UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

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Per your request here are some materials on hospital preparedness for nuclear facility emergencies.

Sincerely,

Brian K. Grimes, Director
Emergency Preparedness Task Group
Office of Nuclear Reactor Regulation

Enclosures:
1. Hospital Article
2. Monitoring Procedures
3. Bibliography
4. NUREG-0654

HOSPITAL MAKES ITSELF CENTER FOR TREATMENT OF RADIATION VICTIMS

by Joseph Michael Galvin Jr.

What is the role of the community health care facility in ensuring that proper care is provided for radiation victims? This and other questions are providing a new challenge to the Nuclear Regulatory Commission and to Civil Defense. These questions also must be carefully weighed by hospital chief executive officers, boards of trustees, and medical staffs, for it is imperative that they review and update the policies and procedures that are presently in force at their own institutions, ascertaining their effectiveness in meeting the needs of the communities they serve.

Salem (NJ) County Memorial Hospital began developing a plan of action in 1972—a plan that led to the development of a prototype hospital radiation trauma and treatment center. Despite its rural setting, the hospital is in proximity to major centers of population and industry. To accommodate the area's growing need for energy, a network of nuclear power plants is being planned and built approximately 10 miles from the hospital. Presently there are two reactors; one is operational and one is scheduled to be on line for this summer. Two additional reactors are under construction with anticipated completion by 1984.

For these reasons—proximity, size, capability, and willingness—the hospital was asked by a local utility company to provide medical support services for a nuclear power plant in the event of an accident. Meetings were held with the utility company; the Nuclear Regulatory Commission; and Radiation Management Corporation, a radiation accident medical consultant retained by the utility company, to assist in the development of policies and procedures for nuclear reactors.

Our initial project was to formulate a group with expertise in nuclear power to develop protocol in resolving problems and meeting the needs of the community in the event of an accident. We set as our immediate priority the definition of the term "accident" as it related to radiation. In addition, we outlined the dimensions of potential health risks caused by such an accident, while looking to the Nuclear Regulatory Commission for further clarification of "radiation accidents."

We believed that accepting this obligation to provide medical care without knowing the dimensions of potential accidents and/or requisite safeguards could jeopardize the health of hospital patients, staff, and employees; the total surrounding community; and, more important, the accident victim.

The hospital felt it was imperative that we develop adequate systems and facilities to work in harmony with the utility company, the consulting firm, and the federal regulatory agency. A project committee, consisting of representatives of the board of trustees, the medical staff, and the utility company, along with the Nuclear Regulatory Commission and Radiation Management Corporation, was formed.

The committee developed an outline of goals and a timetable to meet them and worked to prepare a program for the hospital to cope with any potential accident victims. The term "radiation accident" was defined as "that patient who has traumatic injury and is contaminated with radioactive material."

There are three major types of radiation exposure that may cause injury:

- Penetrating radiation exposure from a source external to the body (gamma rays, neutrons).
- Internal exposure to radionuclides by ingestion, by inhalation, or through a skin break.
- Skin and superficial tissue exposure by contamination of the surface of the body with radioactive materials.

These three types of radiation exposure may occur together.

A patient who has been exposed to excessive external radiation will not present a hazard to attending personnel. Radiation that has injured a patient will harm the attendant no more than heat that has injured a burn patient will harm the attendant. Equally without hazard is the patient who has received an overdose of radionuclides by ingestion or inhalation. He is no more hazardous than the patient who has been given diagnostic radioisotopes in the hospital clinic.

However, the individual whose

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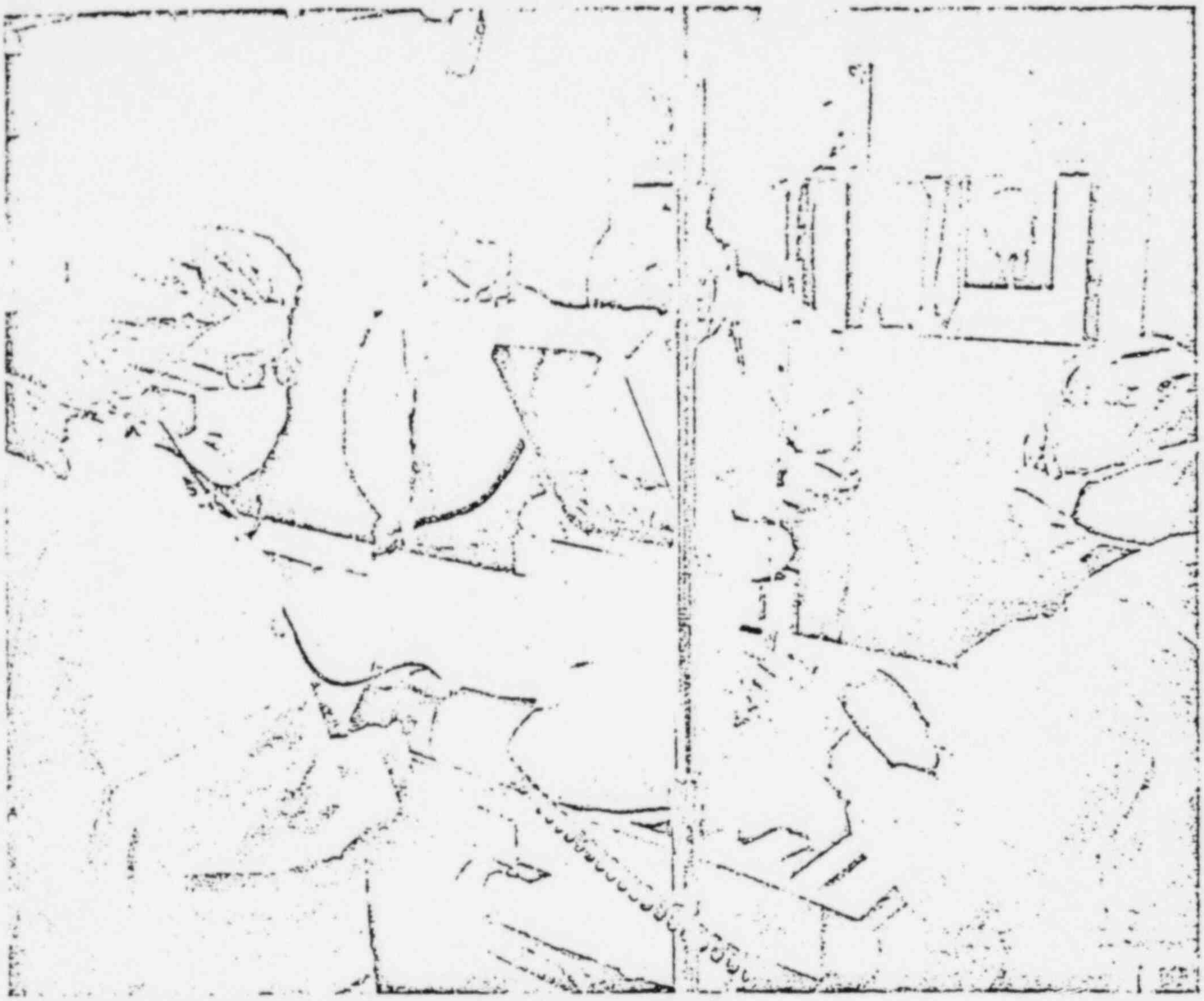


An important ingredient of the treatment center is a well-trained and proficient treatment team. Emergency drills are held twice a year at Salem County Memorial Hospital and are videotaped for later evaluation.

clothing, skin, or wounds are contaminated with radioactive material may present a radiation hazard to attending personnel in the absence of adequate procedures to prevent the spread of the contaminant, or control the radiation exposure in the event of a radioactive shrapnel wound. If practical, the condition of an injured person who is also contaminated should be discussed on the phone with the nuclear generating station's attending physician before the person is sent to the hospital. In all instances, the hospital should be given as much warning as possible of the impending arrival of the patient.

Center concept

Through careful deliberation, the project committee decided that in order to provide adequate safeguards, it was necessary to develop a radiation trauma and treatment center that would be constructed at the hospital to provide the necessary medical support services in the event of a radiation accident. The center would become an adjunct facility to the hospital's emergency service complex, with specifications for construction developed by the project committee with the advice of the Nuclear Regulatory Commission. Specifications were for an outside entrance and a self-contained facility that would have capabilities to meet all requirements of treating a radiation accident, in addition to meeting any physical injuries the patient may have incurred in the course of the accident. Basically, the room is similar to an operating room, with the use of a deluge water system for decontamination purposes. The room is fully air-conditioned, with a separate ventilation system, and includes water and sewage outlets. The room possesses two water disposal systems: a portable tank system and an underground waste water tank for radioactive materials. The project committee, through public hearings and private negotiations, received public support of the concept.

During the course of construction, the project committee developed a new set of emergency procedures and directives for treatment of radiation accidents. The resulting procedures manual details a relatively complex system of emergency care involving close teamwork among the utility company, the hospital, and radiation safety specialists.

An intricate, triple-tiered system of medical care was developed, starting at the power plant, which serves as the backbone of the operation, with the hospital as the operation's nerve center and a university hospital as a long-term care and research center. Initial or preliminary treatment is administered to the radiation victim at the plant and the hospital is alerted. Most of these injury cases would present no hazard to hospital personnel and would be admitted and provided care in accordance with standard operating procedures. However, an accident victim who is radioactively contaminated is admitted, decontaminated, and treated in accordance with specially established procedures. The purpose of these procedures is to ensure protection of the hospital staff, other patients, and visitors during admission and treatment of the radioactively contaminated patient.

The hospital's protection program starts at the nuclear station with an alert or warning telephone call to the hospital informing us that there has been a radiation accident and that one or more injured and contaminated persons may require treatment. On receipt of such a call, the hospital staff prepares to admit patients through the radiation trauma and treatment area.

Hospital involvement

At the hospital, the emergency department radiation team, consisting of two hospital physicians, a team of nurses, and the reactor's physicist, make up the nucleus of the treatment team. As soon as the hospital is alerted that an accident has occurred, an alert is put into effect and the team and support personnel immediately respond to receive the contaminated patient. Team members dress in protective clothing and wear dosimeters to monitor radiation. Maintenance and housekeeping personnel have the responsibility of preparing the radiation and decontamination areas as well as of zoning off that section of the hospital from internal traffic. Physicians consulting with the nuclear power station physicist, attempt to determine the severity of radiation contamination and the precautions that should be taken.

The objectives of decontamination are:

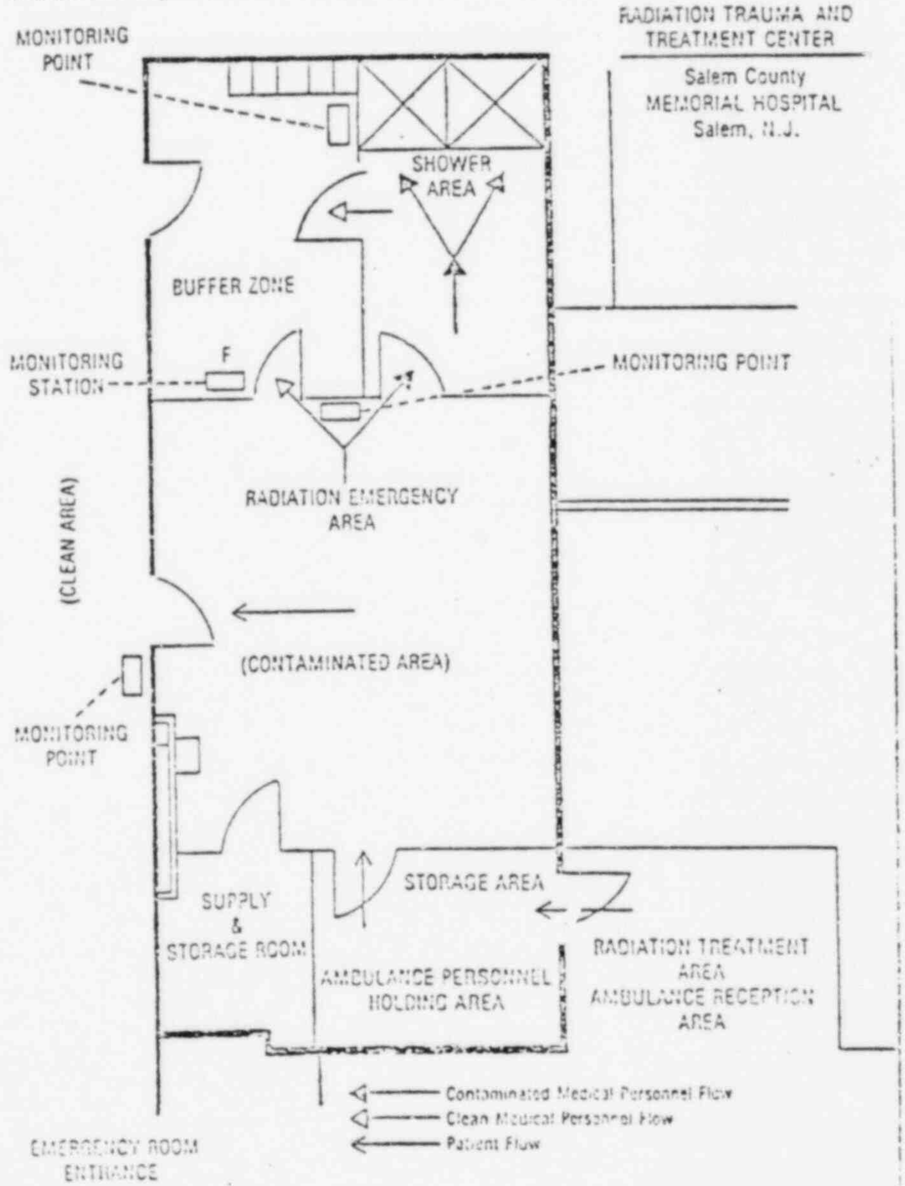
1. To prevent injury caused by the presence of radioactive substances on the body.

2. To prevent the spread of contamination over and into the patient.

3. To protect attending personnel from becoming contaminated themselves or, in extreme cases from being exposed to a source of radiation.

Although decontamination should be started as soon as possible, pri

Salem County Memorial Hospital Radiation Trauma and Treatment Center



mary attention should be given to the alleviation of life-threatening conditions created by traumatic injury. The utility physicist accompanies the patient and is in control of the decontamination process.

If the patient is severely injured, immediate life-support care is administered to stabilize the patient's vital signs before the patient is flown by helicopter to the primary treatment center at a nearby university hospital that is equipped with more sophisticated and precise instrumentation and support systems, not only for radiation exposure but also for any other medical needs that may be involved.

Safety procedures after the radiation patient has been released are considered as important as those during the emergency itself. All clothing of the patient and the medical team must be disposed of, and the facilities must be thoroughly washed down by radiation specialists. Finally, the radiation emergency unit's separate sewage system must be thoroughly drained by the specialists. Disciplined coordination is imperative to successful completion of the safety procedures.

Chief executive officers must be willing to become more familiar and acquire a better understanding and appreciation for the care and treatment of victims of radiation accidents. It is the responsibility of the chief executive officer to become the key contributor to formulating and executing the policies and procedures to provide adequate support facilities and care should the need arise.

Training required

It also is the responsibility of the chief executive officer to provide the medical staff and other hospital staff with training courses and emergency drills to better prepare them for an emergency. Constant evaluation of drills and updating of policies and procedures is important to ensure the success of future responses to an emergency.

At Salem County Memorial Hospital, emergency drills are held twice a year and are videotaped to ensure thorough evaluation. The drills are then critiqued for members of the team, giving them a better appreciation of their overall roles and of any problems observed during the course of the drill. This procedure has become a recommended standard of the Nuclear Regulatory Commission for those institutions providing such a service. The films are used as a source of in-house training for both the medical staff and hospital personnel. In addition, a team from Radiation Management Corporation periodically surveys the facility to determine if the sophisticated monitoring equipment and medical decontamination supplies are in order. This team is also responsible for evaluating and critiquing the emergency drills that are held twice a year.

The results of this cooperation among the hospital, the utility company, the nuclear power plant, and the Nuclear Regulatory Commission have been gratifying. Explicit policies and procedures have been developed and implemented within the hospital, preparing our institution in the event that we are called upon to treat a radiation accident. Assurance is given to employees and residents of the reactor area that their medical needs will be met in the event of a radiation accident. The hospital's image is not only safeguarded but also upgraded. Its radiation trauma and treatment facilities have given it added prestige. The nuclear power plant received regulatory approval and is now in operation.

The approach taken by the hospital, utility, consulting specialists, and federal government stands as a landmark for cooperation among the private and the public sectors. The emergency procedures drawn up for the treatment of radiation-contaminated patients serve as a model for the country. The hospital's radiation trauma and treatment center serves as a prototype for design of such facilities at hospitals throughout the country. Also, several foreign guests have toured the facility to develop ideas that could be applied in their countries.

Going from here

In the shadow of the Three Mile Island nuclear power plant incident, there undoubtedly will be a review of the design and safety of nuclear power plants in the United States. A constructive approach to the evaluation of the incident will produce new safeguards and enable not only the utility industry but also hospitals to make careful evaluations of their policies and procedures in handling radiation accidents, along with their policies and procedures for mass evacuations should the need arise. A constructive approach will be needed to improve these policies and procedures. Perhaps it is time for the Joint Commission on Accreditation of Hospitals to develop standards for the care and treatment of radiation accidents.

The future of our nation will depend largely upon development of our full energy capabilities, including nuclear power. Currently, nuclear energy provides roughly one-eighth of all electric power generated in this country, and there are more than 70 nuclear power plants in 27 states with operating licenses. Our scientists have certainly amassed tremendous information from the Three Mile Island experience and will be able to apply it as they continue their attempts to perfect nuclear energy production and to develop stringent safety requirements.

In the meantime, hospital chief executive officers in proximity to nuclear power plants have a responsibility to assure the communities they serve that the best possible facilities and trained personnel will be available should a radiation accident occur. ■

MONITORING POTENTIALLY RADIOACTIVELY CONTAMINATED INDIVIDUALS

1. Locate an area free of radioactive contamination and with low background.

2. Use a G-M type survey meter such as the CDV-700 (Civil Defense Type). Attach headphones because this allows the monitor to visually follow and better control the position of the detector probe while monitoring. The headphones also respond more quickly to changes in radiation levels than the meter.

3. Check the operation of the survey meter according to instructions provided with meter.

4. Place the survey meter in a transparent plastic bag to prevent contamination, leaving only the probe exposed. For maximum sensitivity, the open (exposed) window of the detector probe should be used. The window is a rotatable cylinder on the probe which exposes or covers the detector tube.

5. Note background reading of meter.

6. Monitor the individual as follows:

   a. Have the individual being monitored stand on a newspaper. This will reduce the possibility of contaminating the monitoring site. Change the newspaper frequently.

   b. Place the survey meter probe about 1" from the person's body, being careful not to touch the person.

   c. Instruct the person to stand straight, feet spread slightly, arms extended with palms up and fingers straight out. with palms up, then repeat with hands and arms turned over.

   e. Starting at the top of the head, cover the entire front of the body, monitoring carefully the head, neckline, trunk, legs, crotch and armpits.

   f. Have the individual turn around, and repeat the monitoring on the back side of the body.

   g. Monitor the shoes and soles.

7. Again note background reading of meter.

8. Use earphones to find areas of potential contamination.

9. Radiation readings that are twice background indicate that the person may be contaminated. Individuals should be decontaminated. Monitor individuals after decontamination to determine that contamination has been effectively removed. Repeat decontamination procedures if required.

NOTE: If the background readings taken before and after monitoring the individual are significantly different the person should be remonitored.

PERSONNEL DECONTAMINATION

1. Remove clothing and place in a plastic bag. Mark radioactive , do not discard.

2. If possible take nasal swab with a cotton swab, identify, and save. Do not delay showering if swabs are not at hand.

3. Shower thoroughly with water and a liberal amount of soap applied. Specific instructions are:

   Skin - Use a soft bristle brush vigorously but lightly so as not to abrade the skin. Particular attention should be paid to cleaning around and under finger nails, between the fingers and at the back of the fingers on the palms, when the hands are contaminated.

   Hair - Scrub the hair vigorously using a liberal amount of soap. Particular care should be taken to prevent suds and water from entering the eyes, ears, nose or mouth. Several washes and rinses should be applied before drying the hair.

4. Monitor individuals after decontamination to determine that contamination has been effectively removed. Repeat decontamination procedures if required.

5. If person still show contamination, seek advice of supervisory personnel.

DECONTAMINATION OF VEHICLES AND EQUIPMENT

1. Upon completion of missions in a contaminated area, vehicles and equipment used by personnel should be monitored, and decontaminated if necessary. Complete decontamination may not be necessary, but attempts should be made to reduce the hazard to tolerable levels.

2. A decontamination station set up at a control point adjacent to the staging area would be the best place for decontaminating vehicles and equipment. A paved area would be desirable so that it could be hosed off after the equipment is decontaminated. Monitoring should follow the application of each decontamination method.

3. The simplest and most obvious method for partial decontamination of vehicles and equipment is by water hosing.

4. Hosing should not be used on upholstery or other porous surfaces on the interior of vehicles, as the water would penetrate and carry the contamination deeper into the material. The interior of vehicles can be decontaminated by brushing or vacuum cleaning.

5. Special precautions should be used when vehicles and equipment are brought in for maintenance. The malfunctioning part of the vehicle or equipment should be checked for excessive contamination.

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