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THE U.S. DOE RADIOLOGICAL ASSISTANCE PROGRAM: PERSONNEL, EQUIPMENT AND RESOURCES*

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ABSTRACT

The Radiological Assistance Program (RAP) of the U.S. Department of Energy (DOE) is intended to provide emergency advice and assistance in the event of radiological incidents. Each of DOE's eight Regional Coordinating Offices in the U.S. provide a 24-hour reporting and response capability.

Specifically, the Brookhaven Area Office (BHO) is responsible for DOE's Region I, which includes the 11 northeastern states of the U.S. Although an inventory of dedicated equipment is assigned to BHO-RAP, it draws upon the resources of Brookhaven National Laboratory (BNL) for trained personnel in health physics and for other specialized personnel in both the day to day operation of the program and in the "on-the-scene" response to an incident.

The organization of the BHO-RAP program and its response procedures are described in detail. An inventory and brief description of the contents of a variety of emergency equipment kits and of additional state-of-the-art instruments is included. The BHO-RAP guidelines and requirements for field operations are also indicated, as are other DOE resources upon which it can draw.

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I. INTRODUCTION

The Radiological Assistance Program (RAP) of the U.S. Department of Energy (DOE) was originally established in 1958 by the Atomic Energy Commission (AEC) to provide emergency advice and assistance from its resources to (1) minimize loss due to incidents involving radioactive materials and properly cope with radiological hazards and (2) protect the public health and safety from these hazards. At that time, the AEC's large multi-purpose research facilities contained most of the nation's readily available radiological competence in both manpower and equipment, so they constituted primary resources for dealing with radiological emergencies. More recently, state and local governmental agencies as well as private academic and research institutions have acquired the ability to deal with minor emergencies, so that the DOE-RAP role has become increasingly that of supplying "backup" to state and local agencies in the event of major emergencies or for those unusual incidents which call for specialized expertise and/or equipment for their assessment and control.

In principle, RAP can respond to direct requests from private individuals, industrial users of radioactivity, or law enforcement agencies. In practice, its response is closely coordinated with state and/or local radiological health authorities, as well as with other concerned local, state and federal agencies as appropriate. In the case of commercial nuclear power plant accidents, the DOE responsibility is specifically that of coordinating off-site monitoring, as formally spelled out in the Federal Emergency Management Agency's (FEMA) "National Radiological Emergency Preparedness/ Response Plan"[1], which is schematically indicated in Fig. 1. Except for an actual or potentially large, extended or unusual accident which warrants RAP's

immediate assistance, the typical "on-the-scene" response to RAP calls from private industrial users and law enforcement agencies is made by state and/or local radiological control personnel, who may then bring in RAP at their discretion.

The Radiological Assistance Program extends nationwide. It is implemented through eight Regional Coordinating Offices, as shown in Fig. 2. The Brookhaven Area Office (BHO) is responsible for DOE's Region 1, which includes the eleven northeastern states of Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, Connecticut, New York, New Jersey, Pennsylvania, Delaware, Maryland and the District of Columbia. With regard to commercial nuclear power, it may be noted that 22 (or 30%) of the nation's 72 operating power reactors are located in DOE Region 1, and that 11 more are currently under construction.[2] The Region also includes two of DOE's high-power research and test reactors, eight low-power university research and teaching reactors, two nuclear powered submarine refueling facilities and three of DOE's naval reactor propulsion experimental and prototype facilities.

The Brookhaven Radiological Assistance Program (BHO-RAP) is described in detail in its Radiological Plan.[3] It is printed in two parts. Part I, which is revised only infrequently, contains general information about the organization and implementation of the Region I Plan. Part II, which is updated every six months, contains specific procedures, checklists, contacts and an inventory of equipment resources and locations. The brief recapitulation of the Brookhaven Radiological Assistance Program which follows is taken largely from this Plan.

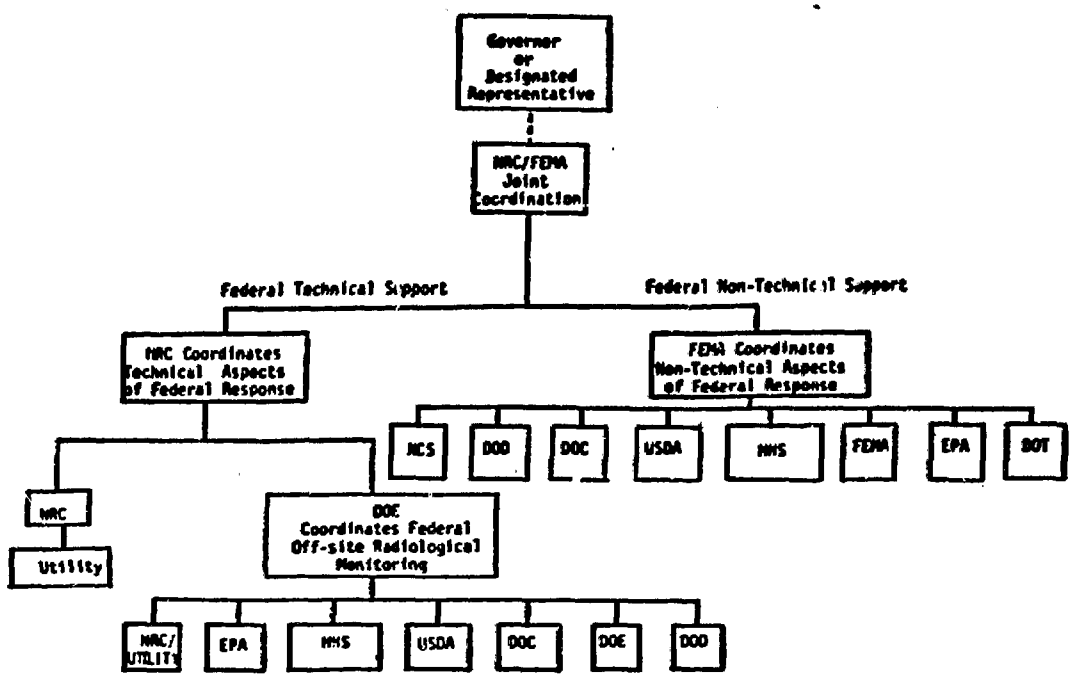
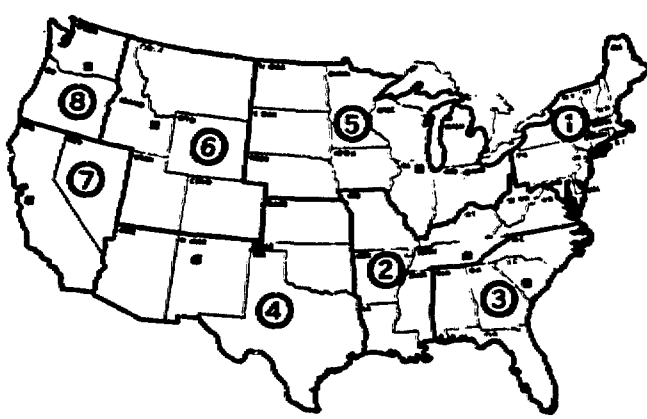


Figure 1: Federal Response Management Diagram

From Ref. 1

DEPARTMENT OF ENERGY

REGIONAL COORDINATING OFFICES FOR RADIOLOGICAL ASSISTANCE AND GEOGRAPHICAL AREAS OF RESPONSIBILITY



	REGIONAL COORDINATING OFFICE	POST OFFICE ADDRESS	TELEPHONE for ASSISTANCE
1	BROOKHAVEN AREA OFFICE		
2	OAK RIDGE OPERATIONS OFFICE		
3	SAVANNAH RIVER OPERATIONS OFFICE		
4	ALBUQUERQUE OPERATIONS OFFICE		
5	CHICAGO OPERATIONS AND REGIONAL OFFICE		
6	IDAHO OPERATIONS OFFICE		
7	SAN FRANCISCO OPERATIONS OFFICE		
8	RICHLAND OPERATIONS OFFICE		

Figure 2

From Ref. 3

II. OBJECTIVES

The objectives of the BHO Radiological Assistance Program are to:

A. Provide an effective radiological assistance capability to ensure the protection of people and property.

B. Provide guidelines to BHO-RAP Team personnel for the evaluation of radiological incidents and the recommendation of corrective actions.

C. Maintain liasion with other DOE installations, and with Federal, state and local organizations that may become involved in radiological assistance operations in Region I.

It should be noted that RAP serves an emergency function and that it would not normally be involved in extensive decontamination or other recovery activities.

III. ORGANIZATION

BHO and Brookhaven National Laboratory (BNL) provide the primary source of radiological assistance personnel and equipment for Region I RAP. Other DOE installations or contractors in the region, including the Environmental Measurement Laboratory in New York City, the Pittsburgh and Schenectady Naval Reactor Offices, the University of Rochester and the DOE Office at West Valley, may be called upon to provide Advance Teams in emergencies.

All requests for assistance are received by BHO on a special dedicated telephone line which is covered on a 24-hour a day, year round basis. The calls are referred directly (or indirectly in off-hours) to a RAP team captain. The captain is then responsible for obtaining the details of the incident and the initiation of an appropriate response either directly or through a cognizant state or local radiological control agency.

In addition to the Team Captains, who are health physicists, RAP draws upon other trained and experienced BHO and BNL personnel with specialized competence within the overall areas of health physics, reactor safety, fire protection, public information and medicine. The selection of a specific team is based on the type and extent of an incident, as well as the special abilities of the team members.

BHO is also the Regional coordinating office for the implementation of the Federal Radiological Monitoring Assistance Plan (FRMAP), which would be activated for significant accidents including those at commercial nuclear power plants which might require a multi-agency response.[4] Accidents involving nuclear weapons and components or radioactive materials indentified as military property, would be referred to and coordinated by the Joint Nuclear Accident Coordinating Center (JNACC) at Albuquerque, New Mexico.

IV. RESPONSE TO CALLS FOR ASSISTANCE

A. General

Requests for radiological assistance are received on a special dedicated RAP telephone number (516-282-2200). During working hours it is answered at the Office of BNL's Safety and Environmental Protection Division (S & EP). During non-working hours (nights and weekends), calls on this line are received by the Desk Officer at the BNL Security Office. In any event, a call is referred to the RAP Team Captain designate for the month, or the preceeding month, etc, until one is contacted. (Sometimes several calls are required, but this system has not yet failed to reach a Captain).

By direct conversation or call back, the Team Captain then obtains as much information as possible about the incident and provides immediate guidance and advice. All incidents are referrred by the Team Captain to the cognizant state or local radiological control bureaus. DOE Headquarters and the NRC are also notified (when the latter's licensees are involved). The state or local agencies and/or the NRC then usually deal directly with minor incidents with no further RAP involvement, except for a follow-up to ascertain what actions were taken.

A RAP team would be formed immediately by the Captain on call to deal with any reported major incident that had resulted in or that threatens to result in a uncontrolled release of significant quantities of radioactive materials.

A typical team of 5-6 individuals would include appropriate personnel from a pre-established list of S&EP's radiological staff. Other BNL specialists in the fields of medicine, public information and security may be included as necessary to deal with the nature of a specific incident. A team would also include a Coordinator from the DOE's BHO. An Advance Team from another DOE facility in Region I might also be called upon so as to provide an early "on-the-scence" response for major incidents in areas of Region I that are remote from BNL's mid-Long Island location. The NRC Regional Office at King of Prussia, Pennsylvania would also be called upon for assistance in the case of major incidents involving its licensees.

B. Transportation

The mode of travel to the locale of these incidents which warrant an "on-the-scene" RAP response will be determined by such factors as location, severity, and urgency of the situation, distance, time of day and weather conditions.

1. Motor Vechicle

For incidents within 150 miles of BNL, RAP teams will ordinarily utilize government vehicles which are available to BNL.

2. Aircraft

Generally for incidents occurring more than 150 miles from BNL, air transportation by helicopter of the U.S. Coast Guard's Search and Rescue service would be utilized. Subject to weather conditions one would be available at Brookhaven within an hour of the requests to the Coast Guard.

3. Commercial Travel

RAP teams may utilize commercial transportation as appropriate. The BNL Security Force acts as custodian of emergency funds and government Transportation Request Forms, which they are authorized to release to any RAP Captain upon request.

In the event that air transportation is utilized, the state or local governmental or other entity requesting RAP assistance should be prepared to provide ground vehicular transportation from the nearest practicable helicopter landing site or airport to the scene of the incident or to the planned RAP Team operating location.

C. Response Time

The response time for a RAP Team to arrive "on-the-scene" of a radiological incident in Region I would be governed by it's distance from BNL and by vehicular speed. For ground transportation, a speed of 50 mph (80 km/hr) on interstate highways may be used in making estimates. Where and when practicable, helicopter transportaion has an airspeed of about 120 knots (140 mph or 225 km/hr).

In either case, an elapsed time of about one hour from first notification to departure would be required to allow for the assembly of personnel and equipment. This would be in addition to the transportation time.

D. Equipment

Several dedicated Emergency Equipment kits and additional "state of the art" equipment items are located in BNL's Calibration and Emergency Support Center. Most of the equipment is contained in portable instrument kits, data and/or reference kits, protective clothing kits and sample collection kits. Several of them are apparent in Fig. 3, which shows the initial BNL RAP team as it prepared to depart for Harrisburg, PA via helicopter on March 28, 1979. In addition, several items of special equipment for an emergency truck are also stored in this building. The current detailed list, as it appears in Part II of the October 1982 update of the RAP Plan, is shown in Appendix I.

These kits contain such standard gear as conventional portable survey instruments (see Fig. 4), air samplers (see Fig. 5), grass and soil sampling tools (see Fig. 6), protective clothing (see Fig. 7) and such miscellaneous items as rope, tape, warning signs, a calculator and record books (see Fig. 8). The equipment dedicated to RAP also provides several unusual and/or sophisticated items. These include:

(1) Two FIDLER (Field Instruments For The Detection of Low Energy Radiation) kits (see Fig. 9). They employ large-diameter thin (5" x 1/16" or 12.5 x 0.16 cm) NaI crystals with very thin windows. They are thus optomized for response to very low energy gamma radiations, such as those associated with ^{239}Pu (Uranium x-rays, 17 KeV) or with ^{241}Am (60 KeV).

(2) A portable Multi-Channel Analyzer (see Fig. 10), with an associated 3x3" (7.5 x 7.5 cm) NaI detector or a High Purity Ge Detector.

(3) A portable Pressurized Ion Chamber Radiation Monitor (see Fig. 11).

(4) Five portable field iodine air samplers. Their design was originally developed at BNL to provide quick assessments of thyroid inhalation dose by relatively untrained persons, using readily available and inexpensive equipment.[5] As shown in Fig. 12, the samplers are intended to accept 12V DC current from an automobile. However, the sampler's motor has a dual winding, so that it will also operate on conventional 110V AC line power.

The filter cannister, which is shown in Fig. 13, holds the filter material in an annulus around an inner cavity. As shown in Fig. 14, the inner cavity is sized to accept the "pencil" shaped tube of a standard CDV-700 GM Counter. Although an ordinary GM tube may be employed, increased sensitivity is provided in the BNL design and operating protocol by the use of one with a high Z cathode. Also, by the use of silver-loaded silca-gel, a high discrimination factor against the unwanted collection of noble gases on the filter medium is achieved.

Ready reference graphs and tables are also provided, by means of which the count from a 5 min (25 ft or 700 ℓ) sample may readily be converted to thyroid dose for specificed immersion periods and post-incident times. For samples obtained within a few hours after reactor shutdown, the minimum detectable inhalation dose is about 0.1 rem.

(5) A portable generator (see Fig. 15).

Figure 3

BNL-RAP Ream and Equipment Enroute to TMI, 28 March, 1979.

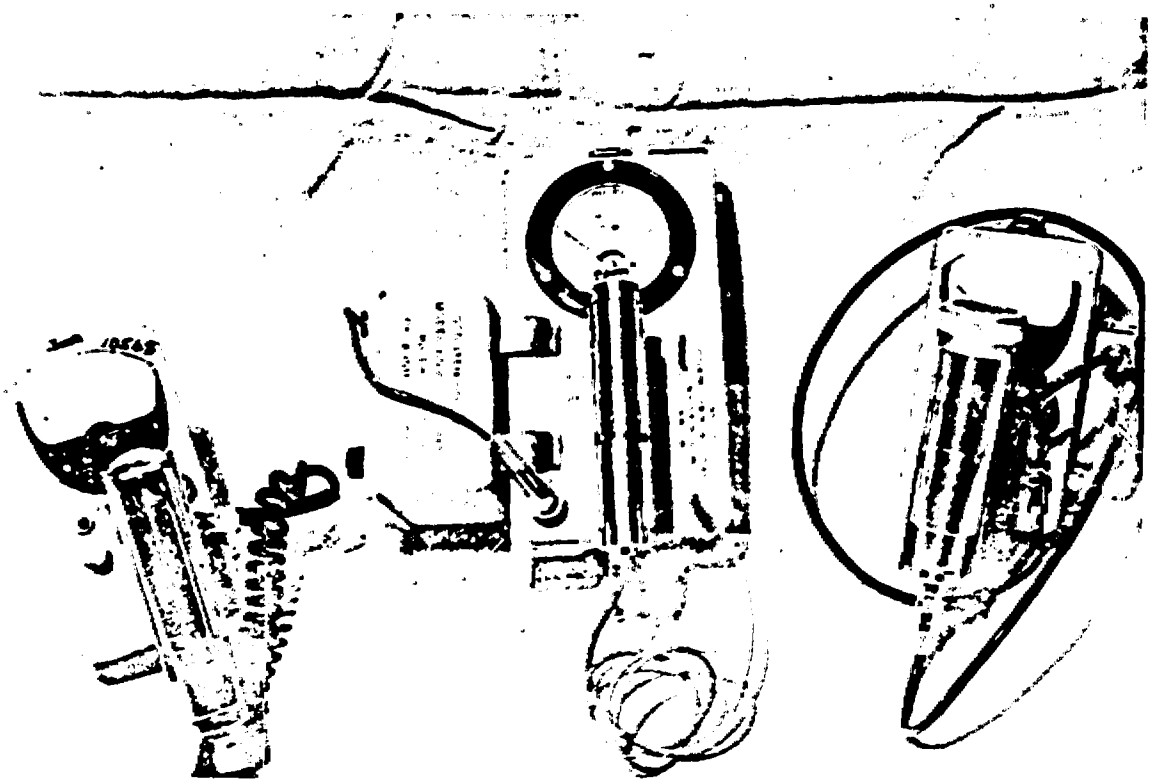


Figure 4. RAP Kit - Portable Survey Instruments

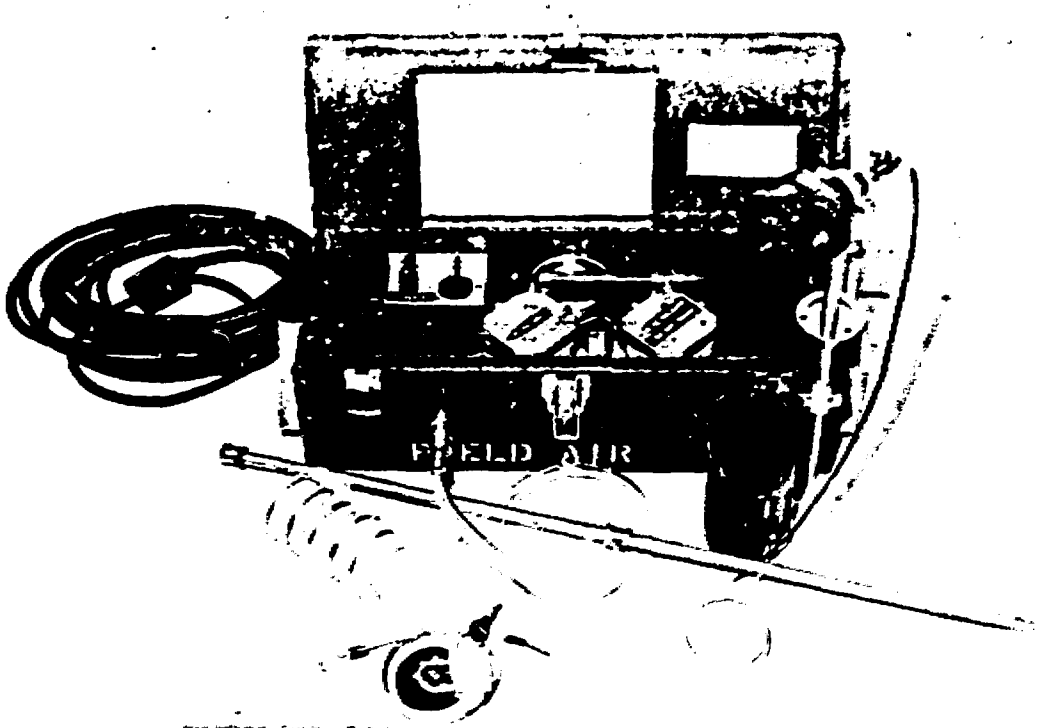


Figure 5. RAP Kit - Portable Air Samplers

Figure 6. RAP Kit - Grass and Soil Sampling Tools

Figure 7. RAP Kit - Protective Clothing

Figure 8. RAP Kit - Miscellaneous Items

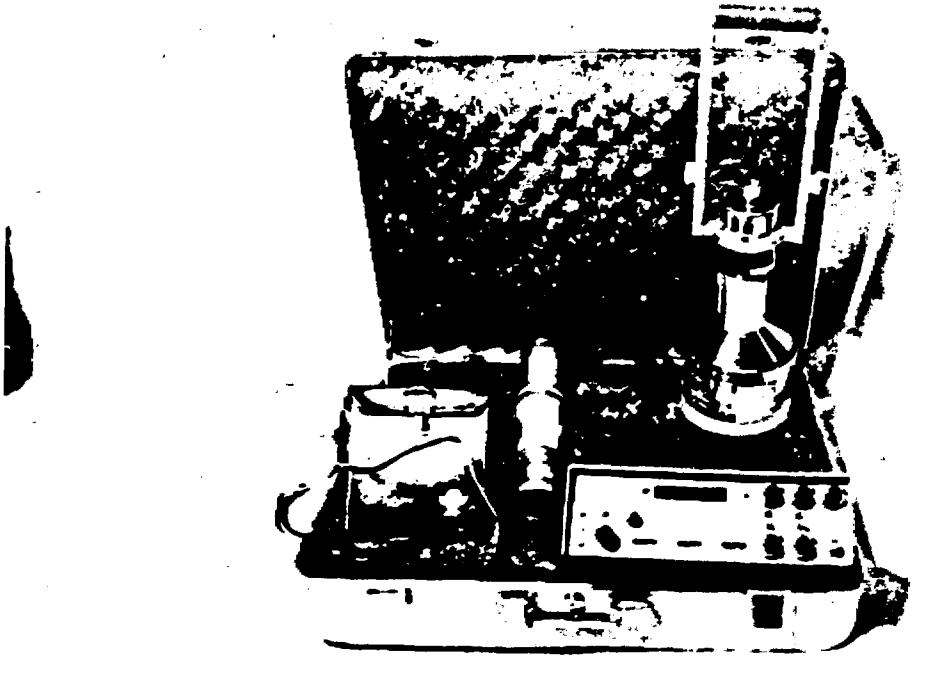


Figure 9. RAP Kit - FIDLER (Low Energy Radiation Detector)

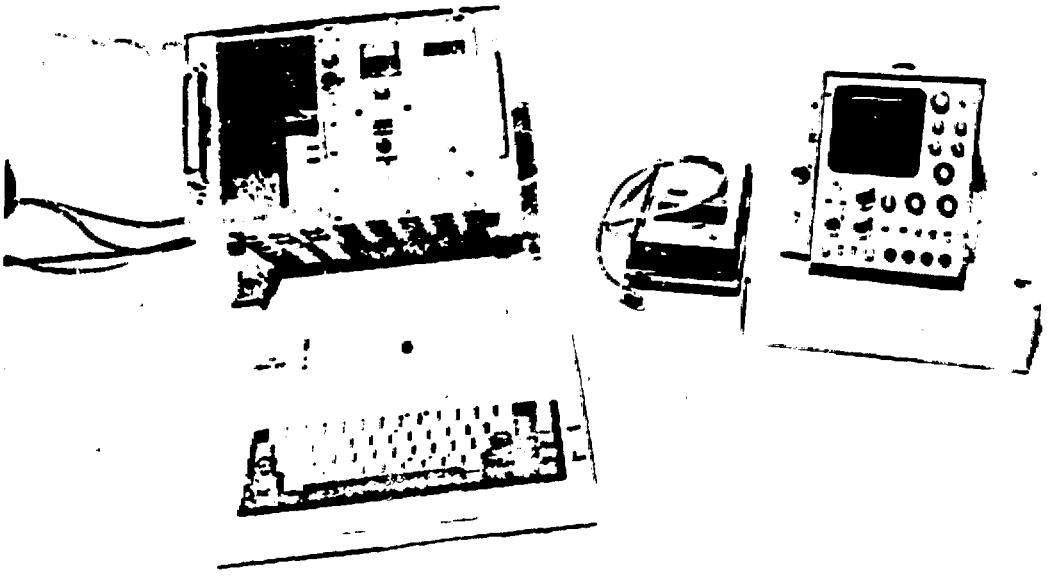


Figure 10. RAP Kit - Portable Multi-Channel Analyzer

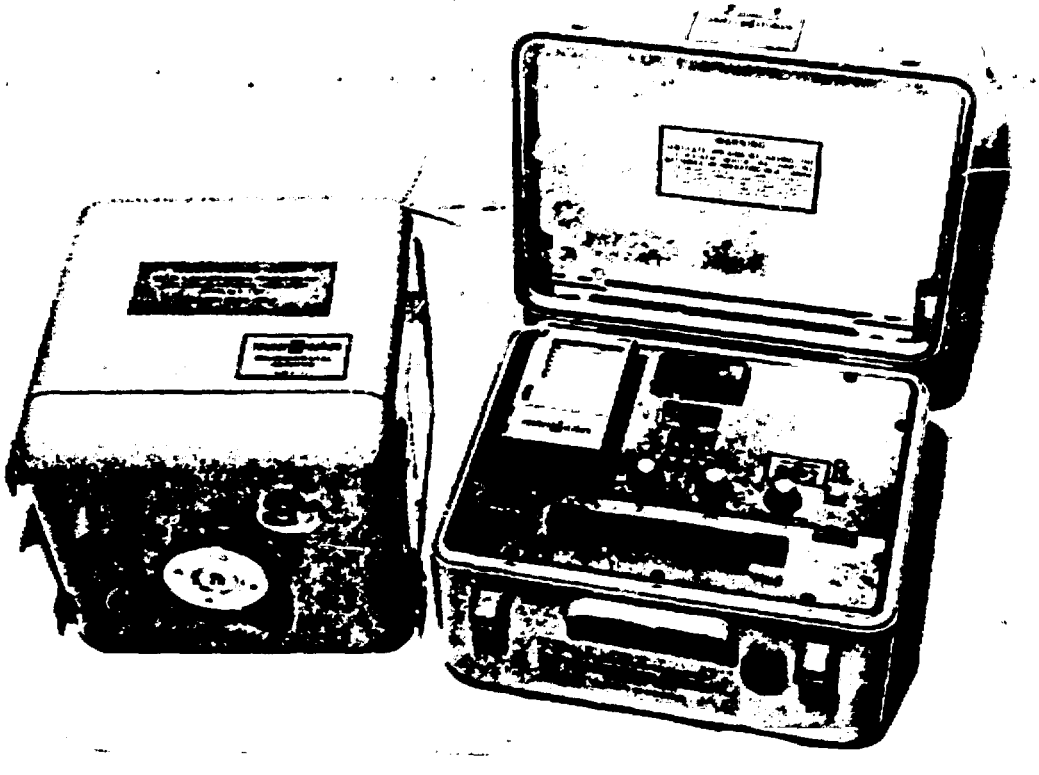


Figure 11. RAP Kit - Portable Pressurized Ion Chamber

Figure 12

BNL Field Iodine Air Sampler

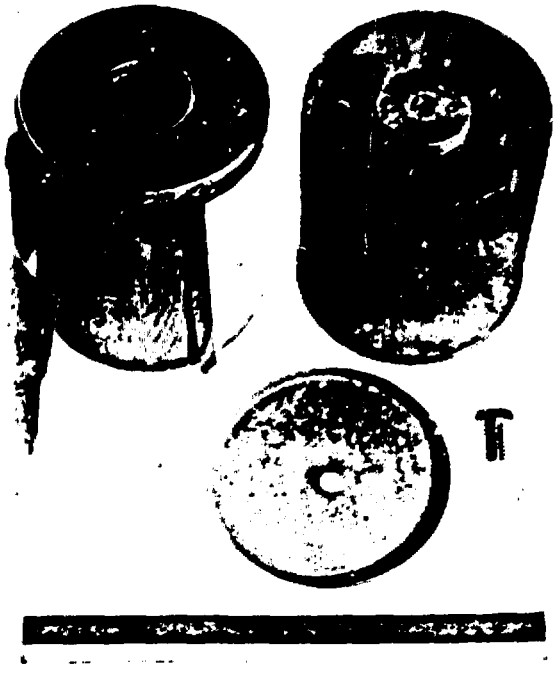


Figure 13. Canister Assembly

Figure 14. Canister Evaluation with a CDV- 700 GM Counter

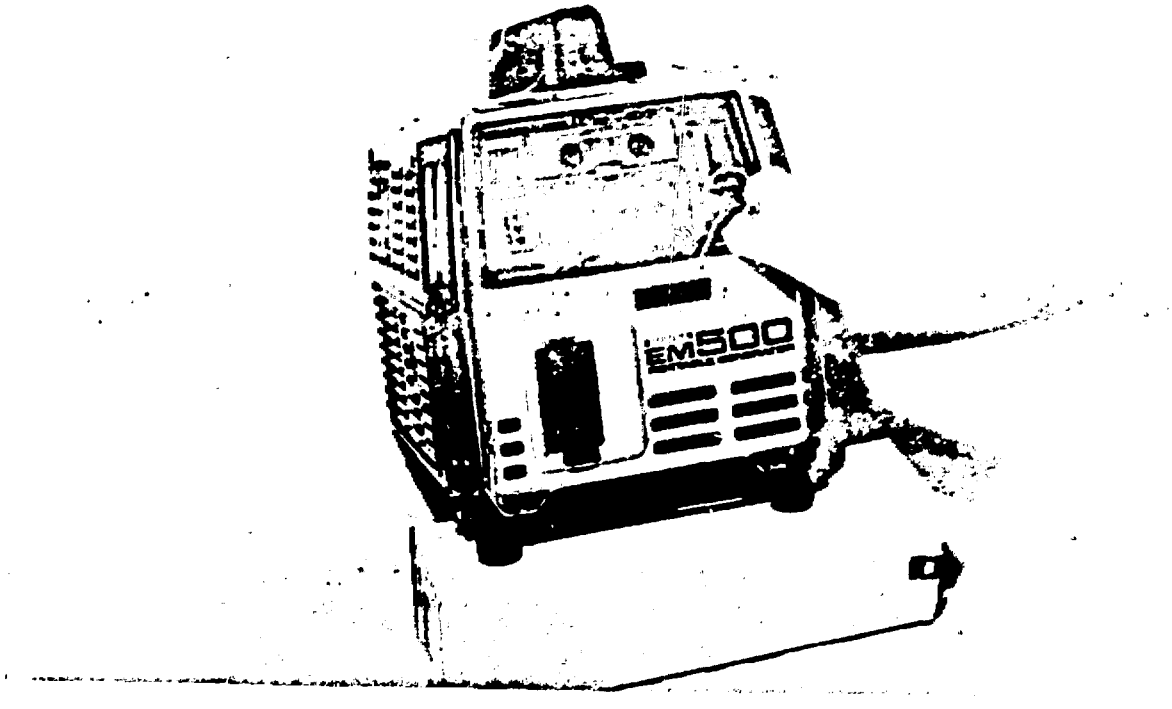


Figure 15

BNL – RAP – Portable Generator

V. FIELD OPERATIONS

Whether responding to a request for radiological assistance in the public or private domain, RAP Team personnel will function at an incident scene through the highest level authority, local, state, or federal. In the absence of such authority, the Radiological Assistance Team Captain will perform the necessary radiological functions. Monitoring activities and corrective actions deemed necessary in the judgment of the Team Captain will be carried out by team members.

RAP Team operations will be performed consistent with the guidelines and limits established by the agency having the primary responsibility at the scene of the incident. These actions are subject to approval by the Team Captain. Actions such as the physical restraint of individuals, impounding of materials, restriction of traffic, etc. are outside the duties and responsibilities of the RAP members.

When the emergency aspects of the assistance response have been brought under control, RAP's "on- the-scene" activities will normally be terminated. Before leaving the scene of the occurrence, the Team Captain will inform the principals involved of the radiological status of the facility or environment and will offer appropriate recommendations regarding its restoration to unrestricted use. If, during recovery operation, personnel or material resources will be required beyond the capabilities of the organization experiencing the emergency, it will be encouraged to contact commercial organizations capable of performing the necessary recovery functions.

State, local and other agencies having cognizance of or jurisdiction over nuclear facilities with a potential for large and/or extended releases of radioactivity are urged to pre-plan for the location and support of a suitable

headquarters for the RAP Team that would allow it to function over a possible duration of up to several days, should this become necessary. This location should be proximate to but not at the site of the facility itself. In the case of emergency planning for accidents at commercial power plants, a remotely located off-site Emergency Operating Facilitity (EOF) could be designated. This would readily provide for convenient liasion with other concerned entities. For other facilities or situations when this is not practicable, nearby local, state or federal governmental offices may provide convenient headquarters for RAP. Those at which related state or local activities are also to be located would be especially suitable. The RAP effort will also be facilitated if the requesting agency is prepared to make radio-equipped cars, with drivers familiar with the locality, initially available to the RAP team.

VI. Other Resources

If the actual or potential consequences of an accident are of such a magnitude as to warrant a major RAP commitment, resources from other DOE contractor facilities such as personnel, equipment, materials and services are available for emergency operations, subject to the essential operating requirements for the health and safety of these facilities themselves. As previously indicated, Department of Defense (DOD) resources are also available through an agreement with DOE.

As also previously indicated, the former IRAP Plan, through which the assistance of other federal agencies may be called upon, is being supplemented by FRMAP. In principle, it will correspond closely to the Federal Response Management Plan for radiological accidents at commercial nuclear power plants and which has already been depicted in Fig. 1.

Aerial surveys may be appropriate for those incidents which result in, or which may result in, the uncontrolled releases of large amounts of gamma emitting gases or particultates. In these situations, BHO-RAP may, at its discretion, call upon DOE's Aerial Measurement Organization, the nearest arm of which is situated at Andrews Air Force Base in Maryland.

For those situations which may require extensive support of its radiological assistance operations, DOE may call upon its Headquarter Emergency Action and Coordination Team (EACT). In turn, EACT may call upon the extensive capabilities of its Nuclear Emergency Search Team (NEST), which is situated at Las Vegas Nevada and those of the Atmospheric Release Advisory Capability (ARAC) which is situated at DOE's Lawrence Livermore Laboratory in Livermore, California.

APPENDIX I

EQUIPMENT RESOURCES AND LOCATIONS

This section of the Manual is devoted to a tabulation of the equipment and other resources available to the RAP and its physical location. The equipment cited is dedicated to the RAP and is above and beyond all other equipment available at BNL or any other Region I RAP participating organization.

On occasion some of the unique devices or special instruments may be used in BNL related activities. This can only be done with prior approval of the DOE Coordinator and only after prior notification of all team captains indicating the new exact location of the devices.

RAP EQUIPMENT STORAGE

The following equipment is maintained in a ready status at the Calibration Facility, Building 348, at 15 West Brookhaven Avenue.

FIELD KITS

Instrument Kit (3 ea.)

Quantity		DESCRIPTION
1	-	Victoreen Radector III, beta-gamma (Ion Chamber)
1	-	Victoreen CDV-700 count rate meter with end window, thin wall and under water GM probes
1	-	Alpha scint. probe
1	-	Battery operated air sampler and filters
4	-	200 MR self reading dosimeters
4	-	200 R self reading dosimeters
1	-	Dosimeter charger
6	-	TLD dosimeters

Misc. - Stop watch, flashlight, tape ruler, check sources and batteries.

Fidler Kit (1 ea.)

Quantity		DESCRIPTION
1	-	1/16 x 5 inch diameter scint. with thin window
1	-	Eberline PRM-5 pulse rate meter
1	-	Eberline RASP-1 Ruggedized alpha probe
1	-	Eberline SPA-3, 2 inch scint. probe
1		Eberline HP-210 beta window pancake GM probe

Misc. - Spare parts, tape ruler, check sources, voltmeter, spare batteries, cables and gloves.

Environmental Radiation Monitor (1 ea.)

Reuter Stokes RSS-111, Range 0-5000 micro R/hr.

Porta-Air Sampler Kit (5ea.)

Quantity		DESCRIPTION
1	-	Portable (AC/DC) field iodine air sampler
1	-	Victoreen CDV-700 count rate meter with 6306GM probe and shield
5	-	Sample canisters (silver loaded silica-gel)
5	-	Sample canisters (TEDA charcoal)
Misc.	-	1 copy sampling proceedure, technical report, battery adapter cable, 25 ft. extension cable, screwdriver.

Porta-Air Sampler Supply Kit (1 ea.)

Quantity		DESCRIPTION
17	-	Sample canisters (silver loaded silica-gel)
4	-	Sample canisters (TEDA charcoal)
2	-	One gallon can (silver loaded silica-gel)
1	-	Roll particulate paper
1	-	Beaker
2	-	Screwdrivers
2	-	Scissors
1	-	CDV-700 & 6306 probe

Misc. - Blank labels, pre-marked labels, plastic bags.

Environmental Air Sampler (18 ea.)

Contains AC powered pump, lapsed time meter, flow gauge, hose, filter holder, rain cover, filter stand and power cord, 5 sample canisters, 6 particulate filters, padlock, chain.

High Volume Air Samplers (2 ea.)

Staplex particulate monitors.

INDIVIDUAL ITEMS

Survey Instruments:

Quantity	Type	Description
3	Victoreen 471A	Wide range beta-gamma (Ion Chamber)
3	Victoreen CDV-720	Wide range beta-gamma (Ion Chanber)
1	Teletector 6112	Beta-gamma with telescoping probe (GM)
1	Victoreen CDV-715	Gamma(Ion Chamber)
2	Victoreen CDV-700	Count rate meter (GM)
1	Victoreen CDV-700	Count rate meter, scint. & GM
3	Eberline E120	Count rate meter(GM)
1	Victoreen Radector III	Beta-gamma (Ion Chamber)
3	Nucor CS-40A	Wide range beta-gamma (Ion Chamber)
2	Ludlum 12-S	Micro R meter (scint.)
1	Eberline PRM-5-3	Lin-Log Pulse Rate Meter with PG-2 low energy gamma scint probe
1	Eberline PAC-4G-3	Lin-Log Gas Proportional survey meter with AC-21 alpha probe
1	Eberline PAC-4G-3 (Floor Monitor Mount)	Line-Log Gas proportional survey meter with AC-21 alpha probe, AC-21B beta probe
1	Eberline PAC-ISA	Alpha scint. detector, SPA-1 probe with sample tray
4	Eberline PAC-4S	Lin-Log alpha scint. detector
1	Ludlum 12	Count rate meter with alpha scint.
2	LFE Corp NP2	Neutron detector (Snoopy)

Scalers and Detectors:

1	Eberline PS-1	Portable Scaler
1	Eberline PS-2	Portable Scaler (2 High Voltage adj.)
2	Eberline MS-2	Portable Scaler & rate meter
2	Eberline SH-3	GM counter with sample tray

Miscellaneous Items

Portable communications transceivers (5)
Portable AM/FM broadcast receivers (2)
Binoculars - 2 pair
Radiation signs & tags (assorted)
Ribbon tape
Rope
Pads
Pencils
Reinforced filament tape
Plastic bags
Plastic bottles, 100ML, 100 each
Marinelli beakers
Spare TEDA charcoal, and silver loaded silica-gel
Vacuum drying oven for silica-gel
Battery packs for Eberline scalers (4each)
Spare type R51 filters for battery operated air samplers
Sample canisters for env. air samplers - (200)
Particulate filters for env. air samplers - (300)

REFERENCES

1. Federal Emergency Management Agency "National Radiological Emergency Preparedness/Response Plan for Commercial Nuclear Power Plant Accidents" (Master Plan), FR 45248, pp 84910-17, (22 Dec. 1980).

2. U.S. Department of Energy "Nuclear Reactors Built, Being Built or Planned in the United States", DOE/TIC-8201-R45 (June 1982).

3. Ibid., "Radiological Assistance Plan", Region I, Parts I (1975) and Part II (updated every six months). U.S. Department of Energy, Chicago Operations Office, Brookhaven Area Office, Upton, New York 11973.

4. Ref. 1, Part C.9, Footnote 5, This plan, still in draft form, is intended to replace the Inter-agency Radiological Assistance Plan (IRAP).

5. a. C. Distenfeld and J. Klemish, "An Air Sampling System for Evaluating The Thyroid Sose Commitment Due to Fission Products Released From Reactor Containment", BNL-NUREG-50881 (1978).

   b. FEMA, "Guidance on Off-Site Emergency Radiation Measurement Systems", Appendix B, FEMA-REP-2 (1980).