IAEA-SM-125/25

BNL-22302

CONF-770220--2

INTERNATIONAL SYMPOSIUM ON THE HANDLING OF RADIATION ACCIDENTS
28 February-4 March 1977
Vienna, Austria
IAEA-SM-125/25

A Short Radiological Emergency Response Training Program*

R. D. Williams+ and N. A. Greenhouse
Safety & Environmental Protection Division
Brookhaven National Laboratory
Upton, New York U.S.A. 11973

ABSTRACT

This paper presents an outline of a radiological emergency response training program conducted at Brookhaven National Laboratory by the health physics and safety training staff. This course is given to groups from local, county, state, and federal agencies and industrial organizations. It is normally three days in length, although the structure is flexible to accommodate individual needs and prior training. An important feature of the course is an emergency exercise utilizing a short lived radionuclide to better simulate real accident conditions. Groups are encouraged to use their own instruments to gain better familiarity with their operating characteristics under field conditions. Immediately following the exercise, a critical review of the students' performance is conducted.

Brookhaven National Laboratory employs many personnel knowledgeable in the nuclear field and has specialized equipment and facilities. In addition, it is the headquarters for the ERDA Radiological Assistance Program in the northeastern United States (an area with the highest density of radiation users) with responsibility for responding to serious radiological emergencies in eleven states. Although this combination of emergency response capability and experience makes BNL a unique resource in its geographical area for such training, this course may prove useful to organizations with similar training requirements and capabilities.

---

*Research carried out at Brookhaven National Laboratory under the auspices of the U.S. Energy Research and Development Administration.

+Present address: Medi-Physics, Inc., 5855 Christie Avenue, Emeryville, California 94608.

DISCLAIMER

INTRODUCTION

The current proliferation in the use of radioactive materials including the generation of electrical power, medical diagnostic and therapeutic radiology, research and testing, and commercial devices and services, indicates that accidents involving these radioactive materials will inevitably occur. Governmental agencies and other groups, including commercial nuclear power plant operators, charged with protecting the health and safety of the public must therefore be prepared to cope with such radiological emergencies, be they large or small.

Brookhaven National Laboratory, located in New York State, has long been recognized as a major resource of personnel trained in the nuclear field and specialized equipment and facilities. In addition, it is a U. S. Energy Research and Development Administration Radiological Assistance Program Headquarters responsible for assisting at any serious radiological incident in an eleven state area. Therefore, BNL is frequently requested to conduct radiological emergency response training programs for governmental agencies at the local, county, state, and federal levels as well as industrial organizations.

TYPICAL BROOKHAVEN NATIONAL LABORATORY PROGRAM

This paper outlines a typical training program given at BNL by health physics staff members which can be modified to accommodate agency requirements and prior training of attendees. Normally, the course lasts about three days and handles up to twenty participants, although the fewer there are the more personal attention each one can receive This is particularly true during the emergency exercise when more "hands on" experience is obtainable.

The course usually addresses response to those emergency situations considered most likely to occur. These would include accidents at fixed sites (e.g. hospital, laboratory, or industrial spills or similar incidents) <u>or</u> accidents involving the transportation of radioactive materials. Major nuclear power plant accidents involving danger to the public are considered at this time to be very unlikely and of more theoretical than practical importance; whereas the types of radiological emergencies discussed in the training program do occur relatively frequently. Finally, these training courses are not static, but evolve and change as a result of real accident experience in the industry and of suggestions made by course participants.

The following is an outline of such a typical three day course. As mentioned earlier, the time allotted to each subject and indeed whether a given subject will be discussed at all, depend upon the participants' needs and prior training and experience.

Suggested Schedule

Day 1

1300-1700--Welcome and Introduction. Division of participants into groups for the emergency exercise. If there are many participants, the exercise is given twice so that more of them may gain practical emergency response experience.

Radiation Safety Lecture. Including nuclear physics, radiation biology, control of internal and external radiation exposure as required by the participants.

Day 2

0900--Instrumentation Lecture. Brief theory of operation of instruments used in emergency surveys including practical uses and limitations.

1000--Instrument Calibration. Course participants are encouraged to bring their own instruments to the course to gain practical experience in their use. During this time period participants may calibrate their own instruments to gain familiarity with calibration procedures and to standardize instrument response. Cobalt-60, cesium-137 and plutonium-beryllium sources at BNL's calibration facility are used.

1200--Lunch

1300--Transportation of Radioactive Materials. U.S. Department of Transportation regulations are discussed as well as testing requirements of shipping containers, experience with container integrity following actual accidents, and suggested response procedures following a transportation accident.

1430-1700--Emergency Response. Discussion of theory of emergency response, organization and deployment of an emergency response team, donning of protective clothing, and theory and actual use of respirators and self-contained breathing apparatus.

Day 3

0900--Key Information. Discussion of important information to elicit from persons telephoning or otherwise notifying responsible organizations in the event of a radiological emergency.

Day 3 (cont'd)

1000--Emergency Exercise (I). Detailed below.

1200--Lunch

1300--Emergency Exercise (II). Detailed below.

1500-1700--Exercise Critique. Detailed below.

Day 4

0900--Exposure Assessment. Discusion of use of personnel monitoring devices, biological indicators and accident reenactment to determine exposures received by persons involved in a radiological accident.

1000--Public Relations. Importance of a single individual as public relations or public information officer supplying timely and accurate information concerning a radiological incident to the press and other public media.

1100--Past Experiences. Discussion of previous experiences of BNL personnel and others in responding to radiological emergencies.

1200--Conclusion.

These sessions are conducted by Laboratory personnel and not limited to those on the Safety & Environmental Protection Division health physics staff.

EMERGENCY EXERCISE

The emergency exercise part of the training program is designed to simulate as closely as possible, realistic accident conditions. Therefore, actual radioisotopes are used in the exercise. The exercise usually simulates one of two accident situations: the collision of two vehicles, one of which carries radioactive materials; or a glovebox "explosion." In either situation, radioactive materials are dispersed around the accident scene. Most recently, our accident scenarios have included one or more live human victims, actually contaminated with small, but detectable, amounts of radioactivity. A mannequin is used to simulate a heavily contaminated, seriously injured victim.

The radioisotopes employed are manganese-56 (9360 s half-life) and cobalt-60. Stable manganese, as 5×10^{-5} kg of manganous acetate, and 5×10^{-4} kg pieces of manganese metal in small pop-top polyethylene vials, are activated in the pneumatic tube facility at the 3 MW BNL Medical

Research Reactor. At least 1 Ci (3.7 x 10^{10} Bq) of cobalt-60 is also employed. The activated manganese metal and cobalt constitute several curies, usually in the form of three to four discrete gamma sources. The activated manganese acetate and manganese metal are delivered to the exercise scene within 30 minutes after irradiation. Experienced health physics technicians using long tongs then remove the vial cap on the manganese acetate and dissolve the material in several liters of water. This contaminated liquid is distributed about the simulated accident scene, and small amounts are spilled on the coveralls and shoe covers of contaminated victims. (Personnel playing these roles wear plastic suits under their contaminated cotton coveralls to prevent actual skin contamination.) Realistic moulages are used to simulate injuries. The discrete gamma sources are then distributed about the scene to produce substantial gamma radiation fields. Referees participate in or observe the deployment of all radioactive materials so that they know the exact locations of sources and contamination when the emergency response team arrives.

The trainees, who have previously organized themselves as an emergency response team, are then called to the scene. Just prior to the team's arrival support personnel from the BNL police and fire groups are deployed around the scene; actors playing roles of curious onlookers, press representatives, hysterical witnesses to the accident, take their places; and smoke grenades are ignited to add an extra sense of stress and realism.

Upon arrival the team establishes a command post and proceeds with rescue and first aid activities, radiation monitoring, location and disposition of high level sources, and preliminary decontamination of the accident scene. All of their activities are closely observed by referees who warn any trainees who might inadvertently place themselves in a hazardous situation (e.g. standing too close to an unmonitored source; attempting to pick up a source bare handed). The referees also take careful notes on the details of the response for later use in the critique session. Particular attention is paid to how expediently the team members conduct rescue operations, don and use protective equipment, make radiation surveys, minimize spread of contamination, and utilize communications channels.

With enough training program participants, the exercise is given twice, morning and afternoon. The entire class is divided into two groups. In the morning one group responds to the accident scene and the other to the clinic to assist the medical staff in the management of contamination problems. In the afternoon session the groups reverse their roles. Representative scenes from previous emergency exercises are depicted in Figs. 1-3.

If the exercise is conducted in an area which is needed for Laboratory business on the next work day, it is usually scheduled on a Friday to allow for decay of the manganese-56 contaminant over the weekend.

EXERCISE CRITIQUE

At the conclusion of the exercise, on the same afternoon while the details are fresh in everyone's mind, the exercise critique is conducted. All participants are present, including representatives of the police and fire groups, the physician, a public relations representative, and any others involved. The exercise is discussed in detail with input from everyone and suggestions are made on how the participants may have handled certain situations in a better way. Also, and very importantly, all participants are encouraged to suggest ways in which the exercise itself as well as the entire course, may be improved for the next presentation of the training program. It should be noted that in spite of the relatively large amounts of radioactivity involved in the exercise, participants receive only a few tens of millirads and never more than 70 mrads (0.7 mGy). The potential for higher exposures exists, but the risk of such occurrences is minimized by watchful referees.

CONCLUSION

It is believed that the training program outlined here may prove useful to other facilities with similar resources. It is a flexible course which through the use of actual radioactivity, experienced staff personnel, and a well thought out scenario in the emergency exercise portion, is realistic.

FIGURE LEGENDS

Fig. 1. Placement by health physics technicians of sources and manganese-56 "spill" prior to arrival of emergency response trainees.

Fig. 2. Team leader directs monitors at command post before initial entry into accident scene. Actors are playing the roles of "curious onlookers."

Fig. 3. A gamma source being secured during the final phases of the emergency exercise by course participants.

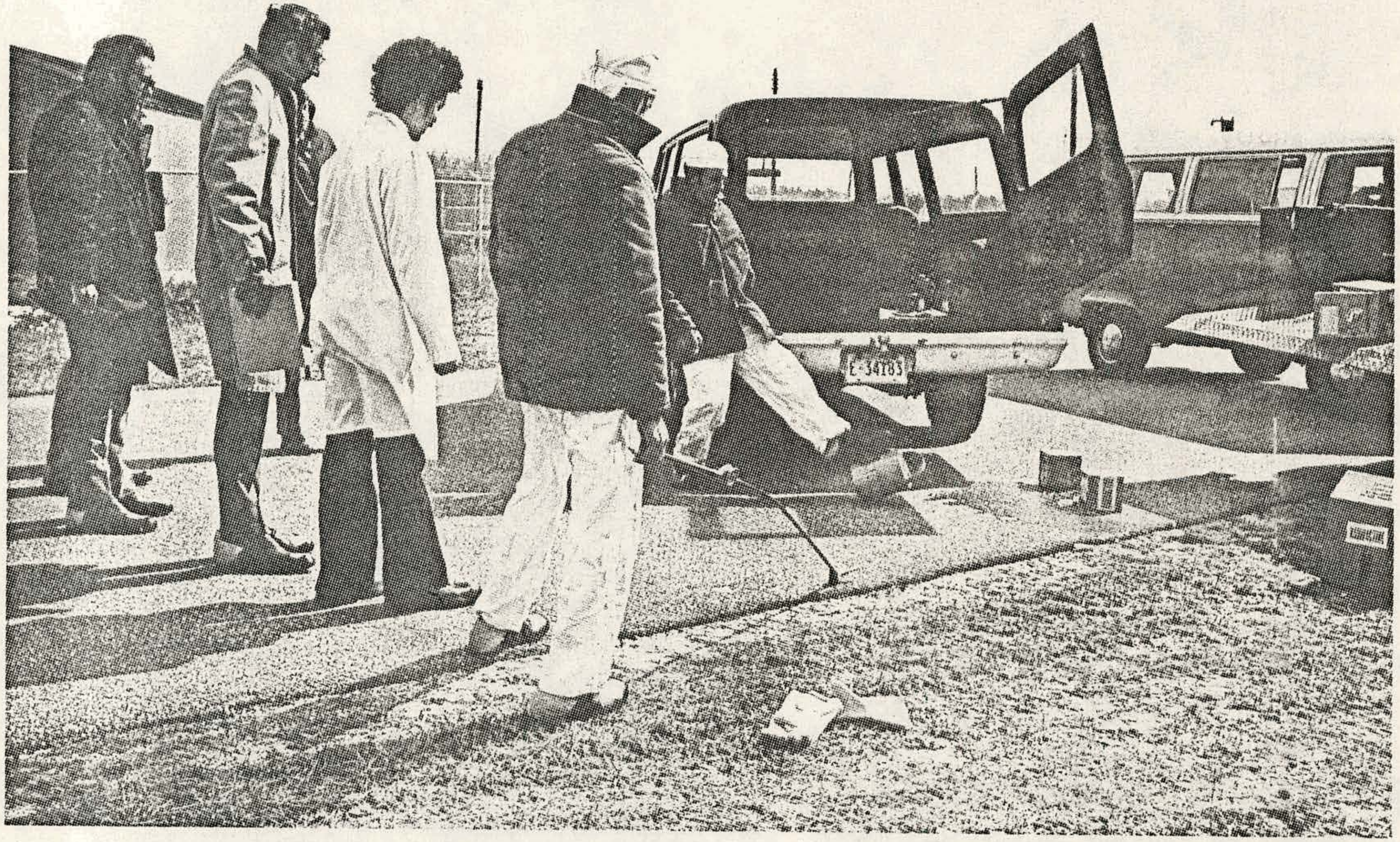

FIGURE 1

Final preparations at the accident scene.

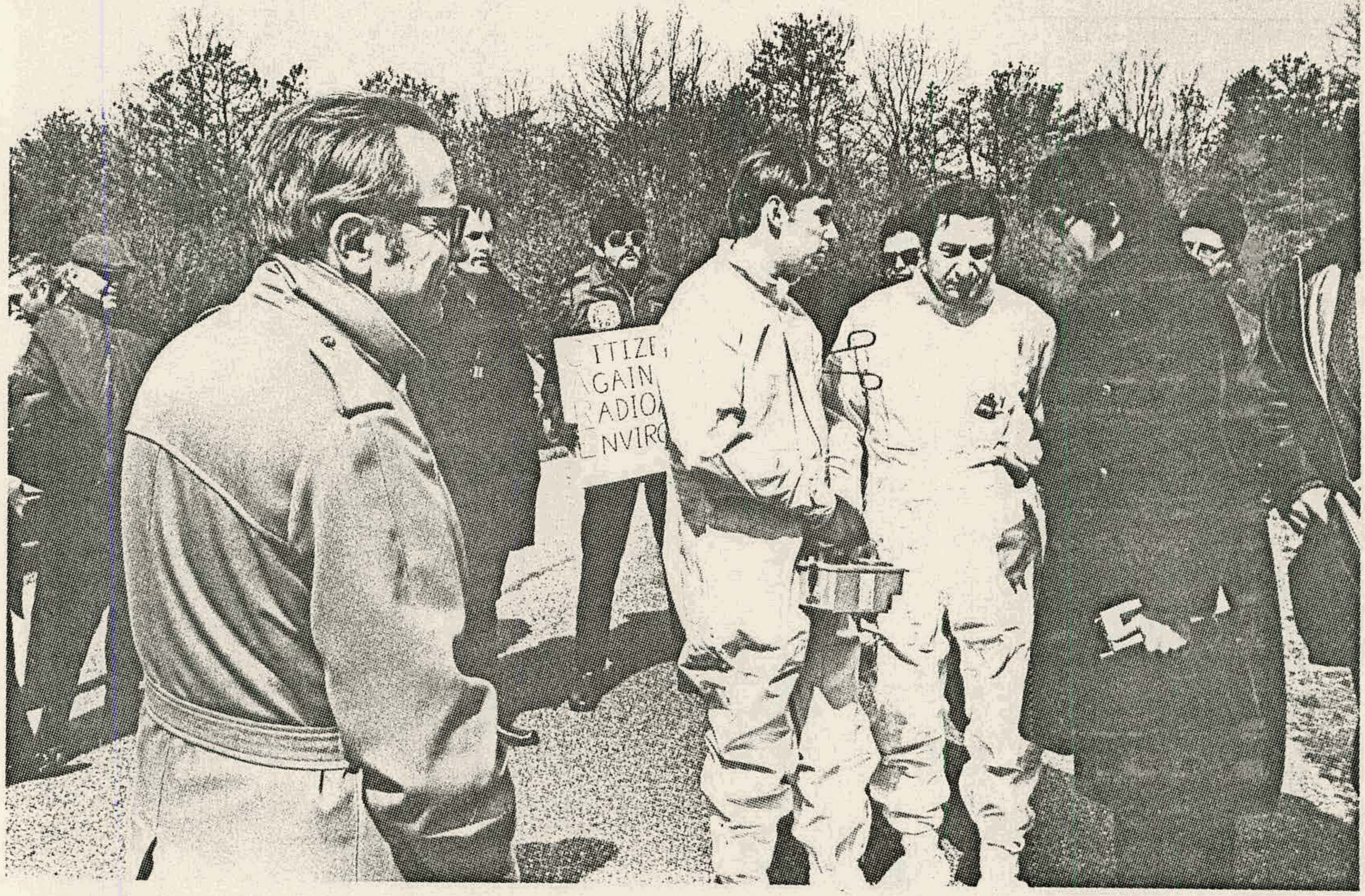

FIGURE 2

Consultation at command post before reentry into accident scene.

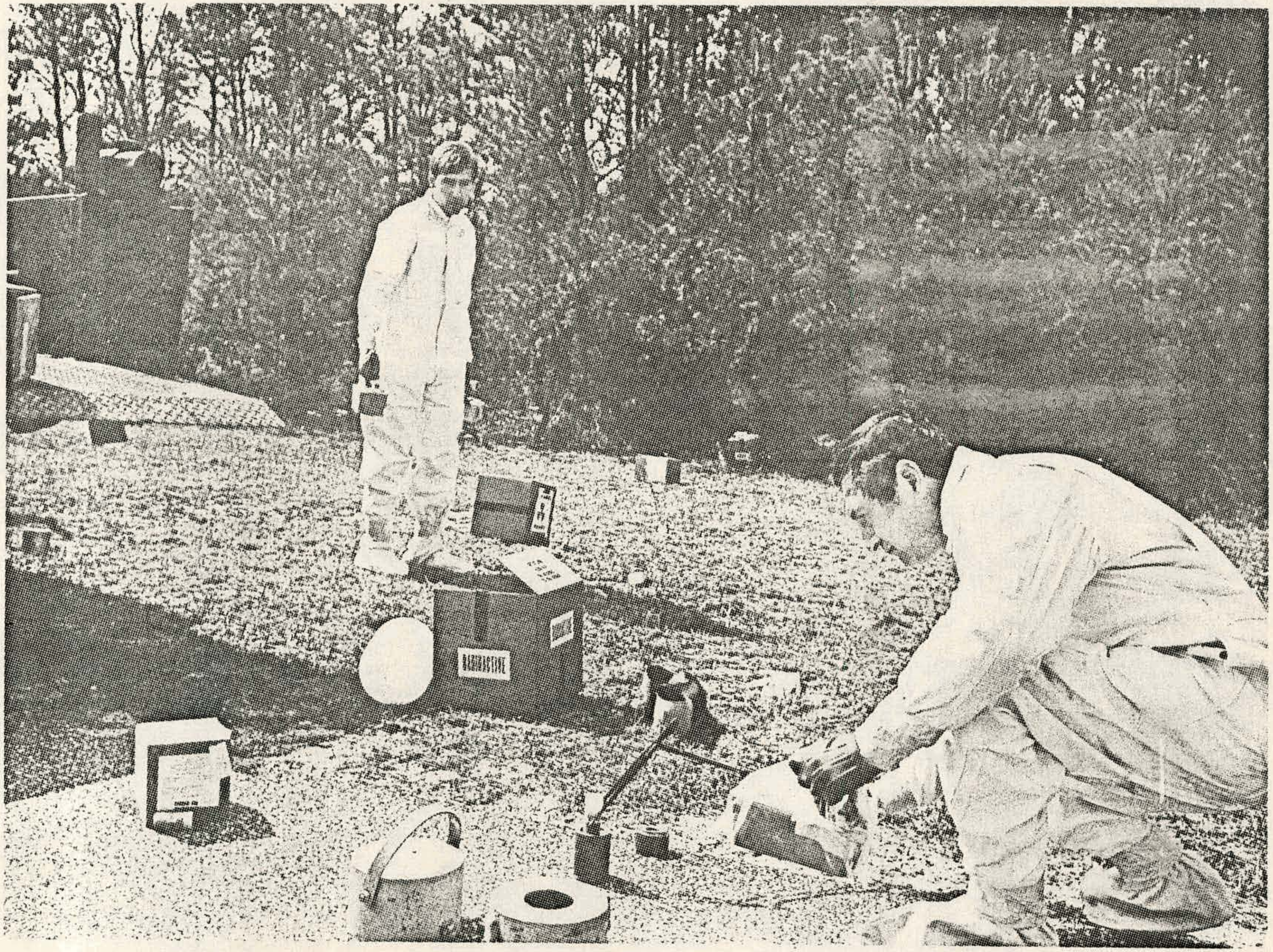

FIGURE 3

Monitoring activities at the accident scene.