therefore essential for this protective service.

Monitoring services will be needed not only immediately after a nuclear attack but also until radiation levels from fallout decrease to a point where activities can be conducted without significant danger to the inhabitants of the area.

Radiological monitors will determine the degree of contamination of personnel, objects, facilities, food, and water; specify the particular area or areas in which decontamination is required; and test the effectiveness of decontamination measures. This information will be acquired by USDA to help determine its ability to conduct its field operations.

Administrative guidance and direction on the Department's emergency radiological monitoring program have been provided the USDA State and County Defense Boards. Chapters 13 and 10, "USDA Radiological Monitoring in an Emergency," of the USDA State and County Defense Operations Handbooks, respectively, contain this information.

PART II.—RADIOLOGICAL DEFENSE TRAINING PROGRAM OF USDA

Those USDA agencies with delegated responsibility in radiological monitoring must: (a) develop and provide adequate numbers of qualified radiological instructors, the number being determined by the field organization of the agency; (b) provide, to the extent practicable, a minimum of four trained monitors for each Department installation where Department personnel work; and (c) provide operational capability and knowledge within the field forces to perform the assigned responsibilities outlined in Secretary's Memorandum No. 1489, Revised. All of the above objectives should be established and maintained within the regular field forces.

Training of Instructors in Radiological Monitoring

Instructors for the training programs will be developed in the following manner:

In compliance with requirements of the Atomic Energy Commission (AEC), instructors must attend an established and recognized 5-day course in radiological monitoring for instructors. Such courses are conducted by the Office of Civil Defense, Department of Defense (OCD-DOD), at the following locations:

Office of Civil Defense Staff College, Battle Creek, Mich.

OCD Civil Defense Training Center, Brooklyn 35, N.Y.

OCD Civil Defense Training Center, Alameda, Calif.

The Agricultural Research Service (ARS) has permission from AEC and OCD to conduct 5-day training courses for radiological monitoring instructors for Department personnel only.

Candidates who successfully complete either the OCD or ARS 5-day course qualify as instructors of monitors and also qualify for AEC licensing, if required, to handle radioactive materials for training purposes.

Training of Radiological Monitors

Radiological monitors normally will be trained by their own agency. The course of instruction should generally follow the suggested agenda for a 2½-day course outlined in the USDA Radiological Training Manual.[1] Subject lectures, visual aids, and sources of visual aids and other instructional materials are listed in the manual.

[1] Agricultural Research Service, U.S. Department of Agriculture. USDA radiological training manual, 232 pp. Revised July 1961.

Information and Refresher Courses

Atomic energy and radiological defense are dynamic fields, with new findings being continually developed from observations, investigations, and research studies. To keep agricultural personnel informed, these new findings and information will be distributed as they become available. Refresher courses will be essential to provide training and information on current research findings and their application to radiological defense and countermeasure programs. These courses should include discussions on revisions in monitoring techniques, operational procedures, new or improved countermeasures, protection standards, policies, and inspection and review of monitoring instruments. Such refresher courses should be of 1 to 2 days' duration, and should be conducted when required and appropriate.

The general orientation course, given in 1 day, can be used for general information to selected groups on the subject of atomic energy, radiation, and its effects on agriculture. Such a suggested course is also outlined in the training manual.

Reports on Radiological Defense Training

An annual report will be made by Department agencies covering radiological defense training and operational capability to include:

1. A list of names and addresses of instructors trained.

2. The number of monitors trained during the year, and total to date.

3. A list of radiological monitoring stations attaining operational status during reporting period, including complete address. Changes in locations previously reported will also be a part of this report.

Reports are due in the Washington offices of the Agricultural Marketing Service, Agricultural Research Service, Forest Service, and Soil Conservation Service on January 1.

Form AD–295, "Record of Formalized Training," will be completed for each employee qualified as instructor or monitor. A copy of the form for instructors will be forwarded to the Washington offices of the USDA agencies. (See ARS Administrative Memorandum 440.2 of November 28, 1960; FS Manual 6191.23; AMS Instruction 380–3 dated January 16, 1961; or SCS Personnel Handbook, chapter on Training.)

Monitoring-Kit Equipment

The current complement of instruments in the CD V–777 Operational Monitoring Kit is:

Item	*Amount*
CD V–700 Geiger counter (0–50 mr/hr)	1
CD V–710 Survey meter (0–50 r/hr) or [1]	1
CD V–715 Survey meter (0–500 r/hr)	1
CD V–720 Survey meter (0–500 r/hr) or [2]	1
CD V–717 Survey meter (0–500 r/hr), remote	1
CD V–730 Dosimeter (0–20 r) and [3]	1
CD V–740 Dosimeter (0–100 r)	1
or	
CD V–742 Dosimeter (0–200 r)	2
CD V–750 Dosimeter charger	1

[1] In future procurement of OCD instruments, the V–710 survey meter will be replaced by the V–715 survey meter.
[2] In future procurement of OCD instruments, the V–720 survey meter will be replaced by the V–717 survey meter.
[3] In future procurement of OCD instruments, the V–730 and V–740 dosimeters will be replaced by the V–742 dosimeter.

Property Accountability

Approved methods for developing and establishing property records will be maintained by each agency possessing monitoring instruments and equipment furnished by OCD. Records should be maintained by location, instrument type, model, and serial number.

Radioactive Source Sets

The Department, through its AEC license, authorizes qualified personnel to possess or use OCD 30-millicurie cobalt 60 radiation source sets for training purposes. Individuals having custody of a radioactive source set are named on the Department's license from AEC. Those who will merely use radioactive source sets, on a temporary basis, receive letters of authorization from the Department's Radiological Safety Officer under the Department's AEC license.

Trainees attending OCD courses for instructors may obtain from the Department's Radiological Safety Officer a letter of authorization to handle radioactive materials. The written request for this authorization should be directed through the Washington office of the agency concerned.

Requests for authority to possess cobalt 60 source sets for training purposes will be made to the Department's Radiological Safety Officer by the Washington offices of the agencies with assigned training responsibilities. Authorization to possess or handle radioactive source materials will be sent directly to the individuals, with copies to the agency's Washington office.

Storage Points of Cobalt 60 Source Sets

Information on the location of the cobalt 60 radiation source sets for USDA is given below. USDA policy is to restrict the number of source sets within the Department to a minimum. Source sets from other departments and agencies should be utilized wherever possible.

CALIFORNIA:
Dr. F. R. Thorndike
Meat Inspection Division
Agricultural Research Service, USDA
Room 225
180 New Montgomery Street
San Francisco 5, Calif.

GEORGIA:
Mr. Gaylord A. Knight
U.S. Forest Service
50–7th Street NE.
Atlanta 23, Ga.

ILLINOIS:
Dr. Robert A. Moody
Meat Inspection Division
Agricultural Research Service, USDA
211 Stockyards Station
4101 South Halsted Street
Chicago 9, Ill.

MONTANA:
Mr. Dallas W. Beaman
U.S. Forest Service
Federal Building
Missoula, Mont.

NEBRASKA:
Dr. Robert C. Buie
Meat Inspection Division
Agricultural Research Service, USDA
709 Livestock Exchange Building
Omaha 7, Nebr.

NEW MEXICO:
Mr. Raymond R. Busby
U.S. Forest Service
New Federal Building
517 Gold Avenue SW.
Albuquerque, N. Mex.

OREGON:
Mr. Clarence E. Edgington
U.S. Forest Service
Post Office Box 4137
Portland 8, Oreg.

SOUTH CAROLINA:
Dr. Herbert Racoff
Animal Disease Eradication Division
Agricultural Research Service, USDA
Post Office Box 1771
Columbia, S.C.

TEXAS:
Dr. Ted Rea
Animal Disease Eradication Division
Agricultural Research Service, USDA
Box 2384, Capitol Station
(Office: 402 West 13th Street)
Austin 11, Tex.

One standard Cobalt 60 Source Set (CD V–784), consisting of 6 sealed metallic capsules totaling 30 millicuries, is stored or will be stored at each location shown above. This material may be used by only those individuals designated as users in a current Byproduct Material License issued by the Atomic Energy Commission. Any questions concerning the care and handling of this material may be referred to the Radiological Safety Officer, Agricultural Research Service, U.S. Department of Agriculture, Beltsville, Md.

The custodians shown above have been designated as users under Byproduct Material License No. 19–915–3 (A65).

The possessor of a radiation source set is responsible to the Department's Radiological Safety

Officer for safe storage, use, and maintenance, and is subject to AEC inspection. The possessor also assumes responsibility for labeling and leak-testing of OCD sources. He will, immediately upon receipt and thereafter at intervals not to exceed every 6 months, conduct the leak test as described in *Procedures and Regulations for the Care and Use of the OCD CD V–778 Radiation Training Source Set* (dated April 15, 1963). Records of leak tests must be maintained by the possessor of the source set. Findings of all leak tests will be reported to the Radiological Safety Officer.

USDA Radiological Safety Handbook [2]

All USDA instructors in radiological defense have been furnished the Department's *Radiological Safety Handbook*. All qualified personnel utilizing radiation sources must be thoroughly familiar with the contents of that handbook and the procedures to be followed in the transportation, use, and storage of radioactive material. The Safety Handbook is provided at the same time as the authorization for handling radioactive material.

Those USDA agencies having custody of a radiation source set may loan it for training purposes to USDA personnel who possess the appropriate letter of authorization signed by the USDA Radiological Safety Officer. Loans to personnel other than USDA may be made on proof of possession of a valid AEC license to have custody and use of OCD CD V–784 source sets for training purposes. Radiation source sets from other departments or State and local civil defense agencies may be obtained by presenting the Department's letter of authorization and proper identification.

Moving of radiological source sets must be in compliance with the State and local laws and regulations, usually found in the State Health Department, and USDA radiological safety requirements. The Department's Radiological Safety Officer should be notified in advance (by at least 2 weeks) if a source set is to be moved for training purposes across State lines. He has on file, for those States requiring them, the registration or reporting forms which govern the introduction of sources of radiation into the several States.

Personnel Radiation Exposure Records

USDA Radiological Safety Handbook, Section 3, "Rules Affecting Personnel," will be rigidly applied. Paragraph 3.3 of that section requires a Personnel Radiation Exposure Report (Department Form OA–22) for training programs, or other exposures as shown in figure 1. This report should be sent to the Department's Radiological Safety Officer, Agricultural Research Service, Plant Industry Station, Beltsville, Md., immediately after each training session or inspection of source set.

Exposure records must be kept both for instructor and for trainees. The dosage received by one trainee can be applied to all trainees present. In addition, instructors or custodians of source sets must maintain a cumulative record of exposure of individuals for use in preparing OA–22 reports and for AEC inspection.

Unauthorized persons will be kept a safe distance from source material to prevent exposure.

[2] United States Department of Agriculture. radiological safety handbook. 29 pp. July 1, 1961.

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U. S. DEPARTMENT OF AGRICULTURE

PERSONNEL RADIATION EXPOSURE REPORT

1. AGENCY

2. DIVISION, BRANCH AND SECTION

3. ADDRESS

INSTRUCTIONS: Complete in duplicate. Forward original to the Radiological Safety Officer, Radiological Safety Committee, Plant Industry Station, Beltsville, Maryland.

4. RADIOLOGICAL SAFETY COMMITTEE IDENTIFICATION

5. SOURCE

6. PERIOD OF REPORT (*From - To*)

NAME A	BADGE OR METER IDENTIFICATION B	WORN 1/ C	TYPE OF USE 2/ D	TOTAL HOURS OF USE E	EXPOSURE REPORTED (*Millireentgens*) F

7. REMARKS

8. TITLE

9. SIGNATURE

10. DATE

USE CODE: 1/ *Worn:* W-WAIST C-CHEST A-ANKLE OTHER (*Specify*)
2/ *Type of use:* C-CALIBRATION F-FIELD L-LABORATORY OTHER (*Specify*)

OA Form 22
May 1959

FIGURE 1.—Example of form for reporting personnel radiation exposure (OA Form 22).

PART III.—RADIOLOGICAL MONITOR REPORTS

Coverage

The USDA State Defense Boards should agree with State and local governments on the types of monitoring information essential to food and agriculture and rural fire defense, and how such information should be obtained and made available in an emergency.

The monitoring information from all sources will help support allocations of food from areas of surplus to areas of shortage, provide protection of USDA employees and facilities, determine the best use of agricultural lands, disposition of agricultural commodities, and care or disposition of livestock. The monitor reports will also provide an important source of information to be used by the Federal Extension Service and other USDA agencies to advise the farm population, in accordance with policy, regarding precautions to minimize the effects of harmful radiation. In addition, monitoring information will also be useful in determining when and where rural fire defense forces can be used with reasonable personnel safety. This information will be made available to USDA representatives and others through prescribed channels.

Exchange of Monitor Reports

Monitor reports prepared by USDA personnel in the county will be submitted to the Chairman of the USDA County Defense Board, who in turn will transmit the reports to local government. Local government will provide the Chairman with composite monitor reports which would be helpful to agriculture. He will see that all monitor reports received are available to USDA agency representatives at the county level, so they can be used in evaluating effects of attack as a basis for determining necessary protective actions and certain other program activity. As communications permit, the Chairman will transmit the significant conclusions from monitor reports to the USDA State Defense Board.

Figure 2 indicates graphically the prescribed flow of monitoring information from the local to the national level.

The USDA State Defense Board will make the monitoring information received available to State government and will, in turn, receive from State government composite monitor reports which would be useful to USDA. The monitor reports will be made available to USDA agency representatives at the State level so they can be used in evaluating the effects of attack as a basis for necessary program actions.

The USDA State Defense Board will make estimates of effects of attack available to the USDA Regional Defense Boards and to USDA national headquarters whenever communications permit.

Dose Rate Reports

Dose rate reports will be prepared in the following format:

ddtttt LLLrrr

where

dd is the day of the month;

tttt is the time in Greenwich Meridian Time (see table 2, Time Conversion, page 15);

LLL is the agency designation and monitoring station location; and

rrr is the observed dose rate to the nearest whole number, measured in roentgens per hour.

(The agency designation AMS, ARS, FS, or SCS will replace the 3-letter code designators used in the past.)

This is an example of a dose rate report or message:

290300 SCS-Merced-280

where:

29 indicates that the fallout observation was taken on the 29th of the month;

0300 indicates the observation was taken at 0300 hours GMT;

SCS-Merced indicates the agency and location of the monitoring station—in this case, the Soil Conservation Service office at Merced, Calif.; and

280 indicates that the observed dose rate was 280 roentgens per hour.

See page 15 for further examples of monitor reports, or flash reports, and page 13 for monthly operability reports.

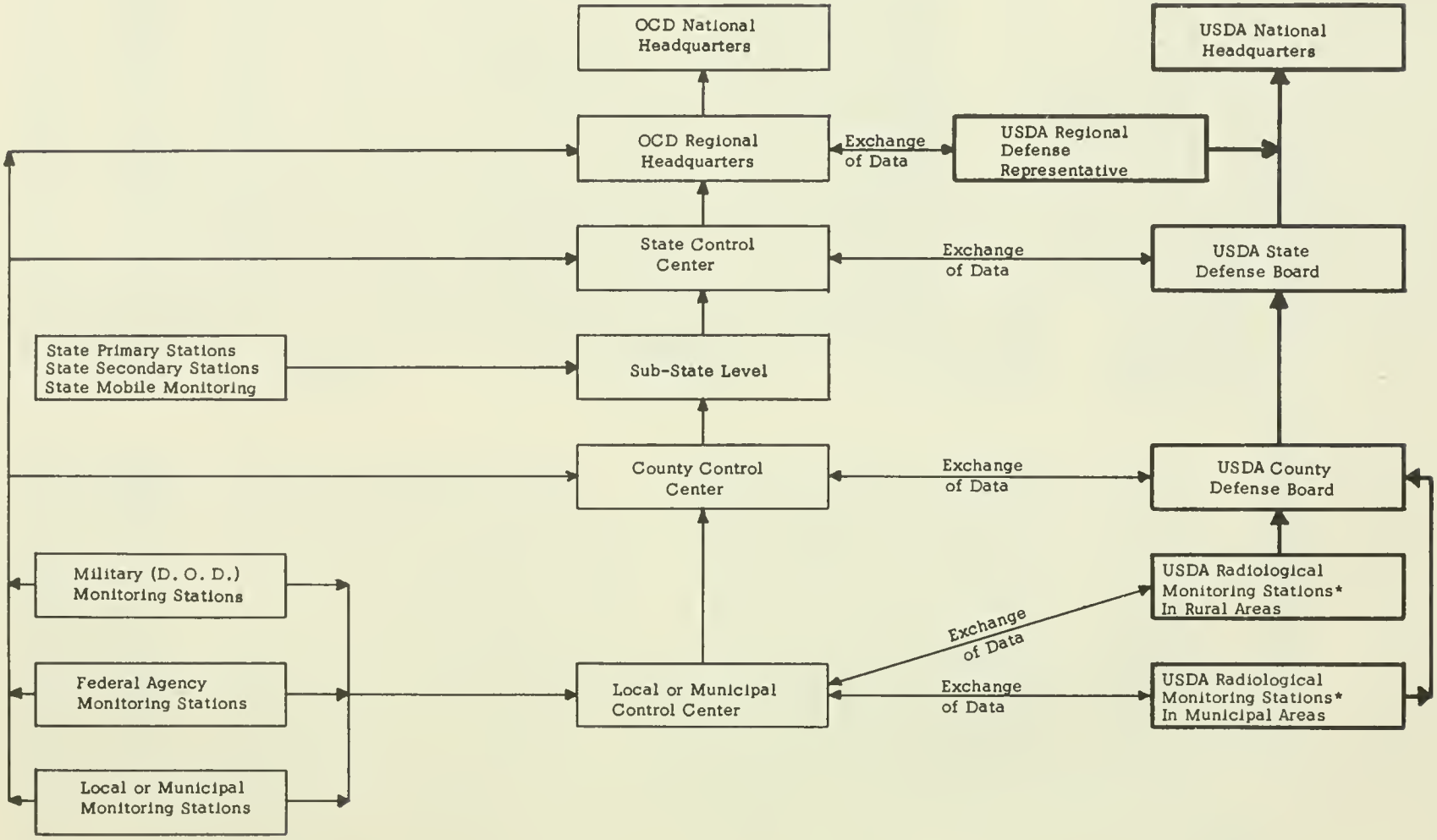
Dose rates will be reported in roentgens per hour (r/hr) as a 3-digit number.

For readings of **less than 100 roentgens per hour,** the first digit will be zero. A reading of 75 roentgens per hour will be reported as 075 (zero-seven-five).

If the reading is **less than 10 roentgens per hour,** there will be two zeros followed by the reading. Example: A reading of 5 roentgens per hour will be reported as 005 (zero-zero-five).

Dose rates which **equal or exceed 1 roentgen per hour** will be reported to the nearest

RADIOLOGICAL DEFENSE REPORTING (COMMUNICATIONS) SYSTEM



* USDA agencies represented are ARS, AMS, FS and SCS.

FIGURE 2.—Plan for flow of radiological defense reports.

whole roentgen per hour. Example: A dose rate of 1.4 roentgens per hour will be reported as 001. A dose rate of 1.5 roentgens per hour will be reported as 002.

Readings **below 1 roentgen per hour** will be expressed in tenths, hundredths, or thousandths of roentgens per hour as required. Example: $\frac{1}{10}$ roentgen per hour will be reported as .100 (point-one-zero-zero); 50 milliroentgens per hour as .050 (point-zero-five-zero).

The agency designation and monitoring station location should always be reported. This will identify the source of the message.

A marked increase of dose rate following a period of decay indicates the arrival of additional fallout. This information is valuable in planning survival operations; the maximum dose rate observed and the time of occurrence should be noted on the record form. Also, whenever a marked increase of dose rate is observed, a new series of observations should be undertaken.

Reports of "no fallout" are just as important for survival operations as are reports of specific dose rates. According to the above general instructions, monitoring stations will not begin to report dose rates until the observed dose rate equals or exceeds 0.5 roentgen per hour. However, if the dose rate does not reach 0.5 roentgen per hour, field stations of USDA should report this fact once each 12 hours during the first 48 hours after attack. No additional reports need be filed thereafter unless the dose rate equals or exceeds 0.5 roentgen per hour, in which case the previously described routine of reporting procedures will be followed.

PART IV.—FEDERAL, STATE, AND LOCAL GOVERNMENT PARTICIPATION IN RURAL RADIOLOGICAL MONITORING

OCD Assistance

The Office of Civil Defense is supporting USDA in those specifically assigned functions which can best be performed by the Department's field personnel, through the loan and transfer of radiological equipment. However, radiological information will be required for many purposes at each level of government and, to the extent feasible, must be supplied by a comprehensive system. Operational capability is being developed by OCD, through the issuance of operational monitoring kits to Federal, State, and local monitoring stations that can qualify. The objective is 150,000 monitoring stations. The USDA has approximately 4,500 monitoring stations.[3]

To avoid duplication of equipment, training, and personnel requirements, the following division of responsibilities should be observed.

Local Government's Responsibilities

The local government has the responsibility:

1. In agreement with State plans and specific guidance, to establish local procedures for monitoring and reporting that are necessary for evaluating and controlling radiation exposure of the rural population, rural fire defense forces, livestock, and poultry.
2. In conjunction with representatives of USDA, to establish local procedures for the radiological monitoring and reporting (or mapping) of contamination of privately owned (1) farmland and (2) agricultural commodities.
3. To establish monitoring and reporting systems to supply the information necessary for short- and long-range protection of the lives and property of rural people. Appropriate monitoring information should be made available to the local government and to USDA representatives. (See figure 2, p. 8.)
4. To perform other appropriate radiological defense functions as directed in the OCD guidance for State and local civil defense.

USDA Local Representative's Responsibilities

The USDA local representative has the responsibility:

1. In conjunction with the local civil defense office, to apply USDA guidance and directives in establishing local procedures for the radiological monitoring and reporting (or mapping) of contamination of privately owned (a) farmland and (b) agricultural commodities (stored or harvestable).
2. Based upon local monitoring information and USDA guidance, to recommend appropriate (a) use of agricultural lands, (b) use or disposition of agricultural commodities, and (c) care or disposition of livestock.
3. In conjunction with the local civil defense, to advise the farm population on precautions to take to minimize radiation exposures associated with important farm work; i.e., denial time,[4] shielding required, shelter, and protection of food, feed, and water.
4. To develop area monitoring required for rural fire defense. The Forest Service will provide area monitoring for fire-control personnel on national forest protection areas; other Federal, State, and local rural fire-protection agencies will be expected to have area radiological capability on lands for which they are responsible. A radiological monitoring plan should be developed to provide for use of radiological information from other agencies having area monitoring capability. This information will be needed by fire-control forces during the critical fire emergency immediately following a nuclear attack.
5. To perform other radiological defense functions as assigned by Executive Order, and mutual agreements between State and county USDA representatives and civil defense organizations.

Organization of Local Government for Radiological Defense

The organization of local government varies significantly from State to State. In most States, however, the county is quite active in administering agricultural programs. For that reason it is expected that local aspects of radiological defense

[3] The locations of all USDA operational monitoring stations as of January 1, 1963 are listed in "USDA Radiological Monitoring Stations," February 1963.

[4] Denial time is that period when persons are prohibited from entering a contaminated area or leaving shelter in such an area because of radiation intensity. Also, the period of time croplands are prohibited from use for designated agricultural products because of radioactive contamination, or milk prohibited from human consumption because of radioiodine content.

for agricultural areas will be organized and administered primarily by county government.

In those States where organization of political subdivisions or local conditions make it necessary, agricultural radiological defense may be centered in government organizations other than the county.

No attempt is made to present a detailed staffing pattern. However, the folowing personnel will be among those concerned with the joint responsibility for local agricultural radiological defense:

1. County civil defense director (policy).
2. County radiological defense officer.
3. Chairman, USDA County Defense Board.
4. Local representatives of AMS, ARS, FS, and SCS having radiological defense responsibilities.

Operational Plans in Joint USDA and Local Functions

Since farm size, land use, terrain, road systems, and communications requirements vary greatly from area to area, detailed plans will also vary and must reflect local conditions. The following are general statements of items for such a detailed plan:

The USDA local representative will apply USDA guides and procedures for that part of the monitoring required for evaluation of: (1) acceptable land and farm water use; (2) the degree of contamination of agricultural commodities stored or harvestable on farms, ranches, and at bin sites, forests and forest products; and (3) the probable effects on livestock and poultry.

In acquiring information for land use, Soil Conservation Service, USDA, will recommend and use methods of reporting, plotting, and mapping the radiological defense (RADEF) situation. In conjunction with the county radiological defense officer, SCS will determine when the monitoring for land or water use evaluation should be undertaken. This would be at some time between the following two conditions:

1. Dose rates decayed to intensity low enough to present an acceptable hazard to monitors.
2. Dose rates high enough for measurement with OCD survey instruments.

AMS, ARS, FS, and SCS will plan the extent and methods of carrying out the additional monitor assignment indicated in the Secretary's Memorandum No. 1489, Revised.

In an emergency, the USDA County Defense Board will apply USDA criteria in recommending:

1. Disposition to be made of commodities, livestock, and poultry;
2. Utilization of agricultural land;
3. Other disposition relating to food and agriculture, and forest lands within the county.

The county civil defense organization will perform radiological defense functions in conformance with directives in the OCD guidance for State and local civil defense. Those functions will include the development of monitoring and reporting capability in accord with USDA requirements listed on page 11.

Food and Drug Administration's Role

The Food and Drug Administration (FDA), in cooperation with State and local government counterparts, is responsible for monitoring food for radiological, chemical, and biological contamination, with the exception of food and related items assigned to USDA. Portions of the plans for such monitoring should be worked out jointly by representatives of FDA, USDA, and State and local governments.

Cooperation in Aerial Monitoring

Several of the States are developing aerial-monitoring capability, utilizing the CD V–710 and CD V–715 survey instruments in cooperation with the Civil Air Patrol. A special aerial instrument is currently being developed for OCD. The establishment of multiple-purpose aerial-monitoring capability at 3,000 public-use airports is planned for completion by the end of fiscal year 1964. At that time, the need for monitoring capability at additional airports will be reassessed.

Direction, or at least coordination, of aerial monitoring will be primarily a State function, for the following reasons:

1. It is appropriately used over areas larger than the typical county or city.
2. Monitoring of highly contaminated areas from bases in less contaminated areas is feasible.
3. During an emergency period, restrictions on use of aircraft are to be expected, as specified in the plan for Security Control of Air Traffic and Electromagnetic Radiation (SCATER).
4. Negotiations for permission for civil defense units to perform aerial monitoring are more practical at State than at local level.

It is planned that aerial-monitoring procedures will be developed for several monitoring purposes, including mapping the contamination of agricultural lands. As these procedures and capabilities are developed, the USDA State plans should be coordinated with those of the State civil defense organization, similar to the local coordination previously outlined.

PART V.—OPERATIONS AND PROCEDURES OF USDA MONITORING STATIONS

Those who are responsible for the operation of USDA monitoring stations should be guided by the following procedures.

Care of Instruments

Instructions for maintenance and operational checks of radiological instruments are found in the *USDA Radiological Training Manual* (page 79).

Special attention will be given to the transportation and use of radiological equipment, to prevent damage.

While recording radiation, the monitors should either carry the equipment by hand or transport it in shockproof boxes designed especially for the instrument.

Batteries

Refer to the instrument instruction manual for the proper battery installation procedure. Particular attention should be given to correct battery polarity during installation. For instruments used every few days, batteries should be removed monthly and the battery contacts inspected for any dirt or corrosion present. Dirty contacts should be cleaned with a cloth or steel wool.

If the instrument is to be stored for more than several weeks, batteries should be *removed* from the instrument and stored in a cool, dry place. Where feasible, batteries can be wrapped in plastic or other *moistureproof* material and placed in refrigerated storage, greatly extending the shelf life. Whenever an instrument is not in use, make certain that it is turned off; otherwise, the batteries will be discharged and the instrument rendered ineffective. With good batteries, all instruments should operate continuously for 100 to 150 hours. Intermittent use should extend the operating life two or three times. Replace batteries annually, or sooner if necessary. For a state of continued readiness, fresh batteries must be available for all monitoring instruments.

Calibration

Each instrument should be calibrated at least biannually to verify that it is measuring correctly, If the operational check of a calibrated instrument is satisfactory, a monitor *must* rely on the instrument reading and *accept* it as an accurate measurement of the gamma dose or dose rate.

OCD has developed and is procuring calibration equipment. The equipment will be located at each of the OCD repair depots. Department agencies and field stations will be advised of details on the availabilty of the equipment and scheduling for the calibration of USDA instruments.

Operability Reports

Each station will record operability checks every 2 months, as indicated in figure 3, Inspection, Maintenance, and Calibration Log for Radiological Instruments.

Repair of Monitoring Equipment

Repair service for radiological monitoring instruments is available at the following OCD Depots:

OCD/GSA Depot
Route 1
Romulus, N.Y.

OCD, care Veterans Administration Supply Depot
Somerville (Royce), N.J.

OCD/GSA Depot
North Fifth Ave.
Lebanon, Pa.

OCD/GSA Depot
Building T–31
Shelby, Ohio

OCD/GSA Depot
440 South Front Street
Rockwood, Tenn.

OCD/GSA Depot
Naval Industrial Reserve Shipyard
Seneca, Ill.

OCD/GSA Depot
Bastrop
Texas

OCD/GSA Depot
1121 Fourth Street SE.
Hampton, Iowa

OCD Depot
Building No. 931
Mira Loma Air Force Station
Mira Loma, Calif.

OCD/GSA Depot, Stockton Annex
Naval Supply Center, Oakland
Rough and Ready Island
Stockton, Calif.

OCD Depot
Building 21
U.S. Naval Supply Depot
Spokane, Wash.

Procedure When Attack Is Imminent

The following courses of action will serve as a check list of appropriate preattack readiness procedures:

1. Insert batteries in instruments not in daily use and perform standard operability checks.
2. Charge dosimeters.

686996 O—63——3

INSPECTION, MAINTENANCE AND CALIBRATION LOG FOR RADIOLOGICAL INSTRUMENTS

DATE	ACTION	REMARKS	SIGNATURE

DIRECTIONS:

1. Keep this log with the instruments.

2. Inspect all radiological instruments every two months. Perform an operational check on survey meters and, if necessary, rezero all dosimeters. Enter the results of the inspection on this log.

3. Initiate action for repair or replacement of inoperable instruments. Enter the appropriate action on this log.

4. Replace batteries annually or sooner, if necessary. Enter replacement on this log.

5. Make instruments available for calibration as required. Enter action on this log.

FIGURE 3.—Sample form of inspection, maintenance, and calibration log for radiological instruments.

3. Check availability of outer clothing and supplies for minimizing contamination of the persons who will perform out-of-doors monitoring.

4. Check communications in accordance with standard operating procedures.

5. Check availability of recording forms, pencils, and equipment required, as well as

equipment needed subsequently for outdoor monitoring, such as flashlights and clipboards.

6. Place vehicles required for later mobile activity under cover to avoid contamination.

7. Alert off-duty personnel to report to assigned stations or alternate stations, or to take instruments to assigned shelter locations, in accordance with the operating plans of the monitor's agency.

Procedure When Emergency Occurs

The fallout station monitor will measure, record, and report unsheltered dose and dose rates to the appropriate USDA office, as shown by figure 4.

Unless otherwise specified by the local organization, the monitor will:

1. Make a **FLASH REPORT** when the the outside dose rate reaches or exceeds 0.5 roentgen per hour. The report will be in the following format:

tttt LLLFallout

where:

tttt is the time of the fallout observation in local standard time; and

LLL is the agency designation and the monitoring station location.

2. Record and report dose and dose rates in accordance with the Radiological Reporting Log (fig. 4).

3. Record and report dose rates as follows:

tttt LLLrrrr

where:

tttt is the time of the reading in local time;

LLL is the agency designation and monitoring station location; and

rrrr is the measured dose rate.

4. For the first 12 hours after the arrival of fallout, dose rate reports will be made at *3-hour intervals*, based upon observations taken at 0300, 0600, 0900, 1200, 1500, 1800, 2100, and 2400 GMT.

5. During the period 12 to 48 hours after the initial report of fallout occurrence, dose rate reports will be made *each 6 hours*, based upon observations taken at 0300, 0900, 1500, and 2100 GMT.

6. Dose rate reports *daily* after 48 hours, based upon observations taken at 0300 GMT.

Time Conversion

Using the Time Conversion Table (table 1 below), enter above each "Z" time designation the corresponding time for your locality. "Z" time is a common reference time essential to analysis and evaluation of radiological data by radiological defense officers, and is often referred to as Greenwich Meridian Time. It is important that the monitor convert and record these times in the appropriate spaces on his log to assure that all reports have a common reference time.

TABLE 1.—*Time conversion*

Greenwich Mean Time	Eastern Daylight	Eastern Standard or Central Daylight	Central Standard or Mountain Daylight	Mountain Standard or Pacific Daylight	Pacific Standard
0100	* 2100	* 2000	* 1900	* 1800	* 1700
0200	* 2200	* 2100	* 2000	* 1900	* 1800
0300	* 2300	* 2200	* 2100	* 2000	* 1900
0400	* 2400	* 2300	* 2200	* 2100	* 2000
0500	0100	* 2400	* 2300	* 2200	* 2100
0600	0200	0100	* 2400	* 2300	* 2200
0700	0300	0200	0100	* 2400	* 2300
0800	0400	0300	0200	0100	* 2400
0900	0500	0400	0300	0200	0100
1000	0600	0500	0400	0300	0200
1100	0700	0600	0500	0400	0300
1200	0800	0700	0600	0500	0400
1300	0900	0800	0700	0600	0500
1400	1000	0900	0800	0700	0600
1500	1100	1000	0900	0800	0700
1600	1200	1100	1000	0900	0800
1700	1300	1200	1100	1000	0900
1800	1400	1300	1200	1100	1000
1900	1500	1400	1300	1200	1100
2000	1600	1500	1400	1300	1200
2100	1700	1600	1500	1400	1300
2200	1800	1700	1600	1500	1400
2300	1900	1800	1700	1600	1500
2400	2000	1900	1800	1700	1600

*Add 1 day to the local calendar date for equivalent date in Greenwich Mean Time (GMT). Example: Observed Central Standard Time is 10:00 p.m. (2200 CST) on the 14th day of the month (142200 CST). Expressed in GMT, that time would be 0400Z on the 15th day of the month (150400Z).

STATION _____ RADIOLOGICAL REPORTING LOG REPORTED TO _____

AGENCY _____

FLASH REPORT (0.5 R/HR OR MORE)

1ST HR. THRU 12TH HR. Δ (HOURLY ON THE HOUR)

13TH HR. THRU 24TH HR. Δ (EVERY 3 HOURS)

26TH HR. THRU 48TH HR. Δ (EVERY 6 HOURS)

AFTER 48TH HR. Δ _____. (DAILY AT 0300 Z)

DATE _____ TIME _____ DOSE RATE _____R/HR

TIME SENT TO CONTROL CENTER _____

NOTE: FLASH REPORT OF FALLOUT WILL BE MADE AS SOON AS DOSE RATE REACHES 0.5 R/HR.

REPORT AS FOLLOWS:

1. _____ (TIME OF OBSERV.)

2. _____ (LOCATION)

3. _____ FALLOUT _____

DATE _____

TIME	DOSE RATE
1. _____	_____R/HR
2. _____	_____
3. _____	_____
4. _____	_____
5. _____	_____
6. _____	_____
7. _____	_____
8. _____	_____
9. _____	_____
10. _____	_____
11. _____	_____
12. _____	_____

O TOTAL DOSE TO _____. _____R 0300Z

DATE _____

TIME	DOSE RATE
1. _____	_____R/HR
2. _____	_____
3. _____	_____
4. _____	_____
5. _____	_____
6. _____	_____
7. _____	_____
8. _____	_____

TAKE OBSERVATIONS AT

_____. _____. _____. _____.
0300Z 0600Z 0900Z 1200Z

_____. _____. _____. _____.
1500Z 1800Z 2100Z 2400Z

O TOTAL DOSE TO _____. _____R 0300Z

DATE _____

TIME	DOSE RATE
1. _____	_____R/HR
2. _____	_____
3. _____	_____
4. _____	_____

TAKE OBSERVATIONS AT

_____. _____. _____. _____.
0300Z 0900Z 1500Z 2100Z

O TOTAL DOSE TO _____. _____R 0300Z

IF AT ANYTIME FOLLOWING A PERIOD OF DECAY, THE DOSE RATE INCREASES MATERIALLY, FILE A SPECIAL REPORT AND START NEW PROGRAM OF OBSERVATIONS.

DATE	DOSE RATE R/HR	O TOTAL DOSE R
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

REPORT DOSE RATES AS FOLLOWS: 1. _____ TIME 2. _____ LOCATION 3. _____ DOSE RATE 4. _____ DOSE TO _____. 0300Z

* ENTER LOCAL TIME

O TDTAL DOSE READ FROM DOSIMETER – CUMULATIVE FROM ARRIVAL DF FALLOUT

Δ AFTER FLASH REPORT

FIGURE 4.—Example of form for radiological reporting log.

PART VI.—PERSONNEL PROTECTION

Safety of Monitors

Safety of the monitoring personnel is to be given first consideration. Plans should be developed so that each person who has rural monitoring or Defense Board responsibilities will know his duties in the event of an emergency. Dosimeters should be worn by monitors at all times while in a contaminated area. The deliberate exposure of workers to radiation in order to save contaminated crops that are not essential or might be discarded later is not warranted.

Radiation protection measures are based on the assumption that all ionizing radiation is harmful. However, experience and research have shown that if exposure is kept below a certain level, medical care will not be required for the majority of the people. The problem, then, is to control exposure so that these recommended levels are not exceeded. To accomplish this, adequate methods and procedures for radiation exposure control and contamination control must be established.

The major protective measure to be taken by monitors against fallout radiation in the early postattack period is shelter. Other measures include control of radiation exposure, control of contamination, and decontamination.

Protective Measures Before Monitoring Mission

Area monitoring, or locating the areas of contamination and determining the dose rates within these areas, is necessary to the planning and execution of recovery operations. However, every mission and activity outside of the shelter must be evaluated in terms of the radiological hazard involved. The monitors should first be informed concerning routes to be followed, locations where readings are needed, the mission dose, and the estimated time needed to accomplish the mission.

The monitors must:

1. Plan to keep personal exposure doses as low as possible.
2. Know the purpose, extent, and importance of each monitoring mission.
3. Know the allowable exposure dose for each mission and the expected dose rates to be encountered.
4. Allow for the exposure to be received while traveling to and from the monitoring area. Obtain information about the condition of roads, bridges, etc., that might prolong travel and lengthen exposure time.

Protective Measures for Postattack Mission

When beginning the outside monitoring activities after an attack, the monitor should take all protective measures possible to prevent contamination of his body. Clothing will not protect personnel from gamma rays, but it will keep the fallout away from the skin and reduce the need for extensive washing or scrubbing of the body to prevent beta burns. Most clothing is satisfactory; however, loosely woven clothing should not be worn.

The monitor should:

1. Wear dosimeters.
2. Spend a minimum of time outside of shelter when dose rates are high.
3. Wear adequate clothing and cover as much of the body as possible. Wear boots or rubber galoshes or cover the shoes and ankles with sufficiently strong materials. Tie pants cuffs over boots to avoid possible contamination of feet and ankles.
4. Avoid highly contaminated areas whenever possible. Also avoid puddles and very dusty areas where contamination is more probable.
5. Avoid inhaling fallout. Under dry and dusty conditions, avoid stirring up dust unnecessarily. Wear a protective mask, if available. A large folded handkerchief or a folded piece of closely woven cloth worn over the nose and mouth will help to minimize the inhalation of fallout.
6. Avoid unnecessary contact with contaminated surfaces such as buildings and shrubbery.

Monitors using vehicles for outside monitoring operations should remain in the vehicle, leaving it only when necessary. To prevent contamination of the interior of the vehicle, all windows and outside vents should be closed when monitoring is not being performed from the vehicle. Vehicles provide only slight protection from gamma rays but excellent protection from beta rays, and prevent contamination of the occupants.

Vehicles and equipment required for postattack operations should be protected from fallout. They should be kept under cover in garages and warehouses. Windows and doors of vehicles and storage areas should be closed.

Each monitor is responsible for controlling his exposure and maintaining his personal Radiation Exposure Record. Radiation exposures of monitor personnel are likely to lack a uniform pattern. The only reliable method for keeping track of exposure is through the use of personal dosimeters and the keeping of complete exposure records.

TABLE 2.—*Example of maximum adult work schedule for areas contaminated by radioactive fallout (4-week basis)*

[ERD 100 roentgens; H+1 dose rate 1,000 r/hr—equivalent to about 100 r/hr at H+7, or 22 r/hr at H+24; [1] shelter factor of 100—1% of unsheltered dose]

Time after explosion	Work period (time outside shelter) [2]	Time after explosion	Work period (time outside shelter per day)
	Hour		*Hours*
12 hours (same day or during first 24 hours)	½	4th through 7th day	2
2d 24 hours	1	8th through 14th day	3
3d 24 hours	1	15th through 21st day	4
		22d through 28th day	6

[1] Equivalent dose rates for H+7 and H+24 hours are stated in order that those citizens possessing their own monitoring instruments will be able to measure the degree of fallout contamination in their specific areas and adjust the work periods to suit their situations.

[2] Work periods may be split—part morning and part evening, for instance. It is assumed that most of the work period on the first day would be spent in a barn or similar structure and that on succeeding days at least one-fifth of the work period would be spent in such structures which provide some protection. First 2 weeks—off-duty hours spent in shelter allowing no more than 1 percent of unsheltered radiation to penetrate. Third and fourth weeks—major portion of the worker's off-duty hours spent in shelter but limited fraction of time could be spent in a typical basement or cellar.

Monitoring for Personnel Protection

Monitoring for personnel protection will be based on the standards and practices outlined in the following:

1. *USDA Radiological Training Manual.*— Personnel Protection, Revised July 1961, pp. 120–135.

2. Agriculture Handbook No. 234, *Protection of Food and Agriculture Against Nuclear Attack*, issued 1962.

3. *Handbook for Radiological Monitors*, FG–E–5.9 Office of Civil Defense, Department of Defense, April 1963.

Calculated Risk of Personnel Exposure to Radiation

Decisions concerning calculated risk of personnel exposure should, if possible, be evaluated by a qualified radiological safety officer who has had training as a radiological instructor or radiological defense officer. If there is any doubt concerning such a decision, personnel safety should be preserved by conservative decision against excess exposure. Weight should be given to genetic concern of younger personnel (below 30 years of age).

Personnel risk will be largely determined by the radiation levels of the area in which monitoring is to be conducted. The following guide will be used by USDA monitors:

An unsafe area is defined as that which has a measured dose rate of more than 0.1 roentgen per hour. A person could enter an area having intensity of 0.1 roentgen per hour and stay for 30 days without receiving an effective dose of more than 50 roentgens. This is due to both natural reduction of intensity and biological repair during 30 days. However, this is a conservative standard and emergency conditions could modify this according to emergency personnel exposure standards previously discussed.

Primary guides for all personnel to follow during emergency operation:

1. Avoid unnecessary exposure to radiation. Hazards must be closely weighed against the requirements for exposure to the hazard.

2. For continuity of essential operations and avoidance of clinical symptoms during emergency conditions, maximum Equivalent Residual Dose (ERD)[5] should not exceed 100 roentgens. Table 2 presents a recommended time schedule for workers in contaminated areas.

3. For emergency activities which require an ERD of more than 100 roentgens, a calculated risk short-term exposure may be administratively decided, based on the following averages for normally healthy persons. These emergency short-term exposure standards are for whole-body exposure within 3 days or less.

Exposure to:

(a) 25 roentgens will give no clinical effects.

(b) 100 to 200 roentgens is expected to cause disabling sickness in only about one-tenth of the people so exposed. The illness may require up to 6 weeks for recovery.

(c) About 300 roentgens usually causes severe radiation sickness and requires a longer recovery period.

[5] The accumulated exposure dose of gamma radiation corrected for such recovery as has occurred at any particular time.

(d) Above 300 roentgens should be avoided, since risk of death is added to that of radiation sickness.
(e) 450 roentgens represents the midlethal dose for humans.

4. All personnel required to work under radiation exposure shall wear dosimeters at all times.

5. All personnel coming from a contaminated area shall be monitored and shall be required to brush shoes and shake or brush clothing before entering the shelter areas.

6. Food or water should not be stored in a contaminated area, and eating, drinking, and smoking in a contaminated area is unsafe and should be prohibited.

Biological recovery of damaged body cells and tissue is actually greater after total long-term exposure than after acceptable short-term exposure, since the damaging effect of radiation is offset by biological repair.

The concept of ERD, sometimes called effective biological dose (EBD), is based on the consideration that 10 percent of the damage due to radiation is irreparable, that 45 percent is repaired in one month, and that the remaining 45 percent is repaired in an additional three months.

Additional information on ERD and denial time may be found in Agriculture Handbook No. 234.

PART VII.—AGRICULTURAL RESEARCH SERVICE: INSTRUCTIONS AND PROCEDURES

Among the responsibilities assigned to ARS by Secretary's Memorandum No. 1489, Revised, are the development and maintenance of a radiological monitoring capability at all federally inspected meat slaughtering and processing plants and at public livestock marketing centers subject to continuing ARS inspection. The duties are divided between the Animal Disease Eradication Division (ADE) and Meat Inspection Division (MID).

Animal Disease Eradication Division

This section provides information and suggestions on protecting livestock against radiation and the handling of animals exposed to radioactive fallout following a nuclear attack.

The use of animals and animal byproducts for food may reduce the hazard of radioactive contamination following nuclear warfare below that which must be tolerated if food is obtained directly from plants. Although total body irradiation and intestinal doses from ingested isotopes will be much higher for animals than for man, their relatively faster maturity and shorter reproductive cycle will compensate for some of the changes produced by the increased radiation from radioactive fallout.

The best estimates by scientists working in the bioradiological field indicate that domestic animals may be relatively less susceptible than humans to damage from ingestion of fallout products, particularly in view of the shorter life span of animals.

Radiological instruments assigned to ADE will be used primarily to protect personnel dealing with animals, to monitor livestock entering public stockyards, to supplement the animal monitoring program of the Meat Inspection Division, and to protect the general human population consuming animal products, rather than for animals per se.

As stated on page 7, site intensity monitoring information should be furnished to the USDA County Defense Board Chairman, who in turn can relay this to the local civil defense authorities.

Radiation Effects on Livestock

Tolerance to radiation varies among species of animals as well as among animals of the same species, as indicated in table 3. All domestic animals, however, have a similar response to total body irradiation. Few, if any, will become ill following exposure up to 250 roentgens, and few, if any, will survive brief doses of as high as 1,000 roentgens. The smaller the dose and the slower the rate, the better the radiation can be tolerated. Body size seems to have little to do with survival, although very young or very old animals may be more radiosensitive.

TABLE 3.—*Percentage of mortality of unsheltered animals after 24 hours' exposure to various radiation doses*

[Values from constant intermediate radiation exposure dose rate experiments]

Species	Mortality				
	100 percent	80 percent	50 percent	20 percent	0
	Exposure dose (roentgens) [1]				
Cattle	650	600	550	450	300
Sheep	700	600	525	450	350
Swine	800	700	600	450	350
Poultry	1, 200	1, 100	900	600	400

[1] Exposure dose in area or building where livestock are located.

Many animals exposed to lethal and midlethal range doses of total body gamma radiation may still be salvaged for food 7 to 14 days after exposure. Red meat from animals exposed to lethal doses of radiation is safe for human consumption without undue hazard from radiation. It would be important in some cases that animals receiving such exposure be salvaged for food at the appropriate time. If animals are clinically ill, they should not be used for food.

A reliable indicator of the health status of an exposed animal is body temperature. Under emergency conditions, if the animal has a normal temperature and is alert and physically strong, it should pass antemortem inspection even though it may have diarrhea, blood-tinged stools, nasal discharge, or increased rate of respiration. Final disposition of the carcass will, however, depend upon necropsy findings.

Studies indicate that if cattle survive 40 days after receiving the most substantial part of the dose, which probably would be received during the first 96 hours after nuclear attack, they would be a good risk for keeping in the herd. Infertility has not been observed in cattle which have survived radiation exposure of relatively short dura-

tion, regardless of the dose. Genetic changes, if and when they occur, can be controlled by selective breeding.

Death will occur mainly from gamma radiation, although beta radiation alone will cause damage to the skin and eyes, and may have an "additive" effect on an animal exposed to a relatively high but sublethal dose of gamma radiation. The outer layers of the skin could receive a large radiation dose from the beta particles, and in some circumstances this might cause serious "beta burns."

Studies have shown that sheep, unless recently sheared, are naturally well protected from beta radiation damage from fallout by the thickness of their wool. During the first nuclear test shot at Alamogordo, N. Mex., in 1945, cattle were exposed to 250 to 400 roentgens of gamma radiation along with approximately 50,000 rad [6] beta radiation (according to best available estimates of physicists). With one or two exceptions, the cattle survived.

Limited experimental evidence and field testing indicate that those animals in the path of fallout that fail to develop "beta burns" will ordinarily escape serious external radiation injury, and the radionuclides from that cloud will be practically innocuous to the grazing animal. The development of "beta burns" depends on the dose received, and several days or weeks may elapse before the physical signs of the burns are apparent. Animals that sustain exposure intense enough to produce beta burns but live longer than 3 weeks or a month will probably survive.

Monitoring of Livestock for Fallout

Determination of whether an animal has been externally contaminated with fallout is made by: (1) knowing that the animal was within, or has come from, a "fallout" area; or (2) monitoring the animal if instruments are available. Monitoring of animals is accomplished in the same manner as with people or inanimate objects—by ascertaining the amount of beta and gamma radiation with instruments held at varying distances from the animals. The heavier the fallout contamination, the greater will be the instrument readings. The more energetic the beta and gamma rays, the higher will be the instrument readings at further distances. (See page 26.)

The USDA County Defense Board or the civil defense monitoring service will give information as to the fallout radiation levels and arrival time in a particular area, and from this compute the dose. However, if outside communication is disrupted, an approximate computation of total radiation received can be made by use of the radiological monitoring instruments and a reasonable estimate of the fallout arrival time.

In a herd of cattle which has not been moved, it will be sufficient to check only a few animals. If, however, animals have come into a stockyard as a mixed group from various sources, each animal should be monitored if possible. Heavily contaminated animals should be kept segregated from relatively "clean" animals. Animals maintained inside barns or other shelters may have been exposed to lethal doses of gamma radiation without being grossly contaminated with fallout particles. In this case, calculation of total radiation which they have received can be estimated from information concerning radiation levels in the area, adjusted for the protection afforded by various shelters.

Knowing the midlethal and lethal ranges of radiation for livestock, and radiation exposure of livestock in various areas, ADE veterinarians will be in a position to advise as to probable immediate and long-term availability of livestock, and to advise which animals must be expeditiously slaughtered to conserve meat for human consumption.

Table 4 presents estimates of the fate of mature food animals exposed to total body radiation.

Medication for Animals

Symptomatic treatment of animals for radiation illness may not be a practical procedure since medical supplies available will probably be needed for treating the human population. In any event, early treatment with antibiotics before signs of illness are observed is contraindicated since it will succeed only in establishing resistant strains of bacteria, and thus hinder adequate antibiotic response when such response is necessary.

Decontamination of Cattle

Cattle should be decontaminated only if this can be done without undue danger to personnel involved. Dry brushing in such cases is *not* recommended because of possible or probable exposure of personnel through inhalation, ingestion, and external contamination. Two practicable methods of decontamination are high-pressure water spray or scrubbing and rinsing. Detergents increase the effectiveness of scrubbing. (See page 26.)

Livestock Protection

The most valuable protection against gamma rays would come from keeping livestock under adequate cover at least during the first critical 24 to 48 hours—and longer, if possible. With sufficient mass of shielding materials between the animals and the fallout, the penetration of gamma rays into the sheltered area would be greatly reduced.

As indicated in table 5, the value of shielding in preventing death among animals would be greatest in areas exposed to brief radiation doses about equal to the midlethal dose. Even at low radiation intensities, however, there would be some beneficial effect from shelter. It would help to prevent fallout from contaminating the animal's coat and would minimize the hazard of contaminating herdsmen and livestock handlers.

In short, the most useful and practical advice that can be given for protection of livestock from fallout is to have them under shelter before fall-

[6] Radiation-absorbed dose.

TABLE 4.—*Estimated fate of 100 mature food animals exposed to total body radiation* [1] [2]

[Exposure time: 4 days or less]

Dose, and time after exposure	Animals		Rejected after—		Salvageable
	Dead	Living	Antemortem inspection	Postmortem inspection	
350 r (LD 0/30):					
1 day	0	100	0	0	100
2 days	0	100	0	0	100
3 days	0	100	0	0	100
7 days	0	100	0	0	100
14 days	0	100	0	0	100
21 days	0	100	2	1	97
30 days	0	100	2	0	98
90 days	0	100	0	0	100
180 days	0	100	0	0	100
1 year	0	100	0	0	100
5 years	1	99	1	0	99
550 r (LD 50/30):					
1 day	0	100	0	0	100
2 days	0	100	0	2	98
3 days	0	100	2	0	98
7 days	0	100	2	4	94
14 days	20	80	75	5	0
21 days	48	52	50	2	0
30 days	50	50	25	25	0
90 days	51	49	0	2	47
180 days	52	48	0	0	48
1 year	52	48	0	0	48
5 years	55	45	0	0	45
750 r (LD 100/30):					
1 day	0	100	0	0	100
2 days	0	100	2	0	98
3 days	0	100	10	5	85
7 days	0	100	30	15	55
14 days	65	35	35	0	0
21 days	90	10	10	0	0
30 days	100	0	0	0	0

[1] From information contained in "Damage to Livestock From Radioactive Fallout in Event of Nuclear War," Publication 1078, National Academy of Sciences, National Research Council, 1963.

[2] These estimates are generalized to include all mammalian food animals. It is likely that young animals and old animals will respond more severely to an exposure; therefore, lowering the estimate by 100 roentgens will be a more accurate value for such animals.

out arrives, and also to have as much feed and water as possible under shelter. Wherever possible, only feed having the lowest possible radioactivity should be fed to animals while radioactive decay is occurring on contaminated pastures and other outside feed sources. Low-radioactivity feed and water supplies are particularly essential for actively milking dairy animals.

Empty trench silos can be converted to livestock shelters by constructing a roof over the trench and covering it with earth. Two feet of earth on the roof would provide a protection factor of over 400. One foot of earth would admit about 13 times as much radiation as would 2 feet. A baffled entrance and watering facilities would be desirable.

When buildings are inadequate to house all livestock, the overflow should be put in a yard, near farm buildings. Covered self-feeders and automatic livestock waterers can reduce contamination of feed and water.

Movable creep fences and other types of small fenced areas that have covered self-feeders in them can provide emergency areas for farm animals after the early external radiation intensity has decreased through decay. These can be used to advantage when animals are to be confined to limited pasturage.

An exact safe value is difficult to set for the return to pasture, but an external dose rate of 25 roentgens per week should permit all animals to survive and be handled with safety. A brief exposure can be tolerated by most farm animals.

Supplemental feeding from noncontaminated rough forage stocks can materially reduce the daily dose of ingested radioactive material when grazing on contaminated pastures is necessary. Grazing on pasture regrowth, after early mowing and re-

TABLE 5.—*Effect of shelter on the mortality rate of livestock* [1]

Kind of livestock and radiation exposure—unsheltered dose (No. of roentgens—1 day)	Mortality rate by nature of shelter			
	No shelter	Tight wooden barn (protection factor of 2)	2-story barn with loft full of hay (protection factor of 5)	Basement-type barn with loft full of hay (protection factor of 10 or more)
Cattle:	*Percent*	*Percent*	*Percent*	*Percent*
500	30	0	0	0
1,000	100	30	0	0
3,000	100	100	80	0
Hogs:				
500	30	0	0	0
1,000	100	30	0	0
3,000	100	100	50	0
Sheep:				
500	38	0	0	0
1,000	100	38	0	0
3,000	100	100	80	0
Poultry:				
500	10	0	0	0
1,000	64	10	0	0
3,000	100	100	20	0

[1] The reduction of radiation by shelter is described as the "protection factor." For example, if the protection factor of any given structure is 2, then the intensity of outside radiation is reduced by one-half. In areas where fallout arrives at H+1, one-half or more of the radiation would be released after the end of the first day.

moval of cuttings, would also help to diminish the assimilated radiocontamination.

Meat Inspection Division

This section includes the field procedures of the Meat Inspection Division (MID) for monitoring and salvaging livestock and meat products in the event of a nuclear attack. These procedures are primarily for guidance during the postattack, operational-recovery phase in contaminated areas, or for immediate postattack production in uncontaminated plants that would receive supplies or animals from an affected area.

Guidelines for a disaster of this magnitude can never be complete and will require further emergency procedures or modification of those suggested here. There can be no substitute for a vast amount of good judgment. Modifications of the emergency procedures to fit local plant conditions will be made by the inspector in charge, or designated alternates.

Decontamination of Livestock and Meat Products

With the development of megaton weapons and improved methods of their delivery, there are even greater uncertainties as to what the contamination problems will be in the event of a nuclear war. The personnel exposure that may be incurred, the time when a decontamination effort can be undertaken, and the level of decontamination that must be attained before the start of production will be established by the USDA County Defense Board or local civil defense authorities. If this information is not received, the criteria in part VI, Personnel Protection, as recommended for agricultural workers, should be used.

Initial monitoring is made to establish or reaffirm the outside radiointensity at the plant location.

In most cases, meat plant decontamination will not be attempted unless there is at least standby power to supply water pressure and a source of water with low levels of radioactivity. Desirable methods of decontamination, as listed in the *USDA Radiological Training Manual*, page 140, should be used if possible.

A minimal decontamination effort should include first the establishment of a base of operations with low levels of radiation where personnel can rest, eat, and change clothes. (See page 143, *USDA Radiological Training Manual*, for personnel decontamination facilities.) A survey should be made of the plant, listing the intensity of the areas that will require decontamination and an order of priority established. All outer plant openings should be closed so that the plant will not be recontaminated with the first strong wind. Next, all surfaces should be thoroughly vacuumed, then scrubbed with water, detergents, and brushes. Instruments to measure the effectiveness of the work are essential, and the wearing of personnel dosimeters is desirable.

Constant vigilance will be needed to prevent recontaminating a clean plant. Air filters, if available, will be needed for any air intakes of the plant. The entrance of contaminated animals and the tracking in of fallout on the feet of employees are obvious sources of recontamination. Additional decontamination efforts should be made as the need arises.

Evaluation of Animals for Food

In determining whether animals affected by nuclear weapons should be slaughtered for food, it is well to remember that injury may be caused by blast, or by thermal or ionizing radiation. Consequently, the following criteria should be used:

1. The critical status of food stocks for the population.
2. Personnel protection.
3. The total or partial ionizing radiation effects, in addition to blast or thermal effects. Also, the nature of the injury to the food animal in question, the sequelae, and the state of its recovery at the time of slaughter.
4. The availability of processing facilities, and the means of storage or preservation of the salvaged meat.
5. The contamination of the animal by radioactive substances.

Critical Status of Food Stocks

The critical status of food stocks for the population can most readily be obtained from local civil defense officials and through the USDA State and County Defense Boards.

Protection of MID Employees

In the event of an emergency, MID employees will work within the framework of their own organization insofar as possible, and under the general jurisdiction of the nearest USDA County Defense Board. In those cases where instructions from local civil defense authorities or USDA County Defense Boards on exposure are lacking, the criteria in table 2, part VI, Personnel Protection, page 18, as recommended for agricultural workers, may be used as a guide. Through these sources, it will be determined when and where employees can work without undue exposure to radiation of themselves and of packing plant employees.

Nature of Radiation Injury to the Food Animal

The total or partial ionizing radiation effects, in addition to blast or thermal effects, on food animals can be determined by those with a thorough knowledge of this field of veterinary medicine. As guidelines, see "Monitoring of Livestock for Fallout," on page 22, and consult the *USDA Radiological Training Manual* and similar publications dealing with radiation of animals. It is possible that such radiation effects will not be evident until postmortem inspection of the carcass is made.

If there is no injury or illness, it is safe to assume that the animal would be passed for slaughter. If, on the other hand, the animal is obviously seriously injured or ill, it should not be passed for slaughter. In cases of intermediate conditions of injury or illness, the inspector should utilize his professional knowledge and consider the other criteria for emergency slaughter.

Food animals exposed to total or partial body external irradiation can be safely used for food if they are slaughtered before the onset of symtoms of radiation sickness or if they have completely recovered from the ensuing illness. The same criteria as those governing the slaughter of animals sick from any cause should be followed. Based upon studies made with food animals exposed to total body irradiation, there is no evidence that the flesh of lethally irradiated animals is harmful if postmortem changes are not pronounced. Because of lowered resistance resulting from exposure to high levels of radiation, infections may develop 7 to 14 days after exposure and be accompanied by a severe generalized illness. The infections may assume the forms of bacteriemias, septicemias, or pneumonias. Such animals would not be suitable sources of food.

Animals rejected for slaughtering because of serious radiation illness or injury should not be accumulated in the antemortem pens of an official establishment. (See table 2, page 18.) Bacterial and viral diseases may develop uninhibited in these defenseless animals and then spread to animals that would otherwise remain uninfected. If moribund or known to be lethally irradiated and ill, these rejected animals should be humanely destroyed. The removal of rejected animals for treatment is to be made with the permission of the responsible Animal Disease Eradication officials.

Processing Facilities and Storage of Salvaged Meat

Information about the availability of processing facilities and the means of storage or preservation of salvaged meat can be most readily obtained through the USDA State and County Defense Boards, or by local inquiry.

Antemortem Monitoring of Animals

The monitoring of live animals will not be attempted unless the background activity is low enough that a usable indication of the contamination level can be obtained. In areas where background makes a measurement inconclusive, it should be presumed that all animals are contaminated and require the procedures outlined below, unless it is known that the animals have been shipped, arrived at the plant, and were slaughtered without contamination.

Measurement of the total beta-gamma activity on the surface of the animal is the objective. Personnel exposure, background radiation, and the radiation on the skin of the animal may limit the measurement capability. A shielded area to reduce background radiation is desirable.

Instruments being dropped or broken because of an unexpected animal movement could seriously impair the plant monitoring capability. Measures to preclude this possibility will be taken before antemortem measurement is attempted. Contami-

nation of the probe or instrument can be prevented by covering the probe and/or instrument with thin plastic.

The CD V–700 with probe open, positioned at 4 inches from the animal's back, and if possible under the abdomen, will give a valid indication of surface activity. Only one or two animals need be measured if the lot originates from the same point. When the capacity (50 milliroentgens per hour) is exceeded, measurement could be made at a further distance from the surface. However, the beta indication will decrease sharply with distance.

If the radiation intensity precludes the use of the CD V–700, the CD V–710 may be used. When background radiation is substantial, its influence on the CD V–710 animal measurement should be checked by remeasuring a few animals in a well-shielded area.

Animals exposed during fallout arrival will have higher surface activity levels along the back. In contrast, those sheltered during fallout descent, but later eating contaminated feed or pasture, would have a more instense abdominal surface radiation from lying in their droppings and from ground and vegetation contact.

Primary Concerns When Slaughtering Contaminated Animals

Meat, fortunately, will contain only a small fraction of the radiation intensity found on the back of the animal and in the intestinal contents. Three primary concerns with the slaughter of such animals are: (1) The transfer of the radioactive materials to exposed meat surfaces during the dressing operation; (2) the danger of skin burns from the beta particles to personnel having prolonged direct contact with the outer covering of the animals or intestinal contents; and (3) the effect that contaminated products will have on the maximum radiation level that has been established for the inside plant areas.

Precautions When Washing Contaminated Animals

The feasibility of washing contaminated animals before slaughter will vary with the amount of water available, the species, and the extent of the contamination. More effective radiocontamination removal will be obtained when detergents are included in the washing process.

The washing of all contaminated swine would be highly desirable since they can be washed more effectively than other species and since swine later pass through a common scalding tank which would tend to accumulate and transfer the activity to uncontaminated or slightly contaminated animals. Approved detergents placed in the scalding tank would assist in the removal of contaminating materials from the hog skin.

Cattle washing should either be done thoroughly or not attempted. Postmortem experience has proven that there is less hide dirt transferred to the meat or to the arms of butchers from a dirty dry animal than from a half-washed, wet animal. It would be well to slaughter contaminated cattle only when dry.

The thorough washing of calves is now done with normal dressing procedures. In view of the existing facilities, this should be continued with radioactively contaminated calves, even though no drying period would be possible between the washing and evisceration operations.

Washing of contaminated sheep would be ill-advised. However, a drying period before the slaughter of any wet sheep is recommended.

Precautions When Dressing Contaminated Animals

Dressing operations should be undertaken with full cognizance of the danger of beta burns developing if all exposed personnel are not properly protected. When a beta burn is incurred, an erythema may develop initially; however, the full extent of the lesion may not be apparent for several weeks.

Employees should wear protective clothing to prevent the transfer of radioactive material from the animal's skin or ingesta to their own body. Wet operations require waterproof gloves, arm coverings, etc. In a time of emergency, these protective devices may have to be improvised. Rubber gloves, protective plastic coverings, masking tape, rubber aprons, and rubber boots are commonly available for this purpose. Keeping these clothes and coverings clean as the work progresses will reduce the exposure hazard.

The animals identified as not showing contamination should be slaughtered at the start of the day's operations. Contaminated animals should be dressed with extreme care to prevent the transfer of radioactive material to any meat surface. Sanitary dressing operations now used in federally inspected meat plants will be more important than ever before. The apparent contamination from hides, pelts, or ingesta should be trimmed away before the final carcass washing, to prevent needless contamination of clean meat areas. Every effort should be made to place in the cooler those carcasses that have little or no radioactivity.

From contaminated animals only the eviscerated carcass, cheeks, and hearts should be saved for further use as food. It may be necessary to identify certain carcasses or lots placed in the cooler so that they may receive further trimming or removal of contaminated shank bones, or held for radioactivity decay. Complete carcass boning will not be required; however, bones should not be used for soup stock or similar products. Pork skins from contaminated animals should not be released for processed items where the skin itself will even-

tually be consumed until monitoring indicates satisfactory removal of radioactive contamination.

Effect of Maximum Radiation Level in Meat Plants

The maximum radiation level that has been established for personnel working inside a meat plant may limit the number of contaminated animals that can be slaughtered, or may require a more thorough skin decontamination procedure before slaughter. It may be necessary to hang fewer animals on the bleeding rail, to empty and wash slaughtering departments more frequently, or to store the hides at remote locations. Contaminated hide packs could constitute an increased personnel hazard because the gamma activity component is not completely self-absorbing. This would cause the proximate intensity to increase as the contaminated hide pack gained bulk.

In many cases, a large portion of the total accumulated body radiation dose will be received during the first 2 or 3 days after the attack period, in homes, travel, rescue, and decontamination operations. A relatively small portion may be received after the meat plant operations resume. The general principle of limiting the number of personnel to the lowest practical level and rotating personnel who work in areas having higher radioactivity rates should be followed to the greatest extent practicable.

Dosimeters, if available, should be worn by one plant employee in each of the more exposed work categories, to register the total whole-body gamma-radiation exposure. This information should be recorded and forwarded to the USDA County Defense Board. The dosimeters now available do not indicate beta activity. A butcher wearing a dosimeter and having direct arm and hand contact with sheep pelts, for example, could receive severe beta burns, while the dosimeter indicated that the dose received within the plant could be tolerated with no ill effects.

Personnel and clothing decontamination must be given adequate attention. (See the *USDA Radiological Training Manual*, page 143.)

Monitoring of Meat and Meat Food Products

Testing for the beta-gamma component during the first 30-day postattack period will be done with the CD V–700. The probe must be open and the window fully exposed to the surface being measured. To prevent contamination, the probe should be covered with a thin plastic bag.

Monitoring when the contaminant is dispersed throughout the food or water.—The use of a quantitative monitoring procedure such as described here implies the use of a quantitative contamination standard. The total human irradiation situation in emergency conditions and the food contamination aspect of this are so complex that a simple gross radioactivity standard for foods must be arbitrarily set and its value will be limited to that of a rough guide to contamination levels.

The standard recommended here is expressed in terms of milliroentgens per hour, as derived from previously used water concentration standards expressed in microcuries per liter. Both this particular value and the basis of establishment of such standards may be altered in the future as a result of additional information or of changes in the technical or official procedures for establishment of standards.

A working area must be selected where the meter indicates a background of less than 30 milliroentgens per hour. Since the space required to conduct this type of monitoring is small, it should not be difficult to improvise a shielded area if needed.

Place a representative sample of the food to be monitored in a cup, glass, or similar container with a 3- to 4-inch open top.

Rest the probe across the edge of the container ¼ inch from the sample, and observe the meter indication, as illustrated in figure 5. Precautions must be taken to avoid contamination of the probe. If the reading is less than 10 milliroentgens per hour above background, the food is acceptable for a consumption period of 10 days.

Monitoring when radioactivity is concentrated at or near surface of food.—Early after the attack period, most meats are expected to have principally surface contamination. If shielding is required to provide a background of less than 30 milliroentgens per hour, a larger railed hallway or room would be useful.

The probe should be positioned an inch from the meat surface. The extent to which the meter exceeded the background would be the degree of contamination. If after trimming or otherwise removing the surface activity, measurement did not indicate the background to be exceeded by 10 milliroentgens per hour, the food would be acceptable for a 10-day consumption period.

10-Day Consumption Period for Human Food

The radioactivity level delineated by the above measurements is considered conservative and is subject to change. It is basic that wherever choice exists, food consumption be limited to the lowest contamination available. It is just as fundamental, however, that people can die if deprived of food.

With the concurrence of appropriate civil defense authorities, the 10-day emergency level may be exceeded for meat or meat food products in critical food situations. The possibility of extending this emergency period is important, since it is not likely that many areas will overcome food contamination within a 10-day period.

Reducing Meat Contamination

Contaminated meat or meat food products should not be discarded. If possible, those exceeding the permitted radioactivity should be placed

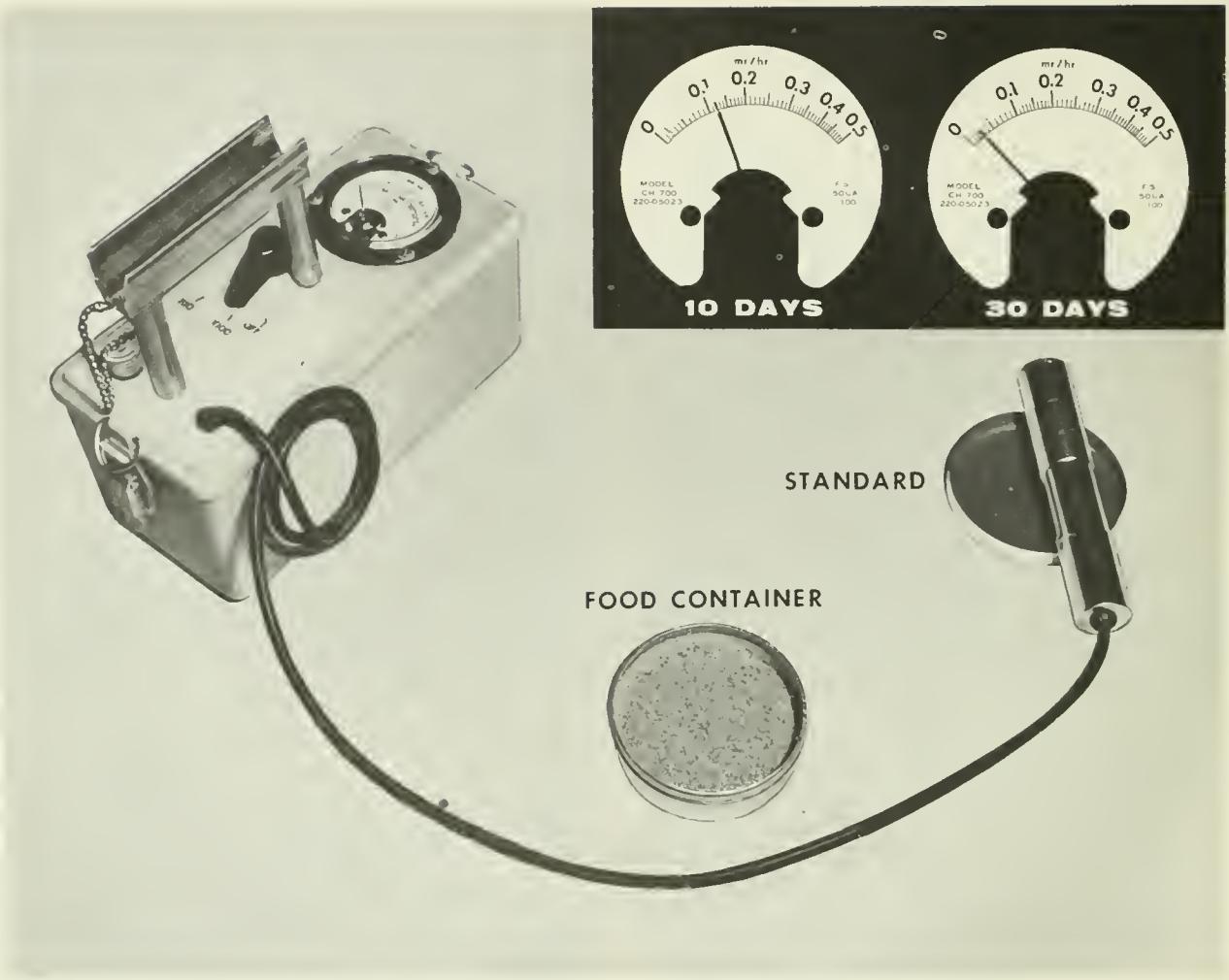


FIGURE 5.—Monitoring food for acceptability for a 10- and 30-day consumption period.

in storage and radioactivity rechecked subsequent to decay.

The decay of fallout on meat follows the usual pattern, and the time when a higher radioactivity will be within the suggested emergency level is not difficult to determine. In the earlier postattack periods, even the distribution time might result in a higher radioactivity food being within acceptable levels.

Removing the surface of superficially contaminated meat or meat food products is consistent with the policy of releasing meat with the least possible radioactivity. Great care must be taken that such trimming or discarding does not unnecessarily contaminate the remainder of the product. Meat trimming is to be done while pieces are individually suspended, to avoid recontamination from a boning table. Any extensive trimming operation will tend to become less effective as the butchers' knives, scabbards, gloves, and clothing become contaminated, unless preventive measures are taken. Monitoring to check the effectiveness of the trimming operation will be more accurate at a distance from the contaminated meat or trimmings.

Postemergency Monitoring

Thirty days after attack those isotopes which are more dangerous for long-term biological reasons will comprise a greater proportion of any contamination. The CD V–700, although useful to indicate contamination, can no longer be used on the basis of the 10-day emergency level to accept food as suitable for distribution. Acceptability determinations on food after 30 days postattack should be made by laboratory analysis, as required, based on the kind and quantity of contamination present.

Salvaging Contaminated and Damaged Food

The principle of salvage of contaminated or damaged food is to segregate the contaminated from the uncontaminated and to clean up the former, if possible. Often the radioactivity or

damage will be on only the surface of a stockpile and by carefully removing the surface, containers may be uncovered which have suffered no damage or contamination. Such unaffected products could be released for immediate consumption. In the portion that must be decontaminated before use, the dusting or washing of containers with a detergent solution will remove much of the contamination. When the contaminating material is radioactive fallout, the contents of completely sealed, undamaged packages or containers will be free of radioactivity.

Refrigerated products.—Meat and meat products located in sealed and undamaged refrigerators or freezers will not be contaminated with radioactive fallout. With the breakdown of refrigeration, which is very likely in a damaged area, perishable products may be salvaged. If it has not been possible to use fresh meat immediately and bacterial damage is not too advanced, the meat may be washed or trimmed and cooked thoroughly before release for consumption.

Sterile canned products.—Sterile canned products will have a greater salvage potential than will many other types of meat product because the canned products are relatively resistant to physical damage and can await the lapse of the denial time that must precede salvage in highly contaminated areas.

Radioactive contamination can be removed from the surface of cans by a relatively simple washing process. The danger of nonpotable water or sewer contamination may be eliminated by washing, dipping in a chlorine solution, and drying.

The monitor's knowledge of the normal appearance of cans will enable him to determine the soundness of most of the product involved. Damaged canned goods must be carefully examined for rust spots, seam damage, lack of vacuum, or other defects. Obviously ruptured or swollen cans should be disposed of without delay.

It would be desirable to incubate doubtful cans if this is feasible. The incubation period is to permit identification of incipient spoilage in progress in slack vacuum cans, from rust spots having perforated the can, or seam ruptures not apparent to the unaided eye. The absence of proper incubation temperatures may require the holding of these cans if emergency conditions permit. Such decisions, however, should be based on the supply of the food stocks and the calculated risk involved.

Products in glass.—Glass containers will be especially subject to crushing and breakage. Radioactive material or contamination from polluted water easily lodges under screw caps or friction-type lids and is difficult to remove.

Meat food product ingredients.—Cereals and other meat food product ingredients will cake when moistened, but some undamaged material may be recovered from the center of bags and drums. Radioactively contaminated fresh vegetables, such as potatoes, carrots, and onions, if not crushed, can usually be salvaged by thorough scrubbing and then peeling.

Glass splinters.—One of the most troublesome results of the blast effect is the contamination of the product with glass particles as from shattered windows. The splinters are driven into cans and through other types of product. No really satisfactory salvage procedure has been developed for this type of contamination.

Radioactivity in Intestinal Contents of Animals

The contents of intestines will have a higher radioactivity rate than will intestinal organs, kidney, and liver. It may be that the dilution factor and the use of sewage screening devices will permit the disposal of contaminated contents into municipal sewage lines without a serious radioactive problem being created. In some situations, however, sewage lagoons may be the answer to this problem, or it may be easier to remove the intestinal tract unopened and dispose of it by burial.

PART VIII.—AGRICULTURAL MARKETING SERVICE: INSTRUCTIONS AND PROCEDURES

As assigned by Secretary's Memorandum No. 1489, Revised, the Agricultural Marketing Service is responsible for "radiological monitoring of the poultry slaughtering and processing plants subject to continuous AMS inspection and for agricultural commodities (including grain) owned by the Commodity Credit Corporation or USDA (except those stored on farms, ranches, or at bin sites)."

Poultry Division

The following section includes suggested procedures for monitoring and salvaging poultry and egg products. It is to be used as a reference and guide by the field personnel of the Poultry Division, AMS, during the postattack recovery phase in plants located in areas contaminated by radioactive fallout, or in plants located in uncontaminated areas but receiving poultry and egg products or other supplies from areas that *may be* contaminated.

It is not possible to predict accurately all of the circumstances that may affect the operation of the poultry and egg-processing plants in the emergency period following a nuclear attack. However, instructions have been developed by the Poultry Division that will shift operations to an emergency basis. All areas of responsibility not covered by emergency instructions will continue in accordance with the laws, regulations, and policies that apply under normal conditions.

Poultry Division employees shall conduct monitoring operations on poultry and eggs at inspected plants. Reports of radiation levels, damage assesment, and productive capacity at their assigned station sites shall be provided to the USDA County Defense Boards, which, in turn, shall relay this information to the local civil defense authorities.

If a nuclear attack should occur, poultry inspectors and egg product inspectors located in the attack areas shall remain in sheltered areas until the USDA County Defense Boards or local civil defense authorities indicate that conditions are once again safe for unsheltered activity. At that time the poultry and egg product inspectors shall proceed to carry out their inspection and monitoring assignments. If such information is not available, the criteria outlined in part VI, Personnel Protection, shall be used. Initially, this may involve advising processing plant management on procedures necessary to clean and decontaminate facilities in preparation for resuming production activities.

The plant facilities shall be reasonably free of radioactive fallout dust before the beginning of operations, and all rooms, compartments, and equipment shall be cleaned as frequently during operation as is necessary to prevent entry of radioactive material into the product and to prevent unnecessary exposure of plant employees to radiation. The background radiation level in the plant must be low enough to permit the proper use of the appropriate food-monitoring instruments. (See page 140 of the *USDA Radiological Training Manual* for methods of decontaminating an establishment.)

Ventilating systems shall be protected with filters adequate to exclude radioactive dust. Openings that could admit fallout to the plant shall be closed.

Only water and ice that are relatively free of radioactive contamination shall be used to wash and chill the carcasses.

When production operations are resumed, monitoring and inspection procedures appropriate for each individual plant's facilities, personnel, and operation shall be instituted by each inspector or grader in charge, to assure the production of a wholesome product containing radioactive contamination within acceptable limits.

Monitoring Responsibilities of Poultry and Egg Products Inspectors

In radiological monitoring, the poultry inspectors and egg products inspectors have two major responsibilities:

1. Supervision of processing operations to assure the production of poultry and egg products that are wholesome and relatively free from radioactive fallout contamination or that meet emergency standards of acceptability. This will necessitate examining the product before, during, and after processing, and a continual examination of the processing environment to assure that it is relatively free of fallout contaminants and acceptable for use. (See monitoring procedures beginning on page 24.)

2. Supervision of the decontamination procedures necessary to remove radioactive fallout from the surfaces of packaged products.

When packed in a container and sealed, a poultry or egg product that is free of radioactive contaminants will not be contaminated by fallout unless there is damage to the container, allowing contamination to enter, or unless the product comes into contact with a contaminated surface when removed from the container.

Monitoring of Poultry and Poultry Products

The following monitoring procedures shall be followed in the inspection of poultry and poultry products.

All poultry or poultry products brought to an official plant together and from one point of origin shall be monitored on a lot basis, to determine whether they have been contaminated with radioactive materials. Uncontaminated lots shall be processed before contaminated lots. Precautions necessary to assure that a wholesome product does not become contaminated during processing must be observed.

When a lot is found to be contaminated, it shall be segregated while the level of radioactivity and the nature of the contamination are determined. (See page 28, Salvaging Contaminated and Damaged Food.)

When a qualified monitor determines that a lot of contaminated poultry may be handled safely by employees working in the live poultry area, such birds may be decontaminated by picking, eviscerating, and washing. In some cases it may be determined that heavily contaminated lots should be returned to the farm and held under such conditions that radioactive decay and the bird's ability to remove dust from its own feathers will render the poultry safe for handling. If a lot is found to be contaminated at a level that would constitute a hazard to employees handling the product or to other products being processed in the plant, it shall be decontaminated if possible. If safe decontaminaton is not possible, poultry shall be condemned and disposed of in a manner that will preclude its use for human or animal food.

Monitoring procedures shall be carried out by only those inspectors or graders who have been trained and certified to act in this capacity. Monitoring shall be conducted on a lot basis by representative sampling. However, birds that, on antemortem inspection, are found to be contaminated with fallout shall be examined with sufficient care to assure that no carcasses contaminated beyond the local limits of acceptability are passed for food. (See Precautions When Dressing Contaminated Animals, page 26.)

Representative samples of bone and meat shall be examined from lots showing evidence of internal contamination. In some cases, the product may be salvaged by raw boning before cooking.

If salvage can be achieved by holding the product until radioactive decay has reduced the activity to an acceptable level, the product shall be identified in a positive manner and segregated under controlled conditions.

Decontamination of Live Poultry

Most decontamination of live poultry should occur at the farm before shipment. Fortunately, the producer may utilize some of the factors peculiar to poultry to decontaminate them with a minimum danger to himself. Birds are more resistant to biological damage from radiation than are most farm animals, and can and will shake dust and debris from their feathers without significantly contaminating the skin. Therefore, if the birds are placed in a suitable environment, they may reasonably be expected to decontaminate themselves effectively.

Unwarranted danger to personnel may result from any attempt to decontaminate poultry on a bird-by-bird basis. The length of time involved, the dusty conditions that would prevail, and the lack of any effective method (vacuuming or washing live poultry is not suitable) would make such a procedure inadvisable.

Personnel employed in decontamination operations shall be protected in accordance with procedures recommended for handling live poultry.

Decontamination of Poultry Product Containers

Packaged poultry products, such as ready-to-cook poultry in plastic bags, and canned products, may be readily decontaminated when, after radioactive decay, they can be safely handled.

Usually the product, in its immediate container, will be stored in a shipping container. Then decontamination can be accomplished by carefully removing the product from the contaminated shipping container, removing any radioactive material from its surface by washing, wiping, or vacuuming, and transferring the product to a clean shipping container.

Decontamination should be accomplished by the simplest, most effective methods in the shortest time and with the least possible radiation exposure of personnel.

Processing Contaminated Poultry

Rigid controls must be used when processing contaminated poultry. They shall be processed last. Management shall protect employees by requiring that all persons handling such live poultry wear suitable clothing and gloves to protect their body surfaces from beta burns. Respirators will prevent the inhalation of radioactive dust. Short work periods with frequent changes of clothing and shower baths will further reduce the hazard.

Scalding tanks shall be overflowed at a rate adequate to prevent the buildup of high levels of radioactive debris in the tank. Line speeds shall be slow enough to assure thorough bleeding so that birds will not struggle upon entering the scalding water

and inhale contaminated water into their lungs and air sacs. Any carcasses showing evidence that this has occurred shall be condemned.

Feathers shall be removed from the plant frequently to avoid buildup of high levels of radioactivity. They should be disposed of in a manner that will not create a hazard.

During the eviscerating process, particular care shall be exercised to see that no tissues contaminated by contents of the alimentary canal are passed for food. Most of the fallout material ingested by the poultry will remain in the digestive tract.

Lungs shall be completely removed from all poultry received from fallout areas. If radioactive particles have been inhaled, they will be deposited on the surfaces of the respiratory passages and the air sacs. Tanks and vacuum lines used for lung removal shall be emptied frequently.

Kidneys tend to accumulate high levels of cesium. They shall be removed from all lots of poultry that show any evidence of fallout contamination.

Gizzards shall not be saved from such poultry. The possibility of contamination with ingesta containing fallout material is too great.

Evisceration shall be followed by a very thorough internal and external wash.

Grading

During an emergency period created by a nuclear attack, the grading of poultry and shell eggs will be suspended. All graders involved in these activities shall be assigned to food management functions, such as salvage, reporting supplies, and food monitoring.

Eggs and Other Poultry Products

Egg products inspectors shall, as previously stated, resume their inspection and monitoring activities as soon as the egg-processing plants to which they are assigned are put back into operation.

Monitoring and inspection activity at egg-products plants shall assure that only wholesome egg products relatively free of radioactive contaminants are released for food.

Steps necessary for such assurance shall include examination of all products received for processing and continual monitoring of processing operations, to assure that the processing rooms, equipment, and product remain substantially free of radioactive fallout.

If products are received in contaminated containers or if shells are lightly contaminated, suitable methods for decontamination, such as dusting, vacuuming, or washing, shall be employed. (See page 28 for additional information.)

Products found to be contaminated at levels acceptable for use in accordance with official emergency instructions may be passed. If holding the products will, through radioactive decay, bring the contamination to an acceptable level, the product may be retained.

Under emergency conditions, poultry or egg products may be processed under conditions that do not assure their wholesomeness from bacterial contamination as defined by applicable regulations. This may be a result of inadequate water supply, shortage of chilling media, shortage of plant personnel, or lack of qualified inspectors.

If such a situation exists, the product shall be identified so that it can be treated as a questionable product by the ultimate consumer or by authorities in charge of food distribution to prevent outbreaks of foodborne disease. Such products could be safely consumed if they are thoroughly cooked to destroy the bacteria before decomposition occurs. (For additional information see pages 25 through 31.)

Food Products of Commodity Credit Corporation and USDA

The following information is presented for consideration and guidance in developing defense plans and radiological monitoring and salvage procedures for AMS field personnel responsible for monitoring and handling food products of the Commodity Credit Corporation (CCC) or USDA.

CCC Stored Food Products and Containers

Generally, the CCC stored food products and types of containers are as follows:

Food Product Commodity	Type of Container
Butter	Fiber boxes, 64-pound.
Cheese	In blocks, 40- and 70-pound; and in processed loaves, 5-pound.
Milk, Nonfat dried	Kraft, multiwalled bags, 100-pound, and in 4½-pound boxes in cartons.
Butter oil	Cans, tin, 7-pound and 10-pound.
Lard shortening	Metal cans, 3-pound and 50-pound.
Dried eggs	Metal cans, 13-ounce and 3-pound.
Cottonseed and soybean oil.	Metal containers, 1- and 5-gallon.
Cottonseed oil (refined) (nonedible).	Steel storage tanks, large, stationary.
Honey	Metal containers, 5-gallon cans and 55-gallon drums.
Canned meats	Metal cans.
Beans	Cardboard boxes, 2-pound and 100-pound bags.
Shelled peanuts	Burlap bag, 100-pound.
Farmers' stock peanuts	Bulk storage in warehouses.
Milled rice	Cloth bags.
Barley, Corn, Grain sorghums, Oats, Rye, Soybeans, Wheat.	(These stocks are in bulk storage at bin sites or in warehouses, and include terminals, subterminals, and country elevators.)

Protecting Food Stocks From Radioactivity

Stored foods do not become radioactive merely by being in an area subject to radiological contamination. Radioactive material, however, may be deposited upon the surface of exposed food or upon containers storing food. Radioactive material may also be dissolved or suspended in water. Food can be contaminated by washing with contaminated water.

The bulk storage stocks will be largely subject to salvage unless located in areas of more extensive physical damage. An important principle is to prevent the spread of surface radiological contamination. The surface of bulk stocks could be carefully removed so that the inside would not be contaminated by the removal of the surface. Stacked products should be handled in a similar manner since the contamination would be mostly on the outside packages or boxes.

Procedures for Avoiding Contamination of Stored Food

To the extent possible, care should be exercised to prevent entry of contaminants into any stored food. Contamination is more easily prevented than removed. Introduction of contaminants can be minimized by closing and sealing, if possible, all doors, windows, or other entrances to storage space before the arrival of fallout, and by care in avoiding any later introduction of contaminants through (1) the ventilation system, (2) use of contaminated equipment in movement of the foods, or (3) exposure of food or containers in transportation.

Decontamination Procedures for Food and Containers

If monitoring indicates that food or food containers have become contaminated, use a vacuum cleaner to remove all possible dust from outer containers (e.g., cases of fiber boxes). This method can also be used with a fair degree of success for removing much of the contamination from paper, cloth, and burlap bags. When using a vacuum cleaner, take care to prevent spreading dust from the exhaust from the vacuum cleaner into the storage space, and use extreme care in removing the collected radioactive material from the vacuum cleaner. Bury such material. If vacuum cleaning is not possible, a reasonable substitute is to brush the material thoroughly in an area where the radioactive dust will not spread to other foods.

Canned products.—Remove outer cartons or boxes of a stack of stored products without contaminating the cartons or boxes remaining in the stack. When removing cans from contaminated cartons or boxes, take care not to transfer contamination to the surface of the cans. Repack in clean containers. If the cans themselves have radioactive contamination, measures for correcting this are outlined on page 29.

Cans of lard, butter oil, shortening, cottonseed oil, and honey would not be especially endangered by a small perforation or seam rupture except for the leakage of liquid products. Stacks of canned products that have become wet will continue to rust unless the stack is opened and the cans dried. Procedures to be undertaken in case canned products are contaminated with nonpotable water are outlined on page 29.

Metal containers of food should be thoroughly scrubbed with a detergent solution in clean water to remove radioactive materials. This is especially important just before opening the container for use. The wash water should be disposed of in a manner that will not subject people or food products to further contamination.

The handling of meats in damaged cans is discussed on page 29.

Fiber-boxed products and multilayer bags.—These products offer good protection against radiological contamination. However, the containers will be especially susceptive to physical damage by flying glass or other objects, and water contamination would make salvage difficult.

Steel storage tanks.—A higher percentage of salvageability from all products stored in this manner is anticipated.

Any food in sealed storage tanks, such as cottonseed oil in the process of further refining, is quite secure from contamination by radioactive material. The only precaution suggested is care of the material after it is removed from the storage tank.

Bagged products.—Fallout is difficult to remove from the outside surface of these containers, and removal of the contents without contamination is most difficult. Water damage and penetration of flying objects could cause a high loss in this type of product.

Farmers' stock peanuts are usually stored in bulk storage warehouses. If these storages are not reasonably tight during fallout and the period immediately following, the peanuts may become contaminated. Much of this contamination will remain on the shell during the shelling process and therefore would be removed from the edible product. This may require special precautions in the shelling process. Proper disposal should be made of peanut shells which have been exposed to fallout contamination.

Bulk stocks.—A high proportion of exposed bulk stocks may be salvaged by removing the top several inches of the radiological contamination without recontaminating the deeper layers. When these bulk stocks are contaminated with water, the outer wet layer tends to congeal and form a solid surface after several days. Often the undamaged center can be recovered by boring through the outer layer and permitting the center to flow out by gravity.

Bulk grains generally are stored in elevators, and are thus weil protected from contamination. The principal precaution to be taken with such grain is to keep out contaminated air, especially during the aeriation process. However, a good filter will remove a great deal of this contamination. Care should be taken to avoid contamination of the grain as it is taken out of the elevator, and while in transit to the point of further processing.

Monitoring Procedures for Human and Animal Food

See page 27 for monitoring procedures for products intended for human consumption, and page 41 for monitoring of animal food.

Personnel Protection

See part VI for details regarding personnel protection.

PART IX.—FOREST SERVICE: INSTRUCTIONS AND PROCEDURES

As delegated by Secretary's Memorandum No. 1489, Revised, dated February 7, 1963, the Forest Service is responsible for "guidance and coordination of monitoring for rural fire control and operational monitoring on lands within National Forest boundaries and all State or privately owned forest and range land protected by the Forest Service under cooperative agreement." This section will show specific Forest Service procedures applying to this responsibility.

Organization for FS Radiological Monitoring

Forest Service organization will generally include a station of one complete minimum set of operational monitoring equipment for each of approximately 800 ranger districts. This guideline may be modified, depending upon size of district, local population, forest use, and defense capability of other agencies in the area.

Each region will provide a monitoring plan that will show the radiological monitoring equipment needed by location and amount, and the essential trained monitoring personnel to do its assigned jobs.

In addition, the Forest Service will provide individual personnel dosimeters as required for continuity of program performance, up to 100 percent of personnel and Station or office locations.

Reallocation of equipment during emergency may be necessary.

Training of FS Monitors

Forest Service training objectives for radiological defense will provide:

1. Qualified radiological instructors, to achieve a regional average of one per National Forest.
2. Four trained radiological monitors for each station. If there are less than 4 employees at a station, all will be trained.
3. Information to all personnel essential to their safety and continued functioning during emergencies.
4. Minimum chemical, biological, first aid, and other defense training essential to the program.

Training programs will be in accordance with USDA standards in part II of this Handbook.

Monitoring for FS Operations

All operations of the Forest Service in nuclear radiation emergencies will involve four procedural approaches:

1. Personnel safety and protection.
2. Land or area monitoring where operational projects are conducted.
3. Product or material monitoring as required for project work.
4. Providing monitoring information to civil defense and other agencies on a cooperative basis.

Monitoring for Personnel Protection

Monitoring for personnel protection will be based on the standards and practices set forth in part VI, Personnel Protection.

A radiological safety officer will be appointed in each forest headquarters to evaluate radiological defense problems. He should have had training as a radiological instructor or radiological defense officer.

Monitoring Lands for Field Activities

Since all Forest Service field activities involve outdoor work on lands subject to residual radiation, monitoring of those lands will be required to assure protection and continued essential production without undue personnel hazard. Radiation intensities in work areas will be monitored, and sufficient continuous record will be kept to establish intensities of residual radiation and rates of decay. Using these figures, supervisory personnel will assure that time spent in work in contaminated areas will not cause personnel exposures in excess of the standards set for personnel protection. Monitors will use standard land or area monitoring procedures for obtaining this information.

Specific considerations for individual activities of the Forest Service follow, with standards and guidance as they apply. In the absence of specific standards, monitoring of all forest products will be done with a survey meter, and any significant increase in background radiation from any products will be reported to a radiological safety officer or a radiological monitoring instructor for evaluation.

Monitoring for Fire Control

Fire-control monitoring is primarily a process of area or land monitoring to assure safety of per-

sonnel engaged in fire-control activities. Standard area monitoring procedures will be used. Unsafe areas will be determined on the basis of the criteria set forth in part VI, Personnel Protection, page 17.

All residents, users, cooperative firefighting agencies, and associated land management groups should be notified of hazardous areas of their concern.

Consideration should be given to such secondary hazards as radioactive smoke from fires in heavily contaminated areas, and associated fallout from the smoke.

All fire-control personnel required to work in contaminated areas will be supplied with dosimeters, either individually or one for a group, and the crew or individual exposure will not be allowed in excess of emergency personnel standards previously given.

Monitoring for Timber Management

There are no specific standards for internal timber product contamination. External contamination can be substantially reduced by washing with quantities of water, or by the normal floating in log ponds, streams, etc. Drainage from washing operations should be monitored and if radioactive should not be allowed to flow into clear drainages and cause further contamination.

Log ponds at sawmills or loading terminals should be monitored if any possibility of contaminated timber exists, because of the possibility of both short-term radioactive dust accumulation and long-term adsorption in banks and mud bottoms of long-life radioisotopes.

Monitoring for Watershed Management

The Forest Service is not responsible for monitoring individual or community water supplies. However, since most Forest Service lands are watersheds for large numbers of water users, the Forest Service should provide information to the direct or indirect watershed users on contaminated watersheds feeding their supplies. Any noticeable contamination of watersheds should be reported to the USDA County Defense Board and to community and individual watershed users so they can arrange to have their water supply tested. Also, special attention should be given to monitoring open-storage reservoirs and stock tanks.

Monitoring for Grazing and Wildlife

Monitoring for grazing and wildlife is essentially an area monitoring problem. All grazing permittees should be notified of hazardous areas. Livestock in general are more resistant to radiation than are humans, but the same standards can be used as guides to protective action. For example, if monitoring and calculations show that livestock have received a dose of 550 roentgens within a 4-day period, moving them to a safe area will save only a portion of them. Specific livestock protection procedures can be found on page 22. The best protection is to move to a safe area if possible.

In the absence of other specific standards, permittees, hunters, and the Animal Disease Eradication Division, ARS, should be notified of known livestock exposure on contaminated grazing lands. Criteria on slaughter of exposed animals are found on page 25.

It should be remembered that the meat of animals exposed to radiation is not damaged if the animals are slaughtered before serious illness develops, so long as the radioactive material itself does not physically contaminate the meat. See page 43 concerning short-term denial, to children, of milk produced in fallout contaminated areas.

Monitoring for Forest Land Management

The long-term strontium 90 hazard and specific strontium 90 tests may result in denial of use of land for direct food products consumption. First-order denial might be to dairy animals, then to fresh vegetable food production. In case of long-term denial of such lands, a logical and practical diversion could be to timber production. Similarly, forest lands uncontaminated by the long-life strontium 90 might need to be converted to farm production to assure continued food production.

Such land-use adjustments will be directed by the Secretary of Agriculture, but the Forest Service will advise on suitability for conversions.

Monitoring for Other FS Activities

Monitoring for engineering, recreation, State and private and cooperative forestry and fire control, pest control, flood prevention, planting, and forest diseases is essentially a land monitoring procedure for protecting personnel. Standard area monitoring procedures will be used, and personnel exposure standards observed.

Early warning of all forest users, such as permittees, residents, and recreation area users, when hazardous fallout is monitored, will be a responsibility of the Forest Service.

Administration, personnel management, and public relations activities will be directed toward meeting the primary Forest Service responsibilities in emergency conditions.

Montoring information from these practices, as well as technical information and assistance, will be made available on request to any authorized State, local, or Federal government agency or public activity whenever practical and in the public interest.

PART X.—SOIL CONSERVATION SERVICE: INSTRUCTIONS AND PROCEDURES

Secretary's Memorandum No. 1489, Revised, dated February 7, 1963, states, in part:

The Soil Conservation Service is responsible for radiological monitoring of agricultural lands and water, farm commodities stored or harvestable on farms, ranches, and at bin sites, and advising on safety for livestock.

This section provides suggestions for carrying out Soil Conservation Service monitoring activities. It is impossible to anticipate every situation that might occur in an emergency. Therefore, these guidelines may be altered as more experience is gained and further information is developed. Good judgment in monitoring and interpreting the information is, of course, essential.

Organization and Training of SCS Monitors

Operational monitoring stations will be established at each of the approximately 3,000 work unit and subunit offices. These stations will have the necessary equipment and trained personnel to conduct radiological monitoring. The State Soil Scientists will also be supplied with radiological instruments and will be responsible for maintaining proficiency of personnel and equipment throughout the state. A sufficient number of monitoring instructors will be trained in each State to assist the State Soil Scientists in developing proficiency among the monitors.

Each of the five SCS training centers will have equipment and personnel qualified to give monitoring training to new Service personnel who pass through the centers.

Personnel Safety

See part VI, Personnel Protection, for procedures to be followed.

Protecting Instruments from Contamination

The monitor should prevent radiological contamination of the instruments at all times. Instruments can be placed in a thin clear plastic bag to prevent contamination. In case of contamination, they can be cleaned with a cloth dampened in a mild soap solution. After decontamination, each instrument should be monitored with a CD V–700 to assure that contaminating material is removed.

Reconnaissance Surveys

When To Conduct a Reconnaissance

A reconnaissance of the county or work unit is first made to determine the levels of radiation and the uniformity of radioactive contamination. This should be done within the limits of allowable personnel exposure, which should be determined before starting the reconnaissance. Monitors should keep their survey meters and dosimeters with them at all times whenever an emergency has been declared or an attack is imminent. The monitor should know the specific accomplishment, extent, and importance of each monitoring mission. Care should be taken to prevent the survey meters from becoming contaminated. This will reduce the chance of incorrect readings. The vehicle to be used in the reconnaissance survey should be stored under cover to help protect it from contamination by radioactive fallout prior to its use.

A reconnaissance survey should not be attempted as long as the radiation level is increasing.

How To Conduct a Reconnaissance

The pattern of road systems, terrain, land use, and farm size will vary greatly from county to county. This, along with variation in intensity of fallout, will influence the type of reconnaissance survey needed. Therefore, detailed plans for monitoring must reflect local conditions at the time the survey is made.

An initial ground survey through the county with readings every few miles will indicate the level and uniformity of the fallout. Any unusual conditions should be noted. If the radiation is uniform, further reconnaissance surveys will not be necessary unless additional fallout is received. If additional information is needed, a more intensive survey can then be made. The pattern of these more intensive surveys will depend largely on the road system in the area.

In areas where the road system follows section lines, a grid-type reconnaissance map can be developed. Where the road system is irregular, the reconnaissance survey will of necessity follow the same pattern. Extremely hilly or mountainous areas may affect the pattern of the reconnaissance survey.

In any case where the radiation is not uniform over the county, it will be necessary to conduct

more detailed surveys to determine the areas of high and low radiation and the extent of each. Localized areas of high-intensity radiation or "hot spots" may be present in the area being monitored. The monitor should be constantly on the alert for these while conducting the reconnaissance.

A map can be developed showing lines of equal radiation (isointensity lines), similar to a contour map showing lines of equal elevations. This will clearly indicate the areas of high and low radiation levels. Base maps should be developed before the emergency, for use in making reconnaissance surveys. These should show the anticipated routes along which the meter readings will be taken. A system of identifying the locations at which the readings are to be taken should be developed by some locally accepted method. This will permit interchange of information on radiation levels by telephone between monitors and the USDA County Defense Board office.

It is important that the survey meter readings taken during the reconnaissance be representative of the general area around the locations at which the readings were taken. Thus the location at which the reading is taken should be on a topography typical of the area. Factors that might affect fallout intensity are buildings, vehicles, fences, windows, ditches, woods, hills, or large bodies of water. Readings should be taken so as to lessen the effect, so far as possible, of these factors. Record the dose rate, the time, and location for each reading. If readings are taken within a vehicle, this should be noted. Until the level of radiation is known, care should be taken so that the monitor does not needlessly contaminate himself or the instrument.

The pocket dosimeter should be read at frequent intervals to determine the accumulated dose.

All readings should be taken as quickly as possible in order to minimize the exposure of the persons taking them. An effort should be made to lessen the effect of gamma shielding by the monitor's body. This can be done by holding the survey meter at arm's length. The survey meter should be held approximately 3 feet above the surface of the ground or above the material being monitored.

Using Reconnaissance Information

Information obtained from a reconnaissance should be furnished to the USDA County Defense Board and the local civil defense officials. This will provide a basis for Defense Board actions and recommendations. The information furnished to the local civil defense officials will give them a more accurate picture of the situation in their local area.

Cooperation, continued liaison, and interchange of information with local civil defense officials are essential in order to avoid duplication of monitoring activities. Procedures should be developed locally to facilitate this close working relationship. Information obtained by local civil defense monitors should be coordinated with that of USDA monitors to provide the broadest possible picture of the fallout situation.

Information on the levels of radiation should be made available to the rural people. This would be done following a prearranged plan with the USDA County Defense Board and local civil defense officials. All methods of rapid communication should be considered.

It will be necessary to report the dose rate at each monitoring headquarters location to the appropriate USDA office. The standard message format will be used. This will facilitate reporting to the USDA State Defense Board. Guidelines for reporting are found in part V, Procedures When Emergency Occurs, page 15. The agency designation (initials) and the full name of the monitoring station location will be used to indicate location from which the message originated. Any unusual conditions should also be reported to the USDA State Defense Board.

Monitoring Agricultural Land

A gamma radiation level of 1 roentgen per hour at 3 feet from the ground surface corresponds approximately to 10 microcuries per square centimeter of surface contamination. This approximation is valid only for surface contamination on land or crops. If some of the land has been cultivated and the fallout mixed in, it will not contribute fully to the reading on the survey meter. This would result in a reading that is too low.

On pasture land, with the survey meter held at a height of 3 feet, a gamma radiation level of 0.2 roentgen per hour would be the equivalent of about 2 microcuries of beta activity per gram of fresh forage. During the first 30 days immediately following a nuclear explosion, a level of 0.2 roentgen per hour on pasture land is within the acceptable risk. If at any time during the first 30 days the radiation level decreases to 0.2 roentgen per hour, the pasture land can then safely be used for the remainder of the 30-day period.

Even if the radiation levels exceed 0.2 roentgen per hour, it may be necessary to permit brief periods of pasturing, for it is better to give contaminated feed than to permit the animals to starve. The objective is to provide feed with the lowest possible contamination. The movement of feed from an area less contaminated, or the movement of the livestock to a less contaminated area, should be considered. The USDA State Defense Boards will have knowledge of radiation levels, based on reports by monitoring locations, of areas from which feed might be obtained or to which livestock might be sent.

Cows that are to be used to produce milk for infants should not be permitted to graze on pastureland where the radiation level exceeds 0.06 roentgen per hour. This may necessitate a priority for giving these animals feed which has been

sheltered or for moving in feed from areas which have not been exposed to fallout.

If initial monitoring indicates unacceptable levels of radiation, an estimation of decay time to acceptable levels can be made and remonitoring carried out later. Rains which wash off the fallout material and new pasture growth will also reduce the contamination. The above acceptable risk limits are based on the assumption that the surface contamination was 2 microcuries per square centimeter, or 80 curies per acre of area, and that 10 percent of this was retained on the forage. It also assumes that the fresh weight of forage amounts to about 5 tons per acre.

After this 30-day period, a new acceptable risk level should be determined. These new risk levels will be based on guidelines that will be furnished by the Department of Agriculture on the national level.

A determination must be made of the type and extent of elements present in the particular fallout causing the contamination before the guides can be applied.

Effects of Fallout on Land Use

Specific Responsibilities of SCS

As stated on page 39, the Soil Conservation Service is responsible for planning and directing, within the county, a program of guidance on the use of land and water under emergency conditions. This will include devoting the best adapted lands to the production of the most needed crops and the application of adapted and needed conservation measures. It may be necessary to bring new land into cultivation to meet emergency needs. These lands should also be protected with adequate conservation measures.

Lands unsuited for agricultural production because of radioactive contamination must be located. These should be identified, by location and extent, on maps made available to USDA Defense Boards, local civil defense, local government officials, and the landowners affected. Radioactive areas that are determined to be above the limits considered safe for people to live without special shelters should also be delineated. The presence of these areas should also be made known to all concerned. Local civil defense officials may wish to consider marking these areas.

Contamination by Radioactive Materials

For weeks following a heavy deposition of fresh fallout, iodine 131 may be a major radioactive contaminant of vegetation, including food crops such as fresh vegetables and fruits. After ingestion by animals and poultry, iodine is rapidly absorbed from the gastrointestinal tract, collected in the thyroid gland, and secreted in milk and eggs.

In the event of a nuclear attack, radioiodine would be the most critical single factor in the contamination of milk during the first few weeks after an explosion. The hazard would decrease relatively rapidly because of radioactive decay, but the short-time problem would be serious in some areas.

As the external radiation hazard (gamma) from the initial fallout decreases, the internal hazard (beta) becomes more significant. It might be 6 months or longer before the strontium 90 becomes the major problem in agricultural production. However, after the first 60 days the principal hazard of radioactive contamination in milk arises from strontium 89 and strontium 90. The strontium 89 will have virtually disappeared by 1 year after its formation. Like other radioactive isotopes of fallout, strontium 90 falls on the surface of plants and can be consumed with foods and forage. Some of the strontium 90 is deposited directly on the soil or washed into it, remaining indefinitely—for all practical purposes—in the top several inches of untilled land.

The return to earth of strontium 90 in worldwide fallout from large nuclear detonations is rather slow. Rainfall is the principal mechanism that brings strontium 90 from the atmosphere to the ground.

The determination of lands which are not suitable for agricultural purposes must be based on levels of strontium 90 contamination. Other radioactive isotopes are not of great concern because they are either not taken up from the soil by plants, are taken up in much smaller amounts, or they have such short "half-lives" that they decay to insignificant amounts in a relatively short time. The acceptable levels of strontium 90 depend upon the use to be made of the agricultural products and the calcium content of the soil.

Recommending Denials in Land Use

One of the first postattack decisions to be made by agricultural leaders is how to use land contaminated with fallout in order to continue to produce, indefinitely, a diet that permits the survival of the people without exposing them to unacceptable internal radiation hazards. Land denial levels are based on the expected strontium 90 content of the foods to be grown on the land. Land contamination levels for denial of the use of the land for the various food groups may be raised or lowered as more information becomes available. Under no circumstances should land be cultivated if the farmer or rancher would thereby expose himself to unacceptable levels of external radiation.

The denial of land use, based on the strontium 90 analyses, is suggested for an indefinite period unless modified by other measures. For example, decontamination of the soil by such methods as surface soil removal and deep plowing would make the land more suitable for agricultural production.

Several months or longer might elapse before strontium 90 analyses could be made on many contaminated soils. Therefore, it is recommended

that temporary land use be based on the standardized gamma radiation intensity at H+1. Soils may be classed as low-, medium-, and high-calcium, with 2,000 pounds available calcium per acre considered low; 6,000 pounds, medium; and 30,000 pounds, high. These fall within the ranges indicated on the calcium-content map. (See fig. 6.) The recommended intensities above which cultivation of the land should be denied are 100, 300, and 1,000 roentgens per hour, respectively, for the low-, medium-, and high-calcium soils. The purpose of the temporary limitations is to minimize, in a practical manner, the cultivation of land that should be decontaminated before plowing. This temporary denial will preclude tillage that would incorporate the fallout material into the soil profile. The temporary denial should remain in effect until a decision is made as to whether to attempt decontamination for use by special crops or to permit cultivation for use by crops with a low strontium 90 uptake.

The reason for the denial of land on a permanent basis is an excessive strontium 90 content in the soil. The use of land that monitoring indicates may have an excess of strontium 90 should be denied until a laboratory analysis can be made. Guidelines for collecting the samples of soil to be analyzed for strontium 90 content will be issued by the national office when the decision is made to collect samples. Cultivation will tend to mix the radioactive isotopes on the surface of the soil throughout the soil profile to the depth of tillage. This may make later decontamination impossible.

Exchangeable Calcium Content of Soil

The map of the exchangeable calcium content of United States soil (fig. 6) can be used as a general indication of where calcium deficiencies might be expected. County maps showing levels of available calcium in soils should be developed in the preemergency period. Individual farm soil fertility test results will also provide valuable information if available in an emergency.

Alternative Land Uses

It may be necessary to remove from food production lands that are heavily contaminated with certain isotopes until the radioactivity has decayed to levels permitting safe use. Such lands might be planted to fiber or lumber producing crops. This decision will depend on the results of an analysis of the radioactive isotopes in the particular fallout causing the contamination.

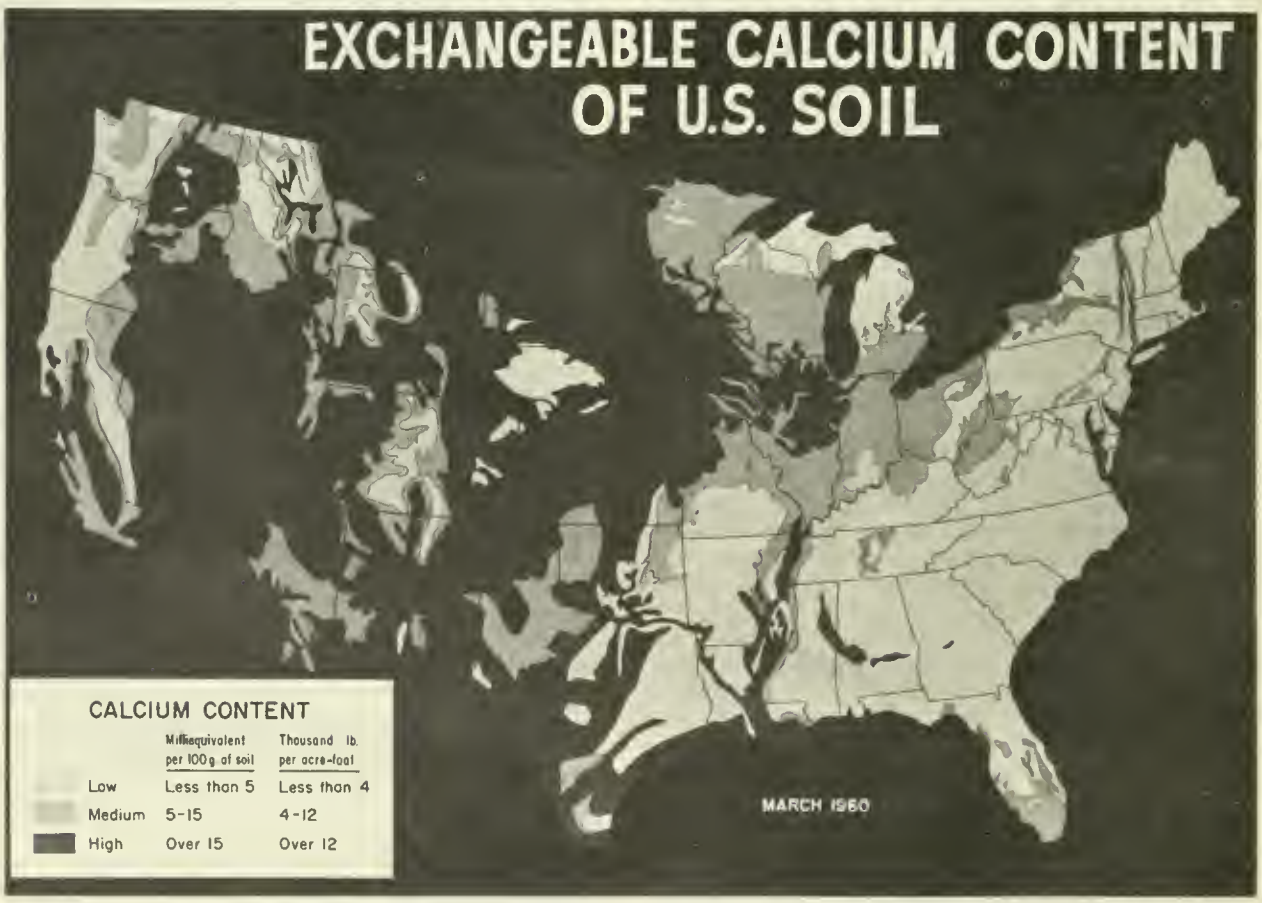


FIGURE 6.—Map of exchangeable calcium content of United States soil.

Land that is less contaminated may be removed from the production of certain types of crops and planted to other crops less likely to take up the radioactive materials from the soil. Land use for this purpose, starting with the crops most susceptible to strontium 90 uptake, is classified as follows: (1) dairy animal forage and leafy vegetables; (2) other vegetables, cereal grains, and fruits; (3) feed for poultry and meat animals; and (4) fiber crops, vegetable oils, and chemically processed foods. Land may be shifted from cropland to grassland if it may be safely used for meat production purposes. These recommendations will be based upon the level of radioactive contamination, the type of soil that is contaminated, the crops that are adapted, and the needs for particular crops.

Remedial Measures Against Fallout

Countermeasures against radioactive fallout include those actions that would reduce or eliminate the exposure of the population to the hazards of radioactive materials. These procedures should be directed to the source of the contamination, to the mechanism that transmits it, or to the substance in which it gains access.

Remedial measures such as decontamination of land would be taken only after responsible authorities had carefully evaluated the situation and declared a state of emergency. The decision would not be an easy one. Medical assessment of the probable damage from radiation would have to be balanced against the cost of the decontamination measures, the resulting reduction in available food supplies, and the economic and social dislocations resulting from the action.

Countermeasures could be drastic, or they could involve changes in generally accepted farming practices. Some measures could be simply an improvement over local conditions and procedures. Some countermeasures could result in reducing the contaminant by only a small factor, but a combination of several of these measures could provide the necessary reduction.

These may include adding lime to acid soils, removing contaminated crop residues, removing radioactive surface soil, or deep plowing to place the radioactivity below the root zone of the crops to be grown.

In general, the addition of lime, gypsum, fertilizer, or organic matter in practical amounts to low-calcium soils will help to reduce the uptake of strontium by the plant by less than one-half. For most soils and crops, it is recommended that **lime not be applied in excess of the amount of calcium needed for maximum crop growth.** In the production of small cereal grains, addition of *more* calcium than is needed for optimal growth may be helpful in reducing the strontium hazard, without reducing the quality or quantity of the crop.

The application of lime to established pastures increases the calcium content of the vegetation. An application rate of 2 tons of lime per acre, for example, has lowered the ratio of strontium to calcium in pasture grass by two-thirds.

Remedial measures such as decontamination by deep plowing or scraping should be recommended only if the agricultural land has been seriously contaminated with strontium 90. These measures, which may permanently bury the radioactivity or concentrate it where it is stockpiled, should not be recommended until responsible authorities have determined that such decontamination measures are advantageous or necessary.

It might be necessary to reduce the radioactivity in small, highly contaminated areas. It also may be necessary to reduce the radioactivity in small parcels of land where the entire area is blanketed with radioactive contamination. The decisions to apply drastic decontamination measures will be based on many factors. Among these are the personal dangers, cost, available food supplies, and possible dislocation of people living in the area.

It is assumed that information and guidance on land-use shifts will be provided by the State and national levels of the Soil Conservation Service in time of an emergency, but that this assistance will be based on the information obtained by the SCS monitor in the field.

Monitoring Agricultural Water

The general method for monitoring livestock water from ponds or tanks would be the same as that of monitoring food for human consumption, as described in Monitoring of Meat and Meat Food Products, page 27. Since 100 milliroentgens per hour is beyond the range of the CD V–700 survey meter, it will be necessary to support the probe a few inches above the sample to be measured. This will reduce the activity readings, after they have been corrected for background, by a constant factor. The reduction factor should be determined, using a sample within the range of the CD V–700 when the probe is held one-fourth inch from the sample.

Runoff may have a tendency to concentrate the fallout and result in higher radioactivity levels in ponds and at the base of slopes. However, it is probable that the radioactive contamination of bodies of water will soon become less than that of surrounding land because the radioactive fallout will settle and be adsorbed by clay particles in the bottom and sides.

Table 6 indicates that the acceptable risk levels for animals are higher than those for human beings, except for dairy cattle furnishing milk for infants or children. This restriction for dairy cattle reflects the need to keep the iodine 131 intake of children much lower than that of adults.

TABLE 6.—*Suggested emergency levels for animal feed and water immediately after a nuclear explosion*

[30-day acceptable risk level]

Use of food and water	Acceptable level [1]
Dairy cattle (milk fed to infants under 2 years of age).	3 mr/hr above background.
Dairy cattle (milk fed to children from 2 to 16 years of age).	10 mr/hr above background.
Other animals	100 mr/hr above background.

[1] Measured with CD V–700 probe (with shield open) held ¼ inch from sample in coffee can or similar container, except to measure a sample which would read 100 milliroentgens per hour at this distance. Then the probe must be supported several inches from the sample.

This table will provide a basis for evaluating the acceptability of livestock feed and water contaminated by radioactive fallout. For livestock, the risk levels are acceptable for a 30-day emergency period. It would be better to exceed these levels somewhat than to starve the animals or to expose personnel to dangerous levels of radiation in order to provide safer feed and water to livestock.

Monitoring Stored Crops

The procedure for monitoring stored crops would be the same as for food and water. Stored crops would be partially or completely protected from contamination by fallout. Grain stored in a tight bin, ensilage in a covered silo, haystacks covered with a tarpaulin, and similarly protected materials should have little or no contamination. Many other materials, such as uncovered haystacks and piles of farm produce, could be used if the contaminated outer portions were removed. If the outer portions are found acceptable by monitoring, then the inner portions can be used with confidence.

Monitoring Unharvested Crops

The first step would be to determine whether workers can safely carry out harvest operations. Harvest should not be recommended where excessive exposure to workers would result.

Procedures for monitoring unharvested crops would be much the same as for monitoring feed and water. It will be necessary to obtain a representative sample of the harvestable portion of the crop. The sample may be obtained by the regular harvest method and checked for radioactivity level.

Weather and normal radioactive decay may lower the radiation level, thus permitting a later harvest if the initial radiation is too high.

Advising on Livestock Safety

Livestock owners will generally find it impractical to remove animals from fallout areas. Therefore, it is desirable to have facilities for the care of animals in some type of shelter. Every effort should be made to supply at least a 2-week supply of uncontaminated feed and water. Animals should be kept under shelter at least during the first critical period of 24 to 48 hours. If feed, water, or shelter space is not available for all animals, priority should be given first to milk-producing or other food-producing animals. Details on livestock protection can be found on page 22.

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