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REPORT BY THE

Comptroller General

OF THE UNITED STATES

12237

Radiation Control Programs Provide Limited Protection

Health effects from high levels of ionizing and nonionizing radiation are known to be serious. The effects of low-level exposure are controversial and uncertain, although it is generally agreed that any radiation exposure involves some risk.

A comprehensive Federal or State radiation control program to protect the public from radiation hazards does not exist. In the eight States reviewed, many sources of radiation were not regulated, the coverage of regulated sources was limited, and there was little assurance that identified hazards were corrected.

HRD-80-25
DECEMBER 4, 1979

COMPTROLLER GENERAL OF THE UNITED STATES
WASHINGTON, D C 20548

The Honorable Abraham A. Ribicoff
Chairman, Committee on
Governmental Affairs
United States Senate SEN66600

Dear Mr. Chairman:

Pursuant to your request of November 16, 1978, this report describes the radiation control programs to protect the public from radiation hazards in selected States. It also discusses the radiation control activities of the Nuclear Regulatory Commission, the Occupational Safety and Health Administration, and the Food and Drug Administration.

Your office requested that we distribute the report on the scheduled day of the committee hearing (December 4, 1979), when the report will be discussed.

Sincerely yours,

Comptroller General
of the United States

COMPTROLLER GENERAL'S REPORT
TO THE CHAIRMAN,
SENATE COMMITTEE ON
GOVERNMENTAL AFFAIRS

RADIATION CONTROL PROGRAMS PROVIDE LIMITED PROTECTION

D I G E S T

With the number of radiation-emitting sources continually increasing, assurance against unnecessary exposure is a growing concern. Health effects from high levels of ionizing and nonionizing radiation are known to be serious (for definitions, see p. 2), and it is generally agreed that any radiation exposure involves some risk.

Radiation health and safety is a complex and varied field, involving Federal and State agencies. Activities and responsibilities are scattered among several Federal agencies. Most States regulate radiation to some degree.

Three Federal agencies--the Nuclear Regulatory Commission, the Occupational Safety and Health Administration (OSHA) of the Department of Labor, and the Food and Drug Administration--exercise major responsibilities which relate to people's protection from radiation hazards.

The Nuclear Regulatory Commission regulates certain users of radioactive material in 30 States and territories through a program of standards, licensing, inspections, and enforcement. It also has agreements with 25 States to which it has relinquished certain authority. Together, the Nuclear Regulatory Commission and the States are responsible for regulating about 17,000 users of nuclear materials. (See p. 5.)

The Department of Labor's Occupational Safety and Health Administration and 24 States operating OSHA-approved plans are responsible for assuring that employers comply with OSHA radiation standards in situations not covered by the Nuclear Regulatory Commission's standards. (See p. 6.)

The Department of Health, Education, and Welfare's (HEW's) Food and Drug Administration regulates electronic products that emit radiation. As part of its X-ray regulation program, it conducts a nationwide testing program in cooperation with States to determine compliance for newly assembled X-ray equipment. It also has several voluntary programs to reduce exposure to radiation. (See p. 7.)

GAO surveyed the radiation control programs of the Nuclear Regulatory Commission, Occupational Safety and Health Administration, Food and Drug Administration, and eight States--California, Colorado, Massachusetts, Missouri, North Carolina, Texas, Vermont, and Virginia. Despite widespread recognition of the hazards of radiation, no comprehensive program exists to protect the public from the hazards radiation presents. Federal programs did not cover many sources of radiation and often provided limited protection in the areas they did cover. Some State programs were broad in scope, but they often lacked depth. Federal support of States' efforts was minimal.

A study completed in June 1979 by an interagency task force found that there was inadequate coordination of radiation protection among Federal agencies. As a result of the task force's findings, the Secretary of Health, Education, and Welfare recommended to the President that a Radiation Policy Council be established. On October 23, 1979, the President announced his approval for the establishment of a Radiation Policy Council. (See p. 9.)

GAO found that:

--State officials believed that they did not have sufficient personnel and funds to adequately perform their radiation control responsibilities.

--Many radiation sources and users were not regulated.

--Elimination of identified radiation hazards was often not assured.

--Desired inspection frequencies usually were not met.

--Federal and State occupational safety and health officials gave radiation hazards a low priority. It appeared few inspections addressed sources of radiation.

--The Nuclear Regulatory Commission identified numerous deficiencies in its evaluations of agreement States.

RECOMMENDATIONS

The Chairman of the Nuclear Regulatory Commission should require that:

--The Commission and its agreement States establish followup procedures to verify that serious violations identified during inspections of licensees are corrected.

--Copies of Commission evaluation reports be provided to agreement States.

--Commission evaluators determine whether licensing and inspection deficiencies identified in previous State evaluations have been corrected.

The Secretary of Health, Education, and Welfare should direct the Commissioner of the Food and Drug Administration to develop procedures to assure that followup tests are made in cases where X-ray assembly field tests have identified serious hazards.

When an interagency Radiation Policy Council is established, the council should give high priority to evaluating the adequacy of Federal and State radiation programs and the need for more coordination among Federal and State regulatory agencies.

AGENCY COMMENTS

Labor agreed that radiation responsibilities were not always as clearly defined as they might be and said it was working to further clarify jurisdictional boundaries. Labor said its responsibilities for providing safe and healthful workplaces for all employees have precluded increased emphasis on radiation. Also, Labor's jurisdiction over radiation hazards is preempted when other agencies, such as the Nuclear Regulatory Commission, have enforceable standards. (See p. 25.)

HEW agreed with GAO's recommendation for developing procedures to assure that followup inspections are made when X-ray assembly field tests identify serious hazards. HEW officials said the Food and Drug Administration is preparing more explicit procedures calling for followup field testing when violations posing an immediate radiation hazard are found.

HEW officials said that the scope of GAO's review was insufficient to support GAO's conclusions. HEW believed that several matters should be clarified to make the report more accurate and useful. GAO believes that it has done enough work to support its conclusions by covering the major sources of radiation in the study. The eight States selected presented a good representation of State radiation programs. HEW's views have been considered in preparing this report. (See p. 27.)

The Nuclear Regulatory Commission chose not to provide formal written comments on a draft of this report. However, Commission officials said they did not agree with GAO's recommendations. (See p. 29.)

Also, six of the eight States provided written comments on a draft of this report which were considered in preparing this report.

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ABBREVIATIONS

BENT	Breast Exposure: Nationwide Trends
BRH	Bureau of Radiological Health
DENT	Dental Exposure Normalization Technique
EPA	Environmental Protection Agency
FDA	Food and Drug Administration
GAO	General Accounting Office
NARM	naturally occurring and accelerator-produced radioactive materials
NRC	Nuclear Regulatory Commission
OSHA	Occupational Safety and Health Administration

CHAPTER 1

INTRODUCTION

Abe Ribicoff, Chairman, Senate Committee on Governmental Affairs, requested that we review Federal and State radiation control programs. (See app. I.)

Everyone is exposed to radiation from manmade and natural sources, and the number of radiation-emitting sources is continuously increasing. The major sources of radiation to which the general population is exposed are the natural background--such as sun and soil--and medical applications of radiation--mostly X-rays. The radiation dose from natural background varies with altitude and geographic location, as well as with living habits. Workers in nuclear and other industrial facilities in which radioactive material or X-ray equipment is used are occupationally exposed to radiation that may be several times the background level. The number of such workers is increasing. The Environmental Protection Agency (EPA) estimates that about 1 million persons are exposed to radiation in the workplace.

SOURCES OF RADIATION EXPOSURE

While exposure to radiation can come from many activities and sources, there are four general sources of exposure.

--Healing arts and industrial applications, including (1) ionizing radiation sources used for diagnostic and medical applications, such as dental and medical diagnostic X-rays, therapy, and nuclear medicine, and (2) industrial uses of radiation, such as radiography, gauging, and well-logging.

--Nonionizing sources, such as radars, television and radio transmitters, microwave ovens, laser devices, high voltage transmission lines, ultrasound and industrial radio frequency.

--Natural radiation sources, which include (1) both terrestrial and cosmic background radiation, (2) construction materials containing significant concentrations of radionuclides; fertilizer phosphates; and mine, milling, and processing residues, (3) energy production involving fossil fuels, and (4) geothermal systems.

--Nuclear energy applications, a broad category which includes all activities relating to the production of electric power by either fission or fusion. They also include the manufacture and use of nuclear explosives as they apply to both weapon devices and peaceful uses.

EFFECTS FROM RADIATION EXPOSURE

The primary health effects associated with ionizing and nonionizing radiation exposure are different. Exposure to ionizing radiation causes cell damage and destruction. The extent of the damage depends upon the total amount of radiation absorbed and the type of organism involved. Very high doses of ionizing radiation can cause sudden death, radiation sickness, cataracts, sterility, cancer, and genetic effects. A National Academy of Sciences' study completed in 1979, on the risk of exposure to low levels of ionizing radiation, concluded that any radiation exposure may involve some risk (particularly cancer induction).

Nonionizing radiation energy is absorbed by human tissue and interacts with the biological systems. High-level exposure increases body temperature and results in such problems as cataract formation, cardiovascular effects, testicular effects, and brainwave pattern changes. The effects of low-level exposure are controversial and uncertain.

RESPONSIBILITY FOR RADIATION PROTECTION IS SCATTERED AMONG FEDERAL AND STATE AGENCIES

Radiation health and safety is a complex and varied field involving Federal and State agencies. Activities and responsibilities are scattered among many Federal agencies. Most States have regulations regarding radiation; for example, States regulate X-ray facilities and their use. In addition, although Federal radiation control authorities generally preempt States, several statutes include provisions permitting Federal authority to be delegated to States through individual agreements.

Major responsibilities for assuring that people are protected from radiation hazards are shared by four Federal agencies--the Nuclear Regulatory Commission (NRC); the Department of Labor's Occupational Safety and Health Administration (OSHA); the Department of Health, Education, and Welfare's Food and Drug Administration (FDA); and EPA.

EPA has authority to provide guidance on radiation to all Federal agencies and establish radiation standards. Because EPA has established only one radiation standard covering the uranium fuel cycle, which becomes effective in December 1979, and has no enforcement responsibility, we did not include EPA in our review. Problems regarding EPA's radiation programs were discussed in our report, "The Environmental Protection Agency Needs Congressional Guidance and Support to Guard the Public in a Period of Radiation Proliferation" (CED-78-27, Jan. 20, 1978).

The radiation control programs of FDA, NRC, and OSHA are discussed in chapter 2.

In June 1979, an interagency task force issued its report on the health effects of ionizing radiation. The task force was established in response to a May 9, 1978, White House memorandum. The report contained information on the need for a coordinated program concerning the health effects of radiation exposure on participants in nuclear tests, workers in nuclear-related activities, and the public. Topics addressed by the task force included

--scientific research and knowledge on the health effects of ionizing radiation,

--legal restrictions on access to records by health researchers,

--existing care and benefit systems for persons harmed by radiation exposure,

--information programs for the public and targeted groups,

--steps to reduce radiation exposure in the future, and

--institutional arrangements for carrying out Federal research and protection activities concerning radiation.

SCOPE OF REVIEW

Abe Ribicoff, Chairman of the Senate Committee on Governmental Affairs asked that we concentrate our review on State-operated radiation control programs. A representative sample of States was to be selected including both States that participate and States that do not participate in NRC agreements and OSHA-approved plans.

We reviewed the compliance programs in Massachusetts, Vermont, Missouri, Virginia, North Carolina, Texas, Colorado, and California. The latter four States are NRC-agreement States. Vermont, North Carolina, Virginia, and California have OSHA-approved plans.

We interviewed Federal and State officials responsible for administering radiation control programs and examined laws, regulations, procedures, directives, standards, and records on compliance activities.

CHAPTER 2

FEDERAL AND STATE RADIATION PROTECTION PROGRAMS

This chapter discusses the activities of the major Federal agencies mandated by the Congress to control radiation and summarizes radiation control efforts in eight States.

FEDERAL AGENCIES

Three major Federal agencies involved in radiation protection are NRC, OSHA, and FDA.

Nuclear Regulatory Commission

NRC, under the Atomic Energy Act of 1954, as amended (42 U.S.C. 2011), is required to insure through a system of regulations that the possession, use, and disposal of certain radioactive materials other than naturally occurring and accelerator-produced radioactive materials (NARM), such as radium and thorium, and the construction and operation of reactors and other nuclear facilities are conducted in a manner consistent with the health and safety of the public.

NRC is responsible for licensing and inspecting certain nuclear material users in 30 States and territories and has agreements with 25 States to which it has relinquished certain authority. 1/ Under these agreements, States regulate manufacturers and users of non-exempt radioactive materials and sources within their jurisdiction. These States are required to have programs that are compatible with NRC requirements. As of December 1978, there were 8,511 active NRC-issued material licenses held by 6,960 licensees. NRC-agreement States for the same period had 11,806 State-issued active licenses held by 10,222 licensees.

NRC has established five regional offices which inspect and investigate material licensees. As of May 1979, NRC had 34 inspectors available to cover about 8,500 licenses.

1/NRC may not transfer regulatory responsibility to States for quantities of special nuclear material (plutonium and enriched uranium) above certain specified limits or for obtaining, distributing, or disposing of licensed materials in certain ways. For example, a State cannot authorize a licensee to export or import materials. Thus, NRC continues to exercise authority including licensing and inspection over some licensees in agreement States.

The basic premise behind NRC's regulations is that all unnecessary exposure to radiation should be avoided because of the possible biological effect. An enforcement action is taken by NRC whenever an inspection discloses that a licensee is operating in violation of NRC regulations or specific license conditions. When violations are detected, NRC notifies the licensee of the violations and requests it to report actions taken or planned to correct the violation. In more serious cases, NRC can (1) levy a monetary penalty, (2) direct the licensee to cease and desist an unsafe practice, or (3) suspend, modify, or revoke a license.

In fiscal year 1978, NRC inspectors made 2,411 inspections, and in about 40 percent of these inspections violations were cited. The most serious actions taken by NRC concerning violations were to issue two orders stopping operations and assessing 13 monetary penalties.

The Atomic Energy Act provides that NRC may terminate its agreement with a State, if it finds that such termination is necessary to protect the public health and safety. NRC periodically monitors each agreement State to assure continued compatibility of the State's regulatory program with that of NRC and its adequacy to protect health and safety.

Occupational Safety and Health Administration

Under the Occupational Safety and Health Act of 1970, employers must comply with job safety and health standards issued by OSHA. OSHA makes workplace inspections to assure compliance with these standards. States may enforce occupational safety and health standards under OSHA-approved plans. States are provided grants to assist them in carrying out their programs. As of July 1979, 24 States or jurisdictions were operating enforcement programs under OSHA-approved plans.

OSHA does not cover worksite hazards addressed by other Federal agencies. Thus, OSHA applies its radiation standards only to workplaces not covered by NRC's standards.

OSHA has standards both for ionizing and nonionizing radiation. According to an OSHA official, its ionizing standards are essentially the same as NRC's. OSHA's nonionizing standard was based on a 1966 standard established by the American National Standards Institute.

In a December 31, 1975, decision, an Occupational Safety and Health Review Commission law judge held that OSHA's nonionizing standard was advisory rather than mandatory. In addition, the Assistant Secretary for Occupational Safety and Health advised EPA in a September 17, 1976, letter that the standard was only a recommended guide.

The National Institute for Occupational Safety and Health, which is responsible for recommending to OSHA new or revised standards, is developing a proposed standard for radio frequency/microwave radiation. The acting director of OSHA's health standard program told us that OSHA will not decide on what action it will take on the standard until the final document is received from the National Institute for Occupational Safety and Health.

Although OSHA and States have made over 1 million workplace inspections since the Occupational Safety and Health Act was enacted, OSHA does not have information on how many inspections covered potential radiation hazards. Data obtained from OSHA's management information system showed that, in fiscal year 1978, only five establishments were either cited for radiation violations or sampled for radiation hazards.

According to an OSHA official, radiation does not have a high priority in OSHA's inspection effort because many sources of workplace radiation are not readily identifiable. For example, the Standard Industry Classification Code, used by OSHA for identifying and grouping many industries, gives no indication whether the industry uses any form of radiation. Also, he said that much of the ionizing radiation is under other agencies' jurisdiction. He added that much of the equipment needed to evaluate nonionizing radiation is not readily available in today's market.

Food and Drug Administration

Under the Federal Food, Drug, and Cosmetic Act (21 U.S.C. 301) and other laws, FDA has authority to regulate the manufacture and distribution of radiopharmaceuticals and medical devices containing radioactive materials. It shares part of this authority with NRC, which has similar authority when the drugs or devices contain material regulated by the Atomic Energy Act.

The Radiation Control for Health and Safety Act of 1968 (42 U.S.C. 263b) provides for a program to protect the public from electronic product radiation. FDA sets basic performance

standards for electronic products that emit radiation, including X-ray machines, lasers, mercury vapor lamps, ultrasonic therapy equipment, television receivers, cold cathode gas discharge tubes, and cabinet X-rays. FDA also issues recommendations for use of X-ray machines and other radiation emitters and conducts education programs for professionals and others.

On August 15, 1972, FDA issued performance regulations for diagnostic X-ray products. The regulations prescribe performance standards for X-ray systems and their components manufactured after August 1, 1974.

FDA conducts a nationwide field compliance testing program in cooperation with the States to determine compliance for diagnostic X-ray equipment. Such tests are used to identify manufacturers, assemblies, and equipment models that fail to comply with the performance standards. From August 1974 through mid-1979, 44,311 newly installed systems had been reported to FDA and 14,333 field tests had been made.

Over 11,700 new diagnostic X-ray systems were reported to FDA in fiscal year 1978. During the same period, FDA and 22 States under contract made 3,152 field tests. They found 1,918 installations that were not in compliance with FDA's standards, including 32 violations which warranted ceasing operations, and 1,119 other major violations. FDA defines violations which warrant cessation as "conditions which pose an immediate radiation hazard to the public health and safety." During fiscal year 1978, neither FDA nor the States did any radiation compliance testing in seven States.

FDA field offices notify the assembler of noncomplying equipment by letter when items of noncompliance are found. The user is usually told of any apparent violations at the time of the field test. A response from the assembler describing corrective measures is required within 30 days. Corrective action is to be verified either through a followup test or service reports which state that corrective measures were taken. According to Bureau of Radiological Health (BRH) officials, field offices often accept the assembler's reply of corrective measures taken and usually no followup visit is made. Any followup action is at the discretion of the field office.

Although the field offices are directed to forward corrective action reports to BRH, often such reports are entered into the computer in an untimely fashion and occasionally the form is not sent or is lost, according to BRH officials.

BRH data showed that, out of 578 systems cited for major performance aspects of noncompliance, field personnel reported corrective action in only 226 cases. The program director said that, because the field personnel did not always report to headquarters that corrective action was taken, headquarters data are incomplete.

In addition to the compliance program for newly installed X-ray systems, FDA has several voluntary programs to assist State radiation control activities, provide educational materials, and determine the extent of unnecessary radiation to which people are exposed. Two programs which FDA operates with the States to help reduce unnecessary X-ray exposure include mammography, Breast Exposure: Nationwide Trends (BENT) program and dental X-rays, Dental Exposure Normalization Technique (DENT) program. BRH estimates that nationwide about 4,000 X-ray units are used for mammography and about 145,000 are used for dental purposes.

The programs involve BRH analysis of information recorded on dosimetry cards. The State mails the cards to X-ray facilities, where the cards are exposed to radiation and returned to the State. The State then mails the cards to BRH, which reads and evaluates the data and reports the results to the State. Since the programs began, 38 States surveyed 35,224 dental units. BRH's analysis indicated that exposures from 12,680 units appeared excessively high. Forty-five States surveyed 3,253 mammographic units, resulting in BRH identifying 1,496 units with either excessively high or unusually low X-ray exposure. 1/ BRH does not know how often the States visited the X-ray facilities to help correct the problems.

INTERAGENCY TASK FORCE

As noted on page 3 the interagency task force studied the health effects of ionizing radiation. One of the task force's conclusions was that there was inadequate coordination of radiation protection among Federal agencies. As a result of the task force's activities, the Secretary of Health, Education, and Welfare on August 2, 1979, recommended to the President that a Radiation Policy Council be established comprised of high-level officials from all Federal agencies with major regulatory, operational, and research responsibilities in the field of radiation. The Secretary recommended that the council

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1/Unusually low exposure could result in an additional X-ray to get an acceptable picture.

--advise on the formulation of broad radiation protection policy,

--coordinate Federal activities related to radiation use and control,

--resolve problems of jurisdiction among the agencies and recommend legislation to fill gaps in authority,

--ensure effective liaison with the States and the Congress, and

--provide a forum for public participation and comment.

On October 23, 1979, the President announced his approval for the establishment of a Radiation Policy Council.

STATE RADIATION CONTROL PROGRAMS

Radiation control programs in the States we visited generally consisted of regulating, licensing, and/or registering users of radioactive materials and inspecting them. Every State registered and inspected X-ray machines. However, only California and Vermont had a certification program to assure that X-ray operators were qualified. Source (uranium and thorium), by-product (radioisotopes produced in nuclear reactors), and special nuclear (plutonium and enriched uranium) materials were covered by the four NRC-agreement States and Massachusetts. Naturally occurring and accelerator-produced radioactive materials, which include primordial and cosmic ray induced radionuclides and radioactive materials produced as a result of nuclear interactions in accelerators, were covered in all of the States. Only two States regulated sources of nonionizing radiation under their radiation control programs. The four OSHA-plan States had standards that covered both ionizing and nonionizing radiation in workplaces. State program coverage is summarized below. (More detailed information on the States we visited is shown in app. II.)

State Radiation Control Programs

	NRC material		NARM		X-ray		Nonionizing	
	License or register	Inspect	License or register	Inspect	Register	Inspect	Register	Inspect
California	license	yes	license	yes	yes	yes	no	no
Colorado	license	yes	license	yes	yes	yes	no	no
Massachusetts	register	yes	register	yes	yes	yes	a/yes	yes
Missouri	no	no	register	no	yes	yes	no	no
North Carolina	license	yes	license	yes	yes	yes	no	no
Texas	license	yes	license	yes	yes	yes	yes	yes
Vermont	no	no	register	no	yes	yes	no	no
Virginia	no	no	license	yes	yes	yes	no	no

a/Regulation is limited to lasers.

The participation in Federal programs operated by NRC, OSHA, and FDA varied among the States as shown below:

	NRC-agreement	OSHA-plan	FDA new assembly field testing	BENT	DENT
California	yes	yes	yes	yes	yes
Colorado	yes	no	yes	yes	yes
Massachusetts	no	no	yes	yes	no
Missouri	no	no	no	yes	no
North Carolina	yes	yes	yes	no	no
Texas	yes	no	yes	yes	yes
Vermont	no	yes	no	yes	yes
Virginia	no	yes	yes	yes	yes

Most of the State programs were primarily operated with State funds for fiscal year 1978. NRC does not have authority to provide funds to NRC-agreement States, and OSHA did not provide funds specifically for radiation protection. FDA paid the States for field testing newly installed X-ray systems. However, it did not provide funds to States that participated in its other programs, such as BENT and DENT. Only California charged licensing and registration fees to help offset the cost of the program. None of the States fined users for violating standards.

Data on the number of radiation control personnel, licensees/registrants, and inspection activity are shown on page 12. Most licensing, registration, and personnel statistics are as of June 30, 1978, and inspection data were for the States' fiscal year 1978 (July 1, 1977, to June 30, 1978). However, because some States did not have statistics for the above time periods, a different time

period was used. (See app. II for the dates that apply to each State.)

State statistics for X-ray sources were sometimes not reported on a consistent basis. For example, a State might report registrations in number of tubes registered and inspections in number of machines inspected or in number of facilities inspected. A tube is the piece of equipment which converts the electrical energy into X-ray energy. Some machines may have more than one tube. FDA's ratios for converting the number of tubes to the number of machines are: 1:1 for dental machines, 1.2:1 for medical machines.

State Radiation Coverage

States	Nuclear material (including NARM)			X-ray machines			Radiation control program	
	Number licensed or registered	Inspections	Violations	Number registered	Inspections	Violations	Professional staff	Expenditure
California	1,800	492	513	36,000	4,231	(a)	55	$1,800,000
Colorado	358	97	138	3,469	305	21	7	434,000
Massachusetts	916	161	b/481	9,186	2,478	c/128	10	231,000
Missouri	47	0	0	5,910	766	13	3	68,000
North Carolina	700	270	215	d/8,539	1,316	240	8	388,000
Texas	1,410	589	885	e/6,261	991	(a)	25	594,000
Vermont	35	0	0	d/785	d/44	e/19	3	74,000
Virginia	79	0	0	f/6,790	f/326	e/146	4	93,000

a/Not available.

b/According to Massachusetts officials, many of these are recommendations for program improvements, rather than violations.

c/The figure consists of 18 machines which were not in compliance and 110 recommendations.

d/Tubes.

e/Facilities.

f/The figures include a mixture of tubes, machines, and facilities.

CHAPTER 3

PROBLEMS IN RADIATION PROTECTION PROGRAMS

Inspecting and licensing programs are the primary ways of protecting people from radiation hazards. Our review of Federal and State compliance programs showed that

--some radiation sources were not controlled,

--inspection frequency goals were not met, and

--often assurance did not exist that radiation hazards identified were corrected.

Also, NRC found numerous deficiencies during its evaluations of NRC-agreement States.

SOME RADIATION SOURCES WERE NOT CONTROLLED

Naturally occurring and accelerator-produced radioactive materials and nonionizing sources of radiation were not controlled by several of the States we reviewed.

Although NRC encourages agreement States to include NARM in their radiation programs, it does not have statutory authority to regulate NARM. According to an NRC task force, the regulation of NARM is fragmented, nonuniform, and incomplete at both the Federal and State levels. Yet, these radioactive materials are widely used; there are an estimated 6,000 users of NARM.

One NARM radioisotope (226 Ra) is one of the most hazardous of radioactive materials. It is used by about one-fifth of all radioactive material users. About 85,000 medical treatments annually use 226 Ra. Also, radium, one of the nuclides in the uranium decay series, is the principal naturally occurring radioisotope in use today. Radium is used in a large number of medical, industrial, and military applications and in consumer items, such as smoke detectors.

All of the 25 NRC-agreement States and 5 nonagreement States have licensing programs covering NARM users. Seven States exercise no regulatory control over NARM users. The remaining States have control programs which vary in scope.

Of the four nonagreement States in our review, Vermont registered NARM users when NARM was identified during X-ray inspections. Inspections are not scheduled for NARM. However, NARM may be inspected incidental to a scheduled X-ray inspection. Massachusetts registered and inspected NARM users. During our review, Missouri, which had registered some NARM users, was beginning a program to identify and register all users. Through June 1978 only 47 users had been registered; however, as of March 1979 the number had increased to 74. Missouri did not inspect NARM users, but planned to in fiscal year 1980. In Virginia, which licenses users, no NARM users were inspected during fiscal year 1978.

According to an NRC task force, no Federal regulation covered the design, fabrication, and quality of sources and devices containing NARM or consumer products containing NARM which are distributed in interstate or foreign commerce. State officials have expressed concern about the accountability and safety of NARM. For example, an out of State or foreign manufacturer may sell products containing NARM to a nonlicensed person in a State that requires licensing. Authorities would not know of the sale.

A Texas official stated that many businesses which manufacture and use NARM tend to do so in nonagreement States. As a result products are not adequately evaluated for safety. For example, he said a Wisconsin firm producing radium moisture density gauges distributed some in Texas. Texas officials became aware of the product and evaluated the device. They found that the radioactive material in the device could present a radiation hazard.

In July 1978, a task force for the Conference of State Radiation Control Program Directors reported that it found at least 86 NARM products for which no hazard evaluation had ever been performed by the States.

Texas and Massachusetts were the only States we visited that included nonionizing regulations as part of their radiation control programs. However, Massachusetts only regulated one nonionizing source (lasers) through a registration program, and had no inspection program. In commenting on a draft of this report, a Massachusetts official said that a number of microwave ovens, dielectric heaters, television receivers, and cathode ray tubes have been surveyed as part of the ongoing radiation programs. Nonionizing sources are also covered by the Federal or State occupational safety and health program. However, State officials with OSHA-approved plans said that radiation was not one of their high priorities

and they could not tell us what effort, if any, was expended on nonionizing radiation. In Virginia, where information was available, out of 2,919 safety and health workplace inspections, the State identified 8 where radiation violations were cited. The violations all dealt with lasers. The Federal OSHA effort, as noted on page 6, was also limited.

INSPECTION FREQUENCY GOALS NOT MET

NRC and most States had established priorities for making compliance inspections. Material license inspections were behind schedule in seven of the eight States visited. Also, many of the States were not meeting their schedules for inspecting X-ray facilities.

NRC has established a materials priority system, which defines the frequency of routine inspections, for the different types of licensed operations. States with NRC agreements generally followed NRC's priority system. NRC inspection frequencies were established for seven categories of licensees. Priority I licensees were to be inspected within 1 month after licensing and once or twice a year thereafter. Only a sample of priority VII licensees were to be inspected. The inspection frequencies for priority II through VI licensees ranged from 6 to 18 months after licensing for initial inspections and 1 to 10 years for later inspections.

Data were not readily available, as to the NRC inspections overdue at the end of fiscal year 1978, in the four nonagreement States we visited. However, NRC data as of May 1979 showed that 51 facilities due for inspection in fiscal year 1978 had not been inspected. None were in priority I; however, 46 were in priorities II, III, and IV.

In agreement States, only North Carolina did not have a nuclear materials inspection backlog. However, State officials said the State was having difficulty in inspecting general licensees because there were staffing shortages, and the State's system for identifying the licensees was inadequate for scheduling inspections. A new system was being developed. In Colorado, data showed that as of March 9, 1979, 21 inspections in priorities I through IV were overdue.

California officials said that information on overdue inspections was not kept by the State. An official said that the State projected 586 licensee inspections for fiscal year 1978 but made only 492. The State estimated that 23 inspections were overdue as of June 1979, but did not know

in which priority. NRC, in its most recent evaluation of California, reported that in fiscal year 1977 the State had made 481 inspections and had 163 licensees overdue for inspection. Four overdue inspections were in priority I, and 159 were in priorities II, III, and IV.

NRC's most recent evaluation of Texas stated that, as of September 1978, about 280 licensee inspections were overdue. Texas was not able to completely classify the overdue inspections by priority category.

Missouri, Texas, Vermont, California, Massachusetts, and Colorado were behind in achieving their goals for X-ray inspections. Virginia and North Carolina did not have inspection priorities during our review. Officials from North Carolina believed their inspection frequency (9 to 11 years) was not adequate.

LITTLE ASSURANCE THAT HAZARDS ARE CORRECTED

Radiation protection agencies' policies required that violations of radiation standards which were identified during inspections be corrected. However, the agencies usually did not follow up to determine whether violations were corrected, except during subsequent routine inspections which may occur years later. Although agencies usually requested responses regarding what was done or planned to correct violations, some inspection files we reviewed did not contain responses. Also, some violations were not cited or were not clearly identified as violations that must be corrected.

NRC did not have followup procedures to determine when to perform followup inspections. The decision as to when to make a followup inspection, rather than waiting until the next scheduled inspection, was made independently at each regional office. Generally States did not follow up on material license inspections.

NRC's evaluation reports for Texas, California, and North Carolina noted that sometimes there was no indication in the inspection reports that previous items of noncompliance were reviewed by the inspector to ascertain whether adequate corrective action was taken. The NRC evaluator noted that, for the 14 compliance files reviewed in Texas, there was either no indication if there were items of noncompliance to follow up, or no indication of the status of previous items of noncompliance. In both California and North Carolina, NRC noted, for some cases involving items of noncompliance in prior

inspections, there was no indication that corrective actions were reviewed and considered adequate. Also, NRC noted that licensees in Texas did not describe steps taken to prevent recurrences of noncompliance.

All of the States we visited except Virginia required a signed response which indicated that the cited violation had been or would be corrected. In addition, many States required the response to state what was or would be done to correct violations. However, our case file review showed that, in some instances, responses were not received and there was no indication of efforts to obtain a response. Corrective action was to be verified in later inspections. According to several State officials, followup inspections may be made if violations are considered serious. However, violations were not classified as to seriousness, there were no criteria defining when followups should be made, and followups were rare.

Although time constraints precluded us from attempting to determine how often violations went uncorrected, we did observe some instances where no corrective action was taken. For example, in 13 Massachusetts Department of Labor and Industries cases we examined where violations had been identified in prior inspections, later inspections showed that in only 1 case were violations totally corrected. In three cases no corrective action was taken, and in the other cases, efforts to correct the violations were only partially effective.

In the only instance where one Virginia inspector followed up, he found that a serious violation of State regulations, involving lack of X-ray shielding at a dentist's office, had not been corrected. The inspector took exposure readings which showed that people in a waiting room could be exposed to radiation levels far in excess of State limits. In a response to the followup inspection, one of the dentists said he had not previously been informed that the lack of shielding was a violation of regulations and he thought there was no urgency to install the shielding.

Items of noncompliance were not always cited

NRC reviews a limited number of case files and makes on-the-job evaluations to determine the quality and effectiveness of State enforcement programs. During the most recent evaluations of the four agreement States, NRC noted items which should have been cited as violations but were not. Such items included

--inadequate training of personnel,

--unauthorized users of radioactive materials,

--unsecured work areas where radioactive material was used and allowing employees to eat near radioactive material, and

--inadequate posting of work areas where high radiation existed and failure to keep records of leak tests.

The first three items would be considered severity II items of noncompliance by NRC regulations, i.e., "Those violations which if not corrected, may lead to or contribute to an occurrence, incident or situation involving radiation exposure * * *."

Some State inspectors in Massachusetts and Virginia made recommendations regarding problems found during an inspection rather than citing violations. Also, a Missouri official told us that some deficiencies are corrected during the inspections of X-ray facilities and never documented.

PROGRAM DEFICIENCIES NOTED IN AGREEMENT STATE EVALUATION

NRC must determine that a State's proposed agreement materials program is adequate to protect the public and is compatible with NRC's program before transferring its regulatory responsibility. Also, NRC may terminate an agreement with a State if the State's program becomes inadequate. NRC annually reviews agreement State programs--primarily through evaluation visits.

An NRC official said that evaluation visits range from 1 to 3 weeks and involve one to three NRC evaluators. The most recent evaluations of North Carolina and Colorado were completed by one NRC staff member within 1 week. California had two evaluators and Texas had three evaluators spending 1 week.

During the evaluation visits, NRC

--reviews license files to determine whether the data provided by licensees justify issuance of licenses and whether the licenses contain proper conditions;

--reviews inspection files to determine whether inspection reports adequately describe the scope of the inspections, support the noncompliance items noted, and whether appropriate enforcement action has been taken;

--accompanies State inspectors to observe and evaluate their performance and to provide training; and

--obtains information on various other aspects of the State's program, such as budget and personnel data.

Although States are advised of NRC's determination of adequacy and compatibility with NRC's program and given general recommendations on how to improve their programs, they are not provided NRC's evaluation reports which contain specific information on the problems identified during evaluations. NRC officials said that the specific problems identified are discussed with State officials during the evaluation. Also, other minor problems may be identified or discussed but not documented in the evaluation reports.

An NRC official said the States are not given the evaluation reports because:

--The evaluator has already discussed the findings in detail with the State officials.

--The reports contain information which could be sensitive, such as the identity of the State official whose work was criticized.

--NRC's evaluators would not describe their findings as accurately or openly if the reports were distributed outside NRC.

Although NRC has a guide for evaluating agreement State radiation control programs, determining adequacy and compatibility is left to the judgment of each evaluator. We could not determine from reviewing NRC's evaluation reports how the final assessment was made for measuring adequacy and compatibility. The reports for the four States we reviewed had identified numerous deficiencies. In some cases these deficiencies had existed for several years. The type of problems identified included

--staff shortages,

--licenses being issued when the applications did not contain sufficient information to support issuance,

--lack of adequate documentation in inspection case files, and

--failure to update State regulations to incorporate changes in NRC's regulations.

Staff shortages

NRC has often stated that having adequate personnel, in terms of numbers and professional qualifications, is the most important part of a State's radiation control program. During the most recent NRC evaluations, only Texas' staff was considered adequate. In California's evaluation, NRC noted that the State radiation control program continued to be hindered by inadequate professional staffing and this had been commented upon in each of the last five review meetings. According to NRC guidelines, North Carolina did not have enough personnel. NRC recommended to Colorado officials that additional staff was needed in the uranium mill licensing area.

Insufficient licensing information

NRC requires that a materials license be issued only if the application demonstrates that the applicant has the necessary training, experience, and equipment to use the materials safely. NRC pointed out licensing deficiencies in all four States. For example, the most recent NRC evaluation for California showed that licensing actions were not fully supported by information in the application and did not always provide an adequate basis for issuing the licenses. In 9 of the 30 cases reviewed by NRC's evaluator, significant aspects of an applicant's radiation safety program were omitted in the application, but the licenses were still issued.

We discussed several of the license deficiencies with an NRC evaluator, who said that some of the licenses being approved by the States would not have been approved by NRC. Several NRC evaluators said that, when deficiencies needing immediate correction are noted in a license review, they inform the State staff during the review. However, they do not determine whether corrective action is taken by the State. We discussed several cases which involved licensing deficiencies identified by NRC's evaluators. Generally, the evaluators could not remember whether they had discussed these cases with State officials.

Lack of inspection documentation

NRC's review of selected files indicated that sometimes State inspectors did not adequately document their review results. Such lack of documentation included (1) no indication that previous items of noncompliance had been corrected by the licensee, (2) no written details to support items of

noncompliance, (3) no indication whether the inspector made radiation surveys, and (4) no comment about whether exit interviews were conducted with top management.

Untimely updating of regulations

NRC's guide for evaluating State agreements says that State regulations should be updated at least every 2 to 3 years. In the four agreement States we reviewed, NRC found that updating regulations usually took 5 years or longer, and then not all required NRC regulations were adopted. For example, an evaluation of North Carolina during May 1976 noted that the State's regulations were last amended on July 1, 1975, and included changes adopted by NRC through September 24, 1971. Since September 1971, NRC had issued 12 changes to its regulations which it required the States to include in the State programs. North Carolina was in the process of updating its regulations during the latest State evaluation.

An NRC evaluation of Texas in September 1977 noted that Texas regulations were last updated in September 1972. The State was drafting amendments to its regulations which would incorporate NRC regulations through January 1975. NRC data showed that the State's regulations became effective October 14, 1977, and brought the State regulations up to NRC changes as of August 4, 1976. According to NRC information, there were four changes since August 1976 which should have been adopted by the State, but were not.

Before a 1978 revision, Colorado's regulations had not been amended since 1970. In commenting on a draft of this report on October 7, 1979, the State said that most NRC changes had been adopted by a policy letter from the State to the affected licensees. The latest evaluation for California shows that it was revising its regulations. The State regulations then in effect were dated 1974 except for one section which was adopted in 1976.

CHAPTER 4

CONCLUSIONS AND RECOMMENDATIONS

CONCLUSIONS

Despite widespread recognition of the hazards of radiation, no comprehensive program existed to protect the public from radiation hazards. Federal programs did not cover many sources of radiation and often provided limited protection in the areas they did cover. Some State programs were broader in scope, but they often lacked depth. Officials in every State we visited believed they needed more staff and other resources to fulfill their responsibilities. Federal support of State efforts was minimal.

NRC licensed and inspected the nuclear material for which it had responsibility. However, NRC did not have jurisdiction over many sources of radiation, including NARM and X-rays, which are common sources of exposure to the public. Also, NRC had delegated some of its authority in 25 States.

Although NRC considered the programs in these States to be compatible with its program and adequate to protect the public, its annual evaluations disclosed many problems in the State programs. These problems involved lengthy delays in promulgating regulations, untimely inspections, and deficiencies in awarding licenses and conducting inspections. Lack of sufficient staff appeared to be a major contributor to the problems identified. Although NRC often made recommendations to correct these problems, the problems recurred year after year. NRC appeared to have little authority over the States. It doesn't provide money to the States. Its only sanction is rather extreme--terminating the agreement. For example, although NRC regularly tells States that they don't have enough personnel, it provides no funds to the States. State officials know they need more people, but they usually can't get the authority to hire them.

The States are not provided with copies of NRC's evaluation reports. Also, in subsequent evaluations, while NRC reviews the adequacy of current license files, it does not determine whether specific problems identified during previous license reviews were corrected.

OSHA is responsible for inspecting for radiation hazards in workplaces, except for radiation sources regulated by NRC or by NRC-agreement States. However, radiation hazards were

not a high priority for OSHA and its efforts and the efforts of OSHA-plan States to protect workers from radiation were miniscule.

FDA has several programs that deal with radiation hazards, including enforcement authority over radiation from electronic products. A major aspect of its enforcement program involves field testing of newly installed X-ray systems. As of 1979, about one-third of the newly installed systems had been tested. In fiscal year 1978, 3,152 tests were made although there were over 11,700 X-ray systems installed.

Of FDA's voluntary programs, two major ones deal with dental X-rays and breast X-rays. Since the programs began 38 States have participated in the dental program and 45 States have participated in the breast program.

The interagency task force's study on the health effects of ionizing radiation found that there was inadequate coordination of radiation protection among Federal agencies. The Secretary of Health, Education, and Welfare recommended that a radiation policy council be established.

The State programs we reviewed varied widely in scope and depth. All the States reviewed regulated X-ray machines. However, only California and Vermont had a certification program to assure that X-ray operators were qualified. NRC material is regulated in all States.

All the NRC-agreement States had licensing and inspection programs for NARM. Of the nonagreement States, only Virginia licensed NARM; however, it made no NARM inspections during fiscal year 1978. Massachusetts registered and inspected NARM. Missouri and Vermont registered some NARM users, but had no inspection program. Missouri plans to make inspections in fiscal year 1980.

Texas registered and/or inspected some sources of nonionizing radiation--primarily lasers, audiometers, and microwave ovens. Massachusetts registered and inspected lasers. The other six States did not regulate sources of nonionizing radiation.

Some State officials said they believed that many sources are not licensed or registered. For example, a Texas official said several thousand X-ray machines in Texas may not be registered. Also, some officials said that NARM may be shipped into their States without their knowledge from manufacturers in States that do not regulate NARM.

Inspection frequency goals varied widely among the States. For example, the number of years between X-ray machine inspections was as follows:

	Hospitals	Physicians	Dentists
California	3.5	5	8
Colorado	2	2	5
Massachusetts	2	5	5
Missouri	2	3	3
North Carolina (note a)	3	4	8
Texas	5	10	10
Virginia (proposed)	4	2	6
Vermont	2	3	3

a/Adopted after the period covered by our review.

Thus, the likelihood of detecting radiation hazards varies. Also, with long intervals between inspections, the potential is great for radiation hazards to go undetected and cause unnecessary exposure to many people.

In every State except North Carolina, material inspection frequencies were not met. None of the six States that had inspection priorities for X-ray machines during our review was meeting its inspection frequency goals. Many Federal and State officials said more people were needed to provide adequate inspection coverage.

When inspections were made, violations of standards were sometimes not cited. When violations were identified, but not immediately corrected, the State, NRC, and FDA relied upon responses from users or assemblers that hazards had been or would be corrected. In some instances, such responses were not received and no action was taken to obtain a response.

Followups to verify correction were rare. The inspectors did not normally verify correction until the next scheduled inspection, which could be years later. In the few instances we identified where followups were made, violations usually had not been corrected.

In summary, many sources of radiation are not regulated, the coverage of regulated sources is limited, and there is little assurance that identified hazards are corrected.

RECOMMENDATIONS

We recommend that the Chairman of NRC require that:

--NRC and its agreement States establish followup procedures to verify that serious violations identified during inspections of licensees are corrected.

--Copies of NRC evaluation reports be provided to NRC-agreement States.

--NRC evaluators determine whether licensing and inspection deficiencies identified in previous State evaluations have been corrected.

We recommend that the Secretary of Health, Education, and Welfare direct the Commissioner of FDA to develop procedures to assure that followup field tests are made in cases where X-ray assembly field tests have identified serious hazards.

We also recommend that, when the interagency Radiation Policy Council announced by the President on October 23, 1979, is established, the council give high priority to evaluating the adequacy of the Federal and State radiation programs, and the need for a more coordinated effort among Federal and State regulatory agencies.

AGENCY AND STATE COMMENTS AND OUR EVALUATION

In October 1979 the Departments of Labor and Health, Education, and Welfare (see app. III and IV) commented on our draft report. The Nuclear Regulatory Commission chose not to comment formally on our draft report. However, we met with agency officials and obtained their views. Their comments and our evaluation of these comments are presented below.

With the exception of Missouri and Texas, the States provided us written comments on a draft of this report. The report has been revised to reflect their comments where appropriate.

Department of Labor

Labor agreed that radiation responsibilities were not always as clearly defined as they might be and said that OSHA is working to further clarify jurisdictional boundaries.

Labor officials said that OSHA is preempted from covering radiation hazards in workplaces where NRC or other Federal agencies have enforceable standards and that OSHA does not register or license those sources of radiation over which it has jurisdiction. Also, Labor officials said that OSHA does inspect radiation sources brought to its attention or noted during general schedule inspections and that OSHA's policy is to evaluate all employee complaints which deal with radiation sources. However, we believe it should be noted that OSHA does not have a specific policy for radiation complaints. OSHA's policy is to evaluate all complaints about workplace hazards.

According to Labor officials, OSHA has a standard for occupational exposure to nonionizing radiation, and it issues citations where inspection reveals a serious hazard. However, its activities are hampered because the Occupational Safety and Health Review Commission has declared its standard advisory rather than mandatory. Labor said it is difficult to propose a new mandatory standard because knowledge of the effects of nonionizing radiation is limited. OSHA has issued a compliance directive dealing with nonionizing radiation with emphasis on radio frequency radiation hazards.

The directive provides guidance on citing serious nonionizing radiation hazards using both the current nonionizing standard and section 5(a)(1) of the Occupational Safety and Health Act of 1970. This section requires that places of employment be free from recognized hazards that cause or are likely to cause death or serious physical harm to employees.

Labor said that OSHA's responsibilities for all employees have precluded increased emphasis on radiation. Labor noted that we did not recommend that OSHA increase its radiation inspections at the expense of its efforts to protect workers against the multitude of other workplace problems, such as toxic chemicals or safety hazards.

We are not recommending that OSHA increase its emphasis on radiation at this time. However, we believe that a basic health standards enforcement plan should be established as mentioned in our report dated April 5, 1978, entitled "Sporadic Workplace Inspections for Lethal and Other Serious Health Hazards" (HRD-77-143). When establishing such a plan, adequate consideration should be given to radiation.

Labor said that, while it is true that OSHA does not specifically designate that funds provided for support of State programs be used for radiation control, neither does

it do so for any other specific hazards. However, according to an OSHA official, OSHA would not provide funds specifically for radiation protection.

Department of Health, Education, and Welfare

HEW agreed with our recommendation for developing procedures to assure that followup inspections are made when X-ray assembly field tests identify serious hazards. HEW said that, although FDA has written followup procedures for violations of performance standards that pose a serious hazard, FDA is preparing more explicit procedures calling for followup field testing when violations posing an immediate radiation hazard are found. For violations which pose a potential hazard, the new procedures would provide for followup, but not necessarily inspection.

HEW said our report would be more helpful if it provided more information about the extent of health risk presented by the various inadequacies in enforcement and regulation so that those inadequacies posing significant risk can be readily identified and remedied as soon as possible.

We did not try to determine the risk associated with radiation exposure, nor did we try to develop what should be the ultimate radiation coverage. In 1979 the National Academy of Sciences concluded that any radiation exposure may involve some risks (particularly cancer induction). The Environmental Protection Agency estimated that about 1 million workers are exposed to radiation in the workplace. In addition, the violations found by the many regulatory control agencies were usually not classified as to their seriousness.

HEW said our report was somewhat confusing and perhaps misleading because:

--The scope of our review was insufficient to support our conclusions.

--The report did not accurately reflect the nature and scope of FDA's radiation control activities.

--Clear distinctions were not made between the responsibilities of the agencies discussed in the report. The responsibilities of many agencies were not discussed.

--Each agency's radiation control authority was not adequately addressed so that its programs could be compared against its authority. Also, States have more authority than our report indicates.

--The report confuses FDA's authority over X-ray equipment assemblers with activities directed toward X-ray equipment users.

We believe that we have done enough work to support our conclusions. The major sources of radiation were covered in the study. FDA has estimated that the use of X-ray machines for diagnosis and therapy accounts for more than 90 percent of the total man-made ionizing radiation to which the country's population is exposed. We looked at both State and Federal control programs for regulating such use. Other radiation sources covered included source material, by-product material and special nuclear materials in quantities below certain specific limits, naturally occurring and accelerator-produced radioactive materials, and worker exposure to ionizing and nonionizing radiation sources.

According to a recent FDA report on State and local radiological health programs, data on total expenditures and radiological health personnel showed that the eight States selected presented a good representation of State radiation programs. States with varying size programs, including some of the largest and smallest programs, are represented. (See app. V and VI, pp. 61 and 62.) In addition, States were selected to include both States which participate and do not participate in NRC agreements and OSHA-approved plans. State selection was also discussed with State and Federal radiation officials to assure that the States selected would provide a representative view of State radiation activities.

We have revised our report to more fully indicate the scope of FDA's radiation control activities. Our review of FDA's programs primarily concentrated on diagnostic X-ray equipment because, according to FDA, such equipment accounts for 90 percent of the man-made radiation to which the public is exposed.

HEW's comments about unclear distinction of responsibilities appear to involve how organizations performed their responsibilities rather than what their responsibilities were. HEW cited the opening paragraph of chapter 3 as identifying deficiencies without linking them to the responsible agency. This is an introductory paragraph, and we believe that the information which follows in the chapter provides the necessary linkage.

Our review was focused primarily on State programs and the NRC and OSHA programs which give certain authority to the States. We included FDA primarily because of its contract arrangement with some States for field testing X-ray equipment. While including the many Federal agencies listed by HEW would provide a broader picture of radiation control activities, it would have little impact on the matters discussed in our report. For example, if the States did not regulate or inspect NARM or X-ray users, none of the Federal agencies that HEW mentioned would fill the gap.

We believe our discussion of each agency's authority is adequate. We are not criticizing agencies for failing to perform functions that they are not authorized to perform; however, we are showing what programs exist.

In addition, HEW made a number of technical comments and where appropriate we have revised the report to include them.

Nuclear Regulatory Commission

Nuclear Regulatory Commission officials met with us on October 15, 1979, to discuss a draft of this report. An NRC official commented that the Commission has procedures for following up on violations. The procedures specify actions to be taken when following up on items of noncompliance. However, a followup is usually made as part of the next scheduled inspection. We believe that procedures should be established to specify when followup inspections (shortly after scheduled abatement) should be made to verify that serious violations are corrected.

Another NRC official said it was not necessary to give the NRC evaluation reports to the States because the fairly detailed letters that inform the States of the results of NRC's evaluations are sufficient. He said the main purpose of the detailed evaluation reports is to help NRC's evaluators prepare for subsequent evaluations. He also stated that NRC does not check on specific deficiencies identified during prior evaluations because they are more interested in current information.

We believe that NRC should (1) give copies of evaluation reports to State officials so that they have complete information on the problems identified in their programs and (2) determine whether previously identified deficiencies which could affect health and safety were corrected.

NRC officials made several technical comments, and our report has been revised, where appropriate, to reflect these coments.

United States Senate

COMMITTEE ON
GOVERNMENTAL AFFAIRS
WASHINGTON, D.C. 20510

November 16, 1978

Elmer B. Staats
Comptroller General of the
United States
441 G Street, N.W., Room 7000-A
Washington, D.C. 20548

Dear Elmer:

In volume V of our regulatory reform study, the Committee considered organizational problems in Federal regulation of radiation health and safety. On that portion of our study, a copy of which is enclosed, the reports of the GAO in that field were particularly useful.

The purpose of this letter is to request GAO to conduct further research in a very much related aspect of that work.

At present, state regulation plays an important role in safeguarding the public against radiation hazards. To our knowledge, there has not been any recent evaluation of the effectiveness of such state programs. Therefore, I would like to request that GAO conduct a study of state regulatory activities in the field. The study would be expected to identify and discuss the existing problems states may have with this function. Since state involvement is quite broad, it may be possible to effectively limit this inquiry to one particular aspect of that overall effort.

I suggest that Jim Graham of the Committee staff be contacted to discuss this request in greater detail. I have enclosed copies of the work the Committee has already done in this area.

Since we are presently considering legislation in this area, it would be appreciated if this Committee request could be treated with priority.

APPENDIX I

November 16, 1978

Again, thank you for your continued assistance in this important matter.

Sincerely,

Abe Ribicoff

Enclosures

DESCRIPTION OF RADIATION CONTROL PROGRAMS IN THE EIGHT STATES GAO VISITED

CALIFORNIA

California's Department of Health Services has primary responsibility for radiation control programs covering ionizing radiation. The division of occupational safety and health was responsible for nonionizing radiation. The Department assigned its responsibility to the radiological health section within the division of public and environmental health.

The section's program involves source, by-product, and special nuclear material in limited quantities, as well as naturally occurring and accelerator-produced radioactive material and X-ray machines.

The section operates three radiation programs. It licenses and inspects radioactive materials under agreement with NRC and registers and inspects X-ray machines. In addition, it certifies X-ray technologists. California spent $1,816,784 on the following radiation control programs for fiscal year 1978: 1/

	Fiscal year 1978
X-ray inspection	$ 743,282
X-ray technologist certification	439,730
Radioactive materials	633,772
Total	$1,816,784

California charged licensing and registration fees to help offset the cost of the program. During fiscal year 1978, California collected $958,030 in fees. In September 1978, the State increased its X-ray registration fees to provide funds for more frequent inspections.

The State contracted with two counties (Orange and Los Angeles) for X-ray machine and radioactive material inspections. As of April 1979, the section had 50 professionals

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1/All the States we visited had fiscal years that ended on June 30.

including 8 county contract and 8 temporary inspectors. The State provided the following staffing data:

Program	Professional staff
X-ray inspection	26.5
X-ray technologist certification	7.5
Radioactive materials	15.0
Administration	1.0
Total	50.0

The State reported six inspector vacancies in its X-ray program. In addition, the section has a contract with the State Department of Industrial Relations to perform industrial inspections. The Department had five inspectors performing radiation-type inspections.

California operates an OSHA-approved plan. However, in accordance with OSHA priorities, radiation is not given a high priority. State officials told us that, when California's OSHA inspectors come across potential radiation hazards in the workplace, they make referrals to the Department of Industrial Relations.

The State also made X-ray assembly field tests under a contract with FDA. In fiscal year 1978, the State made 249 tests (187 medical X-ray machines and 62 dental machines). The 187 medical machines represented about 30 percent of the total new machines registered in the State in fiscal year 1978, and the 62 dental machines represented about 5 percent of the total registered that year. According to FDA data, 104 major and 50 minor violations were identified in 240 State field tests. In addition, the State participated in FDA's BENT and DENT programs.

A State official made the following comments about being an NRC-agreement State.

--Having agreement status allows the State to have a comprehensive radiation program.

--Radiation issues are more effectively addressed if integrated into a radioactive material licensing and inspection program.

Compliance programs

As of December 1978, the State had licensed about 1,800 users of nuclear material. Basically, the State issues two types of licenses--specific and general. Specific licenses are the most common and tend to be broad-scope licenses. They account for about 95 percent of all licenses. General licenses are issued for devices having low-hazard potential. Distribution licenses are issued to manufacturers of generally licensed products.

Licenses must be renewed every 7 years. There was some backlog of applications submitted for renewal. However, the State did not keep records of applications in backlog status. A State official estimated that about 25 renewal applications may be considered in backlog status.

California had registered about 36,000 X-ray machines, and the State estimated the number increased by about 4 percent annually. About 93 percent of the machines were located in medical and dental facilities. The remaining were located in industry.

The State issues three types of permits under its certification program: (1) licentiates, (2) fully qualified operators, and (3) limited permits. Licentiates are persons with a valid State healing arts license. Limited permit operators are those qualified to take X-rays of certain parts of the body.

As of October 1977 (the most recent data available), there were 13,282 licentiates, 13,808 fully qualified operators, and 4,936 limited operators.

The State's inspection frequency goals for X-ray machines in fiscal year 1978 were to inspect medical machines every 4 years and dental machines every 6 years. However, the State had not been meeting its goals. During our review the State changed its inspection goals to inspect hospitals every 3-1/2 years, physicians every 5 years, and dentists every 8 years. California's inspection frequencies for material licenses were compatible with NRC requirements.

During fiscal year 1978, the State made 492 license compliance inspections which resulted in 513 violations being cited. The State generally did not make followup visits to ensure compliance except for licensees which had a poor compliance history.

The State made 4,231 dental and medical inspections in fiscal year 1978. Inspection data for industrial X-ray machine inspections were incomplete. Also, data on violations identified were not available.

COLORADO

Colorado's Department of Public Health regulates all ionizing radiation sources, including X-rays and NARM. Rules and regulations for nonionizing radiation have not been promulgated.

The State's radiation control programs are in the Department's radiation and hazardous waste control division. The division has two control responsibilities: (1) radiation and (2) solid and hazardous wastes. The radiation control section activities included:

Regulatory--including license material, X-ray machines, and NARM.

Environmental--primarily the surveillance at Rocky Flats, a federally owned nuclear fabrication plant, and Fort St. Vrain, a nuclear power plant.

Grand Junction--consisting of a remedial action program to clean up property contaminated by uranium mill tailings.

Colorado's expenditures for radiation control--excluding Grand Junction--were $433,800, $438,607, and $358,248 for fiscal years 1978, 1977, and 1976, respectively. Expenditure data for each aspect of its radiation control program were not available.

The regulatory staff consisted of one senior health physicist assigned to uranium mill licensing and six health physicists assigned to X-ray program compliance (three), radioactive material compliance (two), and uranium mill licensing (one).

Colorado terminated its OSHA-approved plan on June 30, 1978, because the State legislature omitted the required funding.

The State had an NRC agreement and participates in FDA's contract programs for X-ray assembly field tests and FDA's voluntary BENT and DENT programs. According to FDA records, the State tested 65 assemblies finding 18 major

and 17 minor violations during fiscal year 1978. State officials indicated the following advantages of having an NRC agreement:

--NRC provides training to the State.

--There is better communication between State and Federal agencies.

--Local inquiries and questions can be better handled at the local level.

Compliance programs

Colorado attempted to identify all sources and users of radioactive materials and products through licensing and registration programs. Nuclear materials were licensed and X-ray machines were registered.

The State issued two types of licenses--general and specific. Most general licenses were effective without an application. General licenses were subject to all applicable portions of State radiation regulations and involved small amounts of source materials. Specific licenses for the receipt, possession, and use of radioactive materials required the submission of an application. During fiscal year 1978 the State had 358 active material licenses.

State regulations required all facilities with radiation machines to be registered with the State. The registration does not imply approval or disapproval of installation, but is a means to identify, locate, and control radiation machines. Any person who sells, leases, transfers, disposes, assembles, or installs radiation machines in Colorado must notify the State within 15 days. As of March 13, 1979, 2,086 facilities having 3,469 machines were registered with the State.

The State X-ray inspection frequencies consisted of inspecting medical facilities every 2 years and dental and other facilities every 5 years. Colorado's inspection frequencies for material licenses were compatible with NRC.

During fiscal year 1978 the State made 97 specific license inspections. The State reported 138 items of noncompliance during these inspections. This figure is understated because in some cases the inspectors made recommendations, rather than citing violations for items of noncompliance.

Under the X-ray program for fiscal year 1978, the State made 305 inspections and found 21 items of noncompliance. Colorado did not classify violations as to seriousness or assess monetary penalties.

MASSACHUSETTS

Massachusetts law provides for the regulation of both ionizing and nonionizing radiation. Specific regulation of nonionizing radiation was limited to lasers. However, inspections were made of other nonionizing sources, such as microwave ovens or televisions, upon request.

The Department of Public Health's health protection division covers radiation sources in medical facilities and nonprofit and public institutions. The engineering section of the Department of Labor and Industries' division of occupational hygiene covers radiation sources in commercial establishments.

State officials told us that no accurate data were available on radiation program expenditures. They estimated that the division of occupational hygiene and the Department of Public Health spent about $18,900 and $212,500, respectively, on their radiation programs during fiscal year 1978.

Essentially all of the division of occupational hygiene's radiation control activities were performed by one inspector. This official told us that, because one inspector was not enough to perform all assigned responsibilities, an additional staff member was requested for fiscal year 1980. However, the position was deleted from the final budget.

The Department of Public Health's radiation control program primarily involved nine persons--one program director, four radiation health specialists, and four radiation health technicians. The program director said that five more inspectors were needed to carry out inspections and compliance functions; however, there were no plans to hire more people.

Massachusetts is neither an OSHA-plan State nor an NRC-agreement State. Massachusetts officials said that becoming an NRC-agreement State would not be beneficial since NRC provides no reimbursement for the cost of carrying out the agreement. They said becoming an NRC-agreement State would not benefit the public since the State already registers and inspects users of NRC material.

Massachusetts contracted with FDA to field test 125 X-ray assemblies between August 1, 1977, and July 31, 1978. One hundred and thirty tests were made which covered every new installation registered with the Department of Public Health. These tests identified 22 installations that had serious violations of FDA's standards. The State had not participated in FDA's DENT program, but had participated in BENT during fiscal year 1978.

State officials said that coordination with FDA was good, but coordination with NRC could be improved to avoid duplication of effort and conflicting reports. Efforts were being made to improve coordination.

Compliance programs

Massachusetts required regulation of all radioactive materials and machines which emit ionizing radiation. The only sources of nonionizing radiation that were registered are lasers. In commenting on a draft of this report in an October 10, 1979, letter, an official said that recommended safe practice bulletins have been issued and distributed for microwaves, infrared radiation, and ultraviolet radiation. The State had no licensing program. There were no preliminary requirements imposed on any registrant and no registrations were denied. However, if an inspection showed a registrant failed to comply with State regulations, its registration could be revoked.

As of June 1977 (the most recent data available), the Department of Public Health reported that 4,313 medical X-ray systems, 4,640 dental X-ray systems, 250 radioactive material and nuclear medicine facilities, and 33 accelerators were registered. According to Department of Labor and Industries' officials, 934 users of ionizing radiation sources were registered with it as of February 21, 1979. This included 233 X-ray systems and 633 radioactive material and particle accelerator users. The number of lasers registered with the division of occupational hygiene was 297. The Department of Public Health did not know how many lasers it registered.

Officials of both departments said that they identified potential registrants through data obtained from other sources, such as reports by installers of new X-ray assemblies and license listings from NRC.

The division of occupational hygiene's inspection goal was to annually inspect the more hazardous types of radiation sources and those registrants where a violation that the inspector considered serious had been identified in a previous inspection. For other registrants covered by the Department of Public Health, inspection frequency goals were to inspect hospitals every 2 years, radiographers every 3 years, and physicians and dentists every 5 years.

The Department of Public Health reported that it inspected 2,425 machines during fiscal year 1977 and found that 18 machines were not in compliance. Data were not available for fiscal year 1978 and for nuclear material inspections. According to an official in the Department of Labor and Industries, 161 material and 53 X-ray machine inspections were made in fiscal year 1978.

Officials of both departments said they relied on voluntary compliance and have never assessed penalties for radiation violations. Neither department classifies violations as to seriousness.

MISSOURI

The division of health has responsibility for radiation control. The division established regulations for all sources of ionizing radiation. Sources of nonionizing radiation were not regulated.

The division of health assigned its responsibility to the Bureau of Radiological Health. The Bureau is the only State agency that has the authority and responsibility for radiation control. Its radiation control program included X-ray equipment and NARM. In addition the Bureau does some environmental surveillance and microwave inspections upon request.

The Bureau spent $68,455 on its radiation program in fiscal year 1978. This expenditure basically covered its staff of three professionals--one supervisor and two inspectors. Later, the Bureau increased its staff to include four inspectors. Its budget for fiscal year 1979 was $143,209.

Missouri has neither an OSHA-approved plan nor an NRC agreement. The only FDA program which the State participated in was the BENT program.

Compliance programs

As of March 31, 1979, there were about 4,300 X-ray facilities with about 5,900 machines and 74 NARM facilities registered. The State required all users to register within 30 days of acquisition of a radiation source. The registrations are to be renewed every 2 years. According to State officials, there had never been a registration canceled or denied.

During our review, legislation had been proposed which would permit Missouri to enter into an NRC agreement. The Bureau administrator estimated that it would cost $120,000 for the first year of operation.

The State used several sources, including NRC's material licenses, the State Board of Registration for the Healing Arts, and FDA's X-ray assembler reports, to identify users in the State who should be registered. Renewals were generally made during an inspection. The State was making an effort to identify NARM users and had increased its registrations from 47 on June 30, 1978, to 74 in March 1979. The State has actively sought to register NARM users because it plans to implement a compliance program for NARM users in fiscal year 1980.

The State's inspection frequency goals were to inspect hospitals every 2 years and physician's and dentist's offices every 3 years. In fiscal year 1978 the State inspected 278 facilities having 766 machines. State data showed only 13 machines with deficiencies. According to the administrator, this does not represent total deficiencies found because, where possible, deficiencies are corrected during the inspections and never documented. Deficiencies are not classified as to seriousness, and penalties are not levied.

NORTH CAROLINA

North Carolina's regulations cover ionizing radiation but not nonionizing radiation.

North Carolina is both an NRC-agreement State and an OSHA-plan State. The radiation protection section of the Department of Human Resources and the State occupational safety and health administration have the primary responsibility for North Carolina's radiation control programs.

Although North Carolina's OSHA has regulations to control radiation, the State has not been making many inspections covering radiation. A State official said there are more important health hazards within the State and no special emphasis is given to radiation. In commenting on a draft of this report on October 9, 1979, a State official added that when the entire scope of the North Carolina OSHA program is considered along with the immediacy of certain health hazards other than radiation exposure and the presence of other Federal agencies who share the responsibility to monitor radiation exposure, North Carolina OSHA has properly prioritized the problem of employee exposure to radiation sources.

The State participated in FDA's X-ray assembly field test program in fiscal year 1978. According to FDA data, 33 of 64 X-ray assemblies tested had major violations of FDA's standards. The State did not contract to do any tests in fiscal year 1979. According to a State official, North Carolina had not participated in FDA's BENT program because of inadequate staff and funds and has not participated in the DENT program for several years.

A State official made the following comments on the NRC agreement program:

--The proximity of licensed users to the regulatory agency is an advantage to the user and to the regulator.

--It places responsibility for all radiation sources in one place.

--The primary disadvantages of an NRC agreement are that much work is required to keep up with regulation changes and no funding is provided.

The radiation protection section chief estimated that the section would spend about $387,500 in fiscal year 1979--$144,500 for the X-ray programs, $113,000 for the materials program, $99,000 for environmental surveillance, and $31,000 for emergency planning.

The section's radioactive materials branch is responsible for the State's NRC agreement material and naturally occurring radioactive material. It is staffed by a branch head and two health physicists. The X-ray control branch's professional staff consists of a branch head and four radiation equipment specialists.

Compliance programs

The radioactive materials branch was responsible for inspecting about 400 specific licensees and an estimated 300 general licensees. The State's inspection frequencies were compatible with NRC requirements.

During 1978, the branch made approximately 270 inspections of licensees. Of these inspections 207 were performed on specific licensees, 52 were general licensees, and 11 were prelicensing inspections. In 112 specific and 50 general license inspections, about 215 items of noncompliance were cited. They were not classified as to seriousness. A State official said that, to his knowledge, the branch had not cited any items that posed danger.

Licensees were required to respond to the branch about corrective actions for noncompliance items within 30 days. A State official said the branch did not have authority to levy civil penalties, but could revoke licenses or refer cases to the State attorney general for prosecution if corrections are not implemented. He said the State has never taken either action.

As of March 1979, about 3,200 facilities with 8,539 X-ray tubes were registered with the State. They were inspected by the X-ray control branch. State officials believed most X-ray systems were registered. However, occasionally the State found X-ray equipment that had not been registered. Officials estimated there are about 12,000 to 15,000 operators of X-ray equipment; however, the State did not certify or register them.

The X-ray control branch head told us that his unit was understaffed to completely fulfill its responsibilities. He said that inspection intervals were 9 to 11 years, but recently the branch had adopted an 8-year reinspection frequency for dental machines and a 3- to 6-year reinspection frequency for other machines.

State officials said the State did not have authority to issue civil penalties to facilities in noncompliance. During fiscal year 1978, 482 facilities were inspected covering 1,316 tubes. These inspections resulted in 240 noncompliance items identified and 821 recommendations. Recommendations, which do not require any response, are suggestions which the State believes would improve radiation protection. Statistics were not available on how many

facilities were in compliance or noncompliance, or on the seriousness of violations. Users cited for noncompliance must advise the branch, within 30 days, regarding corrective actions. Officials said that most users respond within the required period. Corrective actions are verified in later scheduled inspections.

TEXAS

The Texas Department of Health is the State's radiation control agency. The Department's division of occupational health and radiation control administers a program for both ionizing and nonionizing radiation. The division's radiation control branch administers the ionizing radiation program. The division's occupational health branch covers nonionizing radiation. Although other State agencies have some radiation control responsibilities, their responsibilities are limited. The division is the lead agency for all radiation hazards. Also, it establishes regulations, has licensing and registration programs, and makes inspections of registrants and licensees. During fiscal year 1978, the radiation control branch spent $538,647 and the occupational health branch spent $55,369 on its nonionizing radiation program. Their fiscal year 1979 budgets were about the same as the fiscal year 1978 expenditures.

The radiation control branch had 23 full-time professional staff members and 7 support personnel. Fifteen of the professional staff were involved in compliance and inspection activities, and four of the professional staff were involved in licensing and registration. The branch had requested five more professional staff members and related support. A branch official believed that, with the additional staff, they could inspect about 10 percent of the registered X-ray equipment and about 50 percent of the licensed radioactive material each year.

The occupational health branch had two professional staff members involved in the nonionizing program.

Texas is not an OSHA-plan State. Texas had participated in FDA's DENT program and was participating in the BENT program during our review. Also, Texas field tested X-ray assemblies under a contract with FDA. From September 12, 1977, to September 11, 1978, it made 251 inspections for FDA. According to FDA's records, of 219 assemblies tested by the State during fiscal year 1978, 63 had serious violations and 69 had minor violations.

Texas has been an NRC-agreement State since 1963. State officials believed that being an agreement State has many advantages including (1) better responsiveness by the regulator agency to users, (2) coverage of both NRC-regulated material and other material in the same inspections, and (3) leverage in obtaining funds from the State legislature. Also, one State official said that users are more likely to report problems to State authorities since the State does not fine users.

State officials pointed out the following problems with Federal programs.

--The Federal Communications Commission regulates harmful microwave emissions from radio and television stations. However, the Commission has no program or authority to ensure compliance.

--There should be Federal control over NARM. Although Texas regulates NARM, many States do not. Businesses manufacturing and using NARM tend to do so in non-agreement States. Their products may never be evaluated by any Government agency. There is no way to assure that they do not transfer NARM to nonlicensed persons in States that regulate NARM.

--NRC does not provide enough feedback on what it found during its evaluations of Texas' performance under the NRC agreement.

Texas officials said their biggest problem was insufficient funds and staff to adequately perform all radiation control functions. They said that, because resources are easier to obtain for work required by the NRC agreement, other program areas suffer more. For example, although there are almost five times as many registrants of X-ray machines as there are licensees of radioactive materials, the State spends over five times as much regulating radioactive materials as it does regulating X-ray machines.

Compliance programs

As of March 1, 1979, there were about 6,300 active registrants of radiating machines--mostly dental--and about 1,400 active licenses for radioactive material. Regarding nonionizing radiation, as of December 31, 1978, 260 of the

estimated 1,500 lasers and 2,893 of the estimated 6,000 audiometers 1/ in the State were registered.

State officials believed that nearly all radioactive material users were licensed. However, they believed thousands of X-ray machines, mostly dental, were not registered. They said that, because most dentists have X-ray machines, they were contacting every dentist in the State who has not registered an X-ray machine.

The State's desired inspection frequencies for X-ray machines were every year for radiographers, every 5 years for hospitals, and every 10 years for physicians and dentists. Texas' material license inspection frequencies were compatible with NRC's. Also, between September 1977 and August 1978, 991 registered facilities were reported as being inspected. However, data on the number of violations found were not available. The State reported that it made 589 inspections of licensees during 1978 and found 885 violations at 286 licensees. Violations were not classified as to seriousness. Texas required a written response regarding actions taken to correct violations. However, it normally did not follow-up to verify that violations were corrected. Inspections for nonionizing radiation for 1978 included 10 laser and 287 microwave oven inspections, resulting in only 5 violations. Violators are not fined.

VERMONT

Vermont's laws permitted regulation of both ionizing and nonionizing radiation hazards; however, its regulations only covered ionizing radiation. Nonionizing radiation hazards are covered under the State's OSHA plan. Vermont specifically licenses X-ray technologists and has standards limiting the maximum X-ray doses which can be applied for certain radiographs.

The State's radiation control programs were centralized in the division of occupational and radiological health of the State Department of Health. The division's primary mission is to implement those portions of Vermont's OSHA plan

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1/The major "hazard" from audiometers is inaccurate measurements of hearing ability. Audiometers are inspected by the division of maternal and child health. The division of occupational health and radiation control does not give a high priority to audiometers.

which pertain to the health of the workers. The balance of the division's resources are directed at environmental and community health problems. Vermont's officials estimated that about $74,000 was spent for radiation control during fiscal year 1978. We were advised that a completely accurate estimate would require careful analysis. Expenditure data for each aspect of its radiation control program were not available.

The radiation control staff consisted of one radiation specialist and one radiation technician who were primarily involved with the nuclear power plant and one radiation specialist who worked on the X-ray radiation program. A radiation chemist position was vacant.

In commenting on a draft of this report, Vermont officials advised us that Vermont's staff now consists of two health physicists, an environmental and radiological health specialist, a chemist, and a number of occupational health compliance officers who have been trained in detecting radiological health hazards.

Vermont operated an OSHA-approved plan. However, in accordance with OSHA priorities, radiation was not given a high priority. A State official advised us that, in the few cases where Vermont OSHA inspectors suspected radiation hazards, referrals were generally made to the division's radiation section.

Vermont was not an NRC-agreement State. The radiation section's chief said it should become an agreement State because NRC had little interest in radiation hazards in Vermont other than from the nuclear power plant. However, becoming an agreement State involves a cost burden. Vermont had participated in FDA's BENT and DENT programs, but did not have a contract for field testing X-ray assemblies.

Vermont officials identified the following problems regarding Federal programs:

--While the State's relationship with NRC was adequate, it could be greatly improved if NRC provided more information on NRC's radiation control activities in Vermont.

--The Federal agencies should provide more financial support and leadership. FDA's training courses for State officials had been eliminated. Also, a stronger Federal position could reduce differences in States' regulations and procedures.

Compliance programs

Vermont did not have a licensing program. Its registration program applied only to X-ray equipment and NARM. However, NARM was normally registered when it was identified during X-ray inspections. New equipment was to be registered within 30 days of acquisition. Equipment was reregistered every 3 years. As of October 11, 1978, 435 facilities having 785 tubes were reported as registered based on a July 1978 reregistration. Registrations occurring between reregistration periods were not counted. A State official said that about 35 NARM users were registered.

The registration merely provided a list of all X-ray sources subject to inspection. User qualifications were not solicited, and all registrations were accepted. A State official said that, although no statewide canvassing had been done in 7 to 8 years, he believed virtually all X-ray sources were registered because (1) Vermont's small size allows State officials to be aware of new installations and (2) FDA provided a list of new installations.

The State's inspection frequency goals were to inspect hospitals every year and physician's and dentist's offices every 3 years. In commenting on a draft of this report, a State official said hospitals would be inspected every other year. The head of the radiation program said that the division had not been meeting its inspection frequency goals but the addition of another inspector would bring the division closer to its goals. A State official commenting on a draft of this report believed that recent staff changes will allow the State to meet its goals. The sole X-ray inspector had other duties which limited the number of inspections he could make. A State official said that all aspects of the radiological health program except nuclear power plant surveillance were suspended during 1974-76. Thirty-four tubes were inspected in fiscal year 1977. In fiscal year 1978, 44 tubes were inspected; there were 19 facilities with violations.

Our review of case files showed that, from October 1977 to September 1978, the division made 23 inspections--22 ionizing and 1 nonionizing. The latter inspection was made based upon a request and was not a routine State inspection. Violations were found in eight of the ionizing inspections. Records were not available regarding the nonionizing inspection. The inspector made written recommendations to 15 facilities.

The radiation inspector told us that most of the violations of regulations were not serious and voluntary compliance is nearly always achieved. Registrants must submit information on what they have done to correct violations. Followup inspections were made in some cases. Additional actions, such as repetitive inspections, can be taken in cases where registrants are reluctant to comply voluntarily. We were advised that the State has never issued a civil penalty for violations.

VIRGINIA

Virginia's regulations for ionizing radiation were implemented in 1972 and were being revised during our review because certain portions were vague and unenforceable. In commenting on a draft of this report on September 14, 1979, the State commented that the revised regulations are considerably more comprehensive and specific, facilitating more effective enforcement action. The State expects these revised regulations to become effective early next year.

The radiological health section of Virginia's Department of Health was responsible for ionizing radiation. The State's Department of Labor and Industry was responsible for nonionizing radiation control.

The section spent about $93,000 on its ionizing radiation program during fiscal year 1978. The staff during that period consisted of four professionals--a program director and three health specialists. As of May 1979 the professional staff was increased to seven. In commenting on the draft, a Virginia official said that the staff has increased to nine and the State is requesting an additional seven positions.

Virginia operated an OSHA-approved plan. However, in accordance with OSHA priorities, radiation was not given a high priority. A State official identified 8 out of 2,919 cases where alleged radiation violations were cited. All eight dealt with lasers and were classified as nonserious.

Although Virginia's law allowed the State to eventually assume regulatory functions now carried out by NRC, the State had not entered into an agreement with NRC. State officials said that being an agreement State would be beneficial in that the regulating agency would be closer to the user and agreement States normally get more State funding.

Virginia contracted with FDA for X-ray assembly field tests in fiscal year 1978. The State also participated in FDA's DENT and BENT programs.

According to FDA's records, the State made 32 field tests in fiscal year 1978 in the X-ray assembly program. Thirteen of the tests identified major items of noncompliance. Also, as part of the State's participation in FDA's BENT program, it made 10 inspections of mammography facilities because earlier surveys done through the mail indicated potential hazards. The State reported that several instances of significant dose reduction were achieved.

Compliance programs

Virginia's radiation programs consisted of licensing and inspecting NARM and registering and inspecting X-ray machines.

Virginia was one of only five States without an NRC agreement that licenses NARM users. As of June 1978, 79 NARM users were licensed. During fiscal year 1978, 15 licenses and 31 amendments were issued. The State did not make any onsite verifications of any of the information submitted for a license before issuance. In fiscal year 1978 there were no NARM inspections.

As of June 30, 1978, the State reported that 4,246 dental tubes, 2,424 medical X-ray machines, and 120 nonhealing arts X-ray facilities were registered.

To keep X-ray registrations up to date, the State sends out registration forms to users listed on FDA's report of assembly. Also, the State uses a list of all dentists and physicians to update its registrations. In fiscal year 1978, all dentists were reregistered. The State estimated that there are about 200 industrial users in the State not registered. A State official said that one reason for the unregistered industrial users was that the State at one time did not require vendors to notify it when a unit was sold to a user in the State.

Virginia had no specific inspection frequencies in fiscal year 1978. However, during our review, the State's radiation advisory board proposed inspection frequencies consisting of inspecting medical offices every 2 years, hospitals every 4 years, and dentists every 6 years.

APPENDIX II

During fiscal year 1978, 273 dental X-ray tubes, 48 medical X-ray machines, and 5 nonhealing X-ray facilities were inspected. The State reported that 134 of the dental and 12 of the medical facilities were not in compliance.

APPENDIX III

[redacted]

U. S. Department of Labor

Inspector General
Washington, D C 20210

OCT 2 4 1979

Mr. Gregory J. Ahart
Director
Human Resources Division
U.S. General Accounting Office
Washington, D.C. 20548

Dear Mr. Ahart:

This is in reply to your letter to the Secretary of Labor requesting comments on the draft GAO report entitled "Radiation Control Programs Provide Limited Protection." The Department's response is enclosed.

The Department appreciates the opportunity to comment on this report.

Sincerely,

Marjorie Fine Knowles

MARJORIE FINE KNOWLES
Inspector General

Enclosure

[redacted]

GAO note: The page references in this appendix may not correspond to the page numbers in the final report.

Department of Labor (DOL) Comments on the
General Accounting Office (GAO) Draft Report
"Radiation Control Programs Provide Limited Protection"

This GAO report discusses activities of the Occupational Safety and Health Administration (OSHA)in the area of radiation safety although no recommendations are made to the Secretary of Labor. The Department is pleased to address those issues raised in the report which deal with OSHA. The Department agrees with GAO that radiation responsibilities are not always as clearly defined as they might be and work is being done at OSHA to further clarify jurisdictional boundaries. This will help OSHA identify areas of radiation use where its present inspection and compliance efforts may need to be revised.

Following are the Department's comments:

—OSHA's efforts in the control of radiation, both ionizing and non-ionizing, were characterized in several places as "minimal"; it was also stated that dangers of radiation were not a "high priority" with the agency (e.g., p. iii, 1. 29; p. 10, 1.4; p. 32, 11. 13-15). Section 4(b)(1) of the Occupational Safety and Health Act preempts OSHA coverage of workplaces where other Federal agencies have enforceable standards affecting occupational safety and health. Accordingly, wherever the Nuclear Regulatory Commission or other Federal agencies have jurisdiction for a particular working condition, OSHA does not. OSHA does not have a system of registration and licensing for those sources of radiation over which it has jurisdiction as does NRC. OSHA does inspect those radiation sources brought to its attention (e.g., by employee complaint) or those which it randomly inspects during general-schedule inspections. At this time, it is OSHA policy to evaluate all employee complaints which deal with radiation sources. For example, OSHA has investigated and taken action on employee complaints received about phosphate processing in Florida and exposure to radon daughters at Canonsburg, Pennsylvania.

OSHA has a standard for occupational exposure to non-ionizing radiation. Citations are issued where inspection reveals what is perceived as a serious hazard. OSHA is now drafting a compliance directive which deals with non-ionizing radiation, with particular emphasis on radio frequency radiation hazards. OSHA activities in this field are hampered, however, by certain factors. The first is the question of the enforceability of OSHA's standard. As noted in the report (p. 9), the Occupational Safety and Health Review Commission in the Swimline decision (OSHRC docket #12715) declared advisory (non-mandatory) the OSHA standard for non-ionizing radiation (29 CFR 1910.97(a)(2)(i)).

Although efforts are currently being made to evaluate the need for a new, mandatory standard, scientific knowledge of the biological effects of non-ionizing radiation is limited which makes it difficult to propose a new standard.

In addition, OSHA's responsibilities for providing safe and healthful workplaces for all employees have precluded any increased emphasis on the problems of radiation exposure. The GAO does not recommend (although it may imply) that OSHA increase its radiation inspections at the expense of its efforts to protect workers against the multitude of other workplace problems, such as toxic chemicals or safety hazards.

—The subject report criticized Federal agencies for failing to provide funds to the states for radiation control programs (p. iii, ll. 8-9; p. 14, ll. 16-17). Through the 18(b) plan for OSHA plan States, OSHA provided matching funds of about $37 million in FY 1979. While OSHA does not specifically designate that funds provided for support of State programs be used for radiation control, neither does it do so for any other specific hazards.

The Department would also like to suggest the following changes to the text:

—Page ii, line 10. It is suggested that the section beginning "...assuring that employers comply with job radiation standards in those workplaces not covered by the Nuclear Regulatory Commission's standards..." be changed to "...assuring that employers comply with OSHA radiation standards in situations not covered by the Nuclear Regulatory Commission's standards...." It is possible for both OSHA and NRC to have jurisdiction over different aspects or operations of a single job or workplace.

—Page 6, beginning on line 10, "The Nuclear Regulatory Commission... is required to insure...that the possession, use, and disposal of radioactive materials and the construction..." should be revised to read "The Nuclear Regulatory Commission...is required to insure...that the possession, use, and disposal of certain radioactive materials other than NARM such as radium and thorium, and the construction...."

—On page 6, line 17, the sentence which begins "NRC is responsible for licensing and inspecting nuclear material users..." should be revised to "NRC is responsible for licensing and inspecting certain nuclear material users...."

—Page 7, lines 2 and 3. Where the sentence now says "...States regulate manufacturers and users of radioactive materials and sources within their jurisdiction..." this should more accurately read "...States regulate manufacturers and users of all non-exempt radioactive materials and sources within their jurisdiction...."

—Page 8, line 21. The sentence which begins "... As of July 1979, 24 States were operating enforcement programs..." would be more accurate if it read "As of July 1979, 24 States or jurisdictions were operating enforcement programs...."

DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
OFFICE OF THE SECRETARY
WASHINGTON, D.C. 20201

19 OCT 1979

Mr. Gregory J. Ahart
Director, Human Resources
Division
United States General
Accounting Office
Washington, D.C. 20548

Dear Mr. Ahart:

The Secretary asked that I respond to your request for our comments on your draft report entitled, "Radiation Control Programs Provide Limited Protection." The enclosed comments represent the tentative position of the Department and are subject to reevaluation when the final version of this report is received.

We appreciate the opportunity to comment on this draft report before its publication.

Sincerely yours,

Richard B. Lowe III
Acting Inspector General

Enclosure

GAO note: The page references in this appendix may not correspond to the page numbers in the final report.

COMMENTS OF THE DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE ON GENERAL ACCOUNTING OFFICE'S DRAFT REPORT ENTITLED "RADIATION CONTROL PROGRAMS PROVIDE LIMITED PROTECTION"

General Comments

The Department of Health, Education, and Welfare is concerned with GAO's finding that radiation hazards are inadequately controlled in the eight States that it surveyed. However, GAO's report would be more helpful if it provided more precise information about the extent of health risk presented by the various inadequacies in enforcement and regulation so that those inadequacies posing significant risk can be readily identified and remedied as soon as possible.

The concern about radiation has led to an extensive planning process by the Executive Branch coordinated by the Department. Recommendations presented in the Report of the Interagency Task Force on the Health Effects of Ionizing Radiation, chaired by the Secretary, were sent to the White House in June 1979. Although these recommendations have not been implemented to date because of their recent development, they represent a carefully developed, comprehensive plan to address the health effects of ionizing radiation, posing the greatest health risk. Thus, the Administration has moved to deal with the concerns about radiation hazards expressed by the GAO report. It also represents an essential step in developing more effective State programs.

As GAO has generally recognized in the introduction to this draft report, radiation control is a complex topic, because of the many sources of radiation, the number and complexity of the authorizing statutes, the varying degrees of public health risk from different radiation sources, and the numerous Federal and State agencies which have responsibilities for aspects of radiation control. We found the draft of this report somewhat confusing and perhaps misleading because of the inadequate description of the responsibilities of the agencies. Indeed, this report has examined the control activities of the agencies involved fairly superficially. For example, many radiation control activities of HEW are only briefly mentioned or are not discussed. We believe that the report would be more accurate and of more use to the Senate Committee on Governmental Affairs and the public if GAO clarified the following:

1. The final conclusion reached by GAO is outside the limits of its inquiry and not supported by the evidence in its report.

   GAO concludes that there is no comprehensive State/Federal program to protect the public against radiation hazards; yet the scope of inquiry, as stated in GAO's report on page 5, is to examine a few State programs not Federal programs, and a few radiation emitting products. We do not believe GAO can reach this broad conclusion based upon the limited sample of radiation control programs reflected in this report, and the accuracy of the report is compromised by the failure to consider the entire situation.

2. The report does not accurately reflect the nature and scope of Food and Drug Administration's (FDA) activities regarding radiation control.

The report implies, by failing to state otherwise, that all aspects of FDA's radiation control activities were considered in writing the report, but this is not true. For example, the report describes FDA's responsibilities only as development of performance standards for certain x-ray equipment and microwave ovens and a cooperative program with the States to check compliance of newly assembled x-ray equipment (see pgs. ii, 10, and 32.) In fact, FDA has regulatory responsibilities for a wide range of electronic products that emit radiation, such as lasers, mercury vapor lamps, ultrasonic therapy, television receivers, cold cathode gas discharge tubes, and cabinet x-rays as well as the ones cited by GAO. The report also implies that FDA has no authority over electronic products manufactured prior to August 1, 1974 (see pgs. 10 and 32), which is not the case. We feel that some reference to the full range of FDA's activities is necessary to provide an accurate perspective. If GAO feels that a detailed discussion of the full range of FDA's activity either is not needed or is not possible in the report, then an explicit statement of this limitation of the scope of their discussion should be made.

3. A clear distinction between the responsibilities of FDA, NRC, OSHA, and the various State regulatory agencies should be made and maintained throughout the report.

Although an attempt to identify the responsibilities of each Federal agency and the various States is made in Chapter 2, the discussions are not complete and the distinctions are not maintained clearly throughout the report. It is often difficult for the reader to know which programs are being discussed. For example, at the beginning of Chapter 3 (p. 17), program deficiencies are identified without linking them to the responsible agency. Other examples are in the discussions entitled "Little Assurance That Hazards Are Corrected" (pp. 22-24), "Items of Non-Compliance Were Not Always Cited" (pp. 24-25), and "Conclusions and Recommendations" (pp. 31-35). These discussions could confuse the reader, particularly regarding differing Federal/State program responsibilities.

We also believe that this report would present a more accurate picture of radiation regulation if the responsibilities of other Federal agencies were considered, e.g., National Institutes of Health, Department of Transportation, Department of Defense, Department of Energy, Federal Aviation Administration, Veterans' Administration, Department of Labor, National Bureau of Standards, Consumer Product Safety Commission, Department of Agriculture, and National Oceanic and Atmospheric Administration.

4. The report does not adequately address the authorities granted each of the agencies for radiation control.

While enabling legislation for each agency is briefly mentioned in Chapter 2, the discussion does not adequately describe the parameters of authority for radiation control. A discussion of these statutes would allow the reader to judge the adequacy of the programs based on what the agencies are authorized to do.

FDA has authority to regulate radiation hazards under the Food, Drug and Cosmetic Act, the Medical Devices Amendments of 1976, the Public Health Service Act, and the Radiation Control for Health and Safety Act of 1968. Each law addresses different sources of radiation exposure, gives FDA different responsibilities, and provides for different mechanisms for approaching problems and eliminating risks.

Also, various States have more authority for controlling radiation hazards than the report has indicated. Many States have authority to regulate sources of radioactivity (including naturally occurring radioactive materials), the use of electronic products (including x-ray emitters), the facilities where electronic products are used, and registration of electronic products. Many States have the authority to inspect user facilities, which FDA does not.

5. The report confuses FDA's authority over x-ray equipment assemblers with activities directed towards x-ray equipment users.

FDA field tests equipment at the user's facility to assure that the x-ray equipment meets emission standards and to verify that the assemblers have adequately installed the equipment. If a violation is found, either the manufacturer or the assembler is contacted to correct the violation, although the user is notified if a serious violation is found. Most of GAO's comments seem to be directed at the user level rather than at the manufacturer or assembler level, which is the level at which FDA has enforcement authority.

GAO Recommendation

We recommend that the Secretary of Health, Education, and Welfare direct the Commissioner of FDA to develop procedures to assure that follow-up inspections are made in those cases where x-ray assembly inspections have identified serious hazards.

Department Comments

The Department agrees that FDA should have procedures to assure that follow-up inspections are made in cases where x-ray assembly field tests have identified serious hazards. Although FDA presently has written follow-up procedures for violations of performance standards that pose a serious hazard, FDA is preparing more explicit procedures calling for follow-up field testing of

noncompliant equipment when Class A violations (ones posing an immediate radiation hazard to public health and safety) are found. For Class B violations (generally deviations from the standard which pose a potential hazard if uncorrected) the new procedures would provide for follow-up, but not necessarily inspection.

Technical Comments

1. Change references to BRH or Bureau of Radiological Health to FDA or Food and Drug Administration unless specifically quoting an official of the Bureau, when the identification is necessary for clarity.

2. Whenever the word "inspection" is used relevant to FDA's follow-up programs, change it to read "field test." FDA is not authorized to inspect user facilities, but may, with the permission of the user, test diagnostic x-ray equipment on his premises to assure that the manufacturer or components and the assembler of those components are conforming with the standard.

3. Page 9, paragraph 3, first sentence should read, "The National Institute for Occupational Safety and Health (NIOSH), which is responsible for recommending to OSHA new or revised standards, is presently developing a proposed standard for radiofrequency/microwave radiation."

4. Page 11, paragraph 1 states there were "32 violations which warranted cessation of operations and 1,071 other major violations." The terms are not defined and should be. The FDA defines violations which warrant cessation as "Conditions which pose an immediate radiation hazard to the public health and safety" (Class A). In the same paragraph, GAO uses the term "major violations" as general deviations from the standard which if left uncorrected pose a potential as opposed to immediate hazard (Class B). Clarification of the terminology used in classification of violations or noncompliance is needed to properly assess the conditions discussed in the report.

5. Page 11, paragraph 2 indicated that BRH notifies users of noncompliant equipment by letter when deficiencies are found. This is incorrect. The user is normally advised verbally of any apparent violations at the time of the field test by FDA or the State under contract. The assembler or manufacturer responsible for installing the equipment is then notified in writing by the responsible FDA field office of the violations by the issuance of a Notice of Adverse Findings letter and given 30 days to make corrections. An information copy of this letter is normally sent to the user facility.

6. Page 11, paragraph 3, first sentence should be changed to read "Although the field offices are directed in the program to forward corrective action reports to the bureau, often such reports are entered into the computer in an untimely fashion and occasionally the form is not sent or is lost according to BRH officials."

7. Page 12, paragraph 1. In addition to the BENT program and the DENT program, FDA has the following voluntary programs to assist State radiation control activities, provide educational materials, and determine the extent of unnecessary radiation to which people are exposed: Nationwide Evaluation of X-ray Trends (NEXT), Suggested State Regulations, Criteria for Adequate State Programs, Quality Assurance in Diagnostic Radiology, Referral X-ray Criteria, Radiological Health Learning Laboratroy, Education Package for X-ray Operators, and the National Guidelines for Credentialing Medical Radiation Technologists. These programs should also be included in this discussion.

8. Page 14, chart showing participation in Federal programs: change "FDA New Assembly Inspection" to read, "FDA New Assembly Field Testing Contracts."

9. Page 17, paragraph 1, second sentence. Change inset phrases to indicate the responsible agencies in each case. For example, "Agency X did not meet inspection frequency goals."

10. Page 31, paragraph 2. This paragraph is misleading because no basis for comparison is established. Throughout the report, and from its title, the inference is that GAO is considering all radiation control as a single "comprehensive" system with many shortcomings. This paragraph appears to shift gears and focus upon a single NRC program (unidentified) as being the quote "most comprehensive Federal program," apparently because NRC licensed and inspected nuclear material for which it is responsible. Since other Federal programs do not deal with the same types of problems and the legislative mandate may not provide for licensing and/or inspection, it is difficult to compare their "comprehensiveness" with that of the NRC nuclear licensing and inspection program.

11. Page 32, paragraph 2, first and second sentences are incorrect and should be replaced with the following:

> The FDA has several programs that deal with radiation hazards, including one for diagnostic x-ray equipment. The enforcement authority over radiation from electronic products began with passage of the Radiation Control for Health and Safety Act in 1968. A number of performance standards have been promulgated since that time, including one for diagnostic x-ray equipment which became effective on August 1, 1974.

Further, the remainder of this paragraph is misleading because it implies that Federal law requires the field testing of all certified diagnostic x-ray systems. The statute does not, in fact, make such a requirement. Inspection of x-ray equipment has traditionally been a function of State Radiological Health Agencies. However, in recent years FDA has greatly

APPENDIX IV

expanded its State contract program and its field testing activities to determine compliance with Federal performance standards for certified diagnostic x-ray units. Currently, FDA is offering contracts to any State that is willing and able to participate in this program. In FY 79, 33 States and the Commonwealth of Puerto Rico will have performed over 4,000 contract field tests of diagnostic x-ray systems for FDA. Many contracts that provide data to Federal agencies have the dual effect of providing training for State personnel as well as additional resources to the States.

12. Pages 34 and 35 are confusing in that the agencies under discussion are not always clearly identified. For example, on page 35, following some discussion of State programs and some discussion that includes Federal programs, GAO states that "inspectors do not normally verify correction until the next scheduled inspection which could be years later." This apparently refers to inspections made under State law as part of State programs and is not applicable to FDA's State contract program. States under contract with FDA field test newly installed equipment to determine compliance with the Federal standards and report their findings to FDA on a one time basis. The contracts do provide for follow-up tests (at the direction of FDA) to determine if needed corrections have been achieved. These reinspections would normally occur immediately following receipt by FDA of a corrective report from the assembler or manufacturer. The GAO report does not differentiate between field tests performed as part of State activities and those conducted for FDA under contract. Some clarification should be made of exactly which programs and agencies are the topic of discussion.

APPENDIX V

Total Expenditures for State and Local Radiological Health Activities by Program Area and State, Fiscal Year 1977 (In Thousands)

STATES	TOTALS	BASIC PLANNING AND ADMIN.	X-RAY SURVEY AND CONTROL	ENVIRONMENTAL SURVEILLANCE	RADIOACTIVE MATERIALS	ELECTRONIC PRODUCTS	OTHER RADIOLOGICAL HEALTH ACTIVITIES
TOTALS [a]	12,918.1	1,990.9	4,770.7	2,215.2	3,014.9	368.2	558.2
ALABAMA	216.0	32.5	80.6	42.4	48.9	5.3	6.5
ALASKA	0.0	N/P	N/P	N/P	N/P	N/P	N/P
ARIZONA	339.7	34.1	106.0	52.1	93.2	15.8	38.5
ARKANSAS	139.5	14.0	41.9	27.9	41.7	7.0	7.0
CALIFORNIA	1,496.8	224.5	838.2	44.9	389.2		
COLORADO	438.6	30.7	83.3	120.6	65.8	2.2	136.0
CONNECTICUT	117.4	11.7	44.6	47.0	5.9	2.3	5.9
DELAWARE	25.8	3.9	18.0	1.3	1.3		1.3
D. C.	82.0	20.5	20.5	12.3	8.2	4.1	16.4
FLORIDA	739.0	88.7	221.7	177.4	221.7	14.8	14.7
GEORGIA	255.3	25.5	114.9	-	89.4	25.5	-
HAWAII	30.7	4.6	13.8	1.5	4.6	4.6	1.5
IDAHO	118.0	23.6	29.5	29.5	29.5	-	6.0
ILLINOIS	492.3	68.9	231.4	78.8	98.5	4.9	9.8
INDIANA	131.4	65.7	32.9	17.1	9.2	3.9	2.6
IOWA	82.7	12.4	27.3	37.2	1.7	2.5	1.7
KANSAS	161.0	24.2	56.4	24.2	40.3	8.0	8.0
KENTUCKY	306.9	55.2	85.9	76.7	73.7	3.1	12.3
LOUISIANA	285.4	14.3	85.9	42.9	100.2	14.3	28.6
MAINE	61.7	9.3	22.8	26.5	1.2	0.7	1.2
MARYLAND	247.1	29.7	76.0	77.5	63.9		
MASSACHUSETTS	275.0	27.5	77.0	104.5	49.5	11.0	5.5
MICHIGAN	433.4	78.9	151.7	126.1	61.1	3.9	11.7
MINNESOTA	207.3	31.1	109.9	33.2	4.1	26.9	2.1
MISSISSIPPI	136.1	20.4	44.9	21.8	47.6	0.7	0.7
MISSOURI	62.7	25.0	25.0	3.2	3.1	1.3	5.0
MONTANA	37.9	7.6	22.7	5.7	1.9		
NEBRASKA	112.8	15.0	32.5	23.5	25.3	8.8	7.7
NEVADA	N/R	N/R	N/R	N/R	N/R	N/R	N/R
NEW HAMPSHIRE	47.0	27.7	8.9	1.9	8.5		
NEW JERSEY	502.3	140.6	150.7	150.7	50.2	10.0	
NEW MEXICO	128.7	12.9	42.5	24.5	42.5	6.4	
NEW YORK	1,488.3	180.6	606.1	51.4	487.8	70.2	92.1
NORTH CAROLINA	283.1	11.3	113.2	62.3	82.1	0.0	14.2
NORTH DAKOTA	67.1	14.8	13.4	2.0	21.5	0.0	15.4
OHIO	176.0	40.5	102.1	3.5	10.6	3.5	15.8
OKLAHOMA	272.1	51.7	84.3	84.3	40.8	10.9	0.0
OREGON	322.2	16.1	80.6	135.3	64.4	9.7	16.1
PENNSYLVANIA	711.0	213.3	217.4	146.3	99.8	2.0	32.1
RHODE ISLAND	76.0	14.4	28.9	23.6	2.3	4.6	2.3
SOUTH CAROLINA	291.2	29.1	87.4	110.7	52.4	8.7	2.9
SOUTH DAKOTA	29.0	5.8	22.0	0.3	0.3	0.3	0.3
TENNESSEE	236.6	36.7	78.1	37.9	82.7	1.2	0.0
TEXAS	504.3	60.5	50.4	55.5	277.4	50.4	10.1
UTAH	75.1	18.8	46.5	3.0	1.5	3.0	2.3
VERMONT	N/R	N/R	N/R	N/R	N/R	N/R	N/R
VIRGINIA	100.5	5.0	40.2	30.2	20.1	5.0	
WASHINGTON	214.0	42.8	74.9	2.1	74.9	2.1	17.1
WEST VIRGINIA	49.2	4.9	39.4	3.4	0.5	0.5	0.5
WISCONSIN	176.9	24.8	116.8	28.3	1.8	3.6	1.8
WYOMING	43.5	16.5	21.8	2.2	3.0		
PUERTO RICO	90.5	22.6	49.8	0.0	9.1	4.5	4.5

a) Discrepancies of less than $200 in totals between sum of program areas and total expenditure column for each State is due to rounding off dollars from reported program budget percentages.

Source: FDA's Report of State and Local Radiological Health Programs for Fiscal Year 1977.

APPENDIX VI

Radiological Health Personnel Man-Equivalence by Program Area and State, Fiscal Year 1977

STATE	TOTAL	BASIC PLANNING AND ADMINISTRATION	X-RAY SURVEY AND CONTROL	ENVIRONMENTAL SURVEILLANCE	RADIOACTIVE MATERIALS	NON-IONIZING RADIATION	OTHER RADIOLOGICAL ACTIVITIES
TOTAL	594 47	91.80	200.44	115.67	122.50	13.46	50 60
ALABAMA (a	12.30	1.3	3.5	2.2	2.5	0.3	2.5
ALASKA (a	0 2	0.1	0.1				
ARIZONA (a	10.2	1.0	3.2	1.5	2.8	0.5	1.2
ARKANSAS	9.0	1 5	2.75	1.8	2.25	.25	.45
CALIFORNIA	52.0	10.0	17.0	2.0	12.0	-	11.0
COLORADO	22.08	1.6	4.15	6.0	3.40	.10	6.83
CONNECTICUT	6.00	.65	2.25	2.4	.30	.10	.30
DELAWARE	2.00	.10	1.70	.05	.05	.05	.05
D. C.	5.18	1.35	1.10	1.05	.40	.10	1.18
FLORIDA	31.05	10.55	4.50	9.70	4.60	1.00	.70
GEORGIA	2.30	1.00	5.50	-	4.00	.50	3.00
HAWAII	14.00	.50	.80	.80	.08	.08	-
IDAHO	4.00	1.00	1 00	1.00	1.00	-	-
ILLINOIS	27.50	3.75	13.00	4.50	5.50	.25	.50
INDIANA	6.46	3.25	1.63	.80	.45	.20	.13
IOWA	4.20	.75	1 00	2.10	.07	.08	.20
KANSAS	8 65	.75	3.50	2.30	1.80	.30	-
KENTUCKY	23 00	4.00	9.00	7.00	1.00	-	2.00
LOUISIANA	10 00	.80	3.10	1.45	4.00	10	.55
MAINE	3.00	.50	1.00	1 25	.10	.05	.10
MARYLAND	13 10	1.10	3.00	4.10	4.90	-	-
MASSACHUSETTS	10.85	1.10	3.00	4.00	2.00	.55	.20
MICHIGAN	13.41	1.80	5.50	5.10	.70	.01	.30
MINNESOTA	12 00	.80	8.00	1 30	.20	1.60	.10
MISSISSIPPI	6.10	1.00	2.00	.40	2.50	.05	15
MISSOURI	3.90	1.10	2.20	.30	.10	-	.20
MONTANA	1 60	.30	1 05	.20	.05	-	-
NEBRASKA	4 71	71	1 32	.96	1.05	.35	.32
NEVADA	N/R	N/R	N/R	N/R	N/R	N/R	N/R
NEW HAMPSHIRE	2 18	1.07	.52	12	.47	-	-
NEW JERSEY	20.20	3.20	4.80	10 00	1.00	.20	1.00
NEW MEXICO (a	10.00	2 00	3 00	1 00	4.00	-	-
NEW YORK	56 35	5 90	25.40	-	21 70	2.05	1.30
NORTH CAROLINA	15.00	1.20	6.20	2.20	4.20	-	1.20
NORTH DAKOTA	2.90	.63	.58	.09	.92	-	.68
OHIO	12.00	1.50	6.00	.50	1 00	.50	2 50
OKLAHOMA	11 00	1 80	3.40	4.50	1.20	.10	0.0
OREGON	8.70	.20	2.00	4.00	2 30	.10	.40
PENNSYLVANIA	27 70	6.20	7 30	9.00	3 60	.10	1.50
RHODE ISLAND	3 72	.45	1 24	1 71	05	.21	05
SOUTH CAROLINA	17.00	2.30	4 00	6 50	3 00	20	1.00
SOUTH DAKOTA	2 10	42	1 60	02	02	.02	02
TENNESSEE	16.05	2.25	3.00	.75	4.00	.05	6.00
TEXAS (a	29.50	4.50	5.50	2.50	14.00	2.00	1.00
UTAH	3.72	.76	1 60	1 12	04	11	.09
VERMONT	3 85	.10	75	3 00	-	-	-
VIRGINIA	6 50	1.00	2.50	2 00	50	.50	-
WASHINGTON	7.70	.60	4.20		1.90	-	1.00
WEST VIRGINIA	5.00	1 00	2.50	80	.10	.10	.50
WISCONSIN	6.30	.50	4 00	1.50	10	.20	-
WYOMING	2.00	.76	1 00	10	14	-	-
PUERTO RICO	6.25	1.10	3 50		.75	.50	.40

a) Total man-equivalence not reported

Source: FDA's Report of State and Local Radiological Health Programs for Fiscal Year 1977.

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