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ARGONNE NATIONAL LABORATORY
9700 South Cass Avenue
Argonne, Illinois 60440

ARGONNE NATIONAL LABORATORY RADIOLOGICAL ASSISTANCE TEAM

by

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Industrial Hygiene and
Safety Division

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TABLE OF CONTENTS

TABLE OF CONTENTS

LIST OF FIGURES

TABLE

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ABSTRACT

This document describes the action taken by Argonne National Laboratory in meeting its responsibility as part of the overall Radiological Assistance Plan. The Laboratory's Radiological Assistance Team organization and methods of training, operations, equipment, and utilization are discussed.

This document is not intended to replace the Radiological Assistance Plan - Chicago Operations Office Manual of 7-1-59.

INTRODUCTION

A Radiological Assistance Team was organized at Argonne National Laboratory in December 1957, at the request of the Manager of the Chicago Operations Office, and is presently governed by policy as outlined in Chapter 0526 U.S. A.E.C. Manual.

Several meetings held in Albuquerque, New Mexico, Washington, D. C., and Idaho Falls, Idaho, were attended by a representative of the Radiation Safety Section of the Industrial Hygiene and Safety Division of Argonne National Laboratory, hereinafter referred to as ANL. The overall problems, procedures, and planning were discussed in detail with representatives of the AEC and other organizations who were requested to provide or advise on a Radiological Assistance Capability. The information obtained from these sessions was used as a guide in the development of the ANL Team. The primary objective of the ANL Team, as originally organized, was to provide emergency radiological assistance at the site of incidents involving nuclear weapons, under the direction of the AEC-COO manager's representative.

The original ANL organization consisted of two units of five men each. Prior to January 1, 1958, this team was organized, equipped, and began to function as a unit of the AEC Radiological Assistance Plan.

The ANL Team was advised in March 1958 that the capabilities of all established emergency monitoring teams be extended to include all

types of radiation incidents. This extension required Team response to those incidents involving licensees, contractors, and other organizations, in addition to weapons incidents. The primary area of responsibility assigned to the ANL Team is a ten-state area of approximately 640,000 square miles. This area includes the following states (see Fig. 1):

Ohio	Indiana	Iowa	Minnesota	North Dakota
Michigan	Illinois	Wisconsin	Nebraska	South Dakota

The Team has been involved in 27 off-site call-outs up to May, 1963 (see Figs. 2, 3, and 4).

ORGANIZATION - GENERAL

The original Team composition of two units, of five men each, was discontinued in June 1960 in favor of the following one-team, twelve-man organization: 4 - Team captains; 6 - Team monitors; and 2 - Team instrument repairmen monitors.

Any combination of two or more members, one being a Team captain, may provide radiological assistance either on site (at ANL), at the direction of the Supervisor of the Radiation Safety Section, or off site, at the direction of the Manager of the AEC-Chicago Operations Office.

The twelve-man organization provides the Team captain a choice in the selection and utilization of pertinent skills within the Team membership on a particular call-out. The present organization has also increased the assurance of providing a balanced unit of at least six men within a reasonable time on an around-the-clock basis. The twelve-man, one-team concept also provides for an equalization of call-out experience. All Team members have participated in at least one call-out (see Table I).

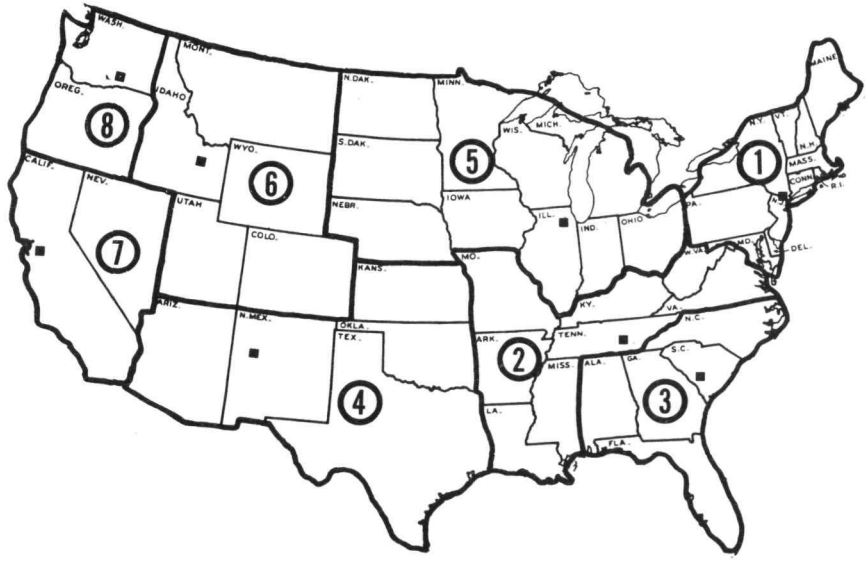
The ANL Team members are obtained from the Industrial Hygiene and Safety Division (IHS) of the Laboratory on a selection-volunteer basis: selection - in the sense that an effort is made to provide a balanced Team with a wide range of health physics skills and experience; volunteer - in that those selected are so informed and advised that participation is solely on a voluntary basis.

Termination of participation in Team activities may be accomplished by the Team member via a simple verbal request made to a Team captain or the supervisor of the Radiation Safety Section.

This method of selecting members has provided a Team with health physics skills and experience in the following fields: reactor research, development, and operation; personnel monitoring; hot lab operations; chemistry

U.S. ATOMIC ENERGY COMMISSION

REGIONAL OFFICE AREAS
OF RESPONSIBILITY FOR
RADIOLOGICAL ASSISTANCE
IN INCIDENTS INVOLVING
RADIOACTIVE MATERIALS



REGION NO. and OPERATIONS OFFICE	POST OFFICE ADDRESS	TELEPHONE for ASSISTANCE	DDD AREA CODE
(1) NEW YORK	376 HUDSON STREET NEW YORK 14, NEW YORK	YUKON 9-1000	212
(2) OAK RIDGE	P. O. BOX E OAK RIDGE, TENNESSEE	483-8611, Ext. 7607 or 483-7486	615
(3) SAVANNAH RIVER	P. O. BOX A AIKEN, S.C.	AIKEN, S.C., MIDWAY 9-6211, Ext. 3333 AUGUSTA, GA., PARK 4-6311, Ext. 3333	803 404
(4) ALBUQUERQUE	P. O. BOX 5400 ALBUQUERQUE, NEW MEXICO	264-4667	505
(5) CHICAGO	9800 S. CASS AVE. ARGONNE, ILLINOIS	CLEARWATER 7-7711 Ext. 2111 or 541	312
(6) IDAHO	P. O. BOX 2108 IDAHO FALLS, IDAHO	522-4400 Ext. 2345	208
(7) SAN FRANCISCO	2111 BANCROFT WAY BERKELEY, CALIFORNIA	THORNWALL 1-5620	415
(8) RICHLAND	P. O. BOX 550 RICHLAND, WASHINGTON	942-1111 Ext. 6-5441	509

Revised: November 1963

Fig. 1

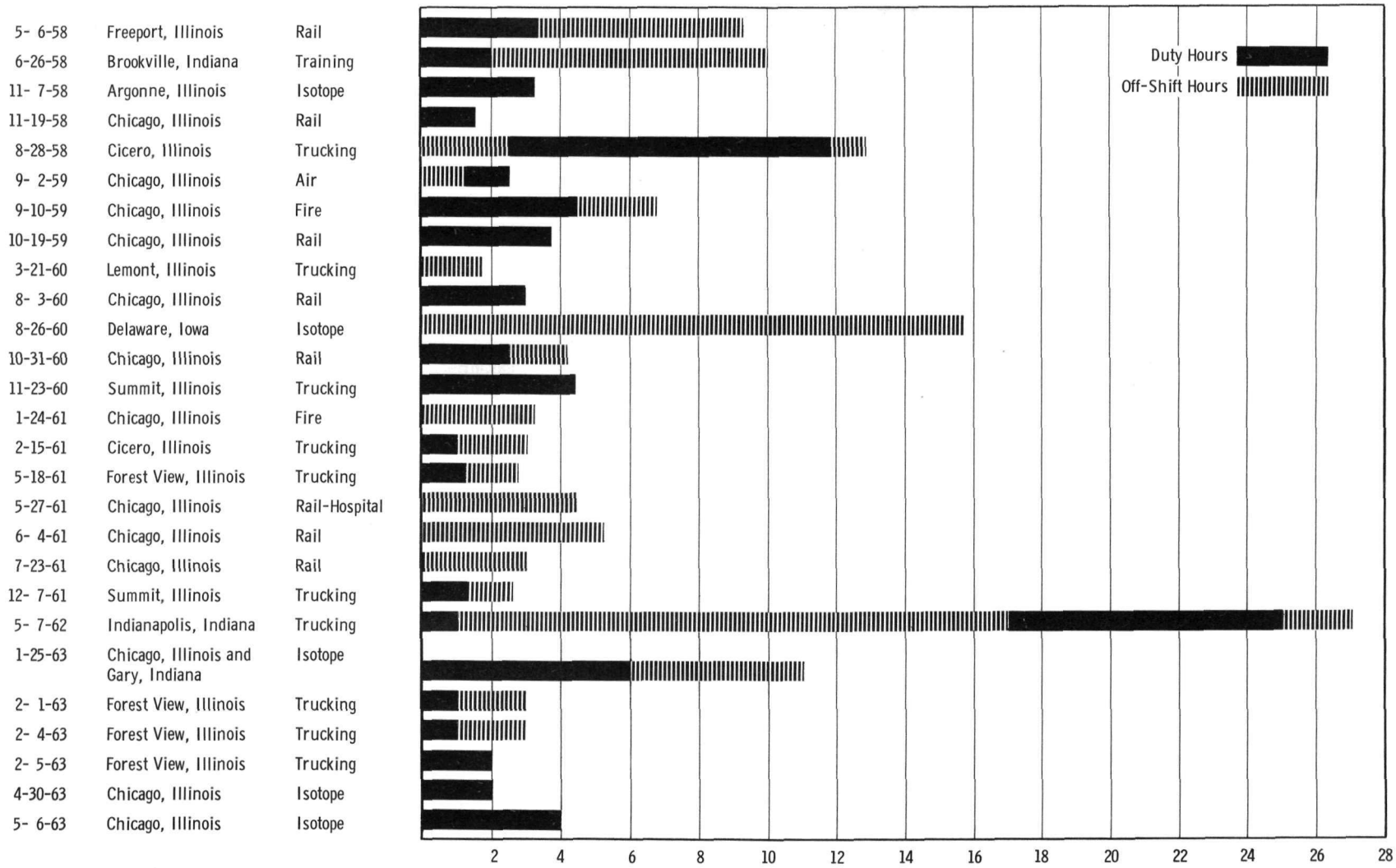


Fig. 2. Duration of ANL Radiological Assistance Team Off-site Call-outs

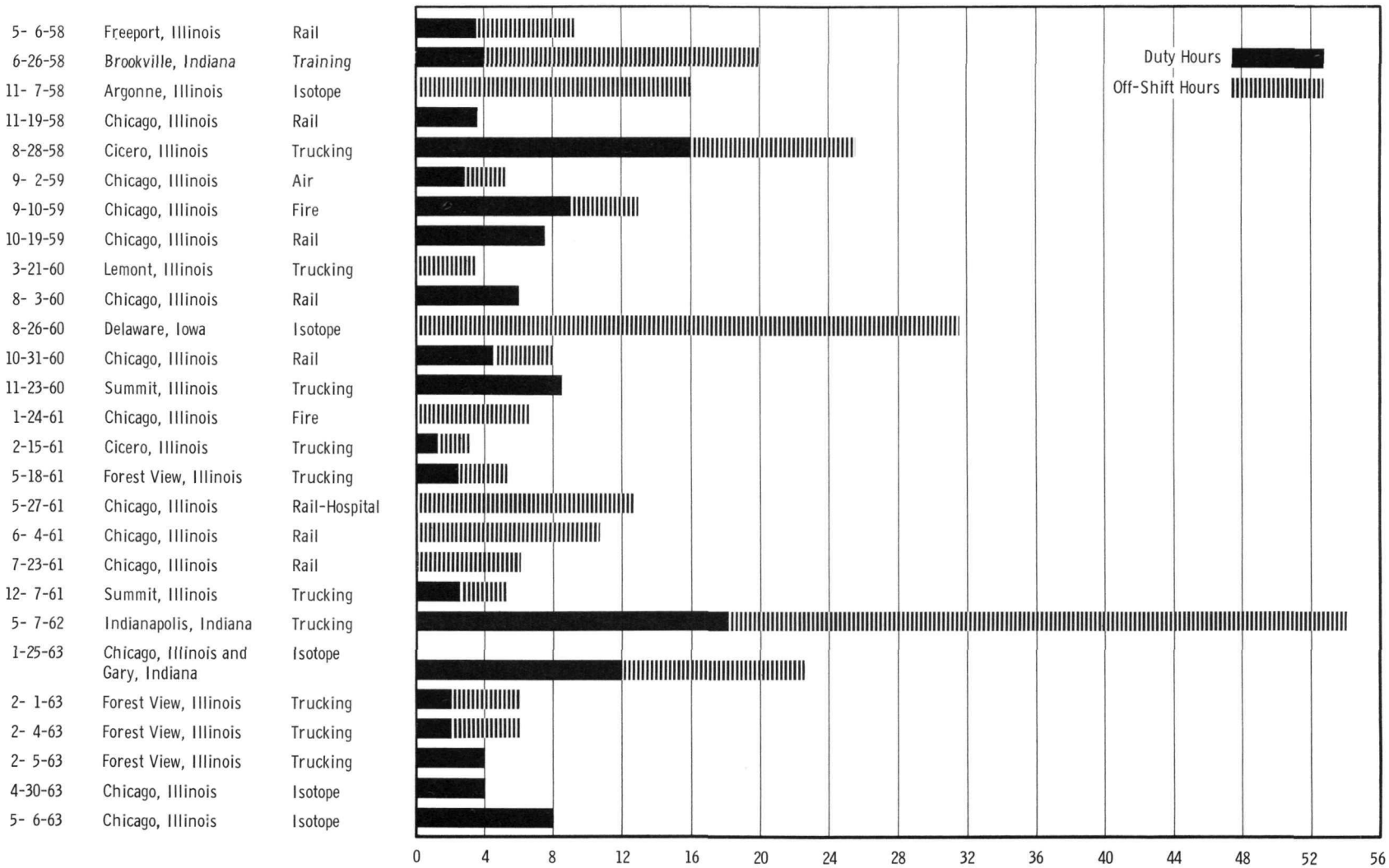


Fig. 3. Total ANL Man-hours Expended per Call-out of the ANL Radiological Assistance Team

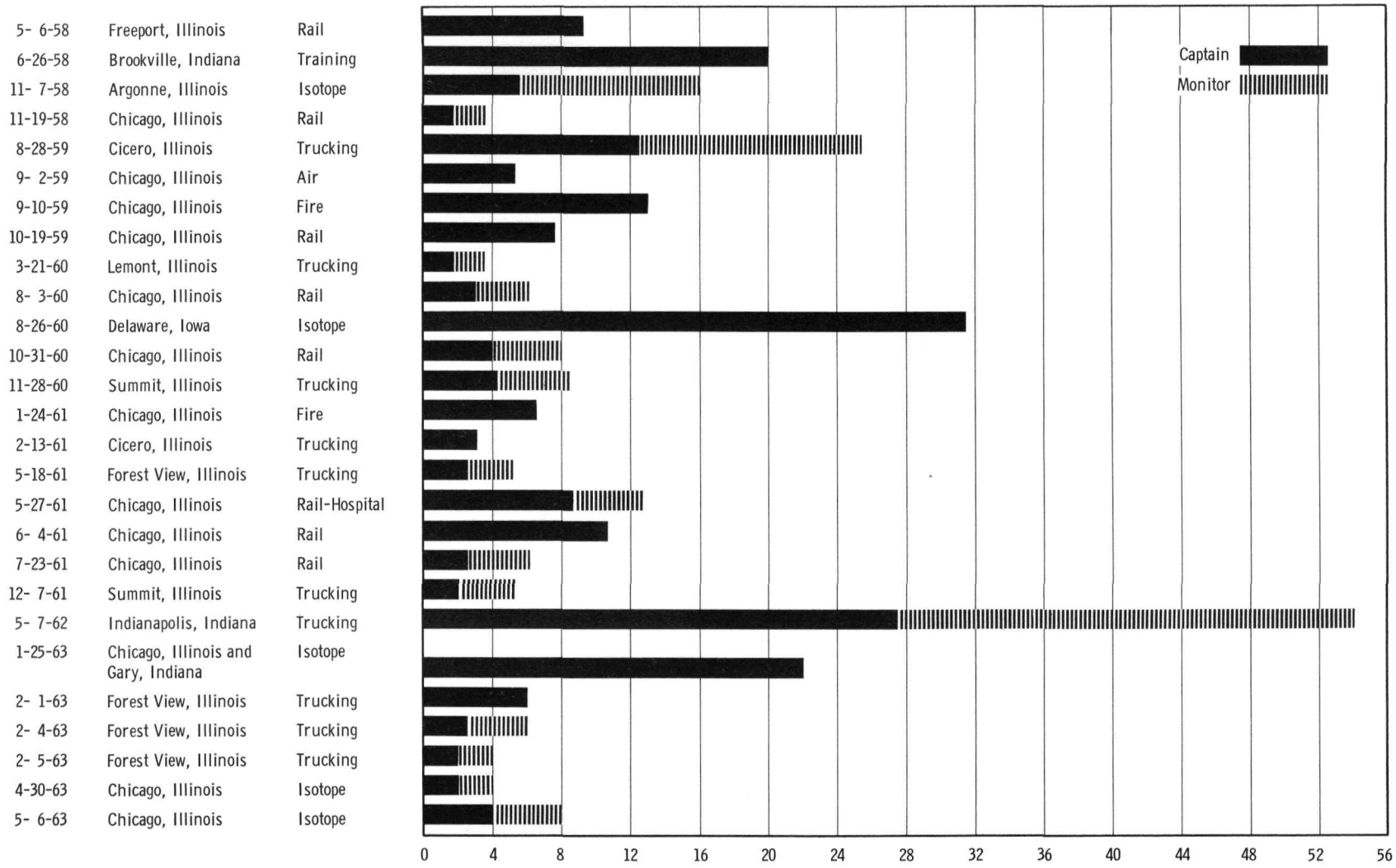


Fig. 4. Total Man-hours (Captain and Monitor) Expended per Call-out by ANL Radiological Assistance Team

Table I

ANL RADIOLOGICAL ASSISTANCE TEAM
PARTICIPATION AND TRAINING

Team Member	Number of Call-outs Attended	Training and/or Experience at Nevada Test Site or Sandia
Team Captain #1	16	Yes
Team Captain #2	11	Yes
Team Captain #3	5	Yes
Team Captain #4	3	Yes
Team Monitor #1	3	Yes
Team Monitor #2	3	Yes
Team Monitor #3	1	Yes
Team Monitor #4	1	Yes
Team Monitor #5	1	No
Team Monitor #6	1	No
Team Instrument Repair Man #1	1	Yes
Team Instrument Repair Man #2	1	Yes
PREVIOUS MEMBERS		
Team Captain	1	Yes
Team Captain	2	Yes
Team Captain	0	No
Team Monitor	4	Yes
Team Monitor	1	Yes
Team Monitor	1	No
Team Monitor	0	No

and chemical engineering operations; plutonium and other high-level-alpha metallurgical operations; instrument maintenance and repair; decontamination operations.

All Team members have regular full-time duties within the IHS Division. Participation in Team training and activities is considered an additional assignment.

DUTIES

Team Captain

Team captains are responsible for the state of preparedness of all Team members and for the procurement and/or development of necessary instrumentation, personal protective clothing, and training.

Team captain's responsibilities while participating in a call-out include the collection, analysis, and evaluation of information and monitoring data pertinent to the incident. He must continually inform and advise the AEC Manager's representative on off-site incidents or the Supervisor of the Radiation Safety Section in on-site incidents, of the Health Physics aspects pertinent to the particular incident.

The arranging for and replenishing of supplies as well as assuring the readiness of equipment for future utilization is also a responsibility of the Team captains.

The preparation of a complete report on Team activities and investigation pertinent to the call-out must be completed by the Team captain or captains in charge. See the report section on p.19 for detailed description of reports.

A meeting of all Team members is usually arranged by the Team captain in charge of the call-out, at which time the call-out is reviewed and critiqued.

The Team captain is responsible for the proper initiation of all necessary forms and procedures as prescribed by ANL approved policy pertaining to issued funds (see p. 20).

A record as to the actual number of hours spent by the Team monitors in participating in call-outs which occur or are extended to other than normal working hours is maintained by the Team captain.

A monthly report of Team activities is submitted to the Supervisor of the Radiation Safety Section in the name of all Team captains. A detailed description of this report is found in the Special Reports section on p. 19.

Team Monitor

Monitors are required to participate in instruction and to take an active part in the preparation of instructional material and activities involving special projects.

They must be familiar with the Team procedures and demonstrate a capability of operating all Team-assigned equipment. They should know the limitations and field expedients pertinent to each item of Team equipment.

The monitors are required to keep abreast of the current status of Team equipment and items assigned to them personally. This is accomplished by completion of scheduled routine maintenance and operational checks of all Team equipment and instrumentation.

Routine reports of the equipment and instrumentation status are maintained by the Team monitors. They are also responsible for the arrangement for repair as needed.

The Team monitor provides assistance to the Team captain in the collection, analysis, and evaluation of information and monitoring data while participating in a call-out.

He assists in the replenishing of Team supplies and in the storage and preparation of equipment for future Team utilization.

Assistance in the preparation of data, critique information, and other report materials is provided by the Team monitor upon completion of the call-out.

The accounting for funds issued within the prescribed time and in the approved manner is the responsibility of each Team member.

A verbal report to the Team captain responsible for the preparation of the monthly report is made by each Team monitor. This verbal report provides the Team captain with information pertaining to Team-related activities participated in during the report period.

Team Instrument Repairman-Monitor

Duties of the two Instrument Repairmen-Monitors are essentially the same as those outlined for the Team monitors.

They must, in addition, be capable of performing both shop and field maintenance, repair, and modification of Team instrumentation.

The development and maintenance of repair equipment, i.e., kits, spare parts, etc., is the responsibility of the Team Instrument Repairman-Monitor.

TRAINING

General

The degree of readiness to cope successfully with the wide range of possible incidents is directly related to the quality and quantity of training participated in by each Team member.

Inspection of the call-out participation chart (see Table I) will readily indicate that the entire Team membership does not participate in each call-out. With this in mind, the importance of full participation by

each member in all training cannot be overemphasized. Full participation in informal and detailed critiques of each call-out provides the best experience short of actual call-out participation.

The training of the Team is very broad when one considers skills obtained from practical experience.

The six Health Physics monitors of the Team have an average of seven and one-half years of experience in the field of applied Health Physics. All of the monitors have completed two years of the Radiation Safety Technician Training course provided by the Radiation Safety Section of IHS.

The two members assigned to the Team as Instrument Repairmen have an average of ten years of experience in the field of Health Physics Instrumentation. The Instrument Repairmen have participated in all Team training and are capable of performing monitoring duties.

The four Team captains, ANL Health Physicists, have an average of ten years of experience in the field of Supervision of applied Health Physics activities.

Training of the membership has, on the average, required a total of 350 man-hours/year since the inception of the Team. This figure represents only the time utilized in training lectures, conferences, or demonstrations, and does not include the time required for preparation of instructional material or travel time by the Team members.

The training of the ANL Team will be discussed for purposes of this report as On-site (at ANL) or Off-site Training.

On-site Training

The training on-site is prepared and conducted by Team members usually during the monthly Team meetings. The training conferences or training exercises are approved by the ANL Radiation Safety Supervisor and delivered by Team members. An approved written procedure or lesson write-up is then distributed to each Team member for future reference and review when applicable.

Most of the early training covered familiarization of Team procedures, equipment, and reporting. However, these training activities require periodic review and modification.

Reports and memos which may be of general informational value pertaining to possible Team activities are circulated for Team member review. However, no set schedule governs the issuance of such informational items.

Procedures pertaining to Team organization, operation, and duty assignments are discussed in detail at regular Team meetings. Although not considered as separate training conferences, but nonetheless of vital importance in Team training, is the review and critique of all Team call-outs. Reports of on-site and off-site incidents are reviewed and discussed at the Team meeting as they become available.

Off-site Training

The major portion of off-site nuclear weapons training for the ANL Team has been conducted at the Nevada Test Site, Mercury, Nevada. Twelve members, since the inception of the Team, have completed the Emergency Monitoring Team training course provided at the Nevada Test Site and two graduated from the course provided at Sandia Base, New Mexico. However, due to personnel attrition, only ten of the present twelve members have been so trained.

Other off-site training activities have covered such topics as large-area cold-weather decontamination exercises, Army-Navy Nuclear Weapons Safety Indoctrinations, Nuclear Weapons Medical Symposium, AEC Nuclear Weapons Indoctrination, and Nuclear Emergency Management.

CALL-OUT PROCEDURES

On-site - General

The twelve members of the Radiological Assistance Team described in preceding paragraphs also function on call as a unit under direction of the ANL Radiation Safety Section Supervisor during any ANL-originated radiation incident. The availability of the Team as organized and equipped by ANL provides an additional capability in coping with emergency situations.

The Team is normally activated during duty and off-duty hours for on-site ANL-originated radiation incidents by the Radiation Safety Section Supervisor or a designated alternate by contacting a Team captain. The method of activating the Team may be accomplished in two ways:

1. The Radiation Safety Section Supervisor or alternate may contact a Team captain and issue an Immediate Call-out Status.
2. He may issue an alert. The alert will be followed by his issuance of either an immediate call-out or a withdrawal of the alert, thereby returning the Team to its normal Standby Status.

The Team captain in either of the above cases notifies appropriate Team members.

Definitions of Team Status Terms

Call-out is the sum of actions by the Team members from notification of the Team to the completion of all actions, including reporting, investigation and/or identification as necessary.

Immediate Call-out Status is defined as the notification of a Team captain by the Radiation Safety Section Supervisor or a designated alternate that a situation exists which requires the immediate response of the Team.

Alert is defined as the notification of a Team captain by the Radiation Safety Section Supervisor or a designated alternate that a situation exists in which the Team may or may not be required to participate. The utilization of this type of activation allows for maximum pre-planning by the Team members.

A Standby Status is defined as the normal Team readiness posture as described below.

> The Team in its normal standby status has the capability of reporting as a unit six (6) men to the Laboratory Site within one hour after notification during off-duty hours or in approximately 20 min from 0830 to 1700 hours Monday through Friday. The availability of the Team is maintained on a twenty-four (24) hour a day basis.

Duties of the Team Captain upon Receipt of Immediate Call-out Status for On-site Incidents

1. Obtain all available pertinent information concerning the radiation incident.

2. Notify and assemble Team personnel at the primary rendezvous point or as designated.

3. Arrange for transportation as requested to accomplish task. Additional transportation will be requested through the Chief Site Administrator during duty hours or through the Duty Officer during off-shift hours.

4. Select the necessary instrumentation. See Appendix I for Team equipment listing.

5. Brief the Team members on the task and situation as known, and assign specific duties.

6. Assign one Team member to the area designated by the Radiation Safety Section Supervisor as an operations center. The function of this Team member is to receive, record, and channel directly to the Radiation Safety Section Supervisor all Team-collected data.

7. Assign subsequent tasks as necessary and directed to evaluate and control the extent of the radiation incident.

8. Upon completion of assigned task or termination of Team participation, all Team equipment will be returned to its normal Standby Status for possible future use.

9. A complete written report concerning Team participation will be submitted to the Radiation Safety Section Supervisor upon his request.

10. A detailed discussion or critique of the Team participation will be held at the next regular Team meeting.

Duties of the Team Captain upon Receipt of an Alert

1. Consider duties #1 through #7 listed under receipt of an immediate call-out status short of actual Team assembly and request of transportation.

Off-site - General

The Team normally provides Radiological Assistance to persons, organizations, contractors, licensees, local and state civil authorities, and military agencies. Assistance to off-site agencies is provided only when so directed by the Manager of the AEC Chicago Operations Office or his alternate. A representative of the Manager's office normally accompanies the Team.

The Chief Site Administrator of ANL or his authorized representative, the ANL Duty Officer, is responsible for the coordination of actions and/or notification of ANL personnel pertinent to utilization or call-out of the ANL Team.

Call-out during Duty Hours

Requests for assistance or notification of incidents involving radioactive material are normally directed to ANL by the Manager of the AEC Chicago Operations Office or his authorized representative.

The request for Radiological Assistance Team services is usually directed verbally to the Supervisor of the ANL Radiation Safety Section or to his designated alternate. He, in turn, follows a preset system of sequential calls until a Team captain is contacted and informed. The code names "Operation Red Dog" or "Operation Hot Spot" are used by ANL personnel when time is of the essence to expedite the notification of Team members.

1. "Operation Red Dog" indicates that the Team is being called out to investigate a radiation incident other than a nuclear weapons-type incident.

2. "Operation Hot Spot" refers to nuclear weapons incidents.

The Team members in both cases report to the Team rendezvous point without delay, and assists in the loading and preparation of the Team vehicle for answering the call-out.

The Team captain, and the entire Team when possible, is briefed on the incident by the AEC representative. Departure of the Team from the Laboratory is reported to the ANL Chief Site Administrator's Office.

Depending on the weather, location, urgency, and estimated duration of the call-out, administrative arrangements for appropriate modes of transportation and issuance of money to individual Team members are accomplished prior to departure. Upon arrival at the incident scene, every reasonable effort is expended by the Team in providing assistance and advice to the responsible representative (see p.16, Duties). Communication and liaison is established with local law enforcement agencies when appropriate.

All Team data and pertinent activities are provided in a formal report to the Supervisor of the Radiation Safety Section (see p. 19, Call-out Report Procedures). Final reports are submitted to AEC-COO when appropriate. A cover letter is prepared for the signature of the Manager of Technical Services as a means of transmission of the formal call-out report to the AEC-COO.

Call-out during Off-duty Hours

Calls requesting radiological assistance during off-duty hours are directed to the ANL Duty Officer. The Duty Officer informs the Director of the AEC-COO Health and Safety Division or his representative as listed on a notification sequence list published in the Radiological Assistance Plan - Chicago Operations Office. The AEC-COO Health and Safety representative contacts the manager of the COO and advises him of the request. Appropriate channels within the AEC are utilized in determining whether a Team will be activated. If the ANL Team is to be utilized, the ANL Duty Officer is requested to initiate a call-out of the ANL Team.

The Duty Officer contacts an ANL Team captain according to a prearranged notification sequence list as provided by the ANL Team.

The notified Team captain provides the duty officer with a list of those Team members to be contacted.

Assistance is provided by the Duty Officer in arranging for routine and special requirements of the Team, e.g., cash advances, air travel, and special equipment.

The ANL Team and AEC-COO representative meet at the normal rendezvous point, load appropriate equipment, and depart for the incident site. Team actions and activities follow the pattern outlined under Call-out during Duty Hours, p.17.

Report Procedures

Upon the completion of necessary actions and data collection at the incident site and the return of the Team to ANL, the members involved are required to compile a summary report of the Team's activities and investigation. The report includes the following information:

1. reason for call-out;
2. participating personnel;
3. time of departure from ANL;
4. time of arrival at incident site;
5. description of incident;
6. results of survey and investigation;
7. action taken;
8. copies of illustrations, graphs, and/or photographs;
9. time of departure from incident site;
10. time of arrival at ANL;
11. subsequent investigative results conducted at ANL (when applicable).

The final report is submitted to the Manager AEC-COO through appropriate administrative channels.

SPECIAL REPORTS

In any organization of this type, it is a problem to keep all members aware of the individual and diverse activities of the Team. Team meetings, training sessions, lectures, and conferences are some of the methods utilized to maintain this liaison. Special Team reports are another method of intra-team communication. To this end, a Team progress report is compiled on a monthly basis. The report is submitted to the Supervisor of the Radiation Safety Section, as well as to all members of the Team. The report summarizes the activities of the Team for that month and includes the following information:

1. team call-outs and/or alerts;
2. team meetings;
3. personnel status;
4. team training;
5. special meetings, contacts, and conferences;
6. special projects;
7. special reports;
8. equipment status;
9. results of equipment inspection;
10. additional pertinent information.

In addition to the monthly progress report, certain special reports, such as special projects (procedural, equipment, training, trip, budgetary and statistical), are compiled and distributed.

FUNDS

(a) Expense Allotments

When it is deemed necessary for an off-site call-out and prior to leaving ANL, each Team member is allotted funds at the rate of $150 per man. The disbursement is made by the chief ANL Accountant or his authorized representatives, who are available on a 24-hr basis. It is the responsibility of each Team member to maintain a record of his disbursements. The money is to be utilized for those purposes outlined in the ANL Policy and Practice Guide. Within 5 days after the return of the Team to ANL, each Team member is required to fill out an itemized voucher stating all authorized and justifiable expenditures. All expenditures in excess of allotted funds are reimbursed by ANL. Funds in excess of authorized expenditures are returned to ANL by the pertinent Team members.

The travel and mode of operation of a Radiological Assistance Team does not normally comply with routine policy and practices outlined in organizational guides and manuals covering these subjects. Therefore, at ANL, a series of conditions unique to Team experiences were reviewed and used as the basis in determining management-approved methods of disbursement and reimbursement.

(b) Budgetary

Team equipment and material is procured and maintained for the exclusive use of the Team. New, additional and/or replacement items for the Team are incorporated in the total IHS yearly budget under a separate heading. As a general rule, Team budget requests are made one year in advance of the expected procurement. Pre-budgeting for Team expenses

incurred as the result of call-outs, such as overtime, per diem, lodging, and travel, is not possible since incident occurrence cannot be predetermined. The allowances made for this type of expenditure must remain flexible without setting a definitive limit that would tend to deactivate the use of the Team in the event this limit was exceeded.

COMMUNICATIONS

Team communications are based on two requisites: (1) the maintaining of contact between individual Team members and the Team's base of operations, and (2) contact between the Team's base of operations and ANL. To this end the Team maintains and utilizes radio communication as well as commercial means, such as telephone, telegraph, and teletype.

Radio equipment used by the Team consists of one (1) 25-w mobile transmitter-receiver and five (5) 1-w portable Handie-Talkies. The mobile transceiver is mounted in and operated from the Team's vehicle, whereas the Handi-Talkies are battery operated and are carried by the individual to his point of operation. All units are frequency modulated and operate on an ANL-assigned carrier frequency.

This equipment comprises the Team's radio network with the mobile transceiver serving as the base station, and the Handie-Talkies completing the local net. The base station is also used as a means of contact with ANL on off-site call-outs when conditions permit. Telephone, telegraph and/or teletype are used when radio communication is not possible.

Each Team member is assigned a specific call letter that he uses as a means of identification. Operation of all radio-communication facilities by Team members is subject to the rules and regulations of the FCC.

It should be recognized that range, power output, topographical, and meteorological conditions are some of the limiting factors inherent in the use of this type of equipment.

TRANSPORTATION

Types of transportation available for Team use include government or chartered vehicles, commercial or chartered aircraft, and rail. The mode of travel used depends upon the type of incident, distance, weather, number of personnel, and the amount and type of equipment needed.

Vehicular transport (ANL Radiological Assistance Team vehicle) has been the most frequently used method of travel to and from incident

sites to date. This allows greater utilization of the Team's capabilities as compared with air or rail travel where the amount and type of equipment that can be transported is limited.

As a general rule, the Team operates on the following premise. Vehicular transport is considered for distances up to 250 miles when road and weather conditions are favorable, and up to 150 miles for unfavorable conditions. Chartered or commercial aircraft are to be considered for distances greater than 250 miles, plus the use of chartered or other vehicular travel from the commercial terminal to the place of incident. Rail transportation is considered when either air or vehicular travel is not feasible or when an incident has occurred on or near rail lines.

All Team members are experienced in and appropriately licensed to operate vehicles rated as passenger cars and/or trucks up to and including one ton.

Team transportation requirements, other than vehicular, is arranged for by the ANL Duty Officer in conjunction with the Travel Section.

EQUIPMENT

Since the Team's inception in 1957, the type and quantity of equipment utilized by the Team has been varied in order to meet its designated responsibility. Originally, the equipment inventory consisted of items necessary to cope with weapons incidents only. After March 1958 this inventory was expanded to cover the Team's additional responsibilities, i.e., radiation incidents other than and including weapons incidents. The equipment situation is not and has not been static, but is rather viable in order to meet the additional problems continued experience dictates.

In general, the Team's equipment can be classified in three categories:

(1) instrumentation;
(2) supporting equipment;
(3) personnel protective clothing and equipment

(see Appendices I through V). For the most part the items listed are commercially available.

It has been found necessary in some instances to develop special equipment to meet the Team's needs. Equipment in this category developed to date is as listed:

(1) gasoline-operated air sampler;
(2) the soil-, water-, air-sampling kit;
(3) two-man kit (see Appendix IV);
(4) modification of the Team's vehicle;
(5) Mylar Spun Top Assembly.

Instrumentation and equipment allocated to the Team is used expressly for Team activities. Otherwise such equipment is stored in a central location on a standby status. Experience has proved that the equipment can become defective during these periods of storage. For this reason, a periodic inspection of all equipment is maintained on a weekly basis by a Team member on rotating assignment. Defective equipment is repaired or replaced, and a record is kept of all inspections conducted.

The following is a brief description of the various types of instrumentation comprising the Team's instrument inventory:

Portable Alpha Counter (PAC-3G)

Detector: Gas (Propane), proportional, approximately 0.85 mg/cm^2 window

Power Supply: Batteries

Primary Use: Low-to-intermediate-range alpha survey

This instrument has been modified to provide the additional capabilities of low-energy beta emission plus fast-slow neutron counting. Low-energy beta counting is accomplished by increasing the gas proportional detector voltage. Neutron determinations are accomplished by employing an unmoderated BF_3 detector for slow neutrons and a paraffin moderator (long counter type) for fast neutrons.

Portable G-M Counter

Detector: Geiger-Mueller tube, approximately 32 mg/cm^2 window

Power Supply: Batteries

Primary Use: Low-to-intermediate-range beta-gamma survey

Ionization Chamber (Juno 500 r)

Detector: Ionization chamber, approximately 0.85 mg/cm^2 window

Power Supply: Batteries

Primary Use: High-range alpha, beta, and gamma surveys. An additional range scale has been incorporated in this instrument, increasing the maximum range from 50 r/hr to 500 r/hr.

Portable G-M Counter (End-window type)

Detector: Geiger-Mueller tube approximately 2 mg/cm^2 window

Power Supply: Batteries

Primary Use: Low-to-intermediate-range low-energy beta survey

Ionization Chamber (Samson)

Detector: Ionization chamber, approximately 0.4 mg/cm^2 window

Power Supply: Batteries

Primary Use: Low-range alpha, beta, and gamma surveys

Wet Plutonium Monitor (WM-1)

Detector: Scintillation (17-kev plutonium X ray)

Power Supply: Batteries

Primary Use: Wet plutonium survey

Portable Neutron Counter (PNC-1)

Detector: BF_3 tube with paraffin moderator

Power Supply: Batteries

Primary Use: Fast and slow neutron detection

2π Internal Gas-flow Counter (PC-3A)

Detector: 2π Gas Proportional (90% argon, 10% methane)

Power Supply: 110-v, 60-cycle AC

Primary Use: Air-, water-, soil-, and gas-sample counting

Gas Sampler (3.5 liter)

Detector: Geiger-Mueller tube, approximately 32 mg/cm^2 window

Power Supply: None

Primary Use: Beta-gamma gas samples. This unit utilizes an AC-operated vacuum pump to flush and evacuate the samples. The 2π counter is utilized as the counting device.

Air Sampler (particulate) (PAS-GE-2)

Collector: HV-70 filter paper

Power Supply: Gasoline engine (2-cycle)

Primary Use: Air sampling. The filter count is determined in the 2π counter.

PROTECTIVE CLOTHING AND EQUIPMENT

The protective clothing issued to individual Team members is somewhat diverse in that it must serve as both work and protective clothing. Due to the geographical location of Team's primary operational area, one can expect to encounter temperatures ranging from -35°F to 100°F. For this reason the Team must be supplied with cold-weather gear, such as parkas and fleece-lined boots, as well as lighter apparel for warm-weather wear.

The primary respiratory protective device is the M9A1 field protective respirator with M11 canister. A half mask respirator with "ultra" filter is also assigned to each member. The M9A1 is used almost exclusively when hazardous radioactive aerosols are encountered.

Team members who require the aid of corrective lenses are supplied with prescription lenses. The lenses are mounted for insertion in the M9A1 respirator.

ANL RADIOLOGICAL ASSISTANCE TEAM VEHICLE

A vehicle was acquired during the spring of 1960, for the express purpose of increasing the field capabilities of the Team. Modifications and installation of equipment in the vehicle were primarily based on the assumption that the Team should be able to function as a self-sufficient unit.

Vehicle (see Fig. 5)

Type: 2-door Sedan Delivery Truck*

Engine: 6 Cylinder

Drive: Standard Transmission

Passenger Capacity: 6

*A sedan delivery truck is similar in construction to a nine (9)-passenger station wagon. However, the sedan delivery has a seating capacity of only three (3). A second seat was added increasing the passenger seating capacity to six (6).

Fig. 5. Two-door Sedan Delivery Truck

The following is a list of modifications and equipment incorporated in the vehicle.

AC Power Supply (see Fig. 6)

1 Generator (1.2-kva, 110-volt, 60-cycle AC)
1 Voltmeter
1 Frequency Meter (vibrating-reed type)
1 Four-way Receptacle (mounted in cargo space)
1 Two-way Receptacle (dash mounted)
1 Hand Throttle (dash mounted; lock type)
1 Additional pulley to DC generator

The AC generator is mounted above the vehicle DC generator and derives its power from the engine. Operation of the AC unit is accomplished only when the vehicle is stationary. The AC generator is placed in operation by manual installation of a drive belt between the pulley of the AC generator and a secondary pulley on the DC generator. This technique does not affect the normal operation of the DC generator. The lock-type hand throttle serves the purpose of regulating the frequency and voltage output of the AC generator, by adjusting the speed (rpm) of the engine.

Communications

1 Mobile Transceiver (25 w); see Fig. 7.

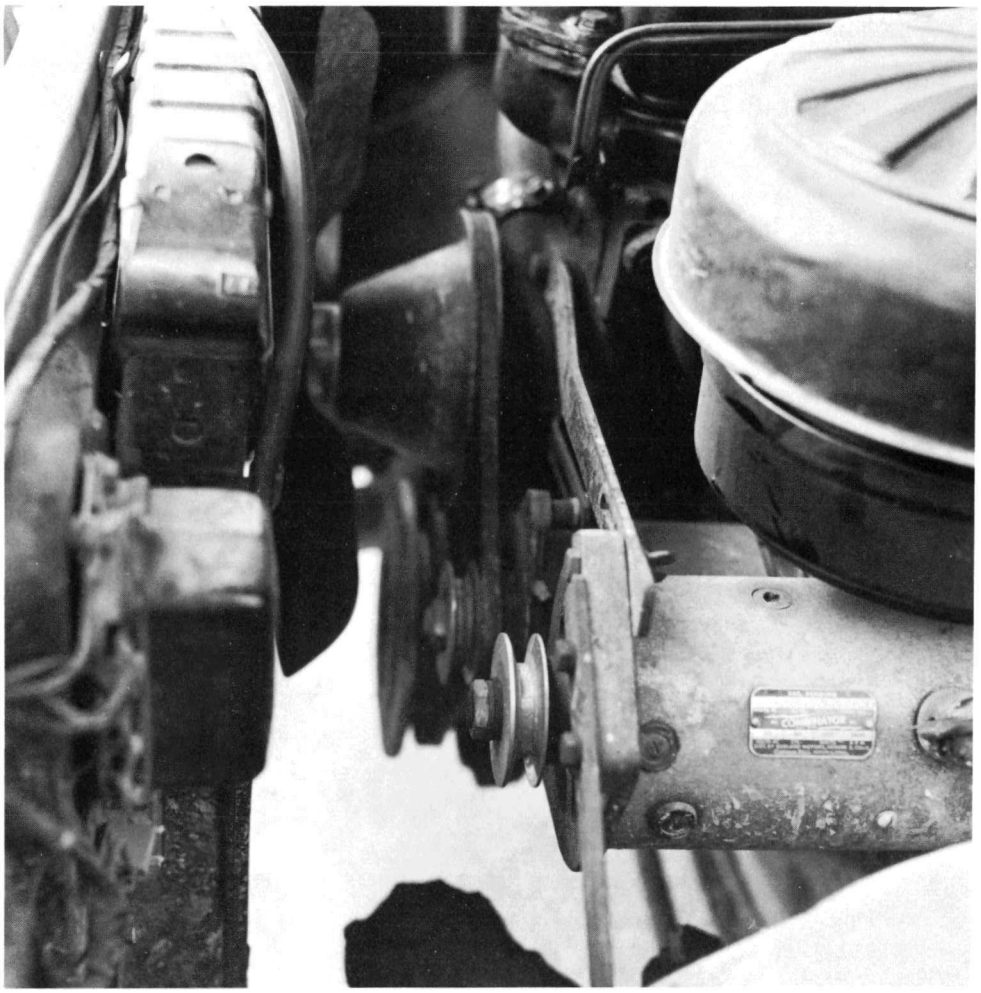


Fig. 6. AC Power Supply

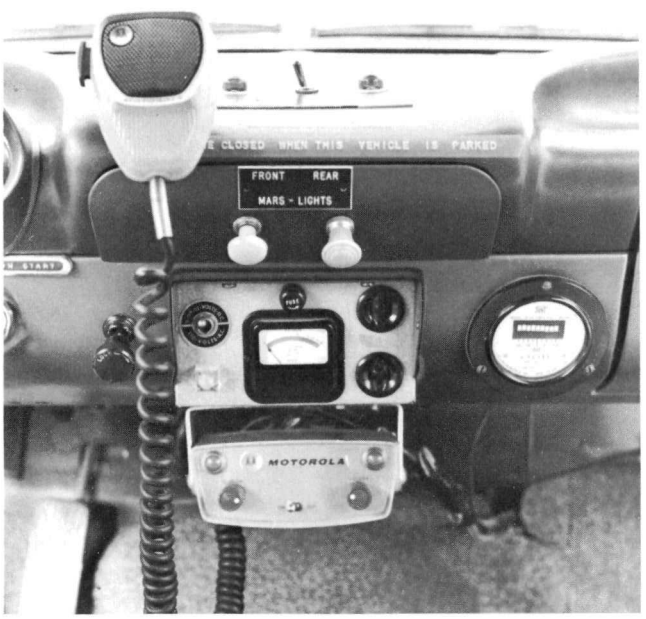


Fig. 7
Mobile Transmitter

Signals

1 Large Red Flasher Light (roof mounted, forward)
1 Small Red Flasher Light (roof mounted, rear)
1 Siren

Cargo

1 Luggage Rack (roof mounted)
1 Tarpaulin (for luggage rack)
1 Set Tie-down Bars (cargo space inside vehicle)

Counting Devices

1 2π internal gas flow counter (PC-3A) - Rack, spring loaded
1 #2 cylinder P-10 counting gas - Rack, tie down
2 3.5-liter gas samplers - Rack, solid
1 Vacuum Pump - Floor mounted

The PC-3A is utilized to count air, water, soil and gas samples, and is operated from the AC power supply. The vacuum pump (AC operated) is used to flush and evacuate the 3.5-liter gas samplers.

In addition to the AC-operated equipment, the Team utilizes the various portable instrumentation, protective clothing, and respiratory devices. This equipment is packed in cases and duffel bags, and is loaded in the two cargo areas as the need dictates. See Figs. 8, 9, and 10.

Miscellaneous Equipment

2 Spotlights (side mounted)
2 Rear-view Mirrors (side mounted)
2 Snow and Mud Tires (rear)
1 Set Tire Chains
1 Tire-repair Kit
1 Set Tire Irons
1 Jack-bumper
1 Lug Wrench - 4-way
1 Fire Extinguisher (CO_2)
1 Lantern, Portable (Battery-operated)
4 Fuses

The vehicle, since acquisition, has been utilized primarily during the normal work week by personnel other than the ANL Radiological Assistance Team and is not garaged. Therefore, all instrumentation is stored as previously stated and is loaded into the vehicle at the initiation of a call-out.

Fig. 8. Storage of Equipment in Cabinets

Fig. 9. Equipment Loaded in Duffel Bags

Fig. 10. Equipment in the Process of Loading in the Two-door Delivery Truck

APPENDIX I

Instruments and Accessories

Item	Number Assigned
Ionization Chamber - Alpha Survey Meter	2
Portable Alpha Counter (PAC-3G)	6
Cables (PAC-3G)	12
Probes (PAC-3G)	12
Handles (PAC-3G)	6
Cases, Carrying (PAC-3G)	4
G-M Portable	6
G-M Portable End Window Counter	1
Ionization Chamber - Juno 500 r	3
2π Internal Gas Flow Counter (PC-3A)	1
Portable Neutron Counter (PNC-1)	1
Wet Plutonium Monitor (WM-1)	1
Air Sampler with Sampling Head (PAS-GE-2)	1
Air Sampler without Sampling Head (PAS-GE-2)	1
Dosimeters (100 r)	12
Charger, Dosimeter	1
Standards, Field (Pu^{239})	6
Standards, Calibration Flat Plate (Pu^{239})	4
Sampler, Gas, 3.5 liters	2
Head-set Earphone	6
Badges, Film	12

APPENDIX II

Equipment

Item	Number Assigned
Case, Aluminum (Spare parts and repair equipment)	1
Cabinet, Storage, Wood (Clothing)	1
Cabinet, Storage, Metal (Instrument)	1
Case, Aluminum (Two-man kit)	1
Foot Locker, Metal	3
Case, Wood (Sampling kit)	1
Flashlights - 2-cell	12
Floodlight with 100-ft Extension Cord	1
Balance, Double-pan (2-kg capacity)	1
Camera, Polaroid Model 150, with Accessories	1
Print Copier	1
Slide Rule, Log Duplex-trig	1
Transit - Pocket	2
Converter, 12-v DC to 110-v AC	2
Meter, Simpson Midget Tester	2
Kit, Plier	2
Screwdriver, Various Sizes	6
Iron, Solder, 110-v AC	3
Gun, Solder, 110-v AC	1
Compass, Lensatic	12
Battries, Flashlight	48
Batteries, Miscellaneous	40
Pump, Vacuum	1
Container, Gasoline, $2\frac{1}{2}$ gal	1
Transceiver Handy-Talkie (ANL frequency)	5

APPENDIX III

Personnel Protective Clothing and Equipment

Each of the 12 Team members are supplied with the following protective clothing (see Fig. 11) and equipment:

Item	Number	Item	Number
Bag, Duffel, String Tie	1	Cap, Cold Weather	1
Mask M9A1 with Cannister M11	1	Coat, Parka	1
Cannister, M11, Spare	1	Gloves, Cotton Work	12 pair
Prescription Lenses, Snap-in Type (As required)	1 pair	Gloves, Leather, Fur-lined	1 pair
Respirator, Half Mask	1	Shoes, Safety, Oxford	1 pair
Coveralls, Cotton	2 pair	Boots, Leather, Fleece-lined	1 pair
Trousers, Cotton Work	2 pair	Underwear Top, Insulated	1
Shirts, Cotton Work	2	Underwear Bottom, Insulated	1
Shorts, Cotton	2 pair	Tape, Roll, Industrial, 2 in.	1
Undershirts, Cotton	2	String, Cotton, ½ -lb Ball	1
Socks	2 pair	Compass, Lensatic	1
Towels	2	Shoe Covers (Plastic)	3 pair
Cap, Skull Type, String Tie	2	Clipboard, Knee, 4 x 5 in.	1
Hood, Shoulder Length, Nylon	2		

Fig. 11. Individuals Protective Clothing and Equipment

APPENDIX IV

Two-man Kit

The two-man kit was designed to provide basic survey equipment and at the same time maintain maximum mobility. The case is constructed of 18 gauge aluminum, measuring 29 x 16 x 9 in. and weighs approximately 66 lb, fully loaded. All instruments are compartmented and shock mounted in foam rubber.

Contents of the Kit are as follows:

Item	Number
PAC-3G	2
PAC-3G Probes	4
PAC-3G Leads	4
PAC-3G Probe Handles	2
G-M Portables	2
Ionization Chamber (Juno 500 r)	1
Dosimeters (100 r)	2
Spare Propane Cylinders	4
Head-set Earphone	2
Flashlight with Batteries	2
pH Paper, Dispenser, Range pH 2 to pH 10	1
Standards, Alpha field (Pu^{239})	2
Screen, Spare (Juno)	1
Tube, Spare (G-M)	1
Screwdriver	1
Tags, Radiation Hazard	20
Ball Twine, Cotton, $\frac{1}{2}$ lb	1
Clipboard and Paper	1
Pair Tongs, 24 in.	1
Plastic Bags, Approximately 24 x 24 in.	2
Batteries, Assorted Sizes, Spares	
Bottles, Sample, 2 oz	4

APPENDIX V

Air-, Water-, and Soil-sampling Kit

The kit (see Fig. 12) contains the necessary equipment to prepare samples, in the field, for counting in the PC-3A scaler. The kit is constructed of $\frac{3}{4}$-in. plywood, measures $21\frac{1}{2}$ x $14\frac{3}{4}$ x $21\frac{1}{2}$ in., and weighs approximately 58 lb with contents.

Fig. 12

The Air-, Water-, and Soil-sampling Kit

Contents of the kit are listed as follows:

Item	Number
Stainless Steel Planchets, 5-cm Diameter (20 cm^2)	100
Boxes, Tissue	2
Atomizer, Bulb Type	1
Infrared Lamp with Receptacle	1

Item	Number
Hot Plate	1
Ring Stand	1
Propane Torch Kit	1
Leveling Table	1
Dispenser pH Indicators	1
6 N HNO_3	250 cc
Spray Solution for Air Filters	250 cc
Ethyl Alcohol	500 cc
Sheets HV-70 Paper	100
Bottles (Plastic, 250-cc)	10
Wash Bottles (250-cc)	2
Pipettes (1-ml)	18
Pipettes (2-ml)	10
Pipettes (5-ml)	2
Pipettes (10-ml)	2
Beaker (100-ml)	1
Beaker (250-ml)	1
Beaker (400-ml)	1
Graduate (5-ml)	1
Graduate (10-ml)	1
Graduate (50-ml)	1
Graduate (100-ml)	1
Funnels, Analytical	2
Box Whatman Filter Paper (#40)	1
Pair Tweezers (5 in.)	1
Pair Tweezers (10 in.)	1
Pair Scissors	1
Bulb, Pipette	1