SECURITY CLASSIFICATION OF THIS PAGE

AD-A220 145 DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

	1b. RESTRICTIVE MARKINGS
2a. SECURITY CLASSIFICATION AUTHORITY	3. DISTRIBUTION/AVAILABILITY OF REPORT
2b. DECLASSIFICATION/DOWNGRADING SCHEDULE Unclassifed	
4. PERFORMING ORGANIZATION REPORT NUMBER(S) 147-88	5. MONITORING ORGANIZATION REPORT NUMBER(S) Approved for public release; Distribution unlimited
6a. NAME OF PERFORMING ORGANIZATION US Army-Baylor University Graduate Program in Health Care	6b. OFFICE SYMBOL (*If applicable*) Admin/HSHA-IHC
	7a. NAME OF MONITORING ORGANIZATION
6c. ADDRESS (*City, State, and ZIP Code*) Ft. Sam Houston, TX 78234-6100	7b. ADDRESS (*City, State, and ZIP Code*)
8a. NAME OF FUNDING/SPONSORING ORGANIZATION	8b. OFFICE SYMBOL (*If applicable*)
	9. PROCUREMENT INSTRUMENT IDENTIFICATION NUMBER
8c. ADDRESS (*City, State, and ZIP Code*)	10. SOURCE OF FUNDING NUMBERS

PROGRAM ELEMENT NO.	PROJECT NO.	TASK NO.	WORK UNIT ACCESSION NO.

11. TITLE (*Include Security Classification*)
A STUDY OF EMERGENCY ROOM HEALTH CARE PROVIDERS AND THE FIXED FACILITY PHYSICAL CAPABILITIES TO MANAGE THE PRESENTING RADIOLOGICALLY INJURED PATIENT

12. PERSONAL AUTHOR(S)
LTCR Elaine M. Wolf

13a. TYPE OF REPORT	13b. TIME COVERED	14. DATE OF REPORT (*Year, Month, Day*)	15. PAGE COUNT
Study	FROM Jul 84 TO Jul 85	Aug 84	84

16. SUPPLEMENTARY NOTATION

17. COSATI CODES			18. SUBJECT TERMS (*Continue on reverse if necessary and identify by block number*)
FIELD	GROUP	SUB-GROUP	Emergency Care, Radiologic Emergency Care

19. ABSTRACT (*Continue on reverse if necessary and identify by block number*)

This study examined emergency room health care providers to determine if their knowledge and clinical expertise is sufficient to appropriately manage radiologically injured patient. This study posed an unannounced disaster preparedness drill to measure the ability of the emergency room staff to care for radiologically injured patients. This study produced a checklist for measurement of the care. The clinical expertise and performance were satisfactory. The instrument for measuring the abilities of the clinical staff provided useful, but required some modification.

20. DISTRIBUTION/AVAILABILITY OF ABSTRACT	21. ABSTRACT SECURITY CLASSIFICATION
☒ UNCLASSIFIED/UNLIMITED ☐ SAME AS RPT. ☐ DTIC USERS	

22a. NAME OF RESPONSIBLE INDIVIDUAL	22b. TELEPHONE (*Include Area Code*)	22c. OFFICE SYMBOL
Lawrence M. Leahy, MAJ(P), MS	(512) 221-6345/2324	HSHA-IHC

DD Form 1473, JUN 86 *Previous editions are obsolete.* SECURITY CLASSIFICATION OF THIS PAGE

A STUDY OF EMERGENCY ROOM HEALTH CARE PROVIDERS AND THE FIXED FACILITY PHYSICAL CAPABILITIES TO MANAGE THE PRESENTING RADIOLOGICALLY INJURED PATIENT

A Graduate Research Project

Submitted to the Faculty of

Baylor University

In Partial Fulfillment of the

Requirements for the Degree

of

Master of Health Administration

by

Lieutenant Commander Elaine M. Wolf, NC, USN

August 1984

ACKNOWLEDGEMENTS

I wish to thank Commander Thomas K. Stefanakos, Head, Radiation Safety, Naval Hospital, Portsmouth, Virginia; Mr. William Bradley, Radiation Safety, Norfolk Naval Shipyard; Lieutenant David Thompson, Head, Operating Management Department, and the entire Emergency Room crew at Naval Hospital, Portsmouth, Virginia, for their assistance and participation in the graduate study. The support and encouragement of my preceptor, Commander Douglas N. Benander, MSC, USN, is deeply appreciated.

TABLE OF CONTENTS

TABLES

LIST OF ILLUSTRATIONS

CHAPTER I

INTRODUCTION

Summary of Conditions

The use of nuclear energy for both military and sectarian purposes is firmly established in modern society. In addition to employing it in weaponry, Navy ships and submarines utilize it as a fuel power source and military aviation employs radioactive materials as component parts for aircraft. Large-scale nuclear energy plants dot the landscape throughout the United States. Statistically, nuclear power as a source of total electricity generated in the U.S. has increased from 1% in 1969 to 11.5% in 1979. There are 72 licensed commerical reactors now in place. Increasingly, radioactive materials destined as the supply base for the aforementioned are transported in ever greater criss-crossing patterns across the country. Two-thirds of the emergency responses in 1981 of the Radiological Assistance Program have involved radioisotope transport mishaps with highway accounting for 60% and rail and air - 20% each of the responses.[1] Medical applications of radiation now include sterilizing supplies and identifying and treating disease processes in humans. Universities, government laboratories, and military installations employ reactors for research. Further, nuclear weapons are dispersed throughout the country in both operational and storage facilities. It appears that utilization of nuclear power as an alternative weapons and energy source to the fossil fuel source is here to stay.[2]

However, its ever-expanding employment in the fabric of society does not mean that its use, misuse, or implications of either is understood by the

average individual. Nuclear power and concomitant radiation hazards to human health exist in a virtual vacuum with regard to the average citizen's comprehension and perception of it. Additionally, with increasing utilization, the propensity for human error and nuclear accident grows proportionately.[3]

This would indicate that providers of health care will become involved in caring for radiologically injured individuals. However, as a Registered Nurse involved with both the clinical and administrative aspects of direct patient care delivery, personal introspection of a knowledge base on the subject indicated dire ignorance as to the appropriate course of action to pursue should such a casualty present for emergency treatment. Further, it is premised that such ignorance would be in evidence should the situation arise with regard to the majority of fellow health care providers.

Indeed, health care providers as a microcosm of society, find themselves deeply invested in a technology for which they are largely ill-prepared. In the past three years only a handful of articles by a small group of authors has been directed toward planning for and care of radiation casualties. Hospitals, administrators, and providers have shown little interest in this aspect of emergency medical care.[4] There has been reluctance or even refusal by hospitals to admit patients with actual or suspected contamination.[5]

Protocol and procedures for care do exist, as a review of the literature revealed. However, their scope is limited and the topic is narrowly addressed. Generally, few hospital disaster preparedness drills are conducted, which deal exclusively in the direct care of the radiologically injured victim. Too, scant attention has been paid to preparation of fixed facilities for accommodation of the radiologically injured casualty. In fact, prior to 1979, the Joint Commission on Accreditation of Hospitals requirements concerning disaster preparedness or functional health and safety standards did not address this

topic with any specificity.[6, 7] Primary impetus for the cursory existent data has been the Three-Mile Island nuclear reactor accident in 1979.[8] Since then JCAH has required all general hospital emergency rooms to have a written procedure for handling patients exposed to or contaminated by radioactivity as well as one drill per year involving radiologically contaminated patients.[9]

The average health care provider receives no to minimal training in radiologically injured casualty management. The literature exhorts preparedness but provides little select means, other than protocol and procedures outlines, for obtaining or maintaining same.[10] Following the Three Mile Island incident several community hospitals located near isolated nuclear reactor sites did publish articles relating their specific preparation for a radiation accident contingency. One large hospital located in a major city, Brigham and Women's Hospital in Boston actively drills and prepares formally for the radiologically injured patient with teaching emphasis on injuries which might be incurred from industrial sites, transportation accidents, and hospital-based accidents.[11]

Study Stimulant

Since the military health care delivery system reflects that of society's in microcosm and, as a provider member of that military health care system, it was felt that a baseline study addressing the topic could prove informative. Therefore, the intent of the study is to determine provider preparedness and facility readiness to receive, assess, and clinically treat the radiologically injured casualty. Support for this study is offered for the following reasons: (1) preparedness for dealing with the radiologically injured casualty should not begin with meeting the presenting patient at the emergency room entrance, (2) a study may contribute to decreased mortality and morbidity from this accident source, (3) dissemination of accurate information pertinent to the topic can

dispel ignorance and misinformation, and (4) a study may allow for evaluation of the providers' knowledge and the fixed facility's capabilities with regard to treatment of the radiologically injured casualty.

Research Question

To determine if the knowledge level and clinical expertise of the Emergency Room health care providers is sufficient to appropriately manage the presenting radiologically injured patient concomitant with the fixed facility's capability.

Objectives

This study is meant to be an assessment of the provider preparedness and fixed facility's capability to manage the radiologically injured patient. It is centered around six objectives:

1. To conduct a thorough search of the available literature pertinent to the topic.
2. To determine what, if any, protocols may already be available.
3. To determine what, if any, formal educative programs may already be available.
4. To determine established procedures for the management of the radiologically injured patient.
5. To determine advocated physical layout for care and treatment of the radiclogically injured patient within the confines of the fixed facility.
6. To conduct an unannounced disaster preparedness drill with singular emphasis on the radiologically injured casualty.
7. To determine the degree (percentage) of procedural compliance in following the established protocol.

Criteria

The criteria for this study are:

1. A successful disaster drill will have occurred if 90 percent of the established protocol is followed.

2. The fixed facility will be considered adequate with respect to physical capability if it meets 90 percent of the recommendations of the REA/CTS Syllabus on Radiation Accident Management, Oak Ridge Associated Universities, Oak Ridge, Tennessee, 1979.

3. The logistic capacity (supplies) of the fixed facility will be considered adequate if it meets 90 percent of the recommendations as set forth in "Management of Persons Accidently Contaminated with Radionuclides" NCRP Report No. 65, April 15, 1980.

Assumptions

The following assumptions were made:

1. The knowledge of health care providers in Naval Hospital, Portsmouth, Virginia, mirrors that of the health care providers in other military facilities.

2. A nuclear accident with accompanying radiologically injured human casualties, in all probability, will occur due to increasing employment of nuclear energy (i.e., construction of plants, site-to-site transfer and transportation of radioactive materials) and the ever-present chance for human error.

Limitations

The following constraints are applicable to this study:

1. Research is directed to the administration of and the clinical handling of emergency care for the radiologically injured patient in a fixed facility under peacetime conditions.

2. Assessment and clinical treatment are limited to the Emergency Room of a fixed facility.

3. The fixed facility to be utilized for this study is the Naval Hospital, Portsmouth, Virginia.

4. The health care providers' care provision to be evaluated is limited to those military ER personnel currently providing emergency care and who are on duty at the time of the 0800 weekday unannounced drill at the Naval Hospital, Portsmouth. Evaluation of the safety team's actual performance is not included in this study.

5. Management of the radiologically injured casualty is limited to drill participants for purposes of this study.

6. Persons evaluating the drill are limited to the researcher, the ER Charge Nurse, and Head, Radiation Safety Division of Naval Hospital, Portsmouth, Virginia. None of the evaluators are drill participants.

Review of the Literature

As has been previously presented, a search of the literature has established that prior to the Three Mile Island nuclear reactor accident, little attention was given to the management of the radiologically injured patient or to the fixed facility's capability to receive same. With the 1979 occurrence acting as a catalyst, published calls with concomitant plans appeared exhorting preparedness with increased frequency. American Douglas Unsel, Assistant Administrator of York Hospital cited the growing need for hospitals to develop and test effective disaster plans for dealing with radiologically injured

patients.[12] P. Owe Petersson, Director of University Hospital in Sweden indicated international response with his publication of the protocol and procedure established for that country's health care system.[13] Shepherd of Ajax and Pickering General Hospital in Ontario published that hospital's contingency plan and documented their yearly "run-through" exercise employed to maintain personnel proficiency in handling the radiologically injured casualty.[14] St. Mary's Hospital in Russellville, Arkansas, exercises yearly drills as does Salem County Memorial Hospital in New Jersey.[15, 16] Indeed, all hospitals seeking to attain or maintain JCAH accreditation now follow JCAH requirement for this topic.

Waldron et al verify the importance of having repetitive training exercises to keep physicians, nurses, hospital administrative personnel, ambulance attendants, monitoring teams, and support personnel in a "ready" state and for the purpose of testing procedures and equipment.[17] Likewise Galvin feels it is the responsibility of the Chief Executive Officer to provide medical and ancillary staff with training courses and emergency drills to better prepare them for an emergency.[18] Richter et al state training is essential to any preparedness program with periodic assessment of effectiveness attained by scheduled and unscheduled exercises.[19]

Therefore, the precedent for preparation and drill exercise is established for this study at Naval Hospital, Portsmouth, in terms of general applicability to the health care system. However, it is important to note that nowhere in the literature search could publication or example be found whereby specific statistical evaluation of said exercises for any given health care provider group or fixed facility had been accomplished.

Thorough examination of the published protocol and procedures for health care providers and hospitals to follow pertaining to managing the radiolog-

ically injured patient, reveal general uniformity of plan and conformity to standards established by the REAC/TS at Oak Ridge. The programs are then tailored to meet the needs of the specific hospital. Such is the case with the Hospital Reception of Radiological Casualties Plan for Naval Hospital, Portsmouth, Virginia (Appendix E).

Typically, basic radiation physics, biologic effects, types of accidents, pre-hospital care, emergency department preparation, varied team members' duties, and actual reception and management of the patient are areas covered by the authors. Richter et al advocate and describe management of radiation accident patients using a multi-disciplinary and systems approach. Saeger's detailed outline on hospital planning for radiation accidents is excellent. It is included as Appendices B and C. Jankowski's synopsis of measurement and effects of radiation is representative and is included as Appendix D.

Research Methodology

The scenario for the simulated disaster drill follows:

1. Purpose.

a. To study provider preparedness to assess and clinically treat the radiologically contaminated and injured patient.

b. To study the facility readiness to accommodate the radiologically contaminated and injured patient.

c. To provide training for medical personnel in handling the radiologically contaminated and injured patient.

2. Objectives.

a. To evaluate hospital plan for reception and treatment of radiological casualties.

b. To evaluate the ability of medical personnel to respond to a radiation accident.

c. To test the capability of the hospital's administrative and communications network to provide support for clinical personnel.

3. Problem.

On the morning of 20 March 1984, an accident has occurred involving two workers who were performing maintenance on a radioactive component of a nuclear submarine reactor plant.

a. One worker is scalded on his face, neck and upper chest by steam issuing from a broken pipe.

b. The other worker has suffered multiple lacerations on his upper body from metal shards from the broken pipe and from a pipe cutting machine being used by the workers.

c. A third worker, while in the process of assisting to control the situation suffers chest pains and passes out in the area of the spill, thus becoming contaminated on his clothing and skin from contact with contaminated surfaces and components.

4. Notes.

Injuries and Radiological Data

		Injuries	Contamination Levels
Worker #1	face	2nd degree	40,000 ccpm**
	neck	2nd degree	40,000 ccpm
	chest (shirt on)	1st degree	30,000 ccpm
	(shirt off)	1st degree	2,000 ccpm
	right hand (palm)	2nd degree*	100,000 ccpm
	right forearm	2nd degree	50,000 ccpm
	lower body		400-250 ccpm
	back		400-250 ccpm

*in addition to burns the worker has a laceration to the right palm due to impingment of high pressure/high velocity steam. Possible cracked/broken bone(s) in right hand.
**Cubic centimeters per million

Worker #2	face	lac over R eye	15,000 ccpm in wound
			3,000 ccpm on forehead
		lac L cheek	5.000 ccpm in wound
			1,000 ccpm on cheek
	upper body	L shoulder	25,000 ccpm in wound
			500 ccpm on shoulder
Worker #3	head	Bruise on back of head	2,000 ccpm in hair
	back	none	2,000-400 ccpm

Two ambulance attendents involved in transporting casualties have 200-400 ccpm on hands and on front of pants. Ambulance cots and floor are contaminated to less than 100-300 ccpm.

Graders are CDR Stefanakos, LCDR Robson and LCDR Wolf. LCDR Robson will asssess health care provider adherence to the clinical patient care protocol. CDR Stefanakos will assess protocol utilization regarding provider preparation and supplies (i.e., dressing out and breaking out of radiation supply packs) and adherence to facility preparation and decontamination procedures. LCDR Wolf will assess administrative protocol and procedural conduct through out the drill. Grading sheets are included as Appendix F. Patient/victims will be located in an ambulance parked in Manpower Management parking lot. The drill will commence at 0800, 20 March 1984 with initial phone call to OOD. First two patients (burn and laceration victims) will arrive at ER at 0830 and third victim (chest pain) will arrive at 0845.

The methodology employed for conducting the unannounced drill is:

1. Protocol followed will be that established protocol on hospital reception of radiological casualties as set forth in Annex Q of NAVHOSPPTSVAINST 3440.1 - 1983 (Disaster Preparedness Recovery Plan). It has been drawn from the recommendations for management of the radiologically injured patient as advocated by the Radiation Emergency Assistance Center Training Site, Oak Ridge, Tennessee and Saengers plan. Further, local military command policy dictates adherence to approved and established NAVHOSPPTSVAINST protocol in this case.

2. 1983 JCAH standards for conducting an emergency preparedness - radiation safety drill will be used.

3. A "YES-NO" check off grading sheet (Appendix F) addressing the various aspects of the protocol will be developed incorporating the material found in Methodology #1 and #2. It will be a composite of protocol requirements of Annex Q (Appendix E) and other previously used notification checklists, and protocol outlines (Appendix G).

4. Definitions and characterizations of radiation accident victims as stated in Emergency Handling of Radiation Accident Cases, U. S. Atomic Energy Commission and American Medical Association 1969 (Appendix A) will be used in setting the disaster drill scenario.

5. An unannounced disaster preparedness drill will be conducted whereby three radiologically injured casualties present to the Emergency Room facilities at Naval Hospital, Portsmouth, Virginia.

6. Conduct of the drill will be coordinated with the Head, Operating Management Department, Naval Hospital, Portsmouth, Virginia, to ensure compliance with JCAH yearly drill requirement on radiation safety.

7. The ER health care providers' function (i.e., adherence to protocol, supplies and facility use) in the management of the radiologially injured patient will be assessed during the drill utilizing a pre-coordinated (by researcher) set of observers and the check off sheet (Appendix F).

8. The method of analyzing the data will be to take the negative responses as a percentage of the total protocol responses as enumerated in the checkoff list. This figure will be subtracted from 100% and the result will be judged against pre-established criteria for this study.

Endnotes

[1] Robert L. Waldron, Robert Danielson, Harold E. Schultz, Dieter E. Eckert, and Kenneth O. Hendricks, "Radiation Decontamination Unit for the Community Hospital," American Journal of Roentgenology 136 (May 1981): 978.

[2] "Nuclear Power and Public Health," WHO Chronicle 28 (1974): 451.

[3] Carol B. Jankowski, "Radiation Emergency," American Journal of Nursing (January 1982): 90-91.

[4] Waldron et al., AJR: 977.

[5] E. L. Saenger, "Hospital Planning to Combat Radioactive Contamination," Journal of the American Medical Association 815 (1963): 578-581.

[6] Joint Commission on Accreditation of Hospitals, Accreditation Manual for Hospitals, 1983 Edition: 29, 46.

[7] Fred A. Mettler, Jr., "The Hospital Administrator and Radiation Accidents," Emergency Medical Services (May/June 1978): 78.

[8] Ralph B. Leonard and Robert C. Ricks, "Emergency Department Radiation Accident Protocol," Annals of Emergency Medicine (September 1980): 462, 467-70.

[9] Joint Commission on Accreditation of Hospitals, Manual (1980): 29.

[10] *Editoral*, Modern Healthcare (June 1979): 3.

[11] Personal letter from Carol B. Jankowski, R.N., Brigham and Women's Hospital, to LCDR Elaine M. Wolf, September 20, 1983.

[12] Douglas B. Vinsel, "Hospitals Must Plan for Nuclear Accidents," Hospitals (August 16, 980): 113-121.

[13] P. Owe Peterson and Kerstin Schimura "Sweden's Disaster Plans-after Harrisburg," Hospitals (November 16, 1979): 14.

[14] Frances Shepherd, R.N., "Treatment for Patients with Radioactive Contamination," Dimensions in Health Service (June 1980): 19-20.

[15] "Arkansas Hospital Trains Personnel to Cope with Nuclear Emergency," Federation of American Hospitals Review (July/August 1982): 57.

[16] Jospeh Michael Galvin, Jr., "Hospital Makes Itself Center for Treatment of Radiation Victims," Hospitals (May 1, 1979): 37.

[17] Waldron et al, AJR: 979.

[18] Galvin, Hospitals,: 40.

[19] Linda L. Richter, Harold W. Berk, Charles D. Teatus, Nancy E. Larkham, Elroy J. Friesen, and Richard W. Epllich, "A Systems Approach to the Management of Radiation Accidents," Annals of Emergency Medicine 9:6 (June 1980): 309.

CHAPTER II

DISCUSSION

Drill Preliminaries

With the precedents for the occurrence of radiation accidents, the need for health care delivery system preparation to receive the radiologically injured, and the JCAH requirements for training for same established, it became the primary task for this researcher to organize, coordinate, and participate in the conduct of a radiation training drill. Again, the purpose of the drill was to gather fundamental data to assess the effectiveness of the protocol and procedure and the provider capability and facility adaptability to render appropriate care to the radiologically injured patient as specific to the Naval Hospital, Portsmouth, Virginia.

The differentiating factor for a drill of this type was that no previous study for assessing the aforementioned was found formally described in the literature. Compliance with the JCAH yearly drill requirements, narrative as to ways of formulating and adapting procedure and protocol to meet individual need, resource sources, and clinical management of the radiation accident victim were all available information. Checksheets for notification and step-by-step guidance for sequential procedures adherence were in evidence. However, no such definitive sequential checksheet could be located for use as an evaluation tool. Likewise no pre-established criteria for determining drill effectiveness were noted.

Therefore, an evaluation instrument in a checklist format (Appendix F) and incorporating the approved procedure for Hospital Reception of Radiologic Casualties (Appendix E) was developed. The instrument was designed to be broken

into broad segments corresponding to Administrative, Provider, and Facility/Logistic divisions, from which the selected evaluator for each part could assess compliance with the elements incorporated in the respective area. A Likert scale was considered but rejected in favor of a "Yes-No" form of assessment. It was felt that use of the "Yes-No" would aid in eliminating subjectivity since three individuals would be providing evaluation input. Too, all elements of the checklist were given the same weight as each was felt to be an equally necessary step in contribution to corporate success. Validity was lent to the instrument since it is a composite of previously used and tested notification check sheets and accepted procedures and protocols.

Pre-established criteria for determining a successful outcome on provider performance and facility capability during the drill were formulated. These criteria were based upon the accepted protocol and procedures, logistic requirements, and fixed facility adaptive standards as espoused by the REAC/TS in Oak Ridge and the National Council on Radiation Protection which provide the foundation for all published protocols inclusive of that of Naval Hospital, Portsmouth.

In order to conduct this study of which the drill occupied such an integral part, detailed preparation for and coordination with several departments within the hospital was necessary. It was accomplished in three phases - (a) preliminary; (b) intermediate, and (c) final phases.

The preliminary phase required formulation of an accepted Graduate Research Proposal on the topic. Then the laying of such local groundwork as gaining command approval, formulating of criteria and an evaluation tool, determining depth and breadth of departmental involvement, choosing evaluators; constructing a drill scenario, and locating appropriate resources followed. This phase was

initiated six months prior to the actual data-gathering drill and was of three months' duration.

The intermediate phase ensued and lasted two and one-half months. During this time detailing the scenario, coordinating specifics as to the date, time, location with Operating Management Department and attaining compliance with JCAH drill requirements were areas addressed. The results of this phase are detailed in the drill scenaro presented in the methodology section and may be herewith reviewed.

It is important to note that selection of three as the number of patients and the date and time for the event as well as the choice of and number of evaluators could be viewed as having impact on the outcome of the data.

By using three patients with varying injuries and degrees of contamination, it was felt that a wider range of provider care and employment of protocol could be observed while neither under nor over taxing the system or facility. The study purpose was to gather baseline data on these functions during routine conditions and not under catastrophic ones. This decision was arrived upon following consultation with CDR Thomas Stefanakos, Head, Radiation Safety, who has twenty years' experience in the field.

Too, it is recognized that choice of a date and time for the event were crucial. Certainly running the test during night or week-end time slots during which time variables as number or types of available crew could have skewed results is recognized. However, this study sought to establish a baseline of data and it was deemed appropriate that use of optimal conditions be employed where possible. Certainly the results of the study are not reflective of the aforementioned variables.

Determination of evaluators was considered carefully. Local policy called for reception of the radiologically injured to be in the Emergency Room where the provider team would assemble and the patient management initiate. The charge nurse of the ER was knowledgeable of procedure, personnel, and facility. Additionally, he was not targeted officially as a team member of the provider team. The Head, Radiation Safety was chosen as an evaluator due to his expertise in the field and his occupying no official place on the decontamination team. This researcher rounded out the evaluator trio. All evaluators were known to one another but maintained the privacy standards required to conduct the drill. Use of the evaluation instrument, assigned areas for assessment, and briefing for the evaluators was coordinated and conducted by the researcher.

Final stage began two weeks prior to actual drill date and continued through until successful completion of the drill. Obtaining transportation for and locating volunteer "victims," making moulage arrangements, briefing evaluators, and initiating, evaluating, and debriefing for the drill occupied this block. It is of import to note that the volunteer victims were individuals who were, in no way, attached to the hospital staff or who had any prior medical knowledge or training. The individual who applied the moulage wounds for the drill was an Emergency Medicine Technician instructor actively teaching in that program and was not a drill participant.

The Emergency Room Setting

The ER for Naval Hospital, Portsmouth, is located in the main building in the northwest corner of the first floor of the hospital. It is easily accessible to both vehicular and pedestrian traffic and is actively used as a primary entrance to both the ER and the rest of the hospital building. It is charac-

terized physically as being cramped with areas of unusable space. However, means for adapting the facility to receive the radiologically injured have been devised. It is a fully equipped and staffed department. Indeed comparison of the supplies and physical facility adaptation features as suggested requisites for appropriate care provision by the agencies listed in the criteria addressing same demonstrated 100% compliance by Naval Hospital, Portsmouth, in these areas. Figure 1 provides a composite diagram of the entire setting.

Protocol and Procedure

The protocol and procedures employed were those as set forth in Annex Q of NAVHOSPPTSVAINST 3440.1 (Appendix E). This area has been thoroughly discussed previously.

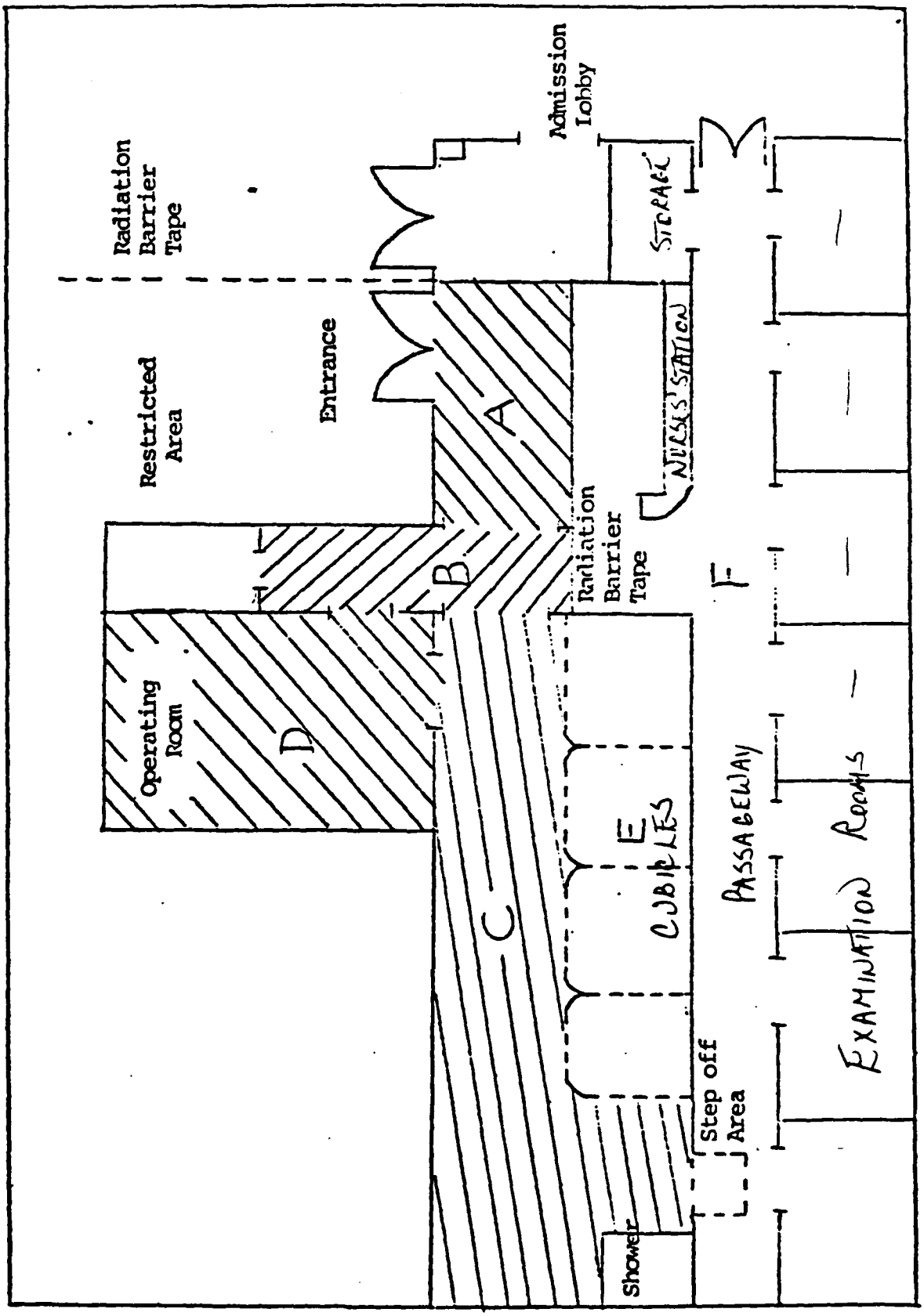
Data-Gathering Format

The evaluation instrument, its formulation, and format as well as the particulars of the drill as a data-gathering base have been re-iterated in the Drill Preliminaries section. Reference is now made to that section in explanation of the data gathering format.

Results of Data-Collection

Upon completion of the drill, the evaluation sheets were collected and the results as assessed by the three evaluators were compiled. The raw data was grouped together into subsection headings with percentages tabulated following the pre-established methodology as outlined in the methodology section. The compiled results may be viewed in Table 1. A worksheet detailing those results is enclosed as Appendix H.

EMERGENCY ROOM DECONTAMINATION AREAS



COMPILED RESULTS OF DRILL

Table 1

Administrative Actions

Actual Number "Yes" Responses	28	Percent of "Yes" Responses	78%
Actual Number "No" Responses	8	Percent of "No" Responses	22%
Subtotal for section	36	Subtotal Percent	100%

Facility Preparation/Decontamination Preparation

Actual Number "Yes" Responses	6	Percent of "Yes" Responses	67%
Actual Number "No" Responses	3	Percent of "No" Responses	33%
Subtotal for section	9	Subtotal Percent	100%

Decontamination of Facility (After Procedures Completed)

Actual Number "Yes" Responses	7	Percent of "Yes" Responses	100%
Actual Number "No" Responses	0	Percent of "No" Responses	0%
Subtotal for section	7	Subtotal Percent	100%

Provider Preparation/Supplies

Actual Number "Yes" Responses	9	Percent of "Yes" Responses	100%
Actual Number "No" Responses	0	Percent of "No" Responses	0%
Subtotal for section	9	Subtotal Percent	100%

Provider Care Provision

Actual Number "Yes" Responses	15	Percent of "Yes" Responses	100%
Actual Number "No" Responses	0	Percent of "No" Responses	0%
Subtotal for section	15	Subtotal Percent	100%

Total "Actual Yes" Responses	65	Percent Total "Yes" Respnses	85%
Total "Actual No" Responses	11	Percent Total "No" Responses	15%
Total Actual Response	76	Percent Total	100%

By actively considering the results and making comparison of the composition of the ratio of yes to no responses within the various subsections listed in Table 1, some critical points are illuminated. It is within the first two categories wherein negative responses indicating failure to perform each respectively iterated function are noted. In the administrative actions 22% of the functions registered as negative. They centered principally in the failure to notify certain designated individuals particularly Security as protocol dictated. In the case of Facility Preparation/Decontamination Preparation, 33% of the assessed elements proved negative. Significantly two-thirds of the failed compliance with protocol in the section pertained to security responsibilities. Security notification was a failed action in the administrative section. This may be viewed as indicative of the interdependence of each section upon the successful outcome of the whole. The other three sections experienced 100% compliance with protocol and procedure.

When the overall 85% compliance with protocol and procedure during the drill is judged against the pre-established criteria for drill success, it may be seen that the standard was not achieved. Strict adherence to study criteria necessitates this statement. However, consideration of the component parts of the drill with respective compliance percentages could lead to interpretation that the primary area requiring corrective action is in that of administration. The providers were prepared and appropriate in both their actions in managing the radiologically injured and in logistic readiness. Too, the facility was adapted to accommodate these patient types as the data indicates.

Prior to this point, the discussion has dealt only with the data results as gathered from the listed points on the evaluation checklist. However, some pertinent subjective comments were generated and recorded by the evaluators. These could have import for improving performances, and the physical capabil-

ities, of the facility. They included: (a) Comment --> "It is good to have actual 'patients' involved in drill rather than a 'walk-through' process; it provides for realism." (b) Comment --> "Is the ER ventilation system a closed one or could air and possible radioactive particles be circulated conceivably throughout entire hospital?" (c) Comment --> "Is the protective gear worn by providers truly protecting those providers?"

The drill, serving as the catalyst, provided the impetus for those responsible for ensuring provider and facility preparedness to explore these points futher.

Summary

In summary the question was to assess the effectiveness of providers and the fixed facility to appropriately manage the radiologically injured patient. The goal was to provide the highest quality health care possible for such a patient. Review of the literature indicated that some interest in the area of study had been generated primarily through the Three Mile Island nuclear accident. Protocol and procedures for the care of the radiologically injured have been prepared. Too, JCAH has defined criteria whereby hospitals must conduct a yearly drill involving a radiation accident in order to attain or maintain accreditation. However, no instance of development of testing of a specific drill evaluation tool as the one used in this study was revealed from the literature search. The methodoloty constraints and assumptions for the conduct of the study were stated. The background and the preparation for the data gathering drill were specifically outlined. The baseline data collected from the drill revealed that provider and facility did meet pre-established standards in most areas with primary exception to this being in effecting appropriate administrative action. This single area's slight non-compliance to

procedure, was sufficient to lower the total percentage for overall compliance to the point that the drill must be strictly interpretecd as unsuccessful. A proviso must be added with respect to the equal weighing of each section of the evaluation instrument. While it was initially felt such equality was a necessity, the drill results prompted a reconsideration within this area.

Finally, conducting this drill generated additional pertinent comment which can be employed to effect improvement to both provider performance and the facility's physical adaptive qualities.

Chapter III

CONCLUSIONS AND RECOMMENDATIONS

It is concluded that the data gathering drill must be considered unsuccessful based on strict interpretation of study criteria as applicable to that drill. The logistics and fixed facility's capabilities must be judged appropriate following this same strict interpretative posture. Examination of the component subsections may be more liberally interpreted, and based upon this, it is concluded that the overall study was successful and that the providers' clinical expertise and performance levels are sufficient to appropriately manage the radiologically injured patient. Likewise, it is concluded that the fixed facility is capable of and does adapt sufficiently to serve as the appropriate setting from which providers may render care to the radiologically injured.

Further, it is concluded that the employment of the evaluation tool (i.e., checklist) could be a useful innovation for measuring proscribed functions within the drill if implemented on a routine basis as a means for evaluating the effectiveness of provider and facility preparedness. However, observation of the total score vice component subsection scores prompts the conclusion that equal weighing of all areas deserves reconsideration and that a refining of the test instrument and scoring might well be in order.

Too, the conclusion is reached that the objectives as outlined for the study were successfully realized.

Finally, this research effort prompted formal and active consideration as to the protocol and procedure implementation required should such a radiation accident event occur. This is concluded to be a most positive outcome with

respect to its implication to both the institutional effort to attain and maintain proficiency in health care delivery and to any efforts for future research in this area.

Recommendations

The following recommendations are made:

1. Conduct a comparable drill during other than working hours as a component of a follow-on comparative study.
2. Refine the checklist evaluation instrument to incorporate variables previously discussed.
3. Institute a training effort to familiarize staff members on protocol and procedure particularly addressing the administrative area.
4. Conduct a comparative study addressing provider function and facility adaptability within the "clinics" setting of this military community.
5. Incorporate the use of an evaluation tool in any future drills.

APPENDIX A

DEFINITIONS

A. Definitions

Radiation Accident - an unforeseen occurrence, either actual or suspected involving exposure of or contamination on or within humans and the environment by ionizing radiation.

Ionizing Radiation - radiation which cannot be felt, seen, or tasted but which produces certain chemical changes in the body since it penetrates the body to varying degrees.

External Radiation - source of radiation is entirely outside of the body.

Internal Radiation - source of radiation is deposited within the body.

Radiation Accident Cases

There are four types of radiation accident patients:

1. Radiation exposure - the individual who has received whole or partial body external radiation may have received a lethal dose of radiation but he is no hazard to attendants, other patients or the environment. He is no different than the radiation therapy or diagnostic x-ray patient.

2. Internal contamination - such contamination results from inhalation or ingestion of radioactve material. Such a person is no hazard to attendants, other patients, or the environment. Following cleaning of minor amounts of contaminated material deposited on the body from airborne exposure, this person should be handled similarly to a case involving exposure to a chemical poison such as lead. His body wastes should be collected and saved in order that measurements of amount of radioactive materials present can be made as an assist in determining appropriate therapy.

3. External contamination - external contamination of body surface and/or clothing by radioactive liquids or by dirt particles presents a type of case with problems similar to vermin infestation. Surgical isolation techniques to protect other patients and the hospital environment must be employed in order to confine and remove any potential hazard.

4. Contaminated wounds - when external contamination is complicated by a wound, care must be taken not to cross-contaminate surrounding surfaces from the wound and vice versa. The wound and surrounding surfaces are cleasned separately and sealed off when clean.

These radiation and/or contamination problems may or may not be complicated by injury.

APPENDIX B

RADIATION ACCIDENT PROTOCOL FOR EMERGENCY DEPARTMENTS

APPENDIX B

RADIATION ACCIDENT PROTOCOL OR EMERGENCY DEPARTMENTS

I. Notification

A. Director of Emergency Department

1. Decides whether to implement radiation accident plan

2. Notifies others (B-E)

3. Takes charge of vicim(s) or designates person to do so

B. Director of Nursing

C. Radiation Safety Officer

D. Security

E. Informational services

II. Obtain On-Site Information

A. Number and condition of victims - uncontaminated

B. Number and condition of victims - uncontaminated

C. Type of radioactive isotopes involved

D. Type of radiation accident

1. Irradiation

2. Contamination

3. Incorporation

III. Emergency Department Preparation

A. Evacuation of Emergency Department

1. All patients or others near route from ambulance entrance to decontamination room to be moved to other areas

a. Patients with noncritical problems to waiting rooms or other suitable areas

b. Patients with critical problems to another section of emergency department with continued medical supervision and care

c. All pregnant or possibly pregnant women to areas free of possible contamination

B. Preparation for arrival of victim(s)

1. Floor

a. Route from ambulance entrance to decontamination room to be covered with roll of plastic or paper or with sheets, the covering secured to floor with tape

b. Above route to be marked off with ropes and marked "radioactive" until cleared by radiation safety officer

2. Decontamination room

a. Room should have separate ventilation system; if not, turn off ventilation system (call hospital engineer)

b. Floor to be covered smoothly with plastic or paper floor covering (or sheets) secured to floor with tape

c. Strip of tape on floor at entrance to decontamination room to delineate contaminated side from noncontaminated side

d. Radiation safety officer to designate person with counter to stay at entrance to monitor all personnel, equipment, and samples leaving decontamination room

e. Nonessential equipment to be removed from or covered with plastic.

f. Light switches and handles on cabinets and doors to be covered with tape

g. Charge nurse to designate person to stand outside to obtain supplies for medical and decontamination teams

h. Place contamination tray on stretcher or make trough on decontamination table as follows:

(1) Roll two sheets lengthwise and place along edge and head of table

(2) Place plastic sheeting over rolled sheets, tucking it under the sides and head

(3) Form ends of plastic sheet at the foot of table into a trough that empties into a large plastic container or wastebasket lined with a heavy plastic bag

(4) Elevate head of table or stretcher so that all water runs into container

i. Provide large plastic or metal containers with plastic bags to receive discarded contaminated clothes, gauze, supplies, etc

C. Decontamination team

1. Physician

a. Takes charge of medical problems of patient

b. Directs decontamination procedure

2. Nurse

a. Assists physician

b. Is responsible for collecting all specimens

(1) Laboratory (blood for complete blood cell count, typing and cross-matching; urine for analysis, etc)

(2) Swabs of contaminated areas (see below)

c. Monitors vital signs and records data

3. Radiation safety officer

a. Monitors patient and decontamination team during care of patient

b. Responsible for analysis of all swabs of contaminated areas of patient

4. Circulating nurse

a. Assists team as needed

b. Labels all specimens

c. Obtains all needed supplies from outside decontamination room from persons stationed at door

d. Records on chart areas and levels of contamination as measured by radiation safety officer

D. Decontamination team preparation

1. Use rest room

2. Attach film badge to clothes - should be labeled with name

3. Don full surgical dress:

a. Surgical trousers and pull-over shirt

b. Surgical hood

c. Waterproof shoe covers

d. Surgical gown

e. Surgical gloves - tape gloves to sleeves and cuffs to shoe covers

f. Second pair of surgical gloves

(1) Do not tape

(2) Change as needed if torn or contaminated

g. Surgical mask

4. Attach outside dosimeter

a. Attach at neck so it will not become contaminated easily

b. Read at intervals during decontamination; report readings to radiation safety officer

IV. Patient Arrival

A. Phyician and radiation safety officer to examine patient in ambulance on arrival

1. Physician determines if patient is critically injured

a. If patient is criticaly injured, he goes directly to decontamination room whether or not his clothes have been removed

b. If patient is not critically injured, his clothes are removed in the ambulance

2. Radiation safety officer determiines if patient is contaminated

a. If patient is contaminated and is not critically ill, he goes to decontamination room after his clothes are removed in ambulance

b. If patient is not contaminated, he goes, still dressed, to regular trauma section of emergency department

B. Stretcher with decontamination tray or improvised trough is brought to the ambulance to receive contaminated patient

1. Patient is transferred to stretcher

2. Patient is covered with plastic or cloth sheet

C. Ambulance attendants stay by the ambulance until they and the ambulance are monitored for contamination

1. If noncontaminated, released for duty

2. If contaminated, follow radiaion safety office's instructions for decontamination

V. Decontamination of Patient

A. Airway, breathing, and cardiovascular status must be attended to first

1. Physical examination done by physician

2. Required laboratory material, electrocardiograms, and radiography obtained as required by patient's condition

3. Procedures, fluid and drug administration done as required to stabilize patient's condition

B. Patient evaluation

1. Remove patient's clothes if not done in ambulance; place in plastic bag and seal

2. Cotton-swab samples of ear canals, nares, and mouth

a. Place each in glass container labeled with patient's name, the site, and the time

b. Stopper glass container and place in lead container for later analysis

3. Radiation safety officer monitors entire patient, including back

4. Circulating nurse notes in record areas and amounts of contamination

5. Cotton swab samples of all contaminated areas are obtained and stored as above

C. Physical decontamination of radioactive areas

1. Contaminated open wounds (these have first priority)

a. Begin decorporation (see_____)

b. Wash with normal saline for three minutes

c. Monitor - repeat step b as needed

d. If contamination persists

(1) Wash with 3% hydrogen peroxide

(2) Consider surgical debridement

(3) Save and monitor all tissue removed

e. After wounds are decontaminated, cover them if other areas need to be decontaminated

2. Contaminated eyes

a. Rinse with water; stream should go in nose-to-temple direction, away from medial aanthus

b. Monitor and repeat step a as needed

3. Contaminated ear canals

a. Rinse gently with small amount of water; suction frequently

b. Monitor and repeat step a as needed

4. Contaminated nares or mouth

a. Turn head to side or down, as patient's condition permits

b. Rinse gently with small amounts of water, suction frequently

c. Prevent water from entering stomach as much as possible

d. Insert nasogastric tube into stomach; suction and monitor contents. If contents are contaminated

(1) Lavage with small amounts of normal saline until contents are clear of contamination

(2) Begin decorporation (See _____)

5. Contaminated intact skin

a. Wash with soap and tepid water, gently scrubbing with soft brush for three minutes

b. Monitor and repeat step a as needed

c. Do not redden or irritate skin with hot water or harsh scrubbing

d. If contamination persists:

(1) Use Lava® soap or

(2) Use mixture of 1/2 Tide® and 1/2 cornmeal

(3) If those fail to remove contamination, use Clorox® either full strength for small areas or diluted for large areas

6. Contaminated hair

a. Shampoo with mild soap for three minutes and rinse

b. Monitor and repeat step a as needed

c. If contamination persists:

(1) clip hair off

(2) Do not shave scalp

VI. Removal of Patient from Decontamination Room

A. Dry patient thoroughly

B. Re-swab all previously contaminated areas

1. Label swabs with site, time, and "post-decontamination"

2. Give swabs to radiation safety officer for future analysis

C. Radiation safety officer monitors patient's entire body

D. New covering is placed on floor from door to patient and, if needed, from door to clean stretcher outside decontamination room

1. Clean stretcher is brought in

2. Patient is transferred to new stretcher by patient attendants not involved in the decontamination procedure

3. Radiation safety officer monitors stretcher and wheels as it leave decontamination room.

VII. Exit of Decontamination Team

A. Each team member goes to clean line at door and removes protective clothing (placing all of it in a plastic container marked "contaminated")

1. Remove outer gloves first, turning them inside-out as they are pulled off

2. Give dosimeter to radiation safety officer

3. Remove all tape at trouser cuffs and sleeves

4. Remove outer surgical gown, turning it inside-out; avoid shaking

5. Remove surgical shirt

6. Remove head cover

7. Pull surgical trousers off over shoe covers

8. Remove shoe cover from one foot and let radiation safety officer monitor shoe; if shoe is clean, step over clean line, then remove other shoe cover and have other shoe monitored

9. Take off inner gloves

B. Have hands and feet monitored for final time

C. Take shower

VIII. Radiation Safety Officer's Responsibilities

A. Monitoring

1. Ambulance and attendants

2. Route from ambulance entrance to decontamination room

3. Decontamination room, patient, and personnel

B. Decontamination of areas if found in A above

C. Analysis of all specimens taken of potentially contaminated areas

D. Proper disposal of any contaminated items or water

E. Examination of all film badges and dosimeters and proper follow-up if indicated

IX. For 24-hour Assistance in Dealing with Radiation Accidents: Call REAC/TS, Oak Ridge National Laboratory, (615) 576-1004.

APPENDIX C

ER SUPPLIES REQUIRED TO PREPARE FOR A CONTAMINATED PATIENT

APPENDIX C

I. For Emergency Department Preparation

A. Rolls of 4-foot-wide plastic sufficient to

1. Cover floor from ambulance entrance to decontamination room (rolls of paper or sheets can be substituted)

2. Cover the floor of the decontamination room (rolls of paper or sheets can be substituted)

3. Prepare several stretchers to contaminated patients

B. Rolls of 2-inch-wide masking tape to

1. Secure floor covering

2. Tape decontamination team's sleeves and cuffs

3. Cover handles in decontamination room

4. Make "clean line" at door to decontamination room

C. Rope to delineate contaminated route from ambulance entrance to decontamination room

D. "Radioactive" signs to place on rope and on door to decontamination room

II. For Decontamination Room

A. Decontamination tray, or

B. Plastic and cotton sheets to make decontamination trough on stretcher

c. Three 5-gallon containers for wash water

D. Three large waste containers

E. Plastic bags to line waste containers

F. Cotton-tipped applicators

G. Stoppered glass containers for swabs of contaminated areas

H. Lead storage containers for stoppered glass containers - obtain from Nuclear Medicine Department

I. Chart with drawing of patient outline (front and back) for recording of contaminated areas

J. Clorox®

K. Lava® soap

L. Soft scrub brushes

1M. Mixture of 1/2 Tide®, 1/2 cornmeal (keep airtight or refrigerate)

N. 3% hydrogen peroxide

III. For Decontamination Team

A. Large and extra-large surgical scrub suits

B. Surgical gowns (waterproof)

C. Surgical hoods

D. Surgical masks

E. Surgical gloves (various sizes)

F. Waterproof shoe covers

G. Film badges

H. Dosimeters

IV. For Radiation Safety Officer

A. Beta-gamma detector

B. Alpha detector

C. Extra batteries for detectors

D. "Radioactive" tape labels to mark containers holding contaminated specimens or swaps

E. "Post-decontamination" tape labels to mark containers holding relevant swabs

APPENDIX D

MEASUREMENT AND EFFECTS OF RADIATION

MEASUREMENT AND EFFECTS OF RADIATION

Radiation exposure is quantified in terms of the **roetgen (R)**. The **rad** is a generic measure of absorbed dose that varies according to the radiation source and the nature of the tissue irradiated. The **rem** is a special unit of absorbed dose used to indicate a rad-equivalent effect in humans. For most beta, gamma, and x-rays of low energy, the rem is used as if it were equivalent to the rad. For alpha and neutron radiation, the rem is a multiple of the rad. New units are now supplanting the rad and rem: 1 gray (gy) = 100 rads; 1 sievert (Sv) = 100 rems.

The intensity of emitted radiation can be measured by several types of instruments. Geiger-Mueller (G-M counters are generally used for surveying low-level radiation and are calibrated either in counts per minute (CPM) or milloroentgens per hours (mR/hr). Ionization changer-type meters are most useful in higher radiation areas. Laboratories use liquid or crystal scintillation isotope counters; these can both detect radiation and identify the particular radioactive element.

The familiar film or thermoluminescent dosimeter (TLD) badge worn by radiology department personnel registers cumulative exposure dose in mR. Pen dosimeter allow an immediate readout of cumulative exposure, and ring badges reflect hand exposures.

Biological effects. The biological consequences of radiation depend somewhat on the type of radiation involved. Large alpha particles, positive charged and composed of two protons and two neutrons, deposit energy very rapidly, causing serious cellular damage in their immediate vicinity. They are, however, readily absorbed by the outer dead layer of skin or normal clothing. Removing clothing and washing the skin eliminates this type of radiation. Alpha particles are biologically harmful only if ingested, inhaled, or inserted beneath the skin.

Beta particles (electrons) are able to penetrate up to several mm into tissue; they are smaller, have only a single charge, and usually are lower energy than alpha particles. They, too, are most injurious if deposited internally.

Gamma rays or photons, like x-rays, are far more penetrating. A large portion of gamma rays go right through the body with no interaction whatsoever. Those that do interact with cellular molecules are responsible for most of the hazardous effects of radiation known today. Their penetrating ability allows them to reach all parts of the body, including the bone marrow, gonads, and gastrointestinal epithelium - all of which are high radiosensitive.

Cellular damage from radiation is most commonly caused by water radicals (H*, OH*, and e^-_{aq}) that form when water molecules in cells are dissociated by radiation. These radicals can chemically oxidize and destroy parts of the DNA molecule, disrupting normal functioning of the cell.

APPENDIX E

NAVAL HOSPITAL PORTSMOUTH PLAN FOR HOSPITAL RECEPTION OF RADIOLOGICAL CASUALTIES

ANNEX Q

PLAN FOR HOSPITAL RECEPTION OF RADIOLOGICAL CASUALTIES

Appendixes: (a) Radiological Accident Check List; Working Hours
(b) Radiological Accident Check List; After Working Hours
(c) Medical Decontamination and Treatment Teams; Orgranization and Activation
(d) Emergency Room Entrance and Exit Routes: Contamination Control Measures
(e) Guide for Decontamination of Radiologically Contaminated Persons
(f) Procedures for the Disposal of Contaminated Materials
(g) List of Required Supplies to be Maintained in Radiological Casualty Decontamination Equipment Box
(h) Signal for Activation

1. Information. Humans may be involved in a radiological accident in two ways. The source of the radiation may be outside the body so that the radation strikes the body and is absorbed. Radiation from X-Ray generators, particle accelerators, sealed sources of radionuclides and reactors are examples of this type. The radiation may be alpha, beta, gamma or neutron. Second way in which humans can be involved is by contamination with radionuclides. These radionuclides can be deposited on the skin, inhaled, ingested or enter through wounds. The role of any hospital in the treatment of persons involved in a radiological accident is to provide the best possible medical care and treatment to these persons while at the same time limiting the spread of contamination to as small an area and to as few medical personnel as possible.

2. Background. Reference (n) is an agreement between Norfolk Naval Shipyard (NNSY), and Naval Hospital, Portsmouth for the handling or radiological personnel casualties occurring at the NNSY. This agreement does not preclude the reception of radiological casualties from any other area within the region, and the Naval Hospital will activate this plan whenever necessary. The Naval Hospital may expect to receive victims of radiological casualties who fall into one of the following categories:

a. The individual is free of contamination, but has received whole body exposure of 50 rem or more at the time, and/or is in need of definite patient care for life/limb threatening injury/illness.

b. The individual is contaminated, skin intact, but life/limb threatening injury/illness exists, (i.e. internal injuries).

c. The individual is internally contaminated with radioactive material.

d. The individual has a contaminated wound.

Medical care and treatment of these personnel should not be withheld from the patient due to being contaminated with radioactive nuclides or that the possibility of the spread of radioactive contamination exists. Because of the unusual nature of a radiological accident, apprehension and frequently unreasonable fear may be an accompanying complication of an accidental exposure. Consequently, every effort should be made to reassure and allay the patient's fears.

3. Action. When the OOD is notified that a radiological casualty is being or will be transported to the Naval Hospital for treatment, the OOD shall immediately implement the Notification Check List as listed in appendices (a) and (b). Notification should be made by utilizing the Signal for Activation in appendix (h) of this Instruction. Copies of these check lists shall be maintained in the OOD's office. The necessary information on the check list should be obtained and passed on to members on the list. The Radiation Safety Officer as head of the Medical Decontamination Team and the Chief of Radiology as head of the Medical Treatment Team shall implement recall for their respective teams as they deem necessary. Upon notification, the Security Service will institute traffic control insuring that vehicles are removed from the area in front of emergency entrance and that this area is kept clear. Security will ensure that non-authorized personnel do not enter the restricted area.

a. An individual who is free of contamination, but received whole body exposure of 50 rem or more and/or is in need of definite patient care for life/limb threatening injury/illness will be received and evaluated in the Lobby of the Admission Office. (If there are no accompanying contaminated casualties, this individual may be seen and evaluated in the Emergency Room). If there are contaminated casualties, the Lobby of the Admission Office will be sealed off to normal traffic and specific areas of the Emergeny Room will be set aside for contaminated patients. (Refer to enclosure (4). If radiation exposure is the only problem, the patient will be admitted and treated as outlined in references (i), (o), and (p).

b. An individual who is contaminated, skin intact, but with a life/limb threatening injury/ilness will be received in the Emergency Room. (A person who is the victim of a heart attack or a stroke during a radiological emergency may fall into this classification.) Upon being notified that a person with these illnesses is to be received by the Naval Hospital, the OOD will direct that all unnecessary equipment and personnel be removed from the areas of the Emergency Room specified in Appendix (d), 4 annex Q and that the Radiological Contamination Control Equipment located in the Supply Storeroom (Room 1-189) of Building 215 be taken to the Emergency Room. The Senior Hospital Corpsman assigned to the Emergency Room will ensure all fixed equipment, decks,

examining tables, and operating tables in the Emergency Room are covered as indicated in appendix (d). The entrance and exit of personnel into and out of the Emergency Room will be as described in appendix (d). All personnel who enter a "controlled surface contamination" area or are involved in the treatment and handling of the casualty shall wear protective clothing. The protective clothing shall either meet with the requirements of the major surgery, i.e., rubber gloves, gown, plastic apron, cap, mask, shoe covers, and greens,.or shall be anti-contamination clothing. Decontamination of the patient will be accomplished in accordance with reference (i). All contaminated clothing, dressings, washings, etc., will be disposed of in the manner described in appendix (f). Appendix (e) is a ready reference guide for the radiological decontamination procedures outlined in reference (i). All personnel who exit "controlled surface contamination" areas shall be monitored with an RM-3 with a DT-304 probe, or other instrument of equivalent sensitivity.

c. An individual who is internally contaminated with radioactive material will be received and evaluated in the Emergency Room. After admission to the Naval Hospital, the patient will be transferred to Building 123 via stretcher and ambulance for a whole body scan to determine the internal distribution of the radionuclides. The Chief, Nuclear Medicine Service, assisted by the Radiation Safety Officer and the Chief of Radiology will conduct the whole body scan and determine the internal distribution of the radionuclide. Procedures indicated to reduce the radionuclide body burden of the patient will be instituted immediately following the evaluation of the whole body scan. Guidelines for these procedures are given in references (i), (o), and (p). The precautions and guidelines given in references (i) and (q) must be strictly observed during the treatment of these individuals.

d. An individual with a contaminated wound will be received and treated in the Emergency Room. Prior to the arrival of the patient, the Emergency Room and those persons required to treat the patient will be outfitted as described in paragraph 4, b. Decontamination of all wounds will be carried out with cleansing, debridement, etc., as indicated. Referenced (i), (o), (p), and appendix (e) may be used for guidance in the decontamination of wounds. Radical or function-impairing surgical procedures to remove contamination should not be undertaken without prior consultation with a Radiation Medical Specialist (see paragraph 5) and COMNAVMEDCOM (Code 53). Following decontamination procedures, the patient will be taken to Building 123 for scanning of the wound area. If emergency major surgical procedures are required the patient will be operated upon in the Operating Room in the Emergency Room shown as area "D" in appendix (d). If there are numbers of casualties requiring surgery, the Chief of Surgery will designate rooms in the MOR and patients will be moved by cover stretcher to the third floor. The designated opera ting rooms will be prepared in the same manner as described in prargraph 4, b.

4. Radiation Medical Specialist. As indicated in reference (i), additional help and advice should be obtained from the following sources:

a. NAVMEDCOM, Code 212 by telephone: Area Code 202, 3-1210; or FTS: 900, 254-4194/4197/4224. After working hours: Area Code 202, 254-4224; or FTS 900, 254-4224.

b. The radiation medical specialist for this area, Dr. E. R. King, Captain, Medical Corps, United States Navy, Retired, at the Medical College of Virginia, Commonwealth Clinic, Richmond, Virginia. Telephone Area Code 804, 770-5138/5701; home phone: area code 804, 794-6462.

5. Release of Information. As directed by reference (j) no local authority shall make any statement or release any information regarding the evaluation of radiation or radioactive contamination related injuries, actual or alleged, without first consulting the Radiation Effects Advisory Board listed in reference (j).

6. Training. A training program for all Naval Hospital personnel on the procedures for handling radiological casualties shall be established. This training shall include as a minimum radiation and contamination control, and personnel decontamination procedures. The Radiation Safety Officer shall be responsible for training Naval Hospital personnel as follows:

a. Medical Officers - on a semi-annual basis.

b. All Hospital Corpsmen attached to the Naval Hospital - once a year.

c. Nurse Corps Officers - on a semi-annual basis.

d. Nuclear Medicine and X-Ray Technicians - on a quarterly basis.

e. Emergency Room Staff - on a quarterly basis.

7. Reports. Reports of radiological accidents shall be made in accordance with Chapter 5 or reference (k).

APPENDIX A
RADIOLOGICAL ACCIDENT CHECK LIST - WORKING HOURS

1. The following information is to be filled in by the Chief of the Day when word is received of a pending radiological accident or drill:

a. Radiological Accident _____ Radiological Drill _____

(1) Date _____ Time Call Received: _____
Call Received by: _____

(2) Location of casualties: _____

(3) Number of casualties: _____

(4) Extent of injuries, if known: _____

(5) Name of caller giving the information: _____

b. Notification

(1) Radiation Health Officer, ext. 5175
(2) Emergency Room, ext. 5064
(3) Security, ext. 5222
(4) Radiology Service, ext. 5471, Pager 675
(5) Nuclear Medicine Service, ext. 5162
(6) Industrial Hygiene Branch 444-7377
(7) Commanding Officer, ext. 5111
(8) Executive Officer, ext. 5106
(9) Director of Administrative Service, ext. 5113
(10) Ambulatory Care Services 5302
(11) OOD, on pager no. 191
(12) Public Affairs Officer, ext. 6986

c. Casualty Information: Time: _____ Caller: _____

	Type of Injury	Isotope Involved
Casualty #1		
Casualty #2		

2. All requests for information concerning injuries, incidents, or events received from the general public or news media will be referred to the Public Affairs Officer.

APPENDIX B
RADIOLOGICAL ACCIDENT CHECK LIST - AFTER WORKING HOURS

1. The following information is to filled in by the Chief of the Day when word is received of a pending radiological accident or drill:

a. Radiological accident: _____ Radiological drill: _____

(1) Date: _____ Time call received: _____
Call received by: _____

(2) Location of casualties: _____

(3) Number of casualties: _____

(4) Extent of injuries, if known: _____

(5) Name of caller giving information: _____

*b. Notification

(1) SMO- _____
(2) OOD pager 191 _____
OOD shall notify: (a) Security, ext. 5222
(b) Director of Administrative Services
(c) Executive Officer
(d) Commanding Officer
(e) Ambulatory Care Services
(f) Public Affairs Officer
(3) Radiation Health Officer, ext. 5175 _____
(4) Emergency Room, ext. 5064 _____
(5) Radiology Service, ext. 5411, Pager 675 _____
(6) Nuclear Medicine Service, ext. 5162 _____
(7) Duty Nuclear Medicine Technician, ext. 5167 _____
(8) Duty Radiology Department Technician, ext. 5482 _____
(9) Industrial Hygiene Branch, pager 351 _____

*Consult Recall Lists for home phone numbers.

c. Casualty Information

Time: _____ Caller: _____

	Type of Injury	Isotope Involved
Casualty #1		
Casualty #2		

2. All requests for information concerning injuries, incidents, or events received from the general public or new media will be referred to the Public Affairs Officer.

APPENDIX C
MEDICAL DECONTAMINATION AND MEDICAL TREATMENT TEAMS: ORGANIZATION AND ACTIVATION

1. Personnel assigned to the medical decontamination and medical treatment teams will be notified by letter from the Commanding Officer of their assignment to these teams and these duties will be performed as collateral duties.

2. The medical decontamination team shall be composed of the following personnel:

a. Radiation Safety Officer
b. Radiation Health Specialist/Physicist
c. Five (5) X-ray Technicians (HM-8452)
d. Five (5) Nuclear Medicine Technicians (HM-8416)

3. The medical treatment team shall be composed of the following personnel:

a. Chief, Radiology Service
b. Chief, Surgery Service, or his designated representative
c. Chief of Internal Medicine, or his designated representative
d. Chief, Nuclear Medicine Service
e. General Surgeons (as many as needed, to be assigned by the Chief, Surgery Service)
f. Anesthesiologists (as many as needed, to be assigned by the Chief, Anesthesiology Service)
g. Operating Room Technicians (as many as needed, to be assigned by the Chief, Surgery Service)
h. X-ray Technicians (as many as needed, to be assigned by the Chief, Radiology Service)
i. Emergency Room Personnel
   (1) Two (2) Hospital Corpsmen
   (2) One (1) Medical Officer
   (3) One (1) Nurse Corps Officer

4. The Chief of Radiology will be assigned as the senior member of the medical treatment team. The junior member of the medical treatment team shall be designated as the recorder for the medical treatment team. The Radiation Safety Officer shall be designated as the senior member of the medical decontamination team. The senior member of the medical treatment team is responsible for the coordination of the medical treatment and medical decontamination teams. The Radiation Safety Officer and Head, Industrial Hygiene Branch will be advisors to the medical treatment team.

5. The Chief of Radiology, Chief of Surgery, Chief of Medicine and the

Chief of Nuclear Medicine are responsible for maintaining current recall lists for personnel in their services.

6. In the event of a radiological casualty the senior member of the medical decontamination team and the senior member of the medical treatment team shall decide which members of their teams shall be activated.

APPENDIX D
EMERGENCY ROOM ENTRANCE AND EXIT ROUTES: CONTAMINATION CONTROL MEASURES

Upon being notified that a patient who is contaminated with radioactive materials is to be received by the Emergency Room, the Emergency Room personnel assisted by the Medical Decontamination Team, appendix (c), will ensure that the following steps are taken prior to the arrival of the patient (refer to Diagram of Emergency Room Area on the last page of this appendix.)

1. Evacuate the Emergency Room of all personnel and material not required for patient treatment.

2. Obtain the Radiological Casualty Contamination Control Equipment stored in the Supply Storeroom, RM #2 - 189 of Building 215 and have the box transported to the Emergency Room and placed in the Admission Lobby or in Area F.

3. Cover the floor in Areas A, B, C, D, and E with kraft paper or yellow herculite.

4. Cover the floor under the edges of the operating table in Area D with blotting paper or other absorbent material.

5. Set up "restricted area" signs at all entrances to the Emergency Room and "controlled surface contamination" area signs at all entrances to the "hot" side of the Emergency Room (Area A, B, C, D and E). For a patient in "category a" (paragraph 3,a), no precautions are necessary if contaminated casualties have not been received. If contaminated casualties are being treated in the Emergency Room, then "category a" patients should be evaluated in the Admission Lobby. All other category patients shall be treated in the Emergency Room. For one or two contaminated casualties use Areas A, B, C and D. Only if multiple contaminated casualties are received should Area E be used for the treatment of contaminated personnel.

6. Move into the reception and treatment areas any material to be used and remove unneeded material.

7. Cover unneeded fixed equipment and all other floor areas with plastic sheeting.

8. Personnel who will be examining or caring for the patients shall don protective clothing (e.g. surgical garb or Anti-C's). These personnel include:
   a. Medical treatment team - greens.
   b. Medical decontamination team - Anti-C's

9. All personnel entering or working the Emergency Room must wear film badges or pocket dosimeters under their protective clothing.

10. All personnel stationed at the exit areas to monitor personnel leaving the "controlled surface area contamination" area shall wear shoe covers, rubber gloves, and a laboratory coat.

11. All materials and equipment removed from the Emergency Room will be monitored by the Radiation Safety Officer, the Medical Decontamination Team or other designated individuals using the RM-3 with a DT-304/PD probe or other instrument of equivalent sensitivity. Any material found to be contaminated in excess of 450 uuCi beta-gamma or 50uuCi alpha measured with an AN/PDR-56 (if alpha contamination is suspected) or which contains inaccessible surfaces which cannot be frisked or swiped will be placed in yellow plastic bags, the bag sealed, and identified as radioactive material.

12. All personnel will be monitored upon exiting the Emergency Room with the RM-3 with the DT-304 probe or other instrument of equivalent sensitivity. Any individual found to be contaminated in excess of 450 uuCi beta-gamma will be decontaminated in accordance with appendix (e). A record of the contamination incident will be prepared in accordance with Chapter 5 of reference (k).

EMERGENCY ROOM DECONTAMINATION AREAS

APPENDIX E
GUIDE FOR THE DECONTAMINATION OF RADIOLOGICALLY CONTAMINATED PERSONS

AREA	DECON AGENT	TECHNIQUE	ACTION	ADVANTAGES	DISADVANTAGES
SKIN (Intact)	*Tape	Monitor. Apply self-adhering adhesive tape to lift removable contamination from skin. Monitor.	Physical removal.		
	*Water	Monitor. Flush thoroughly with fresh water. Monitor.	Physical removal by flushing	If used immediately, should remove contamination.	
	*Soap (Phisohex and Water	Monitor. Wash 5 minutes and monitor. *Do not* wash more than 3-4 times. Monitor after each wash.	Emulsifies and dissolves contaminant.	Readily available and effective for most radioactive contamination.	Continued washing will defat the skin. Indiscriminate washing of other than affected parts may spread contamination.
	*Tide or Other Household Detergent (Plain)	Monitor. Make into paste. Use with additional water. Massage skin for 5 minutes. Use care not to erode the skin. Monitor.	Emulsifies, dissolves, and erodes.	Slightly more effective than washing with soap.	Will defat and adrade skin. Must be used with care.
	*Mixture of 50% Tide and 50% Corn Meal	Monitor. Make into paste. Use with additional water Massage skin for 5 minutes. Use case not to erode the skin. Monitor.	Same as above.	Same as above.	Same as above.

*Procedure to be performed under supervision of Medical Officer.

GUIDE FOR THE DECONTAMINATION OF RADIOLOGICALLY CONTAMINATED PERSONS

AREA	DECON AGENT	TECHNIQUE	ACTION	ADVANTAGES	DISADVANTAGES
SKIN (Intact)	DO NOT USE THE CHEMICAL PROCEDURES BELOW NEAR FACE OR OTHER BODY OPENINGS				
	**Titanium Oxide Paste	Monitor. Make into a paste with small amount of lanolin massage for 2 minutes, then wash with soap and water. Monitor. Make into a paste with small amount of water. Massage skin for 5 minutes. Wash with soap and water. Monitor	Same as above.	Removes contamination lodged under scaly surface of skin. Good for heavy surface contamination	If left on too long, will remove skin.
	**1% Solution of Citric Acid or 1% Edta in Detergent	Monitor. Make into paste, add water as necessary. Massage skin for 2 minutes. Flush thoroughly. Monitor.			
	**Mix equal volumes of a saturated solution of potassium permanganate and 0.2N sulfuric acid (saturated solution of $KMnO_4$ is 6.4 gm per 100 ml of H_2O).	Monitor Pour over previously wet surface. Rub surface using 4" x 4" gauze pads for nto more than 2 minutes. Rinse with H_2O.	Dissolves contaminates absorbed in epidermis.	Superior for skin contamination	Will remove layer of skin if in contact with the skin for more than 2 minutes.
	Apply freshly prepared 5% solution of sodium acid	Apply in same manner as above. Apply for not more than 2 minutes.	Removes the permanganate stain.		

*Procedure to be performed under supervision of Medical Officer.

GUIDE FOR THE DECONTAMINATION OF RADIOLOGICALLY CONTAMINATED PERSONS

AREA	DECON AGENT	TECHNIQUE	ACTION	ADVANTAGES	DISADVANTAGES
SKIN (Intact)	Sulfite (dissolve 5 gms of $NaHSO_3$ crystals in 100 ml of H_2O).	CAUTION: These solutions must not remain on skin longer than 2 minutes. The above procedure may be repeated. Apply lanolin or hand cream when completed. Monitor.			
	**Sweating	Monitor. Cover area to be deconned with plastic. Tape down Rubber gloves can be used for hands. Place near source of heat for 10-15 minutes until area is sweating profusely. Remove covering and wash with soap and water using standard techniques. Area can be covered for several hours using only body heat. Monitor.	Physical removal by sweating.	Cleansing action is from inside out Area does not dry out.	If covering is not removed shortly after profuse sweating starts and area washed with soap and water immediately, contamination may seep into pores. If too large an area is covered, heat prostration can be induced.
HAIR	**Soap and Water	Monitor. Wash several times. If contamination is not reduced to acceptable levels, clip close, but DO NOT SHAVE and repeat washing. Monitor.	Emulsifies and dissolves contamination Physical removal.	Readily available and effective for most radioactive contamination.	Continued washing will defat the skin. Indiscriminate washing of other than affected parts may spread contamination.

**Procedure to be performed by a Medical Officer or under direct supervision of a Medical Officer present.

GUIDE FOR THE DECONTAMINATION OF RADIOLOGICALLY CONTAMINATED PERSONS

AREA	DECON AGENT	TECHNIQUE	ACTION	ADVANTAGES	DISADVANTAGES
EYES ***	Normal saline or Sterile Water	Monitor Irrigate using low pressure and directing stream laterally across the eye. Encourage individual to blink eye during irrigation. Monitor after each decon attempt. Consult ophthalmologist if efforts fail. Magnetic probe may be used since nuclides normally encountered are magnetic.	Physical removal by flushing	If used immediatley, should remove contamination	
EAR *** (Tympanic Membrane Intact)	Normal saline, Sterile water or Phisohex and HH2O	Monitor. Irrigate with copious amounts of normal saline carrying out irrigation in a sitting position with the involved eat inclined downward. Remove any foreign bodies. Swab canal with moist applicator. Monitor. If contamination levels are not satisfactory, repeat the above procedure which should take approximately 2-4 minutes for each effort. Magnetic probe may be used since nuclides normally encountered are magnetic. Monitor.	Physical removal by swabbing.	If used immediately, should remove contamination.	

***Procedure to be performed only by a medical officer.

GUIDE FOR THE DECONTAMINATION OF RADIOLOGICALLY CONTAMINATED PERSONS

AREA	DECON AGENT	TECHNIQUE	ACTION	ADVANTAGES	DISADVANTAGES
EAR *** (Perforated Tympanic Membrane)	Normal Saline, Sterile Water Phisohex and	Swab the external canal gently and repeatedly with moist applicator with the involved area in a dependent altitude to prevent material from running deeper into the ear canal. Monitor. Repeat procedure until an acceptable radiation level is attained. If swab moistened in saline or water is not effective, swab moistened in Phisohex may be used. Monitor. Consult Otolaryngologist if efforts fail. Magnetic probe may be used since nuclides normally encountered are magnetic.	Physical removal by swabbing.	If used immediatley, should remove contamination	
NOSE (MOUTH)	***Normal Saline or Sterile H_2O	Monitor Have patient blow the nose several time, keeping mouth open slightly, prior to any nasal irrigation or cleansing with swabs. Clip hair. Irrigate with copious amounts of normal saline or water through catheter with head bent over basin and mouth open. Instruct patient to refrain from swallowing and encourage the patient to expectorate or discharge all secretions from the nose	Physical removal by flushing	If used immediately, will remove contamination - not traumatic to skin or mucous membranes.	Patient could swallow contaminated fluids.

***Procedure to be performed only by a Medical Officer.

GUIDE FOR THE DECONTAMINATION OF RADIOLOGICALLY CONTAMINATED PERSONS

AREA	DECON AGENT	TECHNIQUE	ACTION	ADVANTAGES	DISADVANTAGES
NOSE ***		and throat. Distal nasal orifice can be cleansed with swab moistened in saline or water. Have patient rinse mouth throughly with tap water. Spray nasal passage with vasoconstrictor. Irrigate again with saline. Give expectorant. Give antacid to neutralize acid in stomach if inhaled or swallowed particles are known to be acid solube. No further action (such as nebulization or pulmonary lavage) should be attempted without hospitalization and approved medical or surgical specialist and consultation with BUMED (Code 74)			
WOUNDS***	Salipe or Sterile Water	Monitor. Cover wound with self-adhering disposable surgical drapes. Cleanse neighboring skin as per previous instructions on intact skin, avoiding contaminated wound. Seal off cleaned areas and irrigate wound with sterile water.	Physical removal by flushing.	Quick and efficient if wound not severe.	May spread contamination to other areas of the body if not done carefully.

***Procedure to be performed only by a Medical Officer.

GUIDE FOR THE DECONTAMINATION OF RADIOLOGICALLY CONTAMINATED PERSONS

AREA	DECON AGENT	TECHNIQUE	ACTION	ADVANTAGES	DISADVANTAGES
WOUNDS	***		Monitor wound and washings. Continue washing until level of contamination is constant. Grossly radioactively contaminated wound with crushed tissue and dirt particles, perform as described above, then simple wet debridement. Scrub wound area with Phisohex and water using 4" X 4" gauze. Scrub gently for 3 minutes for abrasions and lacerations. Remove foreign bodies. A magnetic probe may be useful. If dose at the wound is excessive, perform minimal debridement of hot areas. If, and when, the contamination becomes below maximum permissible limits and skin is likewise below maximum permissible contamination limits, treat as any non-contaminated wound. Caution: Under no circumstances should radical or functional impairing surgical procedures be undertaken because of radioactive contamination without hospitalization and consultation with a radiation medical specialist and BUMED, Code 74.		

60

***Procedure to be performed only by a Medical Officer.

APPENDIX F

PROCEDURES FOR THE DISPOSAL OF CONTAMINATED MATERIALS

After the contaminated patient has been received in the Emergency Room the following steps should be taken for the disposal of contaminated materials:

1. The blotting paper in the passageway should be rolled up and placed in yellow plastic bags for disposal as radioactive waste.

2. Additional blotting paper should be placed in the areas that the contaminated blotting paper was taken up.

3. blotting paper should be placed outside of the controlled surface contamination areas to serve as a step-off area prior to leaving the "hot" side of the Emergency Room.

4. All persons involved in the emergency will be notified with an RM-3 with a DT-304/PD probe prior to leaving the "hot" side of the Emergency Room.

5. All contaminated clothing and materials removed from the patient(s) or those persons attending the patient(s) shall be placed in a yellow plastic bag and marked as radioactive material for disposal as radioactive waste or decontamination.

6. All contaminated water or other fluids shall be deposited in 5 gallon polyethylene bottles. All other contaminated materials not previously mentioned will be placed in yellow polyethylene bags, tagged as radioactive material, monitored and disposed properly.

7. All fixed equipment and room areas will be monitored with a RM-3 with a DT-304 probe or other instrument of equivalent sensitivity. Any surfaces that do not lend themselves to frisking will be swiped and the swipe will be monitored with a RM-3 with a DT-304 probe or other instrument of equivalent sensitivity. All areas and equipment will be decontaminated to less than 450 uuCi of loose surface contamination.

8. In the event that casualties are from NNSY, area decontamination and disposal of all radioactive waste will be handled by NNSY personnel.

APPENDIX G

LIST OF REQUIRED SUPPLIES TO BE MAINTAINED IN THE RADIOLOGICAL CASUALTY CONTAMINATED CONTROL EQUIPMENT BOX

ITEM	QUANITY
1. Protective clothing (shoe covers, gown, cap, mask, rubber gloves, plastic apron, greens).	10 sets
2. Sets of yellow anti-contamination clothing	10 sets
3. Film badges	10
4. Dosimeters	10
5. Yellow polyethylene	1 roll
6. Kraft paper	1 roll
7. Diaper paper (blotting paper)	1 roll
8. Radiation Barrier rope/tape	150 feet
9. Controlled Contaminated Surface area sign	4
10. Restricted Area-Keep Out signs	6
11. Large yellow plastic bags	24
12. Radiation tape	3 rolls
13. Masking tape	3 rolls
14. Extra surgical gloves (size 6½, 7, 8)	1 box each
15. Laboratory coats	7
16. 5-gallon yellow polyethylene bottles	2
17. Decontamination agents	
a. Phisohex or Betadine	1 gallon
b. Tide detergent	1 small box
c. Cornmeal/tide mixture (50/50)	1 small box
The following decon supplies, because of their nature (liquids) will be maintained in the radiation physics office:	
a. Titanium dioxide	1 bottle
b. 17% solution of citric acid or 17% EDTA in detergent	1 quart
c. 1:1 saturated solution of KMnOH4 and 0.2 N H_2SO_4 sat'd sol'n of $KMnO_4$ is 6.4 gm/100 ml H_2O)	
1. 0.2 N H_2SO_4	1 pint (473 ml)
2. $KMnO_4$ crystals (in 6.4 gm packs)	4 packs
d. Sodium Acid Sulfite ($NaHSO_3$) in 5 gm packs	5 packs
e. Normal saline solution	1 quart

The supplies in the Radiological Casualty Contamination Control Equipment Box should be checked for completeness after each drill or on a quarterly basis.

APPENDIX H

SIGNAL FOR ACTIVATION

1. When the Officer of the Day receives notification that Radiological Casualties are expected to arrive at the Naval Hospital, the OOD shall activate the Plan for Naval Hospital Reception of Radiological Casualties by notifying designated individuals (see appendixes (a) and (b)) utilizing the following signal:

FOR A DRILL: This is (Name, Title). This as a drill. The Plan for Naval Hospital Reception of Radiological Casualties has been activated. Repeat, this is a drill.

NOT A DRILL: This is (Name, Title). This is not a drill. The Plan for Naval Hospital Reception of Radiological Casualties has been activated. Repeat, this is not a drill.

APPENDIX F

PROTOCOL EVALUATION CHECKLIST

APPENDIX F

Protocol Evaluation Checklist

ADMINISTRATIVE ACTIONS	YES	NO
1. Radiological Check-list-working hours readily available.		
2. Checklist completed in toto.		
a. Radiological accident vs drill		
(1) date; time call received; call received by		
(2) location of casualties		
(3) number of casualties		
(4) extent of injuries, if known		
(5) name of caller giving information		
b. Notification process implemented		
(1) Radiation Health Officer		
(2) Emergency Room		
(3) Security		
(4) Radiology Department		
(5) Nuclear Medicine Division		
(6) Industrial Hygiene Branch		
(7) Commanding Officer		
(8) Executive Officer		
(9) Director, Administration		
(10) Ambulatory Care Services		
(11) Officer of the Day		
(12) Public Affairs Officer		

c. Casualty information: time; caller			
(1) Casulaty #1 type injury; isotope inv.			
(2) Casualty #2 type injury; isotope inv.			
(3) Casualty #3 type injury; isotope inv.			
3. Requests for information from public or news media appropriately referred to Director, Administration.			
4. Drill activation and announcement appropriately implemented.			
5. Administrative personnel familiar with administrative protocol/procedures.			
6. OOD (Administrative support) cognizant of team composition; protocol; procedure and/or source of obtaining same.			
7. Security activated appropriate procedures.			
PRE-PLANNING			
1. Facility receiving area lends itself to segmentation/ segregation as protocol requires.			
2. Auxillary equipment, supplies easily accessible.			
3. Radiological Casualty Contamination Control Equipment Box checked for completeness on a quarterly basis.			

FACILITY PREPARATION/DECONTAMINATION PREPARATION	YES	NO
1. All nonessential personnel and material evacuated from ER.		
2. Rad. Casualty Contamination Contingency Equipment Box obtained and placed at ER.		
3. Designated floor areas in ER covered with Kraft paper or yellow herculite.		
4. Floor under edges of the operating table in designated area covered with blotting paper or other absorbent material.		
5. Restricted area signs set up at all ER entrances.		
6. Controlled surface contamination signs set up at all entrances to "hot" side of ER.		
7. Unneeded materials removed from reception and treatment areas.		
8. Needed material (i.e., Radiation Casualty Contamination Contingency Equipment Box) moved into reception and treatment areas.		
9. Unneeded fixed equipment and all other floor areas covered with plastic sheeting.		
DECONTAMINATION OF FACILITY (AFTER PROCEDURES COMPLETED)		
1. All blotting paper in passageways rolled up and appropriately disposed.		
2. Additional blotting paper placed in areas that the blotting paper taken up.		
3. Blotting paper placed outside controlled surface contamination areas of the "hot" side of ER.		
4. All contaminated material within patient treatment area appropriately handled and disposed.		
5. All contaminated water or fluids appropriately handled and disposed.		
6. All fixed equipment and room areas monitored and appropriately decontaminated.		
7. Ambulance and attendants monitored and appropriately handled.		

PROVIDER PREPARATION/SUPPLIES	YES	NO
Preparation		
1. Personnel involved with patient care/handling donned appropriate protective clothing.		
2. Each such individual placed a dosimeter on person under protective clothing.		
3. Personnel at exit areas (to monitor personnel leaving contaminated surface area contaminated area) wore shoe covers, rubber gloves, lab coat.		
4. All personnel observed appropriate procedure for removal of contaminated protective clothing.		
5. All personnel monitored upon exiting hotline the ER and treated appropriately.		
6. Providers cognizant of procedural protocol.		
Supplies		
1. All materials and equipment removed from ER monitored and appropriately handled during and after procedure (this includes all specimens, X-rays, EKGs taken during procedure.)		
2. Supplies required for effecting protocol available and present in Radiological Casualty Contaminated Control Equipment Box.		
3. Providers cognizant of special supplies/equipment.		
PROVIDER CARE PROVISION		
1. Appropriately designated members of health care provision team reported to ER.		
2. Providers cognizant of medical protocol as outlined in NRMCINST 3440.5.		
3. Providers proceeded with provision of medical care		
a. Immediate stabilization of patient		
(1) Examined by physician		
(2) Require tests done as required by patient's condition.		

	YES	NO
b. Patient evaluated		
(1) Patient's clothes removed and placed in plastic bag and sealed.		
(2) Cotton swab samples of ear canals, nares and mouth obtained; appropriately labeled and handled.		
(3) Radiation safety officer monitored entire patient.		
(4) Areas of and amount of contamination noted in record.		
c. Physical decontamination of radioactive areas begun following appropriate medical protocol as outlined in NRMCINST 3440.5.		
(1) Contaminated open wounds.		
(2) Contaminated eyes.		
(3) contaminated ear canals.		
(4) Contaminated nares.		
(5) Contaminated intact skin.		
d. Patients removed from emergency room following appropriate decontamination and medical treatment protocol implementation. They then accessed the hospital health care delivery system in the normally prescribed manner.		

APPENDIX G

SAMPLE OF REPRESENTATIVE NOTIFICATION CHECKLISTS AND PROTOCOL

Shands Teaching Hospital and Clinics
Emergency Room

Radiation Emergency Notification Report

(To be used by Emergency Room Clerk to enter available data when a notification is received of the impending admission of a case involving radiation exposure or contamination.)

A. Person making notification:

Name _____ Date _____

Title _____ Affiliation _____

Address _____ Telephone _____

B. Patients to be admitted: Total number _____

Name (if available)	Injury but no radiation or contamination	Radiation Exposure	Internal Contam-ination	External Contam-ination	Contam-inated wounds
1.					
2.					
3.					
4.					
5.					

C. Will patients be: surveyed for contamination? _____ Decontaminated _____

D. Nature of accident: Type radiation source _____

Other Details: _____

_____

_____

E. Person in charge of radiation evaluation: _____

F. Expected time of arrival at Shands Hospital: _____

Notification taken by: _____

Instructions to Physician in Charge (Radiology Resident)

A. Upon initial notification-

1. If contamination is suspected, have the Trauma Room prepared for receiving a contaminated patient. A floor area from the emergency entrance to the Trauma Room should be covered with absorbent paper. This area should be adequate for stretcher-cart and professional attendants. Prepare to restrict this area from the time the patient arrives until Radiation Control certifies it is contamination-free.

2. Open Radiation Emergency locker and check supplies and instruments.

B. Upon arrival of patient*-

1. Assist the Radiation Control representatives in checking patient for contamination (preferable as stretcher is removed from the ambulance) by use of a survey meter.

2. If seriously injured, give emergency lifesaving assistance immediately.

3. Handle contaminated patient and wound as one would in a surgical procedure, i.e., gown, gloves, cap, mask, etc.

4. If possible external contamination is involved, save all clothing and bedding from ambulance. If possible internal contamination or neutron exposure is involved save all blood, urine, stool, and vomitus. If possible neutron exposure is involved, save all metal objects (e.g., jewelry, belt buckles, dental plates, etc.). Label with name, body location, time and date. Save each in appropriate containers; mark containers clearly, (Radioactive—Do Not Discard).

5. Decontamination should start, if medical status permits, with cleansing and scrubbing the area of highest contamination first. If only an extremity is involved, the clothing may serve as an effective barrier and only the affected limb may need to be scrubbed and cleansed. If the body as a whole is involved or if the clothing is generally permeated by contaminated material, showering and scrubbing will be necessary. Give special attention to hair parts, body orifices and body folds. Remeasure with a survey instrument and record measurement after each washing or showering.

---

*Adopted from: *Emergency Handling of Radiation Accident Cases*, U.S. Atomic Energy Commission and American Medical Association, 1969.

If wound is involved, prepare and cover the wound with a self-adhering disposable surgical drape. Cleanse neighboring surface of skin. Seal off cleansed areas with self-adhering disposable drapes. Remove wound covering and irrigate wound with sterile water, catching the irrigating fluid in a basin or can, mark and handle as described in rule 4 above. Each step in the decontamination should be preceded and followed by radiation monitoring and recording of the location and extent of contamination.

6. Save the physicians', nurses' and attendants' scrub or protective clothing as described above for patients. Physicians, nurses and attendants must follow the same monitoring and decontamination routine as the patients.

7. The physician in attendance in the Emergency Room, if confronted with a grossly contaminated wound with dirt particles and crushed tissue, should be prepared to do a preliminary simple wet debridement. Further measurements may necessitate sophisticated wound counting detection instruments supplied by the radiation control consultant who will assist in determining if further definitive debridement is necessary.

8. If internal contamination is suspected after external decontamination, request a whole-body count as soon as patient's condition permits.

C. Upon completion of Emergency Room procedures—Patient should then be handled according to the following guidelines:

1. Decontaminated and no injuries requiring hospitalization—discharge.

2. Decontaminated and injured—admit to a nursing floor.

3. Irradiated—admit to intensive care.

4. Serious radiation exposure, serious internal contamination, and/or external and wound contamination not responsive to decontamination—admit to nursing floor with special contamination control procedures and initiate arrangements for transfer to Medical Division, Oak Ridge Associated Universities.

Instructions to Radiation Control Personnel

The Radiation Control officer on duty will be notified by the Shands Hospital Emergency Room clerk of an impending admission of a radiation emergency case.

A. Upon receiving initial notification:

1. Obtain as much information as possible from the Emergency Room about the nature of accident and the likelihood of contamination.
2. Notify additional Radiation Control Personnel if the available information seems to warrant this.
3. Pick up any additional supplies or instruments suggested necessary by the available information.
4. Proceed to the Emergency Room.

B. At the Emergency Room:

1. Assist Emergency Room personnel in instituting contamination control procedures at the time of the radiation emergency admission.
2. Establish a checkpoint and monitoring station for entry and exit from the contamination control area.
3. Survey patients and advise physician in charge on external radiation levels to personnel and on patient contamination.
4. Survey personnel, equipment and facilities and designate those that must be restricted for decontamination.
5. Supervise decontamination of personnel and facilities and release areas that are not contaminated.
6. Direct handling of radioactive waste.
7. Arrange for whole-body counting and radioassays of clothing, excreta, etc., as required.
8. Other duties as dictated by responsibilities of the Radiation Control Office to the University.

APPENDIX H

DATA SUMMARY WORKSHEET

APPENDIX H

Protocol Evaluation Checklist

ADMINISTRATIVE ACTIONS - LCDR Wolf (Evaluator)	YES	NO
1. Radiological Check-list-working hours readily available.	X	
2. Checklist completed in toto.		
a. Radiological accident vs drill		
(1) date; time call received; call received by	XXX	
(2) location of casualties	X	
(3) number of casualties	X	
(4) extent of injuries, if known	X	
(5) name of caller giving information	X	
b. Notification process implemented	X	
(1) Radiation Health Officer	X	
(2) Emergency Room	X	
(3) Security		X
(4) Radiology Department	X	
(5) Nuclear Medicine Division		X
(6) Industrial Hygiene Branch		X
(7) Commanding Officer		X
(8) Executive Officer		X
(9) Director, Administration		X
(10) Ambulatory Care Services		X
(11) Officer of the Day	X	
(12) Public Affairs Officer		X

c. Casualty information: time; caller	XX	
(1) Casulaty #1 type injury; isotope inv.	XX	
(2) Casualty #2 type injury; isotope inv.	XX	
(3) Casualty #3 type injury; isotope inv.	XX	
3. Requests for information from public or news media appropriately referred to Director, Administration.	X	
4. Drill activation and announcement appropriately implemented.	X	
5. Administrative personnel familiar with administrative protocol/procedures.	X	
6. OOD (Administrative support) cognizant of team composition; protocol; procedure and/or source of obtaining same.	X	
7. Security activated appropriate procedures.		X
PRE-PLANNING		
1. Facility receiving area lends itself to segmentation/ segregation as protocol requires.	X	
2. Auxillary equipment, supplies easily accessible.	X	
3. Radiological Casualty Contamination Control Equipment Box checked for completeness on a quarterly basis.	X	

FACILITY PREPARATION/DECONTAMINATION PREPARATION CDR Stefanakos - evaluator	YES	NO
1. All nonessential personnel and material evacuated from ER.	X	
2. Rad. Casualty Contamination Contingency Equipment Box obtained and placed at ER.	X	
3. Designated floor areas in ER covered with Kraft paper or yellow herculite.		X
4. Floor under edges of the operating table in designated area covered with blotting paper or other absorbent material.	X	
5. Restricted area signs set up at all ER entrances.		X
6. Controlled surface contamination signs set up at all entrances to "hot" side of ER.		X
7. Unneeded materials removed from reception and treatment areas.	X	
8. Needed material (i.e., Radiation Casualty Contamination Contingency Equipment Box) moved into reception and treatment areas.	X	
9. Unneeded fixed equipment and all other floor areas covered with plastic sheeting.	X	
DECONTAMINATION OF FACILITY (AFTER PROCEDURES COMPLETED)		
1. All blotting paper in passageways rolled up and appropriately disposed.	X	
2. Additional blotting paper placed in areas that the blotting paper taken up.	X	
3. Blotting paper placed outside controlled surface contamination area of the "hot" side of ER.	X	
4. All contaminated material within patient treatment area appropriately handled and disposed.	X	
5. All contaminated water or fluids appropriately collected and disposed.	X	
6. All fixed equipment, supplies, and room areas monitored and appropriately decontaminated.	X	
7. Ambulance and attendants monitored and appropriately handled.	X	

PROVIDER PREPARATION/SUPPLIES	YES	NO
Preparation		
1. Personnel involved with patient care/handling donned appropriate protective clothing.	X	
2. Each such individual placed a dosimeter on person under protective clothing.	X	
3. Personnel at exit areas (to monitor personnel leaving contaminated surface area) wore shoe covers, rubber gloves lab coat.	X	
4. All personnel observed appropriate procedure for removal of contaminated protective clothing.	X	
5. All personnel monitored upon exiting hotline the ER and treated appropriately.	X	
6. Providers cognizant of procedural protocol.	X	
Supplies		
1. All materials and equipment removed from ER monitored and appropriately handled during and after procedure (this includes all specimens, x-rays, EKGs taken during procedure).	X	
2. Supplied required for effecting protocol available and present in Radiological Casualty Contaminated Control Equipment Box.	X	
3. Providers cognizant of special supplies/equipment.	X	
PROVIDER CARE PROVISION - LCDR Robson, evaluator		
1. Appropriately designated members of health care provision team reported to ER.	X	
2. Providers cognizant of medical protocol as outlined in NRMCINST 3440.5	X	
3. Providers proceeded with provision of medical care		
a. Immediate stabilization of patient	X	
(1) Examined by physician	X	
(2) Require tests done as required by patient's condition.	X	
(3) Procedures, fluid and drug administration done as required to stabilize patient.	X	

	YES	NO
b. Patient evaluated		
(1) Patient's clothes removed and placed in plastic bag and sealed.	X	
(2) Cotton swab samples of ear canals, nares and mouth obtained; appropriately labeled and handled.	X	
(3) Radiation safety officer monitored entire patient	X	
(4) Areas of and amount of contamination noted in record.	X	
c. Physical decontamination of radioactive areas begun following appropriate medical protocol as outlined in NRMCINST 3440.5		
(1) Contaminated open wounds.	X	
(2) Contaminated eyes.	X	
(3) contaminated ear canals.	X	
(4) Contaminated nares.	X	
(5) Contaminated intact skin.	X	
d. Patients removed from emergency room following appropriate decontamination and medical treatment protocol implementation. They then accessed the hospital health care delivery system in the normally prescribed manner.	X	

BIBLIOGRAPHY

Bibliography

Books

Hall, E. J., Radiobiology for the Radiologist, 2nd ed., New York: Harper and Row, 1978.

Huber, K. R., and Fry, S. A. (eds), The Medical Basis for Radiation Accident Preparedness, Elsevier: North-Holland, New York, 1980.

Joint Commission on Accreditation of Hospitals, Accreditation Manual for Hospitals, Chicago, Illinois, 1983.

Spitzer, Stanley, M.D. and Oaks, Wilbur W., M.D. (eds), Emergency Medical Management, New York: Grune & Stratton, Inc., 1971.

Periodicals

Drum, David E., "Steps to Take Preparing for Radioactive Patients," Emergency Department News (May 1981): 17-18.

Editorial, Modern Healthcare (June 1979): 3.

Galvin, Joseph Jr., "Hospital Makes Itself Center for Treatment of Radiation Victims," Hospitals (May 1, 1979): 37-40.

Garvin, John M. and Miller, Kathyrn P., "The Logistics of a Disaster Drill: Medex-78," Emergency Medical Services (January/February 1981): 39-48.

Goldman, Mitchel P. and Crosson, Jessica, "What If?," The New Physician (November 1981): 30-32.

Holland, R. W., M.D. "Planning a Medical Unit for Handling Contaminated Persons Following a Radiation Accident," Nuclear Safety, 10 (January-February, 1969): 72-84.

"Hospitals Prepare Radiation Plans in Wake of Nuclear Plant Accident," Modern Healthcare (July 1979): 16.

Isleer, Charlotte, "Could You Cope with a Nuclear Accident?" RN (June 1979): 66-77.

Jankowski, Carol B., "Radiation Emergency," American Journal of Nursing (January 1982): 90-97.

Kirby, John, "The Administrative Process of a Disaster Exercise," Emergency Planning Digest (April-June 1979): 2-3.

Krizek, Thomas J., "Difficult Wounds: Radiation Wounds," Clinics in Plastic Surgery (Vol. 6, No. 4. October 1979): 641-3.

Leonard, Ralph B., and Ricks, Robert C., "Emergency Department Radiation Accident Protocol," Annals of Emergency Medicine (September 1980): 462-470.

Maxwell, Christopher, "Hospital Organizational Response to the Nuclear Accident at TMI: Implications for Future-Oriented Disaster Planning," American Journal of Public Health (March 1982): 275-279.

Mettler, Fred A., "The Role of EMTs in Radiation Accidents," Emergency Medical Services (May/June 1977): 22-25.

_____, "Emergency Medical Services Following a Nuclear Reactor Accident," Emergency Medical Services (July/Aug 1979): 52-69.

_____, "The Hospital Administrator and Radiation Accidents," Emergency Medical Services (May/June 1978): 78-80.

Nagel, Eugene L., "Disaster Preparedness," Emergency Medical Services (July/August 1979): 62-63,76.

"Nuclear Power and Public Health," WHO Chronical 28 (1974): 451.

Quaife, Merton A., Jones, E. O., and Dirksen, J. W., "Medical Aspects of Radiation Accidents - Concept of the Regional Radiation Health Center," Nebraska Medical Journal (May 1979): 131-138.

Richter, Linda L., Berk, Harold W., Teates, Charles D., Friesen, Elroy Y., Fraust, Cheryll L., and Edlich, Richard F., "Immediate Care of Patients after a Radiation Accident," The EMT Journal (December 1980) 21-25.

_____, "A *Systems Approach to the Management of* Radiation Accidents," Annals of Emergency Medicine June 1980): 303-309.

Sinclair, Constance, "Management of Radiation Accident Victims: A Suggested Protocol," Journal of Emergency Nursing (May/June 1981): 87-91.

Vinsel, Douglas B., "Hospitals Must Plan for Nuclear Accidents," Hospitals (August 16, 1980): 113-121.

Waldron, Robert L., Danielson, Robert A., Shultz, Harold E., Eckert, Dieter E., and Hendricks, Kenneth O., "Radiation Decontamination Unit for the Community Hospital," American Hospital of Roentgenology (May 1981): 977-981.

Weidner, William A., Miller, Kenneth L., Latshaw, Robert F., and Rohrer, G., Victor, "The Impact of a Nuclear Crisis on a Radiology Department," Radiology 135 (June 1980): 717-723.

Other

Daley, Peter S., Medical Effects of Nuclear Weapons, Armed Forces Radiobiology Research Institute, Bethesda, MD.

Disaster Preparedness Recovery Plan, NAVHOSPPTSVAINST 3440.1, Annex Q, Naval Hospital, Portsmouth, Virginia, 1983.

Management of Persons Accidently Contaminated With Radionuclides, NCRP Report, No. 65, 1980.

Proposed NAVMEDCOMINST 6470.4, Irradiated or Radioactively Contaminated Personnel; initial management of, Norfolk Naval Shipyard, Portsmouth, VA, 1983

Radiation Accident Management, Radiation Emergency Assistance Center Training Site, Medical and Health Sciences Division, Oak Ridge Associated Universities, Oak Ridge, Tennessee, 1979.

Radiation Accidents: Are You Prepared?, cassette, Co-sponsored for CME credit by University of New Mexico School of Medicine in Albequrque, Network on Continuing Medical Education, 1983.