The Radiological Health Program in Rensselaer County, N.Y.

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AVOID all unnecessary ionizing radiation. With this the objective, the Rensselaer County Health Department in New York State developed over the past 4 years a modest but effective radiological health program. Accomplishment of the objective is attempted by providing advice, guidance, and technical service in the use of ionizing radiation sources.

New York State became actively concerned with the health and safety aspects of ionizing radiation as a result of waste disposition problems of the early Atomic Energy Commission installations in the State. In 1952, the State health and labor departments took a census of shoe-fitting fluoroscopes. Under the then existing regulation 2 of chapter IX of the State Sanitary Code a program was initiated for controlling the specific hazards associated with the use of these machines. (As of July 1, 1958, the New York State Health Department outlawed the use of the shoe-fitting fluoroscope by unlicensed practitioners.) Both departments then appointed committees of experts to assist them in a study of the entire radiation problem in New York State. The State health department's Advisory Committee concluded that there was a significant and steadily increasing radiation problem in the State and that the health department should prepare to meet this situation. This culminated in June 1954 with the preparation and acceptance by the commissioner of health of a program plan for radiological health. The objectives of this plan were education and training, regulation of radiation exposure, enforcement of laws and regulations, and research.

A radiological health section was subsequently established in the State department's bureau of environmental sanitation, and chapter XVI was added to the Sanitary Code, effective September 1, 1955, as the basis for a program of inspection, education, and correction. Chapter XVI is intended to control the "location or facility where radiation equipment is used or where radioactive material is produced, transported, stored, or used for any purpose." The regulations cover registration of radiation installations with the health officer having jurisdiction, definitions, construction, maintenance and operation, maximum permissible doses, personnel protection, medical examinations, patient protection, disposal of radioactive wastes, radiation instruments, handling of cadavers, monitoring of radiation installations, therapy rooms, warning signs, accounting for radioactive materials, radiation illnesses, injuries, emergencies, accidents, electrical hazards, vacated premises, and limitations on application of radiation to humans.

The interest of the Rensselaer County Health Department in radiation hazards was aroused

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early in 1956. The department at that time had no personnel trained in this new field, but the staff was able to keep abreast of developments by the division of environmental hygiene's in-service training conferences and by consultation with the radiological health section of the State health department.

Using for a mailing list the county health department inventory, which was incorporated in the State census, letters went to the operators of every shoe-fitting fluoroscope in the county alerting them to the hazards. Also, a letter was sent to all operators of dental X-ray equipment urging them to see that their units had filters with the equivalent filtration effect of 2 mm. of aluminum. Filters were obtainable at a local dental supply house.

In the latter part of 1956, the county health department sanitarian was given training in the mechanics and theory of radiation management by inspecting medical, dental, and veterinary X-ray equipment in the county jointly with a member of the State radiological health staff. The reports on these inspections were reviewed with State radiation officials. Since the county health department had no equipment for monitoring radiations, it had to use the State's equipment when available.

Early in 1957 the county health department requested an appropriation to purchase monitoring equipment. Denial of the request delayed implementation of the radiological program.

During this temporary delay, the department concentrated on personnel training. Courses in basic radiation physics and radiological health survey methods were provided by the radiological health training staffs of the Public Health Service and the Atomic Energy Commission at the University of Rochester and elsewhere, in cooperation with the State health department. These courses were attended by the sanitarian, who was to become the supervisor of the radiological control program, and the director of the division. A course on sanitary engineering aspects of nuclear energy was held at the Robert A. Taft Sanitary Engineering Center, Cincinnati, Ohio, and was attended by the director of the division of environmental hygiene.

Later that year, through the efforts of the county health officer and the director of the division of environmental hygiene, a special appropriation was granted to purchase the following basic monitoring equipment: an ionization chamber "cutie pie," a Geiger survey meter, six direct-reading pocket dosimeters of varying ranges, a dosimeter charging unit, a micrometer caliper, and a stopwatch. The cost of this equipment was approximately $817.

Program Elements

The responsibility for implementing the radiological health program was assigned to a sanitarian in the environmental hygiene division in addition to his other duties.

The first major undertaking was to determine where and in what quantities radiation was being used in the county. Registration of all sources of radiation with the local health department is required by chapter XVI of the State Sanitary Code. In Rensselaer County 52 operators voluntarily registered their installation following a press release by the State health department. It was suspected, however, that this number represented only a fraction of the sources of radiation.

To expedite registration, tearoff return postcards were sent to all other physicians, dentists, veterinarians, podiatrists, and osteopaths asking if they used X-ray equipment or radioactive materials. The list was assembled from the yellow pages of the telephone directory. A followup by telephone was made on those who did not reply, although the postcard reminder was relatively successful.

The survey revealed 111 installations of X-ray equipment as shown below. In addition, one hospital, one university, and one laboratory reported installations using radioactive materials.

Source	*Number of X-ray installations*	*Number of machines*
Medical	39	52 [1]
Dental	60	61
Veterinarian	5	5
Research	2	5
Other	5	5

[1] Includes 3 used for therapy.

Next, a letter was sent to operators whose installations were not registered asking them to register their equipment or materials immedi-

ately. To date, a total of 109 of the 111 operators have registered their radiation equipment. A few operators requested, and were given assistance in filling out the form.

Following the postcard survey and registration, a simple visible card file was set up on all radiation installations. Information on the card includes name of the installation, location, operator in charge, type of equipment, whether or not registered, and date of last inspection. The status of the installation is indicated by a colored tab to denote whether the installation was satisfactory or unsatisfactory.

Field investigations were the second major activity. Those undertaken at the beginning of the program were limited to shoe-fitting fluoroscopes, prohibited since July 1, 1958, dental units, and portable medical radiographic units. Field experience gained in company with the State personnel and the consultation service available from them and the division director helped build up the confidence of the supervisor. As confidence increased, activities were gradually broadened to include detailed investigations of X-ray departments in hospitals and laboratories.

An important adjunct of the field investigations is the education of the professional users of radiation sources to the significance of ionizing radiations, procedures for reducing radiation hazards, and application of improved techniques.

To assist users of dental X-ray equipment, the health department staff did some research in dental radiography, resulting in a suggested technique in which maximum protection from ionizing radiation will be provided, under the most practical conditions, for all persons concerned. X-ray procedures are patterned so that the operator is never in the direct path of "useful" beam for primary protection and his position utilizes distance and any available barrier for secondary scatter protection.

The procedure suggests: (*a*) the provision of a swivel armchair, similar to an executive-type chair, with an attached headrest, for use in X-raying the patient, (*b*) the location of the swivel chair near the X-ray unit, but, more important, against a wall in the room that faces an unoccupied area—the X-ray tube placed in line with the chair so that all X-ray exposures are directed toward the chair which, to repeat, is located against the wall facing an unoccupied area, and (*c*) placement of the patient in the chair in any position desired because of the mobility of the chair. In a full-mouth series the operator can merely adjust the patient to the restricted direction of the X-ray tube and take the necessary exposures. This technique of positioning will prevent the operator from ever being in the direct path of primary beam. The operator must then assume a position as far as possible from the tube and patient and utilize any barrier in the room such as a wall or door for maximum protection from stray radiation.

Currently, the program is being expanded to include the safe management of radionuclides. The program supervisor attended a training course on hazards of radionuclides at the University of Rochester in 1958. He has also observed a representative of the Atomic Energy Commission on inspections of installations in Rensselaer County authorized to use radionuclides. This training has developed the program supervisor's familiarity with the uses of radionuclides in hospitals and laboratory research and the hazards associated with these materials. The use of radium in medical offices has not presented a problem in Rensselaer County because the survey revealed no authorized users.

Inservice training of the health department personnel in radiological health work continued as the program progressed. A particularly valuable course arranged by the New York State Health Department training section was given in a radiation workshop at the University of Rochester in November 1958. The session offered an opportunity for exchange of ideas and discussion of local experiences by those directly engaged in fieldwork in radiation control. Other such workshops are expected to be sponsored in various areas by the State health department.

Program Implementation

In the field investigations, about every type of X-ray machine that might be used in medical, dental, or veterinary practice has been encountered. Poor technique, insufficient filtration, or lack of cones were commonly found

in the installations. Some of the hazards associated with these units and the protective measures suggested follow.

Radiographic Units

A few old radiographic units with glass unshielded tubes are still in use by physicians and dentists. The department has been successful in discouraging the use of two such units. One dentist is buying a new 90-kv. unit, and another is having his X-ray work done by someone else.

One of the most common defects was the lack of adequate filters for the primary beam. The State Sanitary Code requires a total filtration equivalent to at least 2 mm. of aluminum. The filter absorbs the soft, less penetrating radiations, thereby protecting the patient from these dangerous rays. It eliminates scatter haze on film, and appreciably reduces stray radiation. This amount of filtration will not require an increase in the exposure factors to achieve a satisfactory film.

There was a conspicuous absence also of diaphragms or cones for collimating the useful beam. In some installations the collimating device was oversized. A diaphragm or cone of correct size in the useful beam serves to limit the size of the radiated area to that which is clinically necessary. For dental X-rays, the collimation should be adjusted so the patient is exposed to a beam no greater than 3 inches in diameter in order to protect the patient's eyes.

In conventional chest X-rays, operators were encouraged to protect patients from scatter radiation by draping an apron of one-half millimeter lead equivalent below the front of the cassette as an adjunct to close coning.

Frequently advice was provided for improving radiographic operational safety. In many instances the operator customarily stood either adjacent or close to the equipment, and sometimes directly in the path of the primary beam. For maximum protection from primary and stray radiation, operators are advised to stand as far as possible from the tube and the patient during an exposure. An extension cord on the timer button enables the operator to stand in an adjoining room or at least behind a shield. Operators were also informed that it is no longer necessary to use film requiring long exposure. They were advised that modern fast film permits shorter exposures, thus reducing the dose to the patient and the stray radiation to the operator. The shorter exposure time also saves wear and tear on the unit.

When a dentist is contemplating purchase of a new X-ray film unit, the 90-kilovoltage unit should be considered in place of units operating at 45–70 kv., because the exposure time is reduced from the usual 1.5 seconds to 0.5 second. An 18-inch focal distance from the skin with a long lead cone device (15 inches) and 3 mm. of aluminum for filtration purposes will cut down skin exposure and reduce gonadal dose considerably.

Fluoroscopic Units

Diaphragm shutters and tubes of fluoroscopic units were often found off center from the viewing screen. Under these conditions, the useful beam extended beyond the fluoroscopic screen and struck the operator. Centering the beam, of course, was recommended. In addition, operators were told to limit the shutters so that when fully opened there was a visible black margin of at least one-fourth inch around the screen at the maximum working distance from the table. It was also suggested that the smallest possible aperture of fluoroscopic screen be employed during examinations since both the volume dose and the scatter increase more rapidly than the dimensions of the fluoroscopic field.

Fluoroscopic screens frequently were not completely interlocked with the X-ray tube. The screen could be adjusted in various positions so that not all of the primary beam is intercepted by the protective lead glass of the viewing screen. Installation of a pin or hinge between the screen and screen frame was advised to provide an interlock with the tube.

As with radiographic units, absence of adequate aluminum filters was also common.

Leaded aprons and gloves in unsafe condition were occasionally found. Protective clothing for the operator and assisting technician are required to be checked periodically by the person responsible for radiation safety. In horizontal fluoroscopy, to assure adequate protection from scatter, it was recommended that an apron of one-fourth millimeter lead equivalent

hang between the patient and the fluoroscopist. This is in addition to a protective apron worn by the operator.

The time required to adapt the eyes to darkness prior to a fluoroscopic examination is particularly irksome to the busy physician. Dark adaption is essential because it permits adequate examination of the patient with the least possible radiation exposure. A dark adaption period of 20 minutes with polaroid glasses was recommended. Improvement continues up to 20 minutes but a minimum of 10 minutes of dark adaption is necessary.

Few fluoroscopic units encountered in the field were provided with a built-in integrating timer, although units installed after September 1, 1955, in New York State are required to have such a device to interrupt the circuit after 4 minutes of exposure. Operators of units installed before that date can satisfy this requirement by purchasing an interval timer, for less than $10, and manually setting the clock for the 4-minute exposure. This control alerts the physician and reduces the possibility of overexposure of the patient.

Sometimes the dosage rate at the table top exceeded the maximum 10 roentgens per minute. This unsatisfactory condition can be corrected by lowering the milliamperage, by adding more filtration at the tube port, or by increasing the distance between the tube target and table panel.

Operators are also advised of the availability of intensifying screens which make it possible to reduce the dose to the patient as well as to the operator.

Blanket Registration

On May 20, 1959, a blanket registration was granted to Rensselaer Polytechnic Institute, one of the leading educational institutions in the State. Blanket registration is the authority for self-policing in compliance with the State health and safety regulations. This is considered the most practical method of accomplishing the objectives of the State Sanitary Code in view of the institution's increasing use of radionuclides and radiation-generating equipment in research and teaching. Special radiation facilities include a subcritical assembly reactor, a Van de Graff proton accelerator, a betatron accelerator, a Cockcroft-Walton accelerator, and several X-ray diffraction units.

As a result of health department recommendations over a period of 3 years, the institution organized a radiological safety committee and appointed a radiological safety officer. A draft of the institution's proposed administrative control and radiological protection procedures was submitted to the county and State health departments for review and comment. The final draft, incorporating suggested revisions, was officially approved by the institution April 24, 1959. The procedures are divided into three parts: administrative, general radiological protection, and specific radiological protection. A unique feature is that the last part can be changed at any time without amending the entire document.

The radiological safety officer of the university is empowered to make inspections and impose additional requirements and emergency measures he deems necessary to maintain high standards of radiological safety. The radiological safety committee is giving considerable attention at present to radioactive wastes. The current plan is to use a commercial waste disposition agency in lieu of a burial area located in the county. Radioactive wastes at the moment, however, are being stored in a shielded storage room at the institute and are periodically monitored by the radiological safety officer.

Approval by the health department is required for the disposition of radioactive wastes by ground burial. Routine monitoring is specified and maximum concentration limitations are established. In the event of fires, accidents, unauthorized entry, thefts or losses, each such instance is to be reported to the radiological safety officer who in turn advises the Rensselaer County health officer. If the radiological safety officer cannot be reached, the county health officer is to be advised. The county radiological health program is geared then to protect the citizens from any unfortunate consequences that might result from the mishandling of radionuclides or radioactive wastes.

Summary

The New York State Department of Health initiated activities in 1952 to control radiation

hazards. The Rensselaer County Health Department is carrying out this program in Rensselaer County.

The program, under the supervision of a trained sanitarian and with the basic monitoring equipment, consists of registration of installations, a visible card file record system, and inspection of radiation equipment. Activity is presently limited to radionuclides and certain other radiation sources, such as accelerators. The staff, however, is continually increasing its working knowledge and competence to carry out better the legislated responsibilities.

Much of the program consists of education in the safety values of shielding, distance, restricted exposure time, coning, filtration, and protective clothing. Although protective means are available, the county health department must work tirelessly to develop safe habits and promote safe facilities among radiation users. To be effective this educational program seeks to stimulate self-discipline.

Rensselaer County's radiological health program has been developed with currently available space and staff and with an expenditure of less than $1,000 for equipment.

This program is another demonstration of the advantages held by a modern county health department employing only qualified professional personnel. Such a department can adjust its activities to provide optimum public health protection in our ever-changing environment.

Kimble Award

The deadline for nominations for the Ninth Kimble Methodology Research Award is June 1, 1960. The award, $1,000 and a silver plaque, is given annually in recognition of the application of scientific knowledge to the public health laboratory.

Candidates must live in the United States, its territories, or Canada. Their work should be either a fundamental contribution which serves as a baseline for development of diagnostic methods within the province of the public health laboratory or the adaptation of a fundamental contribution to make it useful in a diagnostic laboratory.

Authors, their associates, or others may make nominations. Studies with more than one author will be accepted. The nominations must be accompanied by six summaries and a bibliography, also six reprints if available. A statement justifying the recommendation of the work and a letter of transmittal are required. Documentary evidence and related material should not be signed by the nominator. None of the material submitted will be returned.

The Kimble award, established by the Kimble Glass Company of Toledo, Ohio, and sponsored by the Conference of State and Provincial Public Health Laboratory Directors, will be presented at the annual meeting of the conference in San Francisco, Calif., in October 1960.

Send all nominations to: P. R. Edwards, Chairman, Nominating Committee, Kimble Award, Communicable Disease Center, P.O. Box 185, Chamblee, Ga.