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ASSEMBLY INTERIM COMMITTEE ON PUBLIC HEALTH
SUBCOMMITTEE ON AIR POLLUTION AND RADIATION PROTECTION
House Resolution No. 219, 1957

ATOMIC ENERGY DEVELOPMENT AND RADIATION PROTECTION IN CALIFORNIA

February, 1959

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LETTER OF TRANSMITTAL

ASSEMBLY CHAMBER, STATE CAPITOL
SACRAMENTO, February 11, 1959

HON. RALPH M. BROWN
Speaker of the Assembly, and
Members of the Assembly
Assembly Chamber, Sacramento

GENTLEMEN: The Assembly Interim Committee on Public Health submits this Report on Atomic Energy Development and Radiation Protection in California prepared by the Subcommittee on Air Pollution and Radiation Protection in accordance with House Resolution No. 219 of the 1957 Session.

Respectfully submitted,

W. BYRON RUMFORD, Chairman
Assembly Interim Committee on
Public Health

SUBCOMMITTEE LETTER OF TRANSMITTAL

ASSEMBLY CHAMBER, STATE CAPITOL
SACRAMENTO, February 11, 1959

HON. W. BYRON RUMFORD, *Chairman*
Assembly Interim Committee on Public Health

DEAR MR. RUMFORD: This is the first of two reports on the subject of atomic energy and radiation being submitted by your Subcommittee on Air Pollution and Radiation Protection. The second, submitted this same date, contains basic background information which will supplement the information contained in this report.

The subcommittee found early in its study that extensive and rapidly increasing applications of atomic energy and radiation in California present problems that are clearly a responsibility of the State. It believes that the legislation proposed herein is a necessary first step in meeting this responsibility.

The subcommittee wishes to express its appreciation to the many individuals, the representatives of industry, medicine and labor, state agencies, to the staff and faculty of the University of California whose testimony at the public hearings and whose advice and consultation throughout the interim has been of such assistance.

Respectfully submitted,

SETH J. JOHNSON, Chairman
Subcommittee on Air Pollution
and Radiation Protection

W. S. GRANT
RICHARD T. HANNA
DON MULFORD
W. BYRON RUMFORD

SCOPE OF REPORT

This Report:

1. Discusses the nature of radiation, its applications in industry, agriculture, medicine and research with special reference to the extent of the usage of radiation and atomic energy in California.
- 2 Describes the health hazards associated with exposure to ionizing radiation and the nature of the public health problem posed by the increasing uses of radiation in California.
3. Reviews the existing responsibility and activities of federal and state agencies in California, the problems of federal-state relationships, and the problems of state agency co-ordination of radiation regulations and control measures.
4. Discusses the need for state action and recommends legislation to meet that need.

FINDINGS

1. The extensive and rapidly increasing applications of radiation and atomic energy in California present problems which require immediate state action. Legislation is necessary to establish administrative machinery which will encourage the continuing and orderly growth of the atomic energy industry in California and which will at the same time provide for the protection of the people of California from the harmful effects of ionizing radiation.

2. The properties of radiation which make it such a valuable tool in industry, medicine, agriculture and research, make it hazardous to the individual. All radiation is harmful from a genetic point of view. It is not known whether or not there is a "safe" or threshold level below which radiation is not harmful from a somatic point of view. In light of this, the state program must be directed towards protecting the public from *all* unnecessary exposure to radiation.

3. The U. S. Atomic Energy Commission has been granted extensive authority over certain well defined areas of atomic energy and radiation which it exercises through a detailed licensure and control program. It is not clear whether or not the State has any jurisdiction in this area.

4. The majority of radiation sources in California do not come within the jurisdiction of the Atomic Energy Commission and these sources clearly comprise a state responsibility. At the present time there is no information as to the number or locations of these sources.

5. While a number of state agencies are concerned with the radiation problem and a few have undertaken radiation programs of one type or another, they are limited in scope and in most cases grossly inadequate. Further there is no definitive co-ordination either among the various state agency activities or between the State and the Federal Government.

6. There is inadequate knowledge of the amount of radiation in the environment and this knowledge is essential for the orderly development of a radiological health program.

7. The State does not have adequate laboratory facilities or enough trained personnel for conducting the type of radiation program which will be necessary in California.

RECOMMENDATIONS

Proposed legislation follows which will establish a Co-ordinator of Atomic Energy Development and Radiation Protection, and which will establish the other necessary administrative structure within the State Government to meet the problems discussed in this report.

A proposed resolution follows which requests that the U. S. Congress enact an amendment to the Atomic Energy Act of 1954 to clarify the relationships between the state and federal government with regard to the protection of the public health and safety from radiation hazards incident to the possession or use of materials or facilities regulated by the Atomic Energy Commission.

PROPOSED LEGISLATION

CALIFORNIA LEGISLATURE, 1959 REGULAR (GENERAL) SESSION

ASSEMBLY BILL

No. 1403

Introduced by Messrs. Johnson, Rumford, Hanna, Mulford, Bruce F. Allen, George E. Brown, Chapel, Francis, Grant, Rees, and Thelin

February 16, 1959

REFERRED TO COMMITTEE ON PUBLIC HEALTH

An act to add Chapter 7.5 (commencing at Section 25700) to Division 20 of the Health and Safety Code, relating to atomic energy development and radiation protection.

The people of the State of California do enact as follows:

1 SECTION 1. Chapter 7.5 (commencing at Section 25700)
2 is added to Division 20 of the Health and Safety Code, to
3 read:

4
5 CHAPTER 7.5. ATOMIC ENERGY DEVELOPMENT AND
6 RADIATION PROTECTION

7
8 Article 1. Short Title

9
10 25700. This chapter may be cited and shall be known as
11 the California Atomic Energy Development and Radiation
12 Protection Law.

LEGISLATIVE COUNSEL'S DIGEST

A. B. 1403 as introduced, Johnson (Pub. H.). Atomic energy development and radiation protection

Adds Ch. 7.5 (commencing at Sec. 25700), Div. 20, H. & S. C.

Establishes in the Office of the Governor the position of Co-ordinator of Atomic Energy Development and Radiation Protection for the purpose of co-ordinating the activities of state agencies relating to atomic energy development and radiation protection

Creates a Departmental Co-ordinating Committee on Atomic Energy Development and Radiation Protection to assist the co-ordinator

Establishes an Advisory Council on Atomic Energy Development and Radiation Protection to be appointed by the Governor to advise him on matters relative to atomic energy development and radiation protection

Makes it unlawful to manufacture, construct, produce, transfer, acquire, use, or possess any materials or facilities for which a permit or license is required by the Federal Atomic Energy Act of 1954 without first obtaining such a permit or license

Requires any person possessing a source of radiation to register with the Department of Public Health.

Article 2. Declaration of Policy

25710 The Legislature finds and declares that the peacetime uses of atomic energy and radiation can be instrumental in improving the health, welfare and economic productivity of the people of the State of California if properly utilized, and may be hazardous to the health and safety of the public if carelessly or excessively employed. It is therefore declared to be the policy of the State to:

(a) Encourage the constructive development of industries producing or utilizing atomic energy and radiation and to eliminate unnecessary exposure of the public to ionizing radiation.

(b) Have state agencies retain their traditional jurisdictions wherever possible.

(c) Have various departments and agencies of the State which are concerned with atomic energy and radiation and its various applications develop programs designed to protect the people of the State from unnecessary exposure to radiation.

(d) Assure the co-ordination of the programs of the state agencies and the laws, rules and regulations incident thereto and to insure the co-ordination of these activities with the development and regulatory activities of local agencies, other states and the Government of the United States, including the Atomic Energy Commission.

(e) Keep the public, labor, industry, and all other legitimate interests as completely informed as possible on all matters relating to peacetime atomic energy and radiation development and control in this State

Article 3 Definitions

25720. "Atomic energy" means all forms of energy released in the course of nuclear transformation

25721 "Radiation" means any or all of the following forms of ionizing radiation: gamma rays, X-rays, alpha and beta particles, high-speed electrons, neutrons, protons, and other atomic or nuclear particles or rays, but does not include sound or radio waves, or visible, infrared, or ultraviolet light.

Article 4. Co-ordinator of Atomic Energy
Development and Radiation Protection

25730 There is in the Office of the Governor the position of Co-ordinator of Atomic Energy Development and Radiation Protection who shall be appointed by, and serve at the pleasure of, the Governor. The co-ordinator may appoint such clerical and secretarial employees as are necessary to perform his duties and may fix their salaries, subject to the approval of the Director of Finance. The co-ordinator and his staff shall be known as the Office of Atomic Energy Development and Radiation Protection. The compensation of the co-ordinator

1 shall be fixed by the Director of Finance. He shall be a full-
2 time officer and shall serve as advisor to the Governor with
3 respect to the development of atomic energy and radiation
4 protection in the State.

5 25731. The co-ordinator shall perform the liaison function
6 between the State and the Federal Government, including the
7 United States Atomic Energy Commission, and between this
8 State and other states in matters pertaining to atomic energy
9 development and radiation protection.

10 25732. The co-ordinator shall co-ordinate the programs,
11 and rules and regulations of the several departments and
12 agencies of the State relating to atomic energy development
13 and radiation protection, and shall so far as may be prac-
14 ticable co-ordinate the studies conducted and the recommenda-
15 tions and proposals made in this State on these subjects with
16 like activities in other states and by the Federal Government
17 and with the policies and regulations of the United States
18 Atomic Energy Commission.

19 25733. No state department or other state agency shall
20 adopt, amend or repeal any rule or regulation, except emer-
21 gency rules or regulations, relating to atomic energy develop-
22 ment or radiation protection unless and until the proposed
23 rule or regulation, or amendment thereto, or repeal thereof,
24 has been first submitted to the co-ordinator for such comments,
25 recommendations, or suggestions he may deem necessary or
26 desirable with respect thereto.

27 25734. No rule or regulation applying to atomic energy
28 development or radiation protection or amendment thereto
29 or repeal thereof which any state agency may propose to adopt,
30 unless it be an emergency regulation, shall be noticed under
31 the provisions of Section 11423 of the Government Code prior
32 to 30 days after it has been submitted to the co-ordinator.

33 25735. The co-ordinator may when he deems necessary or
34 appropriate recommend to any state department or other state
35 agency the adoption, amendment, or repeal of rules and regu-
36 lations relating to atomic energy development and radiation
37 protection.

38 25736. The co-ordinator shall keep the Governor and the
39 various interested state departments and agencies informed
40 of private and public activities affecting the peacetime uses
41 of atomic energy and radiation and shall enlist their co-
42 operation in protecting the health, safety and general welfare
43 of the people of the State.

44 25737. The co-ordinator shall disseminate to the public
45 factual data and information and interpretations thereof
46 concerning atomic energy development and the uses of radia-
47 tion in the State with the view to providing a reliable source
48 of accurate information relating to the benefits and hazards
49 of such development and uses.

50 25738. The co-ordinator shall submit a report to the Gov-
51 ernor and the Legislature not later than 10 calendar days
52 following the commencement of each regular session of the

1 Legislature recommending such action or legislation as he
2 deems necessary or desirable, and shall submit his first report
3 to the Governor and to the Legislature at the 1961 Regular
4 Session, including but not limited to information on:

5 (a) The environmental monitoring and surveillance pro-
6 gram of the State relating to radiation.

7 (b) The adequacy of the radiological laboratory facilities
8 of the State necessary for discharging the duties and perform-
9 ing the service required by state agencies, whether or not
10 there should be a centrally located laboratory facility to serv-
11 ice all state agencies, and if so where it should be located
12 administratively, or whether it would be feasible for the
13 State to contract with private organizations for any needed
14 technical laboratory work.

15 (c) The need for personnel trained in various aspects of
16 radiological safety and a recommended program for meeting
17 this need.

18 (d) A recommended program for the inspection of sources
19 of radiation within the State.

20 25739. The co-ordinator may consult with and seek the ad-
21 vice of technically qualified persons within and without the
22 State to advise on matters relating to atomic energy and radi-
23 ation protection.

24 25 Article 5. Departmental Co-ordinating Committee

26
27 25750. There is in the State Government the Departmental
28 Co-ordinating Committee on Atomic Energy Development and
29 Radiation Protection which shall consist of the Co-ordinator
30 of Atomic Energy Development and Radiation Protection as
31 chairman and the heads of the following state departments
32 and agencies, or the individuals designated by the heads of
33 such departments or agencies to represent them: the Depart-
34 ment of Public Health, the Department of Industrial Rela-
35 tions, the Department of Water Resources, the Department of
36 Natural Resources, the Department of Fish and Game, the
37 State Water Pollution Control Board, the California Disaster
38 Office, the Attorney General, the Department of Agriculture,
39 the Department of Public Works, the Department of Educa-
40 tion, the Department of Finance, the University of California,
41 the Public Utilities Commission, and such other state depart-
42 ments or agencies as the Governor may select.

43 25751. Meetings of the committee shall be held as called
44 by the co-ordinator or upon request of four or more of the
45 members.

46 25752. The committee shall assist in the co-ordination and
47 development of the programs and activities of the various state
48 departments and agencies in matters pertaining to atomic
49 energy development and radiation protection and shall report
50 thereon to the Governor from time to time or upon his request.

Article 6 Advisory Council

25760. There is in the State Government an Advisory Council on Atomic Energy Development and Radiation Protection, consisting of the Co-ordinator of Atomic Energy Development and Radiation Protection and nine members appointed by the Governor. One member shall be appointed from each of the following fields: industry, labor, medicine, education, science and technology, agriculture, insurance, city government, and county government.

25761. Members of the council shall be appointed for terms of two years and shall hold office until the appointment of their successors. The chairman shall be selected by the Governor, and the co-ordinator shall act as secretary to the council.

25762. Members of the council shall receive no compensation but shall be allowed their actual necessary traveling expenses incurred in the discharge of their duties.

25763. The council shall meet at least twice each year at the call of the Governor.

25764. The council shall advise and make recommendations to the Governor relating to atomic energy development and radiation protection.

Article 7. Permits and Licenses Required

25770. It is unlawful for any person to manufacture, construct, produce, transfer, acquire, use, or possess any of the materials or facilities for which a permit or license is required under the provisions of the Atomic Energy Act of 1954 (Public Law 85-256) unless he shall have first obtained such permit or license. Violation of this section is a misdemeanor.

25771. The Department of Public Health shall keep current information on the permits or licenses issued by the United States Atomic Energy Commission in the State and shall transmit such information to the Co-ordinator of Atomic Energy Development and Radiation Protection and upon request to any state department or agency or member of the public.

Article 8 Registration of Sources of Radiation

25780. Any person possessing a source of radiation shall register with the Department of Public Health pursuant to rules and regulations which shall be promulgated by the Board of Public Health and shall give such information relating to such source of radiation as shall be required by such rules and regulations on forms to be prescribed by the Board of Public Health and furnished by the department. Violation of this section is a misdemeanor.

1 25781. The information obtained by registrations under
2 Section 25780 shall be transmitted by the department to the
3 Co-ordinator of Atomic Energy Development and Radiation
4 Protection and upon request to any state department or
5 agency or member of the public.

CALIFORNIA LEGISLATURE, 1959 REGULAR (GENERAL) SESSION

ASSEMBLY BILL**No. 1404**

Introduced by Messrs. Johnson, Rumford, Hanna, Mulford, Bruce F. Allen, George E. Brown, Chapel, Francis, Grant, Rees, and Thelin

February 16, 1959

REFERRED TO COMMITTEE ON GOVERNMENTAL EFFICIENCY AND ECONOMY

An act making an appropriation for support of the Office of Atomic Energy Development and Radiation Protection.

The people of the State of California do enact as follows:

- 1 SECTION 1. The sum of ----- dollars (\$-----) is
2 hereby appropriated out of the General Fund for support of
3 the Office of Atomic Energy Development and Radiation Pro-
4 tection during the 1959-1960 Fiscal Year.

LEGISLATIVE COUNSEL'S DIGEST

A. B. 1404 as introduced, Johnson (G. E. & E). Appropriation for support of Office of Atomic Energy Development and Radiation Protection.

Appropriates a blank amount of money from the General Fund for the support of the Office of Atomic Energy Development and Radiation Protection during the 1959-1960 Fiscal Year.

CALIFORNIA LEGISLATURE, 1959 REGULAR (GENERAL) SESSION

Assembly Joint Resolution**No. 15**

Introduced by Messrs. Johnson, Rumford, Hanna, Mulford, Bruce F. Allen, George E. Brown, Chapel, Francis, Grant, Rees, and Thelin

February 12, 1959

REFERRED TO COMMITTEE ON RULES

*Assembly Joint Resolution No. 15—Relative to atomic energy
and radiation protection.*

1 WHEREAS, California is a large user of atomic energy and
2 radioactive materials in industry, medicine, agriculture, and
3 research; and

4 WHEREAS, Radiation, if improperly used, presents a poten-
5 tial hazard to the health and safety of the people of this State;
6 and

7 WHEREAS, Since the enactment of the Atomic Energy Act of
8 1954 by the Federal Government there has been a considerable
9 amount of uncertainty as to the effects of that act upon the
10 State's traditional responsibilities in the field of health and
11 safety; and

12 WHEREAS, There exists a questionable area of state jurisdic-
13 tion regarding facilities and materials licensed by the United
14 States Atomic Energy Commission which are potentially dan-
15 gerous to the health and safety of human beings, and

16 WHEREAS, While the Atomic Energy Commission has indi-
17 cated upon many occasions its desire to co-operate with the
18 states and its desire for state assistance in inspection and
19 enforcement, neither Congress nor the commission has clari-
20 fied the relationship between the Federal Government, includ-
21 ing the Atomic Energy Commission, and the states in this
22 regard; now, therefore, be it

23 *Resolved by the Assembly and Senate of the State of Cali-*
24 *fornia, jointly,* That the Legislature of the State of California
25 respectfully memorializes the Congress of the United States to

LEGISLATIVE COUNSEL'S DIGEST

A J R 15 as introduced, Johnson (RIS) Atomic Energy Act of 1954

Memorializes Congress to enact legislation to clarify the jurisdiction of a state with regard to the protection of the health and safety of the public from radiation hazards incident to the possession or use of facilities and materials licensed by the Atomic Energy Commission under the provision of the Atomic Energy Act of 1954.

1 enact an amendment to the Atomic Energy Act of 1954 which
2 will clarify the jurisdiction of a state with regard to the pro-
3 tection of the health and safety of the public from radiation
4 hazards incident to the possession or use of those facilities and
5 materials licensed by the Atomic Energy Commission under
6 the provisions of the Atomic Energy Act of 1954; and be it
7 further

8 *Resolved*, That the Chief Clerk of the Assembly be hereby
9 directed to transmit copies of this resolution to the President
10 and Vice President of the United States, to the Speaker of the
11 House of Representatives, and to each Senator and Representa-
12 tive from California in the Congress of the United States.

INTRODUCTION

The Subcommittee on Air Pollution and Radiation Protection was appointed following adjournment of the 1957 General Session in accordance with the provisions of House Resolution No. 219. It was directed to study atomic energy and radiation usage in California, the problems relating to radiation protection and control, and to recommend legislation which might be needed in the interests of public health and safety.¹

The subcommittee, prior to holding its first public hearing, studied the results of the work that has been done during the past years, the legislation which has been introduced during the previous legislative sessions, the laws which have been adopted by other states, and the model acts recommended by such groups as the Council of State Governments, the National Committee on Radiation Protection, and the American Public Health Association.

The first formal hearing was held by the subcommittee on February 25, 1958, in Los Angeles. The subject matter of this hearing was confined to a discussion of the existing legal authority and responsibility of various governmental agencies within California which are concerned with the control of radioactive material and a review of their activities in radiation control and regulation. The committee heard testimony from representatives of federal, state and local government agencies with a concern in the field of radiation protection.

The second hearing was held on June 9 and 10, 1958, in San Francisco. The committee heard testimony from radiation experts, from representatives of industry, the medical and dental professions, and the public on the nature and extent of the health problems posed by the increasing uses of radiation, the role the State should assume in determining, preventing, and controlling radiation hazards, and the need for a program to monitor and assess levels of radioactivity in the environment.

At its third and final hearing held in Los Angeles on October 27, 1958, the subcommittee heard additional recommendations as to the type of legislation which should be enacted in California.

During the month of March, 1958, the level of radioactivity in the rainfall in the San Francisco Bay area increased far above the "normal." During and after that period, the committee received many inquiries about this increase, and about the possibility of radioactivity in drinking water and foodstuffs. This incident illustrated the need to analyze and survey the state's facilities for the surveillance of radioactivity. A meeting of the subcommittee members with representatives of the State Department of Public Health, Department of Finance, the University of California, and the Legislative Analyst was held in Sacramento on April 8, 1958. It was decided that \$13 800 would be made

¹ The subject of air pollution and the work that the committee has done in that regard is covered in a separate report Assembly Interim Committee on Public Health, Subcommittee on Air Pollution and Radiation Protection Vol. 9, No. 17, March, 1959.

available immediately from the Governor's Emergency Fund to enable the State Department of Public Health to hire a radiological physicist to appraise the monitoring program and to recommend the type program which should be conducted in this State.

In order to supplement this report, a second report containing some much needed background information on radiation and the atomic energy industry is being submitted under separate cover.² This second report, prepared for the committee by the Bureau of Public Administration, University of California, presents information on the basic concepts of nuclear physics and engineering needed for an understanding of the atomic energy industry, describes nuclear industries and the common uses of nuclear energy, describes the types of legislation adopted by other states to meet the problems posed by this new industry, and discusses various criteria for state legislation and regulation.

Following the public hearings, the subcommittee held several informal meetings to review the many recommendations made to it during the interim. The legislation proposed by the committee as a result of its study, is contained in this report.

² Assembly Interim Committee on Public Health, Subcommittee on Air Pollution and Radiation Protection, Volume 9, Number 15, February, 1959

NATURE OF THE PROBLEM

WHAT IS RADIATION

An appraisal of California's need for radiation protection and control legislation requires a brief discussion of the nature of radiation, its sources, its uses and its effects.

There has always been radiation in our environment: cosmic radiation, the high energy rays which bombard the earth from outer space, and naturally occurring radioactive elements such as radium and thorium in the earth, in food and water, and within living plants and animals. Man is now and has always been exposed to this continuous and unavoidable "background" radiation.

Additional manmade sources of radiation have significantly increased man's total exposure to radiation. Manmade sources (excluding environmental contamination) include the X-rays and radioactive materials used in medicine, industry and research; and other miscellaneous sources such as radium watch dials and shoe fitting fluoroscopes. These affect only a limited or controlled environment—the doctor's office or the industrial plant.

Radioactive contamination of the environment results from nuclear weapons testing, from accidents involving the dispersion of radioactivity from waste disposal operations. In the event of a nuclear explosion or other unusual releasing of radioactive materials, the public would be exposed to radiation during the relatively short-term episode immediately following a nuclear explosion or weapons test. It would also be exposed to residual radiation, consisting of materials left near the site of the initial blast or carried to other locations in the form of fallout. The contamination of air, soil and water with some of the long-lived radioactive materials, strontium 90 for example, may result in increased levels of radiation in food, water and dairy products which could be hazardous to the public.

Radiation may also be added to the environment through the operation of atomic reactors, and through the disposal of high level radioactive wastes, a product of reactor operation. At present, low level wastes from hospitals, industries, laundries, etc., are discharged into public sewers. This radiation added to the environment in these ways is creating a problem of increasing magnitude and public health concern.

What is this radiation? It cannot, in small amounts, be seen, felt, tasted or detected without the assistance of technical instruments. Its description involves the use of highly technical terms, and concepts of nuclear physics far outside the scope of this report. Our concern here is with radiations which have the power to penetrate matter and create physical changes in the composition of the matter they strike or pass through. These radiations are commonly called ionizing radiations because they have the ability to ionize, or alter the state of other atoms.³

³ "Radiation" as used throughout this report refers to ionizing radiation.

The National Academy of Science defines radioactive materials as "those naturally occurring substances such as radium, or those man-produced atoms resulting from atomic experiments, which are inherently unstable. Instead of remaining unchanged like ordinary atoms of familiar substances * * * the atoms of these radioactive substances * * * disintegrate."⁴

When such a substance disintegrates, it emits penetrating rays or radiations which possess the property of changing the chemistry of living matter by producing ionization or physical change.

Most naturally occurring elements are stable (e.g. gold, oxygen, iron). Others are not. These unstable elements including radium, uranium and thorium, are referred to as naturally occurring radioactive materials. In addition to the naturally occurring radioactive materials, normally stable elements or isotopes may be made radioactive by artificial means. Radiation, in the form of gamma rays, alpha or beta rays or particles, is produced in this way by particle accelerators, cyclotrons, nuclear reactors, etc.⁵

APPLICATIONS OF RADIATION AND ATOMIC ENERGY

There is hardly an industry today which does not use radioactive materials for research or process control. These materials are used to gauge the thickness and density and to determine the wearing quality of a wide variety of products (such as rubber, metal, plastics, glass). Radioactive isotopes are used by the tobacco industry to control the quality of cigarettes; by the petroleum industry to locate the dividing line between two different liquids flowing through the same pipeline; by the plastic industry to create new materials.

It has been estimated that, in industry alone, there are more than 1,100 applications of radioactive materials which save American industry some 500 million dollars per year. The use of these materials is almost doubling every year.⁶

The potential of atomic energy as a source of electric power is now apparent. The Panel on the Impact of the Peaceful Uses of Atomic Energy estimates that "by 1975, only 15 years after the operation of the first generation of nuclear power plants, and only ten years after the start of an economically sound atomic power industry, atomic energy may be the source of over 40 million kilowatts of installed elec-

⁴ National Academy of Sciences—National Research Council, *The Biological Effects of Atomic Radiation, Summary Reports*, Washington, 1956, pp. 7-8.

⁵ Each atom is made up of a nucleus composed of protons and neutrons with smaller particles called electrons orbiting around it. The type of atom is determined by the relative number of these constituent parts. (Hydrogen has one electron, strontium, 38, radium, 88, and uranium, 92.) An atom is stable or in balance when the number of protons and the number of electrons is equal. A change solely in the number of neutrons does not change the chemical character of the element. Atoms with a varying number of neutrons (whether more or less than a "normal" atom) are called isotopes.

The atoms or isotopes of elements may be made radioactive by bombarding an atom with a neutron or proton or other subatomic particles. The atom loses its normal electrical balance and in the process of regaining balance, emits radioactive rays or particles until stability is reached. The time required by various radioactive substances to achieve stability or equilibrium varies over a wide range. Some take only seconds, others, millions of years. For example, thorium C has a half-life of a minute fraction of a second, while uranium 136 has a half-life of four and a half billion years. The half-life is that period of time needed for the radioactive element or isotope to decay to one-half its initial amount of radioactivity.

⁶ Congressman Chet Holifield, Committee Hearing, October 27, 1958.

tric capacity, which is equal to 40 percent of the present U. S. generating capacity.⁷

In agriculture, radioactive isotopes are used extensively in research. They are used to study soil-plant relations, to trace the life cycles of plants and animals, and to study plant growth and the effect of fertilizers. The availability of radioactive materials has made possible the more efficient use of fertilizers, the development of new plant strains, and blight and pest control. Widespread research is also taking place to bring about the preservation of food by radiation. Commercial use of food products immunized from natural deterioration by radiation is anticipated within five years.

One of the principal areas in which radiation is used is medicine. Users in this field include physicians, hospitals and clinics, medical schools and medical research facilities. X-rays—perhaps the most familiar of the radiation sources—and radioactive isotopes are widely used for diagnostic, therapeutic and research purposes. For example, they are used in the diagnosis and treatment of cancer, leukemia, and disorders of the thyroid gland. In the laboratory, X-rays and radioisotopes provide vital information about the cause, control and cure of countless other diseases.

Radiation and Atomic Energy in California

Although it is impossible to know the exact extent of atomic energy and radiation usage in California, we do know that the number of uses is increasing at a rapidly multiplying rate.

In the last decade California has assumed a leading position in the atomic energy field. There are more reactors in California than in any other state. The State Department of Public Health reported that there were 32 AEC reactor licenses in California as of January 1, 1959. The University of California at Berkeley has one license; General Electric at Vallecitos has four, Aerojet-General at San Ramon, three, Aerojet-General Nucleonics at San Ramon, 19; General Dynamics Corporation at San Diego, two; while Atomies International at Canoga Park, the Naval Post-graduate School at Monterey and American Radiation and Standard Sanitary Corporation at Mountain View have one each.⁸ This does not include AEC reactor experiments at Santa Susana and Livermore, nor the submarine reactors being installed by the Navy at Mare Island. Nor does it include the Department of Defense reactors which are obtained by presidential decree rather than by AEC licensure.

Two small reactors designed to generate electric power are now in operation in California. One, at Santa Susana, designed and built by the Atomic Energy Commission and Atomies International, is operated by Southern California Edison Company. The second, built jointly by General Electric and Pacific Gas and Electric Company, is located at the General Electric Vallecitos Laboratory in Pleasanton. P. G. & E. plans to have a full-scale commercial plant in operation by 1962 near

⁷ The Panel on the Impact of the Peaceful Uses of Atomic Energy, Digest of the Report to Congress, Washington, 1956, p. 17.

⁸ These figures do not give an accurate picture of the number of reactors in operation. For example, this is particularly true in the case of Aerojet-General Nucleonics, its 19 licenses are for reactor construction and only three are being built at any one time.

Eureka and is reported to have plans for the construction of another Northern California plant by 1965.

One indication of California's leading position in the atomic energy industry is a listing in the Buyers Guide in the November, 1958, issue of *Nuclconics*. This guide, which lists the firms throughout the country engaged in different phases of the industry, indicated that half the accelerators manufactured in the United States are manufactured in California; almost one-half of the firms offering irradiation services by accelerators are in California; one-third of those which offer reactors for sale and one-fifth of those manufacturing nuclear power plants are in California.⁹

The rate of increase in the uses and applications of radiation and atomic energy in California is partially shown by the following figures which indicate the percentage increase in the number of AEC licenses issued in California during 1958.¹⁰

AEC LICENSES IN CALIFORNIA—1958

Type of license	No. of licenses		Percent increase
	1/1/58	12/31/58	
Byproduct materials -----	474	621	29
Source materials -----	82	278	212
Special nuclear materials -----	32*	45	35*
Overall -----			66

* This figure for special nuclear material refers to the number of licenses as of March 31, 1958, percent increase is figured from that date

The importance of radiation and atomic energy to California's continuing economic growth and well-being cannot be overemphasized. In the opinion of the committee, the state should take whatever steps it can to encourage further development of and widespread participation in the peaceful applications of this industry consistent with the health and safety of the public.

THE HEALTH EFFECTS OF RADIATION

The same properties of radiation and radioactive materials which make them such important tools in medicine, industry and research also make them potentially hazardous to the individual, the public and the environment.

The significance of radiation in terms of its health effects depends on a complex array of technical considerations outside the scope of this report. It is sufficient here to indicate a few of these considerations. Different radioactive elements have different effects on different body cells; for instance, the now familiar Strontium 90, which is chemically similar to calcium, tends to gravitate or concentrate itself in the bones as does calcium. Radioactive elements differ from one another on the basis of their half-life; some exist as a source of radiation for a fraction of a second, others for millions of years. Rays or particles emitted from a radioactive material have varying powers of penetration. X-rays and gamma rays have great powers of penetration. Alpha and beta particles which do not penetrate any great distance can cause extensive local damage, especially if they are ingested or inhaled.

⁹ For further discussion, see Report of the Assembly Interim Committee on Public Health, Volume 9, No. 15, p. 77.

¹⁰ Data provided by San Francisco Office of the Atomic Energy Commission.

Other factors influence the biological effects of radiation exposure. They include the magnitude and length of the radiation dose, the amount of body exposed, and the radiation source (internal or external). In addition, some body tissues are more sensitive to radiation than others. For example, the gonads, the skin, the eyes, the intestines, the blood forming tissues in the bone marrow are extremely sensitive.

Factors such as these must be considered whenever and wherever radiation is used. They must be taken into account by users of radiation in establishing adequate safety measures, in the packaging, handling and storage of radioactive material, and the disposal of radioactive wastes.

The health effects of radiation may be broken down into two broad classifications:

1. The *somatic* effects, e.g., the effects of radiation on persons directly exposed. The somatic cells receive the injury but the injury is not transmitted from one generation to another.
2. The *genetic* effects, or the effects that are transmitted from one generation to another.

Somatic Effects

It is well known that large or excessive doses of radiation are fatal. On January 1, 1959, a University of California laboratory technician employed at the Los Alamos laboratory, died "from the effects of a massive overdose of radiation while he was preparing part of a plutonium extraction process. . . . He was the third employee of the University of California Los Alamos scientific laboratory killed by radiation since 1945." ¹¹

We know, too, that large doses of radiation or chronic exposure to radiation may have permanent pathological effects. Illnesses may develop after long latent periods. Chronic irradiation may, according to the United Nations Scientific Committee cause leukemia, bone cancer, malignant tumors, a diminished resistance to infection, and a shortening of life span. ¹²

Dr. John Gofman, Professor of Medical Physics at the University of California, pointing out the dangers of extremely large amounts of radiation said, "We know that very large doses of radiation given at one sitting can be deathly harmful. There is good evidence that very large doses of radiation evenly spaced can, in a small number of people, produce such long term complications as cancer and leukemia." ¹³

Although we are learning more all the time about the somatic effects of radiation, a great deal remains to be learned about the effects of very small doses of radiation. Whether there is a "safe" or threshold level below which no somatic damage occurs is much debated. Dr. Gofman pointed out that we have always been exposed to a certain level of background radiation and that there is "no valid evidence based upon scientific observation to prove that natural sources of radiation have produced injury to man." ¹⁴

¹¹ *San Francisco Chronicle*, January 23, 1959

¹² United Nations, General Assembly, *Report of the United Nations Scientific Committee on the Effects of Atomic Radiation*, Official Records, Thirtieth Session, Supplement No. 17 (A/3838), New York, 1958, p. 6

¹³ Committee Hearing, June 9, 1958

¹⁴ *Ibid.*

One of the problems in the scientific evaluation of very low levels of radiation stems from a lack of adequate medical statistics. In the opinion of Dr. Albert W. Bellamy, Chairman of the Department of Biophysics, U.C.L.A.: "We have not yet lived long enough at the level of radiation we are talking about to have the data. In another 20, 40, 50 or 60 years, we can say whether, and to what extent, these very low levels present a measurable hazard."¹⁵

With regard to low level radiation however, the United Nations Scientific Committee has stated that "as the dose of radiation is reduced below the amounts giving rise to acute functional or morphological alterations, the reactions of the organism become more difficult to detect immediately and the effects may be progressively delayed in time. Thresholds are not easily revealed under these conditions; in fact, for some of the most delayed phenomena, it is uncertain whether they exist.

"It is a very characteristic feature of radiation injury that delayed reactions may occur many months or years following exposure. The morphological and functional alterations which occur during the long periods of latency are poorly understood. It has been shown that even after such periods acute manifestations of somatic effects may develop. * * *

"Small doses of radiation given repeatedly can have a cumulative effect in those cases in which the processes of recovery and compensation are limited. * * *"

The United Nations Committee concluded that there is need for caution in the use of radiation until such time as there is a better understanding of the somatic effects of radiation.

"At the present time, due to the fact that threshold doses for the delayed somatic effects of radiation are not exactly known, it must be recognized that the exposure of human populations to increasing levels of ionizing radiation may cause considerable and widespread somatic damage."¹⁶

Genetic Effects

It is generally agreed among scientists that any amount of radiation is harmful from a genetic or hereditary standpoint. Genes, which are found in every cell in the human body and which are transmitted from parent to child, determine an individual's physical characteristics. Every so often a gene changes or "mutates" causing a change in the organism. One cause of such mutations, the vast majority of which are harmful, is radiation—whether naturally occurring or man-made. If the radiation affects an ordinary body cell, the change is restricted to the individual receiving the radiation. If, however, it reaches the reproductive organs the resulting mutation may be passed on to succeeding generations. The National Academy of Sciences reports that "Although there are many uncertainties about details and certain numerical values, there is complete agreement among geneticists concerning a number of basic facts." These facts may be summarized as follows:

¹⁵ Committee Hearings, October 27, 1958.

¹⁶ United Nations, General Assembly, *Report of the United Nations Scientific Committee on the Effects of Atomic Radiation*, Official Records, Thirteenth Session, Supplement No. 17 (A/3833), New York, 1958, p. 7.

- “(1) Radiations cause mutations
- “(2) Practically all radiation-induced mutations which have effects large enough to be detected are harmful
- “(3) Any radiation dose, however small, can induce some mutations. *There is no minimum amount of radiation dose which must be exceeded before any harmful mutations occur.*
- “(4) Every generation of living things acquires some mutations from natural causes (background radiation and also heat and certain chemicals). These are called ‘spontaneous mutations,’ and are also nearly all harmful.
- “(5) Additional radiation over and above the irreducible background produces additional mutations over and above the spontaneous mutations. To the best of our present knowledge, if we increase the radiation that reaches the reproductive glands by X percent, the number of mutations caused by radiation will also be increased by X percent.
- “The total dose of radiation received by a person over his reproductive lifetime is what counts. *The genetic damage done by radiation is cumulative.*
- “(6) From the above five statements a very important conclusion results. It has sometimes been thought that there may be a rate (say, so much per week), at which a person can receive radiation with reasonable safety as regards certain types of direct damage to his own person. But the concept of a safe rate of radiation simply does not make sense if one is concerned with genetic damage to future generations. What counts, from the point of view of genetic damage, is not the rate; it is the total accumulated dose to the reproductive cells of the individual from the beginning of his life up to the time the child is conceived.”¹⁷

Professor Curt Stern, geneticist, University of California, commented on the absence of a “threshold” or tolerance level:

“If you receive a very small amount of radiation you get the same kind of hereditary changes as with a larger amount. The danger changes in direct proportion with the amount of radiation. There is no tolerance in even the smallest doses; that radiation we get from natural background produces mutations, any added radiation produces added mutations. * * * The same effect is produced whether a certain amount of radiation is received in a short time or whether it is a diluted amount spaced over a long time. The effect is cumulative.”

In discussing the effects of radiation on the population, Professor Stern stated that “At present we get three to four roentgen units from natural background radiation and about the same amount from medical exposure, occupational exposure and fallout.”¹⁸

In effect then, at the present time we all receive an average of about seven roentgen units. The National Academy of Sciences has proposed

¹⁷ The National Academy of Sciences, National Research Council, *The Biological Effects of Atomic Radiation, A Report to the Public*, Washington, 1956, pp 16-17

¹⁸ A roentgen is a unit of measurement for radiation. The figures here refer to the amount of radiation which reaches the gonads or reproductive organs from the time of conception to age 30.

that no one should receive more than 10 roentgen units from conception to age 30. Professor Stern reported that the following results could be expected if we were all to receive this proposed permissible dose of 10 roentgen units:

Of 100,000 children born (assuming the parents of each of the children had received the 10 roentgen permissible dose):

2,000 would be defective for nongenetic reasons.

2,000 would be defective for genetic reasons.

33 would be defective as a result of the radiation added to the natural background radiation.

He indicated that this estimate "may be wrong by a factor of 10 * * *. We might have 330 additional mutations rather than 33." These added mutations will be passed on to following generations. "You will not be able to put your finger on an individual case and say this unfortunate case is due to man-made radiation. However, a certain small fraction of mutations in future generations will be the result of the radiation added to the environment by man * * *. While this is not a matter of individual concern, it is a concern for the hundreds of thousands of people who are born, for the public in general." He concluded that "for this reason, the geneticist is in favor of keeping any radiation which is not necessary for medical or other reasons as low as possible."¹⁹

Exposure Standards

Units of measurement have been developed to describe various types and amounts of radiation.²⁰ Using these units of measurement, exposure standards have been established. In the 1920's when knowledge of the hazards of radioactive substances became apparent, national and international agencies were established to set standards of exposure and recommend methods of protection. The International Commission on Radiological Units and Measurement (ICRU) was first organized in 1925. In this country the National Committee on Radiation Protection (NCRP), made up of leading authorities in the radiation field and under the sponsorship of the National Bureau of Standards, has been the central source of scientific information and guidance on the measurement and fixing of standards since it was organized in 1929. The National Bureau of Standards Handbooks (Nos. 48 through 60) based on recommendations of the NCRP, set forth recommendations for radiation exposure limits or maximum permissible dose (MPD) in many areas of radiation usage.

More recently the AEC has prescribed safety standards and procedures for its licensees. In fixing safety levels above which exposure is

¹⁹ Committee Hearings, June 9, 1958.

²⁰ Standard units of measurement include the *curie* (and small fractions of the curie—the millicurie, the microcurie, and the micromicrocurie) which measures the number of ionizing particles emitted by a radioactive material, the *roentgen* which describes the amount of X-ray and gamma ray radiation exposure as measured by that amount absorbed by a given quantity of air; the *rad* which measures the amount of any type of radiation absorbed by a certain unit of material, and the *rem* or *rep* which measure radiation in terms of the biological effect of specific types and energies of radiation upon different organs, or over the entire body, of man. For further description of measurement units see United Nations, General Assembly, *Report of the United Nations Scientific Committee on the Effects of Atomic Radiation*, Official Records, Thirteenth Session, Supplement No. 17 (A/388S), New York, 1958, p. 5.

prohibited, it has been guided in large part by the findings and recommendations of the NCRP.²¹

A great deal of confusion has resulted from the use of the term "maximum permissible dose" in setting standards for radiation exposure. It should be emphasized that the MPD is not synonymous with "safe" dose. The standards have been set for "the small percentage of the whole population who may be occupationally exposed. . . * * *"²² For persons "outside the controlled areas but who may be exposed to radiation originating in controlled areas" the permissible level is somewhat arbitrarily adjusted downward to one-tenth the MPD for radiation workers.²³ The standards do not take into consideration the radiation dose from natural background, medical or dental exposures. Furthermore the MPD does contemplate some danger. The permissible dose "envisages the possibility of radiation injury during the lifetime of the exposed individual or in subsequent generations. . . * * * [It is defined as the dose] not expected to cause appreciable bodily injury to a person at any time during his lifetime." It should be pointed out that "appreciable bodily injury" means an injury which the "average person would regard as being objectionable and/or competent medical authorities would regard as being deleterious to health."²⁴

The NCRP did not take into consideration possible genetic damage when setting standards. "Genetic changes possibly injurious to the race as a whole in future generations have been considered but they do not constitute the limiting factor in setting up permissible levels of occupation exposure."

Over the past 25 years, as the knowledge of radiation effects has grown, the MPD recommended by the NCRP has steadily decreased. The NCRP predicts that a "reappraisal of the situation will become necessary" in the near future and predicts that future revisions of permissible doses will again be downward.²⁵

The NCRP says its recommendations are intended to serve as practical guides since they are based on presently available information and cannot be considered as permanent. "Unnecessary exposure to radiation should be avoided at all times."

A Public Health Problem

The problem of protecting the worker and the general public against unnecessary radiation is of utmost importance.

Dr. Frederic M. Kriete, Deputy Director of the State Department of Public Health, told the committee that "one of the most important problems of public health in the future will be that of proper protection against the potentially dangerous effects of ionizing radiation. * * * The major objective of a public health program must be the prevention, reduction, and where possible, the elimination of unnecessary exposure to harmful ionizing radiation."²⁶

²¹ Frampton, George T., "Radiation Exposure—The Need for a National Policy," *Stanford Law Review*, Volume 10, Number 1, December, 1957, pp. 7-52.

²² National Bureau of Standards, Addendum to Handbook 59, February, 1957, p. 2.

²³ *Ibid.*, pp. 2 and 5.

²⁴ National Bureau of Standards, Handbook No. 59, pp. 26-27.

²⁵ *Ibid.*, p. 79.

²⁶ Committee Hearings, October 27, 1958.

Dr. David E. Price, U. S. Public Health Service, pointed out the uniqueness of the radiation problem which demands immediate steps to insure the minimization of radiation exposure.

"Past experience in public health has taught us that a problem usually becomes rather serious before people band together to deal with it. Only when a considerable amount of disease could be traced to polluted water did we begin to develop sewage treatment and other antipollution measures. Only when motor accidents had taken an alarming toll did citizens insist on better roads, safety devices, and various accident prevention programs.

"In dealing with the health hazards of ionizing radiation, unfortunately, this traditional approach cannot promise success. The effects of ionizing radiation are cumulative and irreversible. They are subtle and may become apparent only after long delay. If we wait until there are obvious signs of radiation damage it will be too late to help the affected population or to decontaminate the polluted environment successfully. In this situation, prevention is not merely desirable, it is imperative." ²⁷

²⁷ David E. Price, M.D., "Radiation as a Public Health Problem," *Public Health Reports*, Vol. 73, No. 3, March, 1958, p. 197.

RADIATION PROTECTION AND CONTROL IN CALIFORNIA

The problem of radiation control and public safety in California is a concern of many federal, state and local agencies. While the Federal Government through the Atomic Energy Act of 1954 has a direct and controlling interest in several well defined areas of atomic energy, there are other areas that the Atomic Energy Act does not purport to include. In some, but not all of these areas, state and local agencies are engaged in programs which deal with particular aspects of the problem. The responsibilities and activities of these agencies are reviewed in the following sections.

THE FEDERAL GOVERNMENT

Atomic Energy Commission

Protecting the public from radiation is complicated by the ambiguous, dual nature of federal-state authority. The AEC, the principal regulating agency in the field of atomic energy and radiation, has been granted extensive authority which it exercises from a detailed licensure and control program. Whether the State can act in an area of federal authority is not clear. This questionable area of state jurisdiction lies in the regulation of radiation sources, byproduct materials and facilities licensed by the AEC.

It is clear however, that the state can act in those areas where the AEC has no jurisdiction. It can exercise authority over X-ray and fluoroscopic machines, nonreactor produced isotopes and naturally occurring radioactive materials, none of which are regulated by the AEC.

The sections below will outline the general areas of federal authority and the extent of the AEC's regulatory activities in California.

In 1946, the Atomic Energy Act, the first federal legislation concerning atomic energy, was enacted. This act provided for the establishment of the Atomic Energy Commission and reserved to the Federal Government the ownership of all fissionable materials and production facilities including the enriched materials or special nuclear material and the bombs, reactors and atomic propelled machines using these materials. It expressly prohibited their private ownership, production or use.¹

In 1954 the present Atomic Energy Act was passed giving increased impetus to the private use of atomic energy. This present act, although it still reserves to the Federal Government the technical ownership of special nuclear materials and facilities for the production of fissionable materials, does provide for private ownership and operation of utiliza-

¹The AEC was, however, granted the authority to operate government-owned facilities through private contractors and to encourage research and developmental activities through contracts and agreements with private persons. The AEC also could permit fissionable materials to be produced by private persons for research purposes in nongovernment-owned facilities under certain conditions. For history of the Atomic Energy Commission and the Manhattan District Project, see Frampton, George T., "Radiation Exposure—The Need for a National Policy," *Stanford Law Review*, Volume 10, Number 1, December, 1957.

tion facilities under government regulation. Extensive private use and handling of fissionable material used as fuel, and of radioactive by-product materials and wastes resulting from such use, and private operation of facilities has followed the passage of this act.

The AEC retains extensive regulatory power over this private development, however. It is authorized to adopt "a whole scheme of regulation in all phases of the atomic energy industry designed to control the hazards to employees and to the public from ionizing radiation and is granted full and complete authority to deal with the radiation hazards under a system of licensing and regulation."²

Under the provisions of the act, anyone who wants to buy, sell, or possess materials under the jurisdiction of the commission or who wants to construct or operate nuclear reactors, must get a license from the AEC. The AEC is also authorized to regulate the activities of private agencies once they receive their licenses.

The Licensing of Materials

The materials over which the AEC has jurisdiction include:

1. *Source materials* which consist of natural uranium, thorium or any combination thereof and would include the natural ores from which atomic energy, special nuclear materials or byproduct materials may be derived.

2. *Byproduct materials*, which consist of the radioisotopes and fission products which are produced in nuclear reactors.

3. *Special nuclear material* consisting of the enriched uranium or plutonium, more compact and potent sources of energy than the natural uranium or thorium from which they are made. It is a fuel material used in atomic weapons and in nuclear reactors for the production of energy.

There are two types of AEC licenses—a general license and a specific license. *General licenses* are provided for by regulation; that is, licenses are available to anyone who meets the terms of the license as published in the Federal Register, Title 10. The kinds, quantities, and uses of material (either byproduct or source material) coming under the general license are considered by the AEC to constitute an insignificant health hazard. Although the individual does not have to file a formal application for use of these materials, he is expected to comply with AEC protection standards.

Specific licenses are required of those using larger quantities of source or byproduct material, and for anyone using special nuclear material.

The AEC requires a very detailed application from anyone obtaining a specific license. The application must include information as to the quantity, types of material which the applicant desires to possess, a description of his proposed uses, the qualifications of the applicant and his staff, including the training and experience which these people have had relevant to the types of materials and proposed uses that they plan to make, the kinds of equipment which the applicant has available to

² Price, Harold L., "The AEC Program for Licensing and Regulation," National Association of Manufacturers, Industrial Nuclear Development, Proceedings of a Conference, sponsored by the Nuclear Energy and Employee Health and Benefits Committees of the National Assn. of Manufacturers and by the National Industrial Council, May 21-23, 1958, New York, 1958, p. 16.

insure the safe use of the material. Included also is the requirement that the applicant describe his proposed operating safety procedure and the type of training and procedure he requires his employees to undergo and to observe. The AEC also requires information as to the applicant's proposed waste disposal procedure, including the magnitude of the waste and the composition.

A special *waste disposal license* (a type of byproduct license) is required of anyone in the waste disposal business.

Licensing of Facilities

The facilities which require licenses are called "production facilities" and "utilization facilities" and include all facilities which produce special nuclear material or use atomic energy in quantities of significance to the national defense or security or which may affect the public health and safety. The AEC issues a specific license for each facility upon individual application. The application must include a complete description of the facility and the materials that will be used in it, an evaluation of the safety of the proposed facility during normal operation and an evaluation of possible accidents. Evaluation of possible accidents must include both a description of means for preventing the accidents and information on the consequences of possible accidents.

The AEC notifies the California State Department of Public Health and the Division of Industrial Safety of the Department of Industrial Relations of every source, byproduct material and facility license it issues within the State. In addition, the AEC notifies the State of the receipt of every application for a facility license and waste disposal license and requests the applicant to get in touch with the governmental agency in the area where he proposes to operate or locate a facility.

Regulation of Licensed Activities

The commission has established basic standards applicable to all licensees. These standards, among other things, establish minimum permissible radiation dosage levels to which employees and the public can be exposed. They require that certain types of surveys be conducted and that certain types of personnel monitoring be maintained. They specify the kind of caution signs, labels and signals which are required. They require the submission of reports to the commission in case of accidental releases of radiation, and that certain records be kept of exposures of employees and the general public.

Before promulgating a regulation, the commission invites the comment of interested persons and state agencies. In addition, the AEC has established a 10-man committee of state officials to advise it in the preparation of regulations containing standards for protection against radiation. California has been represented on that committee by the Chief of the Division of Industrial Safety.

The Regulation and Inspection Program in California

Because California is such a large user of atomic energy and radiation, and because a large proportion of these activities are licensed by the AEC, it is important to know the extent of the inspectional and regulatory activities of the Commission in California.

In general the licensing program is designed to insure that users of materials or operators of facilities are capable of handling the materials or facilities for which they seek a license and that they have adequate means to prevent injury to employees and the public.

The AEC inspection activities, designed to insure compliance by licensees of the safety standards, are a responsibility of the Division of Inspection. Reactor inspections, which pose technical problems requiring specialized training and experience on the part of the inspector, are handled by the Washington office of the Division.

The greatest number of licenses in California are issued for the use of byproduct, source and special nuclear materials. All inspections of these licensees are handled by four inspectors in the San Francisco area office. Their territory encompasses, in addition to California, all of Nevada, Hawaii and some Pacific islands.

The AEC reported to the committee that, although its staff is limited and does not inspect all licensees, the agency has evaluated all licensees and concentrates its efforts on those representing the greatest potential hazards. Mr. R. W. Smith, Director of the Inspection Division in the San Francisco office, stated that the office concentrates its inspections on the "significant or major operations. * * * We schedule our inspections on the basis of need. I will grant that we cannot catch every shipment. However, our basic concern is to satisfy ourselves that the procedures laid down by the licensee appear to be adequate, and from the knowledge of the licensee, we have reason to believe that he will follow these procedures safely. Of course, this does not preclude accidents from happening." Mr. Smith added that, "in the event of an accident, licensees are required to notify our office immediately. * * * We would then come into the picture to take whatever steps might be appropriate to confine the hazard." ³

Anyone using byproduct or source materials under the provisions of the general license is expected to comply with AEC safety standards. In practice, however, the AEC does not exercise regulatory control over these users since they do not, in the opinion of the AEC, constitute a significant health hazard. Although the commission does have the right to inspect the licensees, it does not do so. It does not know who the licensees all are or where they are located. ⁴

The AEC can apply three types of penalties. There is the administrative penalty of license revocation or suspension. Second, a violation of the regulations or of the licensing and regulatory requirements in the Atomic Energy Act is a criminal offense. Third, the AEC can secure injunctive relief to enjoin threatened violations of the act. The AEC has never used the latter two methods, but has on occasion used the administrative remedies of license suspension or revocation.

In connection with the AEC's inspection process, it has been its practice to invite state representatives to accompany its inspectors whenever they go into a facility of one of their licensees. This has been helpful to both the commission and the State. The AEC reported to the committee in February, 1958, however, that, at that time, no representatives of the State were going on these inspections since the AEC was not clear who in the State should be invited.

³ Committee Hearings, February 25, 1958.

⁴ Interview with R. W. Smith, January 28, 1959.

"We are presently waiting word from the State as to whom the single point of contact will be; until we receive that we have felt it is inadvisable for the commission to try to determine which of the various state agencies should come along with us."⁵

Federal-State Relations⁶

Since the enactment of the Atomic Energy Act of 1954, there has been a considerable amount of uncertainty as to its effect on the State's traditional responsibilities in health and safety matters. The questionable area of state jurisdiction is with regard to those radiation sources and materials licensed by the AEC. Although the AEC has indicated on many occasions its desire to co-operate with the states and while it appears to welcome state assistance in inspection and enforcement, neither Congress nor the commission has clarified the relationship between the AEC and the states in this regard.

The AEC proposed an amendment to the 1954 act to resolve some of the unanswered questions. The proposal, sent by the commission to the Joint Congressional Committee on Atomic Energy in the summer of 1957, is still under study.⁷

The Joint Federal-State Action Committee in their December, 1957, report to the President stated that "the * * * committee agrees that a greater share of the responsibility for the promotion and regulation of the peacetime uses of atomic energy, particularly in the fields of health and safety, should be vested in the state government."

The committee also urged that the AEC act be amended to, among other things, "include a specific statement recognizing the power of the states to adopt, inspect against, and enforce standards, not in conflict with those adopted by the Federal Government, for the protection of the public health and safety." It is their proposal, "That the Atomic Energy Act of 1954 be amended in several respects to clarify the roles of the Federal and State Governments to make possible the assumption of greater responsibilities by the states in the future promotion and regulation of the peacetime uses of atomic energy, and that the states make such changes in their laws, regulations, and organization as necessary to assume increased responsibility."⁸

The problem of federal vs. state responsibility was described as follows by Albert W. Harris, Jr., Deputy Attorney General of the State of California.

"It seems curious to suggest that a state has no authority over the disposal of radioactive wastes in the sea involving effects with respect to health on the shores of the state and associated effects on wildlife. Similarly, it is hard to believe that a state is without control over the proposed storage of wastes in an abandoned mine shaft within its territorial limits, a plan proposed near the San

⁵ Committee Hearings, February 25, 1958.

⁶ For additional discussion of federal-state relations and responsibilities in radiation protection and control see Frampton, George T., "Radiation Exposure—The Need for a National Policy," *Stanford Law Review*, Volume 10, Number 1, December, 1957, and David F. Cavers, "Legislative Readjustments in Federal and State Regulatory Powers Over Atomic Energy," *California Law Review*, March, 1958, Vol. 46, No. 1, School of Law, University of California, Berkeley, pp. 22-33.

⁷ See Appendix I for copy of proposed amendment.

⁸ The Joint Federal-State Action Committee, Report to the President of the United States and to the Chairman of the Governors' Conference, Progress Report No. 1, U. S. Government Printing Office, Washington, D. C., December, 1957, pp. 9-10.

Francisco Bay area. Yet under the Atomic Energy Act of 1954 serious questions of state jurisdiction are presented. By that act the AEC was authorized to impose health and safety standards on licensees, and such regulations have been issued. Nowhere in the act is there any indication of the role of the states. This, of course, has raised many questions: Is there any constitutional basis for this exercise of federal power? Has the Federal Government 'occupied the field'? Or part of the field, and, if so, what part? Or have the states concurrent jurisdiction to regulate?"⁹

Even though the question of *State v. Federal Authority* remains unanswered for the present, the AEC has told this committee that "a great deal can and should be done by the State now." Mr. Robert Lowenstein, Office of the Legal Council, AEC, added that the AEC would favor state legislation which would "direct the attention of state officials to the problems of the atomic energy age, which would establish a co-ordinator who could serve as a point of contact for the AEC, and which would establish machinery to help achieve consistency between federal and state programs for the control of radiation hazards."¹⁰

Further, it is important to emphasize again the importance of those sources of radiation which the Atomic Energy Act does not purport to cover. It has been estimated that "these sources account for a much greater percentage of the total exposure to ionizing radiation in the country than AEC licensed sources—perhaps greater than 20 to 1."¹¹ These sources of radiation, presenting a potential hazard to the public health which is purely local in nature, are a clear responsibility of the state or local government.

The U. S. Public Health Service

The major function of the U. S. Public Health Service, U. S. Department of Health, Education and Welfare is to: (1) provide research, financial and technical assistance to the states; (2) conduct and encourage the conduct by others of research into the causes, diagnosis, treatment, control and prevention of diseases; (3) advise states in matters relating to the preservation and improvement of public health.

Its function is to "back up" the states in their public health programs—not to assume direct operating responsibility for such programs.

The Division of Radiological Health, formed in 1956, began operation on July 1, 1958, to provide technical consultation, information, and other special services to assist states in developing legislation and regulations in radiological health. A research branch is giving primary consideration to long-term epidemiological studies and particularly to low-level radiation exposure. A training branch administers and develops a national training program to help meet the need for health personnel.

⁹ Albert W. Harris, Jr., "State Regulation of Hazards Growing Out of the Use of Atomic Energy," *California Law Review*, March, 1958, Vol. 46, No. 1, School of Law, University of California, Berkeley, pp. 85-6.

¹⁰ Committee Hearings, February 25, 1958.

¹¹ Harold L. Price, "The AEC Program for Licensing and Regulation," Proceedings of a Conference, Sponsored by the Nuclear Energy and Employee Health and Benefits Committees of the National Association of Manufacturers and by the National Industrial Council, May 21-23, 1958, New York, 1958, p. 18.

The National Institutes of Health have made substantial grants to universities, colleges and scientific institutions for research in radiobiology. The University of California, Stanford University and other institutions in the State are sharing in these funds.

Training programs, consisting of one to two-week courses in radiological health, in the monitoring of water, air and food, in reactor hazards, and in occupational hazards are offered to state and local public health personnel at the Robert A. Taft Sanitary Engineering Center in Cincinnati, Ohio, and occasionally at universities in other parts of the country. In July and August, 1958, for example, the service conducted three two-week courses at the University of California campus in Berkeley for personnel from the 11 western states, Alaska and Hawaii.

The Public Health Service provides technical consultation on special problems to the states. However, the Public Health Service informed the State Department of Public Health on May 7, 1958, that it did not have any specialist in California, or close to California, who could spend full time assisting the department develop a radiological health program, nor did it have a technical consultant who could be assigned to the department for assistance in laboratory work, surveillance, etc. It maintains no laboratory in California or at any point close to California.

In co-operation with state agencies, the service is operating air surveillance stations in various parts of the U. S. to measure air pollutants. There are two stations in California operated in co-operation with the State Department of Public Health which check radioactive air pollutants. This represents sampling only and does not in any sense of the word provide the detailed information needed for evaluating radiation activity throughout the State, nor could any intelligent state action result from these data alone.

A study, started in April, 1957, to analyze radioactivity in milk, involves the testing of samples from five areas in the country—the milksheds serving Salt Lake City, St. Louis, Cincinnati and New York City and Sacramento. A monthly one-gallon sample, composed of a day's delivery by a group of dairy farms, is collected from each area for testing. Although the service plans to establish additional sampling points, no more are at present planned for California.¹²

The U. S. Public Health Service feels that the principle responsibility for radiation health protection, as with public health protection in general, rests with state and local health agencies. Dr. Leroy E. Burney, U. S. Surgeon General, has said, "the increasing medical and industrial uses of fissionable materials place this responsibility in the realm of community health protection, since these major sources of exposure are the common experiences of life and work, rather than the extraordinary occasional experiences relating to military operations."

Other Federal Agencies

The many military applications of nuclear energy and the extensive activity of the Defense Department in the radiation and atomic energy

¹² A report on a recent study conducted by Consumers Union on the effects of fallout on milk may be found in *Consumer Reports*, Volume 24, Number 3, March, 1959.

field within California are well known. At the present time, there is no administrative structure to insure co-ordination or communication between the Defense Department and the other agencies active in California.

Many other federal agencies are concerned to some degree in atomic energy activities and radiation protection. Included among them are the following:

1. The Civil Aeronautics Administration, Department of Commerce, which issues safety standards and civil air regulations relating to the transportation of explosives and other dangerous materials (Code of Federal Regulations, Title 14).

2. The Food and Drug Administration has asked for legislative amendments to the Food, Drug and Cosmetics Act to give it authority to act in protection of public health and safety with relation to the use of radiation in the processing of food and drugs.

3. The U. S. Weather Bureau gathers data for understanding the dynamics of natural and man-made radiation in the atmosphere. It is co-operating with federal and local health departments in their efforts to monitor and minimize radiation exposure.

4. The Post Office Department regulates the amounts and packaging of radioactive materials which may be sent by mail.

5. The Interstate Commerce Commission classifies radioactive materials as "Class D Poison" and regulates their transportation by common carriers engaged in interstate commerce (Part 71-78 of Title 49, Code of Federal Regulations.)

6. The U. S. Coast Guard regulates the transportation of radioactive materials within its jurisdiction (Title 46, Code of Federal Regulations.)

Other federal agencies whose activities affect in one way or another the use of radioactive materials in California should be mentioned. These include the Department of Agriculture, the Children's Bureau of the Social Security Administration which is interested in radiation effects upon the health of children, the Office of Education, the Department of Labor (the Bureau of Employees' Compensation and the Bureau of Labor Standards which works with state labor departments to promote industrial health and safety).¹³

THE STATE OF CALIFORNIA

Department of Public Health

The Department of Public Health has received no specific legislative directive to conduct a comprehensive radiological health program. However, the problem of radiation protection is clearly a public health concern. The department has general responsibility and broad authority under the provisions of the Health and Safety Code to protect the public health and safety. It also has the authority to investigate any conditions or circumstances which might affect the public health.

The department was authorized by the 1955 Legislature to prohibit any person from disposing of radioactive wastes when it determined

¹³ Additional information on the federal agency responsibilities and activities in the field of radiation protection and control may be found in the Report of the Assembly Interim Committee on Public Health, Volume 3, Number 15, Chapter 4.

that such disposal would endanger the lives or health of human beings.¹ Although the department has analyzed some samples of sewage to determine radiological content in connection with this responsibility, the department feels the present statute is not broad enough to support a preventative program.

Beyond this, the department has undertaken a limited radiation program under the general provisions of the Health and Safety Code and in accordance with the State Board of Health statement of July 19, 1957, that, "It is the policy of the department * * * to assume its responsibility for the protection of the public against the hazards of radiation. * * *"

The activities discussed below indicate the nature of the existing program.

Environmental Monitoring

Environmental monitoring, although it has been extremely limited in scope, has been one of the department's major activities. Routine monitoring to determine radioactivity in the *air* is done at two stations in California—Berkeley and Los Angeles. Daily samples are taken at one location in each city. This program was initiated in 1956 by the U. S. Public Health Service in co-operation with the state department. The samples are collected and tested by the state department to determine the amount of radioactivity and then are forwarded to the U. S. Public Health Service Laboratories for a more accurate analysis. However, it is approximately six weeks before the department receives an analysis report from the Public Health Service.

Samples of *rainfall* are collected at the Los Angeles and Berkeley stations and in San Diego, San Bernardino, Santa Barbara, Fresno, Sacramento, Santa Rosa, and Redding. These samples are all analyzed in the department's Berkeley laboratory. Rainfall collected at Berkeley and Los Angeles is also forwarded to the U. S. Public Health Service Laboratories for its analysis. The program at Berkeley was made routine by the state department in February, 1958; the rest of the state in late fall of 1958.

Since March, 1958, the department has analyzed *snow runoff* samples at Soda Springs and snow samples from nine points on major snow courses. These samples are collected by a number of state, federal, local and private agencies.

Biyearly checks of *surface water in streams and rivers* is obtained through a co-operative program involving the Public Health Department, the Department of Fish and Game, the Department of Water Resources and the Water Pollution Control Boards. Samples from 75 stations in the State are analyzed to determine their bacteriological, chemical, biological and radiological content. Following the March, 1958, fallout incident, the department tested the water in a number of reservoirs throughout the State. At the present time, checks are occasionally made for radiation in domestic water supplies and sewage. The Public Health Department also analyzes occasional samples at the request of local health departments and water districts.

During periods of bomb testing and fallout, the department obtains information on radioactivity from a number of sources in the State in-

¹ Health and Safety Code, Secs. 25600-604

cluding the University of California, California Disaster Office, the Los Angeles City and County Health Departments, the U. S. Navy, and private companies engaged in measurement of radiation, in order to help it interpret the extent and significance of fallout.

In February, 1958, the department's monitoring program was described by Dr Robert Dyar, State Department of Public Health this way:

"Our activities in relation to surveillance consist of occasional special surveys when problems are brought to our attention by the public and by local health agencies, monitoring of air, water and sewage for limited intervals when potential hazards are known to be possible, continuous air monitoring in Berkeley and Los Angeles, consultation on request with a limited number of prospective users of radioactive materials * * * medical investigations on request of the Atomic Energy Commission of possible injury or hazards from fallout during the spring weapons testing. There is no routine observation of major water sheds, of principal waste disposal systems, no organized departmental system of registration of users of radioactive materials. * * * no control of the use of tracer studies beyond that of the Atomic Energy Commission of the primary user.²

Since that time the additional monitoring activities described above have been undertaken by the department. Still, the present program is a minimal one and does not provide enough data for an adequate evaluation of the exposure of the people of California.

The department has been attempting to augment its existing monitoring program by establishment of a voluntary program among state agencies for the pooling of radiation data. This program is in the planning stages now. If it is established, agencies wishing to co-operate will submit data to the department. The department will summarize and collate this data and distribute it on a quarterly basis to the participating agencies.

In addition a radiological health consultant, employed by the department in the spring of 1958, has been endeavoring to develop a co-ordinated program of radiological health protection. The program tentatively proposed by the department includes a detailed program for environmental monitoring which would involve interested state, federal and local agencies. The program would include the continuous monitoring of air, rain, snow, water supplies, waste disposal, food, and medical, industrial and commercial uses of radiation.³

Other Activities

The department reported to the committee that it has initiated meetings with other agencies to effect some of the needed interagency co-ordination. For example, departmental staff members along with other state and local agency representatives have met with reactor firms to discuss problems relating to reactor location, waste disposal, and the protection of personnel. They have met with waste disposal companies to resolve questions relating to the disposal of waste materials into the ocean.

² Committee Hearings, February 25, 1958.

³ See Appendix VI for Department of Public Health proposed monitoring program.

A list of AEC licensees in California is maintained by the department and distributed to other state agencies, to local health departments, fire departments, police and other interested local agencies. The department also notifies local health jurisdictions of new licenses in that particular jurisdiction.

Plans for new hospital construction and modifications of existing structures are checked by the department to make certain that there is provision for the adequate shielding of personnel from radiation and X-ray equipment.

The department has initiated studies of the health hazards of radiation exposures to industrial workers and to the population at large. It is now studying the propriety of using radioactive tracers to study such things as ground water levels and stream flow. The department also has, on occasion, provided consultation to medical, dental and industrial users of radioactive materials.

Equipment and Personnel

The department's radiological equipment is not adequate for conducting anything more than a very limited program. Its field equipment consists of survey instruments suitable for gamma and X-ray measurement. Pocket dosimeters, capable of showing whether the wearer has been exposed to an excessive amount of radiation in a given day, are available for personnel protection. The department reported to the committee that additional equipment is necessary to measure other types of radioactivity—e.g., alpha and beta particles and neutrons, and to calibrate present field equipment.

The department's laboratory equipment is likewise limited. It has on loan from the California Disaster Office two so-called proportional counter converters and scalars. (It is questionable whether or not they are both in good working condition.) The department was authorized to purchase an automatic proportional counter during the 1958-59 Fiscal Year. These proportional counters are suitable for the separate measurement of alpha and alpha plus beta particles. According to the department, additional equipment is needed:

- (a) to handle a greater sample volume (more proportional counters).
- (b) to handle samples with a low-level of radioactivity.
- (c) to measure gross or separated gamma activity.
- (d) to perform isotopic analysis.

The department has the following personnel:

1. A radiological health consultant employed in the late spring of 1958 to advise the department on the type of radiological health program which should be adopted.
2. One associate sanitary engineer who spends full-time on the program for the disposal of radioactive wastes.
3. One junior chemist devoting a part of his time to the analysis of materials sent in by the above sanitary engineer using borrowed Disaster Office equipment. He has also done some contract work for the State Water Pollution Control Board.
4. Two persons are attending a one-year course in radiation protection given by the AEC. It is anticipated that they will, after the course is completed in mid-1959, train additional department personnel.

California Disaster Office, Division of Radiological Safety

The Division of Radiological Safety was established in 1950 within the Office of Civil Defense (now the California Disaster Office). Its function is to provide for the planning, development and maintenance of a radiological defense program and to effectuate and carry out such a program in the event of disaster or extreme emergency. The division, to carry out this function, acquires, distributes, controls, and maintains radiological monitoring equipment. It performs some laboratory analysis of assorted materials for radioactivity, principally on a contract basis for other agencies. It develops training materials and conducts courses designed to qualify instructors who will in turn train persons for volunteer monitoring work in case of emergency.

Facilities and Equipment

The division's main laboratory, which is maintained in the Sacramento headquarters office, is equipped to analyze and measure various types and quantities of radioactive materials.

The laboratory also has a "growth chamber" capable of measuring the uptake of radioactive materials grown in contaminated soil. Although it is maintained for use on a standby basis, it is not presently being used for any analysis.

Radiological defense equipment for use throughout the State which is owned and maintained by the division includes the following:

a. Sixteen mobile laboratories which are assigned to various agencies throughout the State. Their primary purpose is to provide emergency radioassay service; they are generally capable of analyzing and identifying types and amounts of radioactive material.

b. 105 radiological squad trailers which are also assigned to local jurisdictions. They are equipped with less sensitive portable radiation detection instruments (ion chambers and Geiger counters) and communication facilities. They are capable of conducting area surveys to determine the existence and distribution of radioactivity.

c. Some 4,400 state-procured portable radiation detection instruments or field survey instruments (geiger counters and ion chambers). Most of these have been assigned to hospitals, fire and law enforcement agencies, state highway maintenance stations; others are kept in reserve by the division or are used by the division for training purposes.

d. The Federal Government has provided the division with approximately 1,200 portable radiation detection kits for distribution to high schools, state and local agencies. These kits, containing survey instruments such as geiger counters, ion chambers and dosimeters, must be kept in a state of operational readiness and available for civil defense purposes.

Sampling, Testing and Monitoring

Sampling and testing of air, water, soil, and plant and animal products can be and are made through facilities of the Division of Radiological Safety. Tests may be conducted by the 16 mobile laboratories in the field, or by the fixed laboratory at the Sacramento headquarters.

In the headquarters laboratory, which is staffed with one chemist, much of the sampling and testing is done for other state agencies in order to maintain the laboratory facilities in a condition

of readiness. The stated basis for this laboratory's existence is that it be available "as a backup emergency facility for the mobile laboratories." In this connection, one of its major activities is that of servicing two contracts, one with the State Water Pollution Control Board and one with the State Department of Water Resources, under which water samples from several points in the State are tested for radioactivity. The laboratory also has, on occasion, tested water and sewage samples for the State Department of Public Health, regional water pollution control boards, and the Federal Bureau of Reclamation.

The mobile laboratories exist to provide emergency radio-assay services to radiological defense evaluation boards in time of disaster. They are used during nonemergency periods to keep equipment operative and personnel proficient. Results of tests made in mobile laboratories are not normally reported to the division at Sacramento headquarters unless they indicate unusual levels of environmental radioactivity.

A portion of the division's radiological monitoring is done by specially trained volunteers, who will perform survey monitoring, personnel and equipment monitoring and radiological laboratory assay as required when a state of emergency exists.

The State Disaster Office has in effect plans or projected plans by which periodic reports are made, or will be made to it, by other state or local agencies. For example, California's Division of Highways currently has 63 separate maintenance stations which are equipped with monitoring instruments and are prepared to make reports upon the request of the Disaster Office or when an unusually high level of radioactivity is detected. A similar program is being developed within the California Highway Patrol, the Division of Forestry, the Division of Industrial Safety, and the Department of Fish and Game. It is anticipated that this program will be in operation by the end of the current fiscal year. Generally speaking, the instruments and other equipment distributed by the division to these local agencies will be used for their own protection, e.g., to discover radioactive materials upon persons admitted to a hospital as a means of protecting the hospital, the staff, and patients.

Training Program.

The principal purpose of the division's training program is to instruct selected individuals to conduct courses in local communities for the training of volunteer monitoring specialists, squad and group leaders and radiological meter operators. The division offers: (1) a radiological meter operator course; (2) a radiological defense (RADEF) field operations course; (3) a course in the control and evaluation of radiological hazards; and (4) a mobile laboratory technicians course. Approximately 14,000 persons had been trained under this program as of December, 1958.

The committee believes it is important to re-emphasize that the primary function of the division is to provide for a radiological safety program in the event of a disaster. Its function is not to perform continuous surveillance to determine the amount of radiation in the environment. While the 16 mobile laboratories are being used by local agencies, these agencies do not transmit data on the level of radioac-

tivity on any routine basis to the state headquarters. The central laboratory, presently doing some laboratory work on a contract basis for local governmental agencies, is not adequately staffed to perform radiation analysis for all state agencies which may require such analysis. The division staff has only one chemist engaged in laboratory work. There is some question as to whether or not its equipment is adequate to perform many of the complicated types of radiation analysis which apparently are, or will be, needed by various agencies within the State.

The present program of securing, distributing and maintaining the gross disaster type of equipment is a proper and very necessary function under the present concept of the purpose of the Disaster Office.

Department of Industrial Relations, Division of Industrial Safety

The Division of Industrial Safety of the State Department of Industrial Relations enforces and administers all laws and safety orders relating to life and safety of workers in places of employment.

This is the only agency which, under its general power and authority, has adopted specific and detailed regulations designed to control possible radiation hazards, or which has established specific radiation exposure regulations.⁵ These regulations, first adopted in 1950, established minimum standards for the protection of employees exposed to potentially injurious levels of ionizing radiation or potentially injurious quantities of radioactive materials (excluding such ionizing radiation or radioactive materials as cosmic radiation or normal radon or thoron in the atmosphere). They specify maximum permissible exposures to radiation. They require the periodic inspection and monitoring of areas where ionizing radiation is used, an annual inspection of equipment, machines, and installations producing ionizing radiation, and that employees subjected to ionizing radiation wear monitoring devices. They specify how radioactive materials must be handled and stored, and specify many other details incident to the use of radioactive materials.

The division administers the safety orders by survey, inspection, investigation and followup to make certain that hazards are eliminated. The division reported to the committee that, during the last year, it has been necessary to write some 60 directives requiring employers in about 18 places of employment to make changes affecting radiation hazards.

The division provides technical consultation to employers utilizing atomic energy or radiation and reports that in most instances it is able to achieve compliance with the industrial safety orders without issuing notices or writing formal requirements.

The AEC is responsible for enforcing its safety regulations by those firms operating under AEC licenses. At the same time the Division of Industrial Safety must inspect to insure the safety of employees in all phases of employment; this includes the possibility of unnecessary exposure to radiation. Although the division and the AEC report a close co-operation in the regulating activity, there does appear to be confusion as to where the primary responsibility lies. There are many more sources of radiation in existence which are not subject to AEC licensing and control which are clearly subject to the division's safety orders.

⁵Title 8, Group 6, Article 53, California Administrative Code. Regulations are based on NCRP Standards.

Equipment

The Division of Industrial Safety has no radiation detection equipment to speak of. There are a few dosimeters used in some instances. These are pencil-like pieces of equipment that a person places in his pocket and examines periodically to determine if he has been exposed to an excessive dose of radiation for that day.

When equipment is needed for the measurement of X-rays to insure the proper amount of shielding is provided, the division uses the service of the Bureau of Adult Health, Department of Public Health, which provides the equipment and an engineer. The Bureau of Adult Health has a continuing working relationship with the Division of Industrial Safety and generally provides the medical analysis for the division when it is needed.

Personnel

The division has no people who are specifically trained in the field of radiation protection. However, the top supervisory personnel of the division have attended extension courses at the University of California to learn the theory of radiation protection. The middle supervision level have attended one- to two-week courses and seminars conducted by the Public Health Service and the Atomic Energy Commission.

Gradually the division's safety engineers have been learning the techniques and methods of inspection. It is a slow process, however, and at present only six or eight staff engineers are qualified to do the necessary inspection.

Two of the division's 16 district engineers are attending a one-year educational and training program in radiation protection in the East conducted by the Atomic Energy Commission. It is anticipated that when the course is completed in June, 1959, these two persons will then train additional division personnel.

The division feels that the existing statutes are broad enough to permit it to take whatever action is necessary to control radiation hazards. There is, however, a clear need to clarify the relationships, between this division, the AEC, and other state and local government agencies.

It is necessary to insure that the division's regulations continue to reflect the most current knowledge of radiation hazards and that its regulations be co-ordinated with those which may be developed by other agencies.

Department of Water Resources

The department as a part of its overall planning function is studying the possible applications of nuclear energy for the development of the State's water resources, for the generation of electricity, and for the conversion of saline and brackish waters. Associated with these planning activities and included in the department's program is the consideration and investigation of present and potential water pollution problems involved in a continually expanding utilization of radioactive materials for industrial purposes.

The Department of Water Resources has broad and continuing responsibilities for investigation of water quality conditions throughout

the State. The department's authority is derived from the Water Code, Section 229, which directs that:

The Department * * * shall investigate conditions of the quality of all waters, coastal and inland, as related to all sources of pollution of whatever nature and shall report thereon to the Legislature and to the appropriate regional water pollution control board annually, and may recommend any steps which might be taken to improve and protect the quality of such waters.

A number of continuing state-wide water quality monitoring projects and numerous special investigations which are conducted by the department to implement this directive are described below:

Monitoring of Surface Waters

Surface waters have been monitored by the department since 1951 as a part of periodic stream sampling program initiated at the suggestion of the State Water Pollution Control Board. Samples, collected monthly from about 150 stations located on ninety major streams and lakes, are analyzed for mineral and bacterial content. An analysis of the radioactivity of these samples is made semi-annually by the Radiological Services Unit of the California Disaster Office. The costs of these analyses are borne by the State Water Pollution Control Board.

Monitoring of Ground Waters

The department also conducts a program for the monitoring of ground waters throughout the State. This program covers 50 areas of ground water development and involves approximately 900 wells. Particular attention is paid to problem areas where ground water basins are subject to degradation by such factors as sea water intrusion, adverse salt balance conditions, interconnection of aquifers through faulty wells, or disposal of oil field grinds or other wastes. Determinations of radioactivity have only recently been incorporated in this program to evaluate the effects of the disposal of radioactive wastes either deliberately or accidentally on ground waters.

In view of possible future effect of improper disposal of radioactive waste on ground water supply, the department has this year started monitoring radioactivity in Southern California, and will extend this program on a state-wide basis during the fiscal year 1958-59. During this fiscal year, some 200 samples of water will be tested to determine the existing levels of radioactivity. It is contemplated that particular attention will be paid to areas such as Simi Valley in Southern California, and Livermore Valley in Alameda County, where considerable research and development in the use of fissionable materials is being conducted. At the request of the Regional Water Pollution Control Board No. 2, the Department is conducting a monitoring program in the San Francisco Bay area to observe whether operation of the experimental nuclear reactor and power plant near Pleasanton affects waters in the Alameda Creek watershed.

Laboratory Facilities

The department itself has no laboratory facilities to perform the necessary radiological analyses. The California Disaster Office does this

work for the department on a contract basis. The samples which are collected by the department either in connection with its own state-wide monitoring program or for a specific water pollution control board are forwarded on to the Disaster Office for analysis.

In summary, the Department of Water Resources is now checking the levels of radioactivity at 150 stations located on 90 major streams and lakes twice annually. It is checking levels of radioactivity in the ground water of approximately 50 areas in the State. Lastly, it is conducting an analysis of the levels of radioactivity in the waters of San Francisco Bay.

It should be noted that the department's responsibilities are primarily investigative and do not encompass regulatory or enforcement functions per se. This power, rather, is vested with the several water pollution control boards.

Water Pollution Control Board

Under the Water Pollution Control Act (Division 7 of the Water Code), the State and Regional Water Pollution Control Boards have the responsibility and authority to control water pollution by prescribing and enforcing requirements for *all* discharges of sewage and industrial waste. Pollution is defined as an impairment of the quality of the waters which would adversely affect the use of such waters for domestic, industrial, agricultural, navigational, recreational, or any other beneficial use. (Health hazards created by such pollution would be under the control of the state and local health departments.)

The definitions of sewage and industrial waste given in Section 13005 of the Water Code are sufficiently broad that wastes resulting from the use or processing of radioactive materials would come under the jurisdiction of the agency. Although the boards do not control wastes that are discharged directly into a community sewer system, they do prescribe requirements for the wastes that are ultimately discharged from a community system into the waters of the State.

Under the provisions of Section 13054 of the Water Code, any person or agency proposing to discharge sewage or industrial waste that contains radioactive material must file a report of the proposed discharge with the appropriate regional water pollution control board. The board must then prescribe requirements as to nature of the proposed discharge. It is important to note here that the water pollution control boards have no authority outside the three-mile territorial limit—all ocean disposal of radioactive waste to date has been outside the limit.

The monitoring program conducted by the board and the Department of Water Resources was discussed in the previous section. Background radiological data on ocean waters is being obtained in Southern California coastal waters under the state board's research contract with the Allan Hancock Foundation for an oceanographic survey of those waters.

There is no duplication of work between the Department of Water Resources and the water pollution control boards due primarily to the fact that much of the work undertaken by the department is under contract to the boards. In other words, the department acts as a technical advisor both under specific contract and in connection with its own monitoring program. However, other state agencies such as the Department of Public Health and the Department of Fish and Game

are concerned with the problems of water pollution. In the Federal Government, the AEC is responsible for licensing firms which dispose of radioactive wastes. Such interagency responsibilities as these emphasize the importance of co-ordination to insure that no duplication of work is done by these various agencies, and more important, to insure that no areas of importance to the public health are overlooked by these agencies because of the interjurisdictional problems.

Department of Fish and Game

The Fish and Game Commission and Department of Fish and Game are charged in general with the protection and preservation of the fish and wildlife resources of the State.

The department is specifically charged with enforcement of Section 5650 relating to water pollution prohibition. "It is unlawful to deposit in, permit to pass into, or place where it can pass into, the water of this State * * * (f) any substance or material deleterious to fish, plant life, or bird life." This has been interpreted by the department to include radioactive materials or wastes. (There is no like specific section covering responsibility of the department as it would apply to other game and wildlife on land.)

However, since the department has no authority to regulate or permit any specific acts relating to the use or disposal of radioactive material, it has not carried out any specific control or regulation in this field.

The department has no equipment, other than some Geiger counters on loan from the California Disaster Office with which to monitor radioactivity. Nor does it have any personnel devoting full time to this problem at the present time.

It has, however, attempted to amass information concerning the technical and biological effects of radioactive materials on fish and game populations. At the department's request and in co-operation with the department, the U. S. Navy has set up a radiological environmental monitoring program at the Navy's Mare Island Station. This program has been established in anticipation of potential radioactive buildup associated with the development, construction and servicing of nuclear propelled submarines.

Further, the department has been active in keeping abreast of the developing situation and in pointing out to the West Coast representatives of the Atomic Energy Commission, and to other agencies, the responsibilities and possible effect of actions taken under AEC regulations on fish and game.

Department of Agriculture

The Department of Agriculture which has general authority to insure that food products are free from contamination or adulteration by any substance injurious to the public health, believes that this authority should extend to radioactive substances. However, the department has undertaken no formal radiation program. Departmental staff members have attended courses of instruction dealing with radiological problems and the control of radiation in food products. For instance, the Assistant Chief of the Bureau of Meat Inspection attended a two-week course given at Oak Ridge, Tennessee, in March, 1958.

The department, following the March, 1958, radioactive rainfall incident secured samples of leafy vegetables upon the request of the State Department of Public Health through its regular market sampling procedure. The department itself did no testing since it has no equipment for this purpose.

The department feels that there should be facilities for the routine checking of food for radiation, but has indicated to the committee that there was no justification at this time for the establishment of expensive radiological assay facilities in the department because of the limited use to which they might be put. Rather it feels that, for the present, necessary assay work should be done by some other state agency with the necessary facilities.

California Public Utilities Commission

There are at present no statutes under which the commission acts which refer specifically to the control of radiation hazards. However, it does have general responsibilities and authority in the field of safety which are derived from the broad regulatory authority it exercises over privately owned public utilities.⁶

The commission would be responsible for the protection of the public, the utility customers and employees from hazards presented by the operation of a reactor, if such reactor were a privately owned utility. It would also have jurisdiction over the transportation of radiological materials by common carriers.⁷ Although there are some 850,000 trucks in California, the commission has operating authority over only 148,000 vehicles. Only 38,000 of these come under its safety regulations. The protection of the public due to a vehicle accident involving the transportation of radioactive materials on other than a common carrier would, at the present time, be uncertain.

Other State Agencies

Other agencies, although they are not now engaged in radiation protection activities, do have an interest in the problem. For example, the Department of Insurance has an increasing concern with the effect that radiation will have on workmen's compensation insurance rates.

The Department of Public Works' concern is with the protection of state highways and bridges which could be endangered by accidents involving the transportation of radioactive materials, and with the design of state buildings which may use or store radioactive materials. The California Highway Patrol would be affected by highway accidents involving vehicles carrying radioactive materials. Such agencies as the State Fire Marshal, port authorities and harbor commissioners, the Department of Professional and Vocational Standards and its various boards are or will also be concerned in varying degrees as the uses of radiation and atomic energy become more widespread.

⁶ "Public utility" as defined in the Public Utilities Code, includes every common carrier, toll bridge, pipeline, gas, electrical, telephone, telegraph, and water corporation, wharfinger, warehouseman and heat corporation, performing a service or delivering a commodity to the public.

⁷ By Part 9 of General Order No. 99, the commission has adopted the regulations of the Interstate Commerce Commission for the transportation of explosives and other dangerous articles, including radioactive materials. The regulations relate to packaging, shielding and labeling of radioactive materials.

**Governor's Advisory Committee on Peacetime
Uses of Radiological Materials**

This committee, composed of directors of the various departments in California which are concerned with radiation protection and control, was appointed by the Governor in the spring of 1956, to advise him on radiological matters. The committee, at its first meeting in July, 1956, appointed a staff committee which was charged with the responsibility of studying the problems and proposing solutions.

The staff committee has met on several occasions to determine ways in which the various state and federal agencies could co-ordinate their activities. In addition it worked with the Senate Committee on Governmental Administration during the 1955-57 interim and has been of assistance to this committee in its study.

In December, 1958, the committee submitted a final report to the Governor containing recommendations as to needed state legislation⁸

RADIATION PROTECTION AT THE UNIVERSITY OF CALIFORNIA

Radiation protection activities in the University of California must be considered in two parts. The Radiation Laboratory, with branches at Berkeley and Livermore, is a large scale nuclear science research facility operated under contract with the Atomic Energy Commission. Approximately 125 technically trained persons work at the Radiation Laboratory solely on problems of radiation safety and protection. The policies under which they operate are essentially those established by the AEC.

Outside the Radiation Laboratory, and under a general license from the Atomic Energy Commission, some 1,500 persons on seven campuses and several field stations of the university work with ionizing radiation. This includes X-rays and radium for diagnosis and therapy in two medical schools and a veterinary school; and a multitude of radioactive isotopes for research in every branch of experimental science, in teaching, and in medical research, diagnosis and therapy. This work is subject to the policies, regulations and standards established in connection with the university's own program for radiation protections.

As presently organized, the university's radiation safety program consists of:

(1) A university-wide "Advisory Committee on Radiological Safety," advisory to the president, which is charged with the "formulation of basic policies for uniform practice throughout the university system wherever radioactive materials are involved." These policies, standards and procedures are detailed in a published "Manual for Radiation Safety."

(2) Regional advisory committees—for the northern and southern campuses of the university—"to carry out periodic reviews of the use of radioactive materials in any way whatsoever on the campus under their jurisdiction, to consider the effectiveness of the measures extant and modifications in procedure that seem to be indicated."

(3) A university-wide "Division of Radiation Safety," responsible for administration of radiation safety standards and policies.

⁸ The report of the committee may be seen in Appendix IV.

Among the functions performed by the Division of Radiation Safety in carrying out its responsibilities are the monitoring of personnel, work areas, and radioactive waste disposal areas; the approval for safety of all proposed uses of radioisotopes; the review of building plans and specifications; the maintenance of lists of all users of radioactivity; and the provision of storage facilities for radioactive materials. The division also provides for disposal of radioactive wastes, maintains limited laboratory facilities for special or short-term use by qualified research workers, conducts a health examination program, and offers technical advice and assistance on the safe handling, use and storage of radioactive materials.

In general it may be said that the program administered by the Division of Radiation Safety is designed to provide effective surveillance over all work with radiation, from the initial planning and procurement to the disposal of radioactive wastes.

At the request of the Assembly Committee, the University-wide Committee on Radiological Safety submitted a report containing recommendations for a statewide radiation safety program.⁹

LOCAL GOVERNMENT AGENCIES

In addition to the activity of the state agencies, a number of cities and counties and other local government units are beginning to consider the enactment of radiation safety regulations. Already the City of Los Angeles has adopted an ordinance relating to the procedures for handling, storage, use, and transportation of radioactive materials. The city contemplates the enactment of another ordinance this next year requiring the registration of sources of ionizing radiation.

The Los Angeles Air Pollution Control District has been active in locating present and possible future sources of radiation, studying the factors which would affect the dispersal of radioactive material in Los Angeles County and monitoring the air for radioactivity. The district has been declared the Radiological Defense and Disaster Service for Los Angeles County by the board of supervisors. To meet that responsibility it has sponsored a radiological monitors training course, devised plans for the county in event of war-caused or peacetime radiological disaster, and has procured and distributed radiation detection and measurement instruments.

It is obvious that the concern of local governmental agencies over the problems of radiation protection and control will increase rapidly. "Mayors and county supervisors, city councils, planning agencies, zoning agencies, building code enforcement agencies, fire departments and police departments may all have occasion to understand the dangers of radioactive materials and the methods of coping with them. Local governments need to be informed and consulted in the best interests of their citizens in the direction and control of this new force which recognizes no political boundaries. And what is even more evident there is need for planned co-operation between levels of government."¹⁰

⁹ See Appendix III.

¹⁰ Report of the Assembly Interim Committee on Public Health, Volume 9, No. 15, Chapter 4.

VOLUNTARY CONTROL ACTIVITIES

The various branches of the healing arts and medical profession today account for one of the largest number of users of X-rays and radioactive materials in California. Dr. David E. Price, U. S. Public Health Service, has said in this regard, "One of the major sources of radiation today is the X-ray. If we can reduce needless exposure to X-ray without reducing its manifold benefits in the detection and treatment of disease, we have taken a significant step toward reducing the dimensions of the radiation exposure hazard. * * * One opportunity to reduce unnecessary exposure to X-ray lies in the reduction of the radiation doses delivered in medical and dental examinations. It is an unfortunate fact that many of the more than 160,000 X-ray machines being used in the healing arts today deliver a higher dose of radiation than is necessary. There is room for much improvement both in the machines themselves and in the techniques of their use."¹¹

In response to this need various professional societies have been providing their members with information on the need to and methods of reducing exposure. For example, the American College of Radiology and the American Dental Association have prepared a handbook entitled, "A Practical Manual on the Medical and Dental Use of X-rays with Control of Radiation Hazards," which is being distributed to doctors and dentists and others throughout the Country. The dental and medical journals frequently carry articles relating to the hazards and use of radiation in the healing arts. Medical and dental schools require a course in the technique and practical application of X-rays. Radiologists regularly have their X-ray and fluoroscopic machines checked to insure that they are properly calibrated and operating at top efficiency.

Members of the medical profession who have had more experience in terms of time than any other single group are well aware of the problems. Representatives testifying at the committee hearings emphasized the importance of training and education of all members of the professional groups as to the means available for reducing exposure. Through such education and "self policing" by the doctors and dentists and the various healing arts licensing boards the witnesses felt that the X-ray hazard can be best reduced.

The major atomic energy firms in the state operate under AEC regulation. These and other industrial users of radioactive materials have been guided, in addition, by the recommendations as to safety and control measures made by a number of nongovernmental agencies. Included among these are the Atomic Industrial Forum, the National Industrial Conference Board, the American Public Health Association, the International Association of Industrial Accident Boards and Commissions, The American Standards Association, and various professional groups. A discussion of their activities in the nuclear energy field may be found in the companion committee report. Mr. Robert C. Thorburn, Health Physicist for General Electric Company, reported to the committee that, because of voluntary compliance by industry with these regulations and recommendations, industry has maintained an excellent safety record.

¹¹ David E. Price, M.D., "Radiation as a Public Health Problem," *Public Health Reports*, Vol. 73, No. 3, March, 1958, p. 197.

“The outstanding safety record of users and producers gives clear evidence that potential health problems posed by the industrial use of radiation can be controlled. This record has been made through voluntary compliance by industry with control procedures recommended by the National Committee on Radiation Protection. This committee and other recognized agencies such as the American Standards Association remain active in developing standards of performance for industry. * * * There are additional forces that assure the public against the careless use of radiation by industry. Careful compliance to the aforementioned recommendations is required of industry by insurance companies before issuance of policies. The licensing program of the U. S. Atomic Energy Commission now regulates the proper action for a large segment of all those using radiation. * * * These regulations, the economics of insurance and the principle of ‘doing right voluntarily’ have minimized the potential hazards to the health from radiation use.”¹²

¹² Committee Hearing, June 9, 1958

THE NEED FOR STATE ACTION

Preceding sections of the report have indicated the nature of the many and increasing applications of atomic energy and radiation which offer unprecedented opportunities for economic growth and development in the State. California has assumed a leading position in the atomic energy industry with a very minimal activity on the part of the State. The State should be prepared to promote and encourage the continuing development of this industry in California.

Particular emphasis has been given to radiological health and safety problems accompanying the growth of this industry which must be a primary concern and responsibility of governmental agencies.

Problem areas which have been mentioned only briefly are many and complex. The risks are not yet fully known. The problem of the disposal of radioactive wastes, for example, is one of increasing concern. Many methods of waste disposal are being studied, including disposal at sea, in inland lakes, and burial in the ground. Each of these has complicating factors which demand thorough investigation. For instance, how much of this disposed radioactive material buried at sea may be absorbed by various forms of marine life, eventually to impair a major food supply?

The transportation of radioactive materials may involve hazards to the public along the route. The Interstate Commerce Commission has promulgated rules and regulations for the interstate movements of radioactive materials. The California Public Utilities Commission has adopted the ICC regulations for common carriers coming under its jurisdiction. Intrastate contract carriers, however, are not required to comply with these regulations. The possibility of the increasing transportation of radioactive materials in nonregulated carriers is one of the problems in this area that demands state study to insure that adequate safeguards exist.

The persons most exposed to radioactivity will be the workers coming into contact with such materials in the course of their employment. Within the controlled environment, e.g., the industrial plant, the hospital and the laboratory, procedures for the safe handling and use of radioactive materials have been worked out, and in California the Division of Industrial Safety, is charged with the enforcement of safety orders relating specifically to radiation. However, accidents can happen.

“Improper shielding of sources of radiation; rupture of containers in which radioactive substances are being used, shipped or stored, or careless handling—these are a few of the many ways radiation accidents can occur. Inattention to proper dose levels by those working with or near radiation may have more insidious results. A nuclear reactor's getting out of control may, under special conditions, cause widespread injury to people and loss of use of property because of radioactive contamination. These events should not occur if design and operating standards are properly

established and effectively enforced. Yet men make mistakes and accidents happen."¹

Another related and as yet unsolved problem is that of workmen's compensation. Since the effects of radiation may not become apparent for months or even years after an employee is exposed to radiation, and further since damage may be caused by exposure to small amounts of radiation over a long period of time, it will be difficult to connect a particular injury or disease to occupational connected radiation exposure.

X-rays and radiation used by the doctor, the dentist, and other members of the healing arts comprise a principal source of radiation. Their uses are of incalculable benefit to the public in the diagnosis, treatment and cure of many diseases. In many cases, however, the radiation dose to which the patient is exposed is greater than is necessary to achieve the maximum benefit. The activities of the various professional associations directed towards controlling this hazard, were discussed previously. Whether or not inspection of some of these sources should be a state responsibility is a question that demands further study.

However, since we do not, at the present time, know the number of radiation sources within the State, nor where they are located, it is clear that registration of these sources is needed and is a proper responsibility of the State.

The possibility of a reactor explosion is probably the most dramatic public hazard. Dr. Bellamy reported that "although such an event is highly improbable, * * * should it happen * * * it could involve damages measured in the billions of dollars. Should it occur in a thickly settled or highly industrialized urban area, anywhere from a few tens to a few hundreds of square miles could be seriously involved with contamination. In this context, one will, I believe, want to look to the barn door before the horse is stolen; once radiation damage has occurred, * * * it is too late to do much about it."²

Radiological contamination of the environment affecting the public in general is of increasing concern. The episodes in late March and April of 1958 when the fallout increased the levels of environmental radiation in the San Francisco Bay area far above "normal" aroused widespread public concern. As dramatic as fallout is, many feel that there are other problems equally or even more dangerous. Environmental contamination resulting from the operation of reactors, the disposal of radioactive wastes, or the accidental release of radioactive materials is a vital public health problem that demands state action. We lack adequate knowledge of the amount and distribution of radiation now in the environment, of how it can be controlled, or of the amount of radiation which may be transmitted back to man through the air, the rivers and oceans, plant and animal life.

These are but a few of the problems facing Federal, State and local government agencies.

The responsibility for insuring safety in atomic energy activities was initially vested in the Atomic Energy Commission. However, since the passage of the 1954 Atomic Energy Act, there has been a rapid transi-

¹ The Panel on the Impact of the Peaceful Uses of Atomic Energy, Digest of the Report to Congress, Washington, 1956, p. 48.

² Committee Hearings, February 27, 1958.

tion from government monopoly to private operation under AEC regulation. Whether the State is precluded from acting in those areas in which the AEC retains regulatory jurisdiction is still in doubt. This committee feels that the question should be resolved at the earliest possible date by the congressional enactment of a clarifying amendment. If the 1954 act is a "transitional law for a transitional period," the State should be prepared to assume its responsibilities.³

Even before the question of state vs. federal authority is resolved, this committee feels that there is a vital need for state action. In the first place the State must enact legislation which will provide the administrative machinery to formalize and insure co-ordination between the AEC and the State. Further there is a clear need for the State to assume responsibility for those aspects of radiation which are not covered by the Atomic Energy Act.

The nature of the present activities and interests of the various state agencies clearly indicates the need for co-ordination within the State, to insure the programs of these agencies will add up to a sound total program without duplication. At the present time, there is clearly no definitive co-ordination among these various agencies.

The lack of knowledge of the number or location of radiation sources in the State clearly points up the need for a program of mandatory registration of sources.

The inadequacy of information of the amounts of radiation to which the public is exposed demonstrates the need for a statewide radiation monitoring program.

The many expressions of public concern about radiation exposure especially in the last year amply illustrate the need for the State to disseminate accurate information as to the amount of radiation to which the public is exposed and equally important, authoritative interpretation of that information. The public should be told what it means when the newspapers report, as they have in the last year, "LA Records Heaviest 'A' Fallout," "U. S. Survey Shows Milk at 'safe' Radioactivity Level," "Rains Boost Radioactivity in Vegetables" or "You've Absorbed Only a Bit of Strontium 90, But."

Several different legislative approaches have been suggested as the means for meeting the present need for state legislation. Model state legislation or codes in the atomic energy field have been developed by the Council of State Governments, the National Committee on Radiation Protection, the American Public Health Association and others. The Governor's Advisory Committee on Radiological Safety consisting of representatives of presently concerned state agencies submitted proposed legislation in its report to the Governor dated December 11, 1958. The University of California's University-Wide Committee on Radiological Safety, at the request of this committee, submitted a report on radiation safety legislation on December 16, 1958.⁴

Representatives of the medical profession, industry, and the public testifying at the public hearings have generally agreed that legislation establishing a state policy regarding radiation would be desirable and

³ The Panel on the Impact of the Peaceful Uses of Atomic Energy, Digest of the Report to Congress, Washington, 1956 p. 9

⁴ See Appendices II, III, and IV for copies of the model laws and recommended legislation.

they, too, have offered a variety of suggestions as to the type of legislation which would best meet California's need.⁵

This committee has reviewed and studied these various suggestions and recommendations, and in light of the needs in California believes that legislation to be enacted in California should be guided first by two principal policies.

First, it should insure that the people of California are not needlessly exposed to ionizing radiation, that safeguards are provided to protect the public from the possible misuse of hazardous radiation.

Second, it should insure the orderly and economic development of the atomic energy industry and the beneficial uses of radiation.

Beyond this the committee feels that legislation should:

1. Recognize our existing governmental structure and provide that each state and local agency retain its traditional jurisdiction wherever possible.
2. Provide that the initial organization be flexible so that it can be adapted to new conditions as they arise.
3. Provide for the co-ordination of all state agency activities relating to this field so that their separate programs will add up to a sound total program without duplication.
4. Provide for a single point of contact to facilitate co-ordination with the AEC and other federal agencies.
5. Encompass all types and sources of ionizing radiation since all ionizing radiation has similar effects. Therefore, it should provide for a system of registration of all sources of ionizing radiation.
6. Provide for an advisory committee composed of persons representing various groups and interests within the State to advise the Governor on atomic energy and radiation matters.
7. Provide for a program of continuous surveillance of the environment designed to detect, measure and record the levels of radiation to which the population is exposed.
8. Provide for a program of public information giving the public factual information and authoritative interpretation of data concerning radiation.

Continuing study by the State and its various agencies will be necessary to meet the challenges posed by this new and rapidly growing industry. This committee wishes to direct attention to the following specific problems that demand thorough study.

First, because radiation protection is extremely complex and will be required in fields of activity such as medicine, industry, agriculture, fish and game, research, transportation, and waste disposal, a means will have to be provided to supply state agencies with competent technical advice and consultation. Study is necessary to determine if this need should be met by the establishment in the State Government of a technical staff agency composed of experts in the various fields of radiation, and, if so, what its relationships with other agencies should be.

Related to this is the problem of laboratory facilities. There is no doubt that laboratory facilities are needed to support a radiation control program and that these facilities should be available to serve all state agencies. The present laboratory facilities of the California Dis-

⁵ Recommendations of industry representatives testifying at the committee hearings are summarized in Appendix V.

aster Office and the State Department of Public Health are not adequately staffed or equipped for either the type of radiological analysis or conducting the program of environmental surveillance needed in the State.

It has been suggested that the State set up a large, completely equipped laboratory. The Department of Public Health now has a multimillion dollar investment in laboratories of all types including air sanitation, virus, industrial hygiene, sanitary engineering, food and drug, and bacteriological. Therefore, it has been suggested that, rather than establishing a completely new state laboratory, the needed equipment for radiological analyses be added to the department's existing equipment. In line with that it has been suggested that the Disaster Office Laboratory be incorporated by the Department of Public Health.

Another suggestion has been that the Disaster Office equipment be increased to the point where it could provide the needed services. Or again it has been suggested that the State contract with private laboratories for the performance of this function.

This problem is one which clearly needs immediate and thorough study and one which should be solved before state agencies attempt to meet their individual needs by equipping individual laboratories with costly equipment. During the interim, however, before a final solution is reached, this committee feels that the State Department of Public Health should be equipped with such equipment as is necessary to conduct its proposed environmental monitoring program.

The committee also feels that, for the present, the Disaster Office should retain its mobile laboratories which are necessary to determine whether an area is or is not safe in case of a gross disaster.

Thirdly, one of the most pressing problems is the increasing need for trained personnel. The State should assess the training programs that are now offered by, for example, the AEC and U. S. Public Health Service, the Division of Radiological Safety of the California Disaster Office, and by universities and colleges in the State to determine whether or not provision should be made for additional training programs.

This report has emphasized the need for a statewide surveillance program and believes that the program proposed by the Department of Public Health should be put into operation. It feels, however, that continuing study is called for to assess the State's needs in this area and to determine the adequacy of any program which may be initiated this next year for meeting that need.

APPENDIX I

**ATOMIC ENERGY COMMISSION PROPOSED AMENDMENT
TO THE ATOMIC ENERGY ACT OF 1954**

SECTION 274. Co-operation with States. (a) The commission is authorized to co-operate with any state or group of states in carrying out the commission's responsibilities for protecting the health and safety of the public from radiation hazards incident to the processing and utilization of source, byproduct, and special nuclear material. To this end, the commission is authorized to enter into agreements with any state or group of states to perform inspections or to provide such other services to the commission as the commission deems necessary. Further, the commission is authorized to provide with or without charge training to employees of any state or group of states and such other services to any state or group of states as the commission deems necessary.

(b) Nothing in this act shall be deemed to prevent the states from adopting, inspecting against, and enforcing standards, not in conflict with those adopted by the commission, for protecting the health and safety of the public from radiation hazards incident to the processing and utilization of source, byproduct, and special nuclear material; provided, that this subsection shall not be deemed to authorize any state to exercise licensing responsibilities concerning those aspects of activities with regard to which the commission has licensing responsibilities; and provided further, that state radiation standards shall not apply to facilities operated by the government or facilities operated under contract with and for the account of the government. The commission is authorized to co-operate with the states in the development of such radiation standards.

(c) The commission shall continually study, in consultation with the states, the desirability of recommending to Congress legislation which would further adjust federal and state responsibilities in the radiation protection field.

APPENDIX II

A. THE COUNCIL OF STATE GOVERNMENTS SUGGESTED LEGISLATION

(SECTION 1 Declaration of Policy. (a) The State of [-----] endorses the action of the Congress of the United States in enacting the Atomic Energy Act of 1954 to institute a program to encourage the widespread participation in the development and utilization of atomic energy for peaceful purposes to the maximum extent consistent with the common defense and security and with the health and safety of the public; and therefore declares the policy of the state to be:

- (1) To co-operate actively in the program thus instituted; and
- (2) To the extent that the regulation of special nuclear, byproduct, and radioactive materials, of production facilities and utilization facilities and of other forms of radiation, and of persons operating such facilities may be within the jurisdiction of the state, to provide for the exercise of the state's regulatory authority so as to conform, as nearly as may be, to the Atomic Energy Act of 1954 and regulations issued thereunder, to the end that there may, in effect, be a single harmonious system of regulation within the state.

(b) The State of [-----] recognizes that the production or utilization of atomic energy and other forms of radiation may result in new conditions calling for changes in the laws of the state and in regulations issued thereunder with respect to health and safety; working conditions, workmen's compensation; transportation; public utilities, life, health, accident, fire, and casualty insurance; the conservation of natural resources, including wildlife, and the protection of streams, rivers, and airspace from pollution; and therefore declares the policy of the state to be:

- (1) To adapt its laws and regulations to meet the new conditions in ways that will encourage the healthy development of industries producing or utilizing atomic energy while at the same time protecting the public interest; and

(2) To initiate continuing studies of the need for changes in the relevant laws and regulations of the state by the respective departments and agencies of the state which are responsible for their administration; and

(3) To assure the co-ordination of the studies thus undertaken, particularly with other atomic industrial development activities of the state and with the development and regulatory activities of other states and of the government of the United States

SECTION 2. Definitions. As used in this act:

(a) "Atomic energy" means all forms of energy released in the course of nuclear fission or nuclear transformation.

(b) "Byproduct material" means any radioactive material (except special nuclear material) yielded in or made radioactive by exposure to the radiation incident to the process of producing or utilizing special nuclear material.

(c) "Production facility" means any equipment or device capable of the production of special nuclear material in such quantity as to be of significance to the common defense and security, or in such manner as to affect the health and safety of the public; or any important component part especially designed for such equipment or device.

(d) "Special nuclear material" means plutonium, uranium 233, and uranium enriched in the isotope 233 or in the isotope 235, and any other material which the governor declares by order to be special nuclear material after the United States Atomic Energy Commission has determined the material to be such; or any material artificially enriched by any of the foregoing.

(e) "Utilization facility" means any equipment or device, except an atomic weapon, capable of making use of special nuclear material in such quantity as to be of significance to the common defense and security, or in such manner as to affect the health and safety of the public, or peculiarly adapted for making use of atomic energy in such quantity as to be of significance to the common defense and security, or in such manner as to affect the health and safety of the public; or any important component part especially designed for such equipment or device.

(f) "Radiation" means gamma rays and X-rays, alpha and beta particles, high-speed electrons, neutrons, protons, and other nuclear particles; but not sound or radiowaves, or visible, infrared, or ultraviolet light.

SECTION 3. United States Licenses or Permits Required. No person shall manufacture, construct, produce, transfer, acquire or possess any special nuclear material, byproduct material, production facility, or utilization facility, or act as an operator of a production or utilization facility wholly within this state unless he shall have first obtained a license or permit for the activity in which he proposes to engage from the United States Atomic Energy Commission if the Commission requires a license or permit to be obtained by persons proposing to engage in such activities.

SECTION 4. Conduct of Studies Concerning Changes in Laws and Regulations with a View to Atomic Industrial Development. Each of the following departments and agencies of the state is directed to initiate and to pursue continuing studies as to the need for changes in the laws and regulations administered by it that would arise from the presence within the state of special nuclear, byproduct, and radioactive materials, from the operation herein of production or utilization facilities, and from the generation of radiation, and, on the basis of such studies, to make such recommendations for the enactment of laws or amendments to law administered by it, and such proposals for amendments to the regulations issued by it, as may appear necessary and appropriate.

(a) (The Department of Public Health), particularly as to hazards to the public health and safety.

(b) (The Department of Labor), particularly as to hazardous working conditions.

(c) (The Workmen's Compensation Commission), particularly as to the time and character of proof of claims of injuries and the extent of the compensation allowable therefor.

(d) (The Department of Public Highways), particularly as to the transportation of special nuclear, byproduct, and radioactive materials on highways of the state.

(e) (The Public Utilities Commission), particularly as to the transportation of special nuclear, byproduct, and radioactive materials by common carriers not in interstate commerce and as to the participation by public utilities subject to its jurisdiction in projects looking to the development of production or utilization facilities for industrial or commercial use.

(f) (The Department of Insurance), particularly as to the insurance of persons and property from hazards to life and property resulting from atomic development.

(g) (The Department of Conservation), particularly as to the hazards to the natural resources of the state, including wildlife, and as to the protection of rivers, streams, and air-space from pollution

(h) (The Department of Mines and Minerals), particularly as to the hazards involved in the mining of radioactive minerals.

(i) Such other departments and agencies (including departments and agencies of political subdivisions of the state), as the governor may direct and for the purposes specified by him, and such other departments and agencies as may be provided by law.

SECTION 5. Co-ordination of Studies and Development Activities.

(a) The governor shall appoint a person to serve as adviser to the governor with respect to atomic industrial development within the state; as co-ordinator of the development and regulatory activities of the state relating to atomic energy and other forms of radiation, including co-operation with other states and with the Government of the United States. The person so appointed shall have the title of (Coordinator of Atomic Development Activities).

(b) The (Coordinator of Atomic Development Activities) shall have the duty of co-ordinating the studies, recommendations, and proposals of the several departments and agencies of the state (and its political subdivisions) required by Section 4 of this act with each other and also with the programs and activities of the (Department of Industrial Development). So far as may be practicable, he shall co-ordinate the studies conducted, and the recommendations and proposals made, in this state with like activities in other states and with the policies and regulations of the United States Atomic Energy Commission. In carrying out his duties, he shall proceed in close co-operation with the (Department of Industrial Development).

(c) The several departments and agencies of the state (and its political subdivisions) which are directed by Section 4 of this act to initiate and pursue continuing studies are further directed to keep the (Coordinator of Atomic Development Activities) fully and currently informed as to their activities relating to atomic energy and other forms of radiation.

(d) The (Coordinator of Atomic Development Activities) shall keep the governor and the several interested departments and agencies informed as to private and public activities affecting atomic industrial development and shall enlist their co-operation in taking action to further such development as is consistent with the health, safety and general welfare of this state.

(c) The (Coordinator of Atomic Development Activities) shall be paid a salary of (\$) per annum.

SECTION 6 Atomic Energy Advisory (Board) (a) The governor is authorized and empowered to appoint from among the residents of this state a (board) of not to exceed (----) members, to be known as the Atomic Energy Advisory (Board). The members shall serve at the discretion of the governor. Among the members there shall be one member of the State Senate and one from the State House of Representatives, and those who represent the various activities affected by atomic energy and other forms of radiation. The (Coordinator of Atomic Development Activities) shall be a member and shall be ex officio the secretary of the (board).

(b) The (board) shall advise the governor and the (Coordinator of Atomic Development Activities) concerning the development, utilization and regulation of atomic energy and other forms of radiation. It shall review and evaluate the studies, policies and recommendations developed pursuant to this act, make recommendations to the governor and the (Coordinator), and furnish such technical advice as may be required on matters relating to atomic energy and the protection and welfare of persons from radiation hazards.

(c) The members of the (board) shall receive no salary for services performed on such (board) but may be reimbursed for necessary and actual expenses incurred in connection with attendance at meetings of the (board) or for authorized business of the (board).

SECTION 7 Injunction Proceedings Whenever, in the opinion of the attorney general, any person is violating or is about to violate Section 3 of this act, the attorney general may apply to the appropriate court for an order enjoining the person from engaging or continuing to engage in the activity violative of this act and upon a showing that such person has engaged, or is about to engage in any such activity, a permanent or temporary injunction, restraining order, or other order may be granted.

SECTION 8. Co-operation The heads of the appropriate agencies may co-operate with the Federal Government in the administration of this act or any matter pertaining thereto.

SECTION 9 (Insert effective date.)

**B. NATIONAL COMMITTEE ON RADIATION PROTECTION
SUGGESTED STATE RADIATION PROTECTION ACT**

“An Act for the Control of Radiations from Machines and Radioactive Materials, for the Purpose of Protecting Health.”

Short Title This act may be referred to as the (name of state) Radiation Hygiene Act.

SECTION 1. Statement of Policy. Whereas, radiation can be instrumental in the improvement of health, welfare, and productivity of the public if properly utilized, and may impair the health of the people and the industrial and agricultural potentials of the State if improperly utilized, it is hereby declared to be the public policy of this State to encourage the constructive uses of radiation and to control any associated harmful effects.

SECTION 2 Definitions For the purposes of this act, the following words and phrases are defined:

(a) Radiation is gamma rays and X-rays, alpha and beta particles, high-speed electrons, neutrons, protons, and other nuclear particles, but not sound or radiowaves, or visible, infrared, or ultraviolet light.

(b) Radiation machine is any device that produces radiations when the associated control devices are operated

(c) Radioactive material is any material, solid, liquid, or gas, that emits radiation spontaneously.

Additional definitions may be included

SECTION 3. Creation and Organization of Agency: Advisory Board, Meetings, Employees.

(a) There is hereby created and established a State Radiation-Control Agency hereinafter referred to as the agency. The agency shall be an organizational component of the State Department of ----- (Alternate: There is hereby created and established an independent State Radiation-Control Agency, hereinafter referred to as the agency.)

(b) The Governor shall appoint a director of the agency (hereinafter called the director) who shall perform and carry out all functions and duties given to the agency under this act, and shall direct, carry out, and enforce all radiation safety control activities and measures vested in the agency. The director shall be a person having extensive training and experience in the field of health and of radiation protection.

(c) In accordance with the laws of the State, the agency may employ, compensate, and prescribe the powers and duties of such persons as may be necessary to carry out the provisions of this act. However, technical, legal and other services shall be performed, insofar as practicable, by personnel of existing state departments, agencies, and offices.

(d) The director may delegate to officers and employees of the agency such functions, duties, and authority as are vested in the agency by this act; except the authority to adopt and promulgate standards, rules, and regulations, and to issue or modify orders.

(e) There is hereby established within the agency a State Radiation Technical Advisory Board, hereinafter referred to as the "board," consisting of five members. The director of the agency shall be a member of the board. The other four members shall be persons with scientific training in one or more of the following fields: health, agriculture, medicine, radiology, radiation physics, biology, industry, labor, atomic energy. The Governor shall appoint these four members after seeking recommendations of established authorities or organizations in the above specified fields. The member's term of office shall be four years, except that the terms of those first appointed shall expire as follows:

- 1 at the end of 1 year after such date,
- 1 at the end of 2 years after such date,
- 1 at the end of 3 years after such date, and
- 1 at the end of 4 years after such date

as designated by the Governor at the time of appointment. If a vacancy occurs, the Governor shall appoint a member for the remaining portion of that term. The director of the agency shall be chairman of the board. The board shall hold four regular meetings each calendar year, and special meetings as deemed necessary by the board or the director. It shall be the duty of the board to review the policies and program of the agency as developed under authority of this act; to make recommendations thereon to the agency; to provide the agency with such technical advice and assistance as may be required relative to permissible exposure levels, standards of practice, radiation instrumentation, and other technical matters. Members of the board, other than the director, shall be entitled to receive compensation at -- -- dollars per diem and reimbursement for actual and necessary traveling and subsistence expenses while engaged in the business of the board.

SECTION 4. Powers and Duties of the Agency The agency shall have the following powers and duties:

(a) Shall develop comprehensive policies and programs for the evaluation and determination of hazards associated with the use of radiation, and for their amelioration;

(b) Shall advise, consult and co-operate with other agencies of the State, the Federal Government, other states and interstate agencies, and with affected groups, political subdivisions, and industries in furtherance of the purposes of this act;

(c) May accept and administer loans, grants, or other funds or gifts from the Federal Government and from other sources, public or private, for carrying out any of its functions;

(d) May encourage, participate in, or conduct studies, investigations, training, research, and demonstrations relating to the control of radiation hazard, the measurement of radiation, the effects on health of exposure to radiation, and related problems as it may deem necessary or advisable for the discharge of its duties under this act;

(e) Shall collect and disseminate information relating to the determination and control of radiation exposure and hazard;

(f) Shall adopt and promulgate such rules and regulations as may be necessary to further the purposes of this act; such rules and regulations may incorporate by reference the recommended standards of nationally

recognized bodies in the field of radiation protection such as the National Committee on Radiation Protection or the American Standards Association;

(g) Shall devise, modify, repeal, promulgate, and enforce rules and regulations as necessary to implement or effectuate the powers and duties of the agency under this act;

(h) May issue, modify, or revoke orders prohibiting or abating the discharge of radioactive material or waste into the ground, air, or waters of the State in accordance with the provisions of this act and rules and regulations adopted thereunder;

(i) Upon request, shall render opinion concerning such plans and specifications on the design and shielding for radiation sources as may be submitted before or after construction, for the purpose of determining the possible radiation hazard;

(j) May make inspections of radiation sources, shielding, and immediate surroundings for the determination of any possible radiation hazard; and shall provide the owner, user, or operator thereof with a report of any known or suspected deficiencies;

(k) May exercise all incidental powers necessary to carry out the purposes of this act.

SECTION 5. Registration.

(a) It shall be unlawful for any person to produce radiation, or to produce, use, store, or dispose of radioactive materials, or to modify, extend, or alter such activities, unless he registers in writing with the agency in accordance with the procedures prescribed by such agency, except that a period of 90 calendar days shall be allowed for such registration after the effective date of this act.

(b) It shall be unlawful for any person to produce radiation, or to produce, use, store, or dispose of radioactive materials, except in accordance with the provisions of this act and rules and regulations promulgated thereunder.

SECTION 6. Classification of Sources and Hazards and Standards of Protection.

(a) The agency is authorized, with the concurrence of the board, to classify radiation sources, exposures, and hazards for the purpose of (1) making inspections, (2) determining the competence of the radiation users, (3) determining the adequacy of radiation-protective devices and procedures, and (4) other purposes compatible with the present and future utilization of all forms of radiation, taking into account the protection of the health of the people of this State

(b) Prior to the establishment of a system of classification of sources or uses, or setting standards of protection, or modifying such classifications or standards, the agency shall conduct public hearings in connection therewith. Notice shall be given of time, date, and place of public hearing and shall specify the technical area in which a classification is sought to be made or for which standards are sought to be adopted. Such notice shall be published at least twice in a newspaper of general circulation in the area affected, and shall be mailed at least 20 days before such public hearing to the chief executive of each political subdivision of the geographical area affected, and may be mailed to such other persons as the agency has reason to believe may be affected by such classification and the setting of such standards.

The agency shall utilize the assistance of the board in connection with such hearings.

(c) The adoption of standards of protection and the classification of radiation sources, or any modification or change thereof, shall, upon approval of the board, be issued as an order of the agency and shall be published in a newspaper of general circulation in the area affected. In classifying sources and setting radiation-protection standards, or making any modification thereof, the agency shall permit and announce a reasonable time for the persons or users involved to comply with such classification and standards, if their operations create a known hazard to health; except that a user may be directed to abate without delay a serious known hazard to health.

SECTION 7. Examination for Compliance: Statement of Noncompliance.

(a) The agency shall itself, or by its duly designated representatives, inspect and examine such sources of radiation as it desires, in order to determine their compliance with the adopted classification and radiation-protection standards of the agency.

(b) If such inspection and examination indicates that the source of radiation is not in compliance with the adopted classification and radiation-protection standards, the owner, operator, or user shall be so notified in writing, with full particulars regarding any deficiencies.

SECTION 8. Proceedings Before Board.

(a) Whenever the agency determines there are reasonable grounds to believe that there has been a violation of any of the provisions of this act or of any order of the agency, it may give written notice to the alleged violator or violators specifying the causes of complaint. Such notice shall require that the alleged violations be corrected or that the alleged violator appear before the agency at a time and place specified in the notice, and answer the charges. The notice shall be delivered to the alleged violator or violators in accordance with the provisions of subsection (d) of this section not less than _____ days before the time set for the hearing.

(b) The agency shall afford the alleged violator or violators an opportunity for a fair hearing in accordance with the provisions of Section 9 at the time and place specified in the notice or any modification thereof. On the basis of the evidence produced at the hearing the agency shall make findings of fact and conclusions of law and enter such order as in its opinion will best further the purposes of this act and shall give written notice of such order to the alleged violator, and to such other persons as shall have appeared at the hearing and made written request for notice of the order. If the hearing is held before any person other than the agency itself such person shall transmit the record of the hearing together with recommendations for findings of fact and conclusions of law to the agency, which shall thereupon enter its order on the basis of such record and recommendations. The order of the agency shall become final and binding on all parties unless appealed to the courts as provided in Section 12 within _____ days after notice has been sent to the parties.

(c) Whenever the agency finds that an emergency exists requiring immediate action to protect the public health or welfare, it may, without notice or hearing, issue an order reciting the existence of such an

emergency and requiring that such action be taken as it deems necessary to meet the emergency. Notwithstanding the provisions of subsection (b) of this section, such order shall be effective immediately. Any person to whom such order is directed shall comply therewith immediately, but on application to the agency shall be afforded a hearing as soon as possible. On the basis of such hearing the agency shall continue such order in effect, revoke it, or modify it.

(d) Except as otherwise expressly provided, any notice, order, or other instrument issued by or under authority of the agency may be served, personally or by publication, on any person affected thereby, and proof of such service may be made in like manner as in case of service of a summons in a civil action, such proof to be filed in the office of the agency; or such service may be made by mailing a copy of the notice, order, or other instrument by registered mail, directed to the person affected at his last known post office address as shown by the files or records of the agency, and proof of such service may be made by the affidavit of the person who did the mailing, such proof to be filed in the office of the agency.

(e) Every certificate or affidavit of service made and filed as herein provided shall be prima facie evidence of the facts therein stated, and a certified copy thereof shall have like force and effect.

SECTION 9. Hearings. The hearings herein provided may be conducted by the director, or the director may designate hearing officers who shall have the power and authority to conduct such hearings in the name of the agency, at any time and place. A record or summary of the proceedings of such hearings shall be made and filed with the agency, together with findings of fact and conclusions of law made by the agency. A member of the agency or a hearing officer, designated by the agency, shall have the power to issue in the name of the agency notice of the hearings or subpoenas requiring the testimony of witnesses and the production of evidence relevant to any matter involved in such hearing, and to administer oaths and examine witnesses during such hearings. Witnesses who are subpoenaed shall receive the same fees and mileage as in civil actions. In case of contumacy or refusal to obey a notice of hearing or subpoena issued under this section, the ----- Court shall have jurisdiction, upon application of the agency or its representative, to issue an order requiring such person to appear and testify or produce evidence as the case may require, and any failure to obey such order of the court may be punished by such court as contempt thereof.

SECTION 10. Inspections and Investigations: Maintenance of Records. The agency or its duly authorized representative shall have the power to enter at reasonable times, and after prior notice of at least two days, upon any private or public property for the purpose of inspecting and investigating conditions relative to the purposes of this act; except that such entry into security areas under the direct or indirect jurisdiction of the Federal Government shall be permitted only by and with the concurrence of the Federal Government agency or its duly designated representative.

Any authorized representative of the agency may examine any records or memoranda pertaining to the operation of radiation machines and radioactive materials. The agency may require the maintenance

of records relating to the operation of disposal systems. Copies of such records must be submitted to the agency on request.

SECTION 11. Penalties: Injunctions.

(a) Any person who violates any of the provisions of, or who fails to perform any duty imposed by, this act, or who violates any order of the agency promulgated pursuant to this act, shall be guilty of a misdemeanor, and in addition thereto may be enjoined from continuing such violation. Each day upon which such violation occurs shall constitute a separate violation.

(b) It shall be the duty of the Attorney General on the request of the agency to bring any action for an injunction against any person violating the provisions of this act, or violating any order of the agency. In any action for an injunction brought pursuant to this section, any findings of the agency after hearing or due notice shall be prima facie evidence of the fact or facts found therein.

SECTION 12. Review.

(a) An appeal may be taken from any final order, or other final determination of the agency, by any person who believes himself adversely affected thereby, or by the Attorney General on behalf of the State of the _____ Court of the State in the area affected or to the _____ Court of (Seat of government). Within 30 days after receipt of a copy of the order, or other determination, or after service of notice thereof by registered mail, the appellant or his attorney shall serve a notice of appeal on the agency through its (director) provided that during such 30-day period the court may, for good cause shown, extend such time for an additional period not to exceed 60 days. The notice of appeal shall refer to the action of the agency appealed from, shall specify the grounds of appeal, including both points of law and fact which are asserted or questioned by the appellant. A copy of the original notice of appeal with proof of service shall be filed by the appellant or his attorney with the clerk of the court within 10 days of the service of the notice and thereupon the court shall have jurisdiction of the appeal.

(b) The appellant and the agency shall in all cases be deemed the original parties to an appeal. The State, through the Attorney General or any other person affected, may become a party by intervention, as in a civil action, upon showing cause therefor. The Attorney General shall represent the agency, if requested, upon all such appeals unless he appeals or intervenes in behalf of the State. If the Attorney General or a member of his staff is not available to represent the agency in any particular proceeding, the agency is empowered to appoint special counsel for such proceeding. No bond or deposit for costs shall be required of the State or agency upon any such appeal or upon any subsequent appeal to the Supreme Court or other court proceedings pertaining to the matter.

(c) The appeal shall be heard and determined by the court upon the issues raised by the notice of appeal and the answer thereto according to the rules relating to a trial in the nature of an appeal in equity of an administrative determination. All findings of fact by the agency are to be deemed final, unless it is shown that such findings were not supported by substantial evidence produced before the agency at the hearing. In any appeal or other proceeding involving any order, or other determination of the agency, the action of the agency shall be

prima facie evidence reasonable and valid and it shall be presumed that all requirements of the law pertaining to the taking thereof have been complied with. A copy of the proceedings before the agency shall be certified to the court in connection with each appeal.

(d) A further appeal may be taken to the Supreme Court of the State in the same manner as appeals in equity are taken.

SECTION 13. Conflicting Laws. This act shall not be construed as repealing any laws of the State relating to radiation sources, exposures, radiation protection, and professional licensure, but shall be held and construed as auxiliary and supplementary thereto, except to the extent that the same are in direct conflict herewith.

SECTION 14. Existing Rights and Remedies Preserved. It is the purpose of this act to provide additional and cumulative remedies to evaluate, control, and prevent impairment to health from radiation and to encourage the constructive use of radioactive materials and radiation machines. Nothing herein contained shall be construed to abridge or alter rights of action or remedies in equity or under the common law or statutory law, criminal or civil, nor shall any provision of this act, or any act done by virtue thereof, be construed as estopping the State, or any municipality or person, in the exercise of their rights in equity or under the common law or statutory law to protect the public health and encourage commerce and industry.

SECTION 15. Severability. If any section, subsection, sentence, clause, phrase, or word of this act is for any reason held to be unconstitutional, such decree shall not affect the validity of any remaining portion of this act.

SOURCE U. S. Department of Commerce, National Bureau of Standards, *Regulation of Radiation by Legislative Means*, Handbook 61, 1955

C. THE AMERICAN PUBLIC HEALTH ASSOCIATION, INC., MODEL
STATE RADIATION PROTECTION ACT (With Commission) 1958

An Act relating to radiation protection, creating a Commission on Radiation Protection in the _____ and prescribing functions, powers and duties relating to prevention and prohibition of unnecessary radiation.
(Insert proper title of State health agency)

Be it enacted by _____
(Insert enacting clause proper for particular state)

1. *Title*

This act shall be known and may be cited as the "Radiation Protection Act."

2. *Public Policy*

Whereas ionizing radiations and their sources can be instrumental in the improvement of health, welfare and productivity of the public if properly utilized, and may be destructive of life or health if carelessly or excessively employed, or may impair the industrial and agricultural potentials of the State if improperly utilized, it is hereby declared to be the public policy of this State to encourage the constructive uses of radiation and to prohibit and prevent unnecessary radiation.

3. *Definitions **

The following words shall have the following meanings:

"Commission" means the Commisison on Radiation Protection created under this act;

"Department" means _____
(Insert proper title of state health agency)

"Unnecessary radiation as used in this act means the use of gamma rays, X-rays, alpha and beta particles, high speed electrons, neutrons, protons and other atomic or nuclear particles or rays in such manner as may be hazardoust to the health of the people or the industrial or agricultural potentials of the state.

4. *Commisison Created*

There is hereby created in the _____
a Commission on Radiation Protection, which shall consist of _____ members _____ of whom shall be: the _____
(Insert proper title of head of state health agency) or a member of the _____
(Insert proper title of state health agency)
designated by him _____
(Similarly insert proper titles of heads of other state agencies to be represented on commission and their designees)

who shall serve ex officio and _____ members with scientific training and experience in medicine, radiology, radiation physics,

* Insert definition of person if necessary.

† Alternate suggestion for phrase "may be hazardous" is "may be injurious to the individual or is injurious"

atomic energy, or biology to be appointed from persons to be nominated by the organizations hereinafter enumerated, by the Governor with the advice and consent of the _____

(Insert title of legislative body of the state)

On or before _____ and thereafter as required, at least one month prior to the expiration of the term of the member chosen from nominees of each organization hereafter enumerated, each such organization shall submit to the Governor a list of three recommended nominees for membership on the commission from which list the Governor shall appoint one.

If any organization does not submit a list of recommended nominees at any time required by this act, the Governor may appoint a member of his choice.

The organizations which shall be entitled to submit recommended nominees are: _____

(List appropriate organizations in the State)

5. *Term of Office of Commissioners*

Of the _____ members first to be appointed, one shall be appointed for a term of one year, one for a term of two years, two for terms of three years and two for terms of four years beginning on _____. Thereafter, all appointments shall be made for terms of four years beginning on _____. All appointed members shall serve after the expiration of their terms until their respective successors are appointed and shall qualify, and any vacancy occurring in the appointed membership of the commission, by expiration of term or otherwise, shall be filled in the same manner as the original appointment for the unexpired term only, notwithstanding that the previous incumbent may have held over and continued in office as aforesaid. The Governor may remove any appointed member of the commission for cause after a hearing.

6. *Expenses of Commission*

All members of the commission shall serve without compensation but shall be reimbursed for expenses incurred in attending meetings of the commission and in the performance of any duties as members thereof.

7. *Commission Officers*

The chairman of the commission shall be the _____

(Insert proper title of head of state health agency)

_____ members of the commission shall constitute a quorum to transact its business, except that action on codes, rules, and regulations shall be by at least a two-thirds vote of the entire commission.

8. *Commission Meetings*

The commission shall hold at least ----- regular meetings each calendar year, and such special meetings as it deems necessary.

9. *Rules and Regulations*

The commission shall have power to formulate and promulgate, amend and repeal codes and rules and regulations, including registration of sources of radiation, as may be necessary to prohibit and prevent unnecessary radiation provided, however, that no such code, rule or regulation and no such amendment or repeal shall be adopted except after public hearing to be held after ----- days prior notice thereof by public advertisement of the date, time and place of such hearing, at which opportunity to be heard by the commission with respect thereto shall be given to the public; and provided, further, that no such code, rule or regulation and no such amendment or repeal shall be or become effective until ----- days after the adoption thereof as aforesaid. Any person heard at such public hearing shall be given written notice of the determination of the commission.

10. *Duty of Commission*

It shall be the duty of the commission to review the policies and program of the department as developed under authority of this act; to make recommendations thereon to the department; to provide the department with such technical advice and assistance as may be requested by the department.

11. *Functions and Powers of Department*

The department shall:

- (a) Administer this act and codes, rules, or regulations promulgated by the commission;
- (b) Develop comprehensive policies and programs for the evaluation and determination of hazards associated with the use of radiation, and for their amelioration;
- (c) Advise, consult, and co-operate with other agencies of the State, the Federal Government, other states and interstate agencies, and with affected groups, political subdivisions, and industries;
- (d) Accept and administer according to law loans, grants, or other funds or gifts from the Federal Government and from other sources, public or private, for carrying out its functions under this act;
- (e) Encourage, participate in, or conduct studies, investigations, training, research, and demonstrations relating to the control of radiation hazard, the measurement of radiation, the effects on health of exposure to radiation and related problems as it may deem necessary or advisable for the discharge of its duties under this act;
- (f) Collect and disseminate health education information relating to radiation protection;
- (g) Review * plans and specifications for radiation sources submitted pursuant to codes, rules or regulations promulgated under this act;

*Alternate wording Review and approve

- (h) Inspect radiation sources, their shielding and immediate surroundings and records concerning their operation for the determination of any possible radiation hazard;
- (i) All data obtained as a result of registrations, inspections or investigations shall be kept confidential by the department.

12. *Use of Radiation Sources*

All sources of radiation shall be shielded, transported, handled, used and kept in such manner as to prevent all users thereof and all persons within effective range thereof from being exposed to unnecessary radiation.

13. *Notification of Violation and Order of Abatement*

Whenever the department finds upon inspection and examination of a source of radiation as constructed, operated or maintained that there has been a violation of any of the provisions of this act or any codes, rules or regulations promulgated under this act, it shall notify any person found to be causing, allowing or permitting such violation, of the nature of that violation and order that prior to a time fixed by the department, which time shall not be later than ----- from the date of service of the notice, that

(Reasonable period of time)

such person shall cease and abate causing, allowing or permitting such violation and take such action as may be necessary for the source of radiation to be constructed, operated or maintained in compliance with this act and codes, rules or regulations promulgated by the commission.

Any person aggrieved by the finding or order of the department may bring a civil action in the ----- court at any time within three months after being notified thereof, and said court may hear and determine such action in which the court may proceed in a summary manner or otherwise, and thereupon may affirm the finding or order of the department or reverse or modify the finding or order of the department in whole or in part as the court shall deem just and reasonable.

14. *Authority of Department in Cases of Emergency*

Whenever the department finds that an emergency exists requiring immediate action to protect the public health or welfare, it may issue an order reciting the existence of such an emergency and requiring that such action be taken as it deems necessary to meet the emergency. Such order shall be effective immediately. Any person to whom such an order is directed shall comply therewith immediately, but on application to the department shall be afforded a hearing within ----- days. On the basis of such hearing, the department shall continue such order in effect, revoke it, or modify it.

15. *Injunctive Relief*

A civil action may be instituted in the ----- Court on behalf of the department for injunctive relief to prevent the violation of the provisions of this act or codes, rules or regulations promulgated under this act, and said court may proceed in the action in a sum-

mary manner or otherwise and may restrain in all such cases any person from violating any of the provisions of this act or said codes, rules or regulations.

16. *Exceptions*

Nothing in this act shall be interpreted as limiting intentional exposure of patients to radiation for the purpose of diagnosis or therapy, or medical research, as authorized by law.

17. *Conflicting Laws*

This act shall not be construed as repealing any laws of the State relating to radiation sources, exposures, radiation protection, and professional licensure, but shall be held and construed as auxiliary and supplementary thereto, except to the extent that the same are in direct conflict herewith.*

No ordinances or regulations of any governing body of a municipality or county or board of health not inconsistent with this act or any code, rules or regulations promulgated pursuant thereto shall be superseded by this act. Nothing in this act or in any code, rules or regulations promulgated pursuant thereto shall preclude the right of any governing body of a municipality or county or board of health to adopt ordinances or regulations not inconsistent with this act or any code, rules or regulations promulgated pursuant thereto.

18. *Existing Remedies Unimpaired*

No existing civil or criminal remedy for any wrongful action which is a violation of any code, rule or regulation promulgated under this act shall be excluded or impaired by this act.

19. *Review*

Review of any code, rule or regulation promulgated under this act shall be by appeal to the _____ Court.

20. *Severability*

If any section, subsection, sentence, clause, phrase, or word of this act is for any reason held to be unconstitutional, such decree shall not affect the validity of any remaining portion of this act.

21. *Protection of Powers*

The powers, duties and functions vested in the _____
(Insert proper title)

_____ under the provision of this act shall not be construed
of state health agency)
to affect in any manner the powers, duties and functions vested in
the _____ under any other provisions
(Insert proper title of state health agency)
of law.

22. *Effective Date*

This act shall take effect _____.

* It may be desired to delete this paragraph. If so, at the end of Section 21 entitled "Protection of Powers" add the following phrase: "or those of the _____
(State Stream Pollution and Air Pollution Control Agencies)"

**D. THE AMERICAN PUBLIC HEALTH ASSOCIATION, MODEL STATE
RADIATION PROTECTION ACT (Without Commission)**

(Section headings inserted for ready reference—they would not be included in a bill as might be introduced before a state legislature)

An act relating to radiation protection and prescribing functions, powers and duties relating to prevention and prohibition of unnecessary radiation.

Be it Enacted by _____
(Insert enacting clause proper for particular state)

1. *Title*

This act shall be known and may be cited as the "Radiation Protection Act."

2. *Public Policy*

Whereas ionizing radiations and their sources can be instrumental in the improvement of health, welfare and productivity of the public if properly utilized, and may be destructive of life or health if carelessly or excessively employed, or may impair the industrial and agricultural potentials of the state if improperly utilized, it is hereby declared to be the public policy of this state to encourage the constructive uses of radiation and to prohibit and prevent unnecessary radiation.

3. *Definitions* *

The following words as used in this act shall have the following meanings:

"Department" means _____
(Insert proper title of State Health agency)

"Unnecessary radiation" means the use of gamma rays, X-rays, alpha and beta particles, high speed electrons, neutrons, protons, and other atomic or nuclear particles or rays in such manner as may be hazardous † to the health of the people or the industrial or agricultural potentials of the state.

4. *Rules and Regulations*

The _____
(State Board of Health—Public Health Council or department as may be desired)

shall have power to formulate and promulgate, amend and repeal codes and rules and regulations including registration of sources of radiation as may be necessary to prohibit and prevent unnecessary radiation provided however, that no such code, rule or regulation and no such amendment or repeal shall be adopted except after public hearing to be held after _____ days prior notice thereof by public advertisement of the date, time and place of such hearing, at which opportunity to be heard by the _____

_____ with respect
(State Board of Health—Public Health Council or department as may be desired)

* Insert definition of person if necessary

† Alternate suggestion for phrase "may be hazardous" is "may be injurious to the individual or is injurious."

thereto shall be given to the public; and provided, further, that no such code, rule or regulation and no such amendment or repeal shall be or become effective until _____ days after the adoption thereof as aforesaid. Any person heard at such public hearing shall be given written notice of the determination of the _____

(State Board of

Health—Public Health Council or department as may be desired)

5. *Functions and Powers of Department*

The department shall:

- a) Administer this act and codes, rules, or regulations promulgated under this act;
- b) Develop comprehensive policies and programs for the evaluation and determination of hazards associated with the use of radiation, and for their amelioration;
- c) Advise, consult, and cooperate with other agencies of the state, the Federal Government, other States and interstate agencies, and with affected groups, political subdivisions, and industries;
- d) Accept and administer according to law loans, grants, or other funds or gifts from the Federal Government and from other sources, public or private, for carrying out its functions under this act;
- e) Encourage, participate in, or conduct studies, investigations, training, research, and demonstrations relating to the control of radiation hazard, the measurement of radiation, the effects on health of exposure to radiation, and related problems as it may deem necessary or advisable for the discharge of its duties under this act;
- f) Collect and disseminate health education information relating to radiation protection;
- g) Review plans and specifications for radiation sources submitted pursuant to codes, rules or regulations promulgated under this act;
- h) Inspect radiation sources, their shielding and immediate surroundings and records concerning their operation for the determination of any possible radiation hazard;
- i) All data obtained as a result of registrations or investigations shall be kept confidential by the Department.

6. *Use of Radiation Sources*

All sources of radiation shall be shielded, transported, handled, used and kept in such a manner as to prevent all users thereof and all persons within effective range thereof from being exposed to unnecessary radiation.

7. *Notification of Violation and Order of Abatement*

Whenever the department finds upon inspection and examination of a source of radiation as constructed, operated or maintained that there has been a violation of any of the provisions of this act or any codes, rules or regulations promulgated under this act, it shall notify any person found to be causing, allowing or permitting such violation, of the nature of that violation and order that prior

* Alternate wording: Review and approve.

to a time fixed by the department, which time shall not be later than _____ from the date of service of the notice,
 (Reasonable period of time)

that such person shall cease and abate causing, allowing or permitting such violation and take such action as may be necessary for the source of radiation to be constructed, operated or maintained in compliance with this act and codes, rules or regulations promulgated under this act. Any person aggrieved by the finding or order of the department may bring a civil action in the _____ Court at any time within three months after being notified thereof; and said court may hear and determine such action in which the court may proceed in a summary manner or otherwise, and thereupon may affirm the finding or order of the department or reverse or modify the finding or order of the department in whole or in part as the court shall deem just and reasonable.

8. *Authority of Department in Cases of Emergency*

Whenever the department finds that an emergency exists requiring immediate action to protect the public health or welfare, it may issue an order reciting the existence of such an emergency and requiring that such action be taken as it deems necessary to meet the emergency. Such order shall be effective immediately. Any person to whom such order is directed shall comply therewith immediately, but on application to the Department shall be afforded a hearing within _____ days. On the basis of such hearing the department shall continue such order in effect, revoke it, or modify it.

9. *Injunctive Relief*

A civil action may be instituted in the _____ Court on behalf of the department for injunctive relief to prevent the violation of the provisions of this act or codes, rules or regulations promulgated under this act, and said court may proceed in the action in a summary manner or otherwise and may restrain in all such cases any person from violating any of the provisions of this act or said codes, rules or regulations.

10. *Exceptions*

Nothing in this act shall be interpreted as limiting intentional exposure of patients to radiation for the purpose of diagnosis or therapy, or medical research, as authorized by law.

11. *Conflicting Laws*

This act shall not be construed as repealing any laws of the state relating to radiation sources, exposures, radiation protection, and professional licensure, but shall be held and construed as auxiliary and supplementary thereto, except to the extent that the same are in direct conflict herewith. * No ordinances or regulations of any governing body of a municipality or county or board of health not inconsistent with this act or any code, rules or regulations promul-

* It may be desired to delete this paragraph—if so, it is suggested that the following phrase be added at the end of Section 15 entitled "Protection of Powers"—"or those of the _____"
 (Insert proper title of state stream pollution and air pollution control agencies)

gated pursuant thereto shall be superseded by this act. Nothing in this act or in any code, rules, or regulations promulgated pursuant thereto shall preclude the right of any governing body of a municipality or county or board of health to adopt ordinances or regulations not inconsistent with this act or any code, rules or regulations promulgated pursuant thereto.

12. *Existing Remedies Unimpaired*

No existing civil or criminal remedy for any wrongful action which is a violation of any code, rule or regulation promulgated under this act shall be excluded or impaired by this act.

13. *Review*

Review of any code, rule or regulation promulgated under this act shall be by appeal to the _____Court.

14. *Severability*

If any section, subsection, sentence, clause, phrase, or word of this act is for any reason held to be unconstitutional, such decree shall not affect the validity of any remaining portion of this act.

15. *Protection of Powers*

The powers, duties and functions vested in the_____under the
(Insert proper title of state health agency)
provisions of this act shall not be construed to affect in any manner
the powers, duties and functions vested in the_____ under any
(Insert proper title of state health agency)
other provisions of law.

16. *Effective Date*

This act shall take effect_____.

APPENDIX III

THE UNIVERSITY OF CALIFORNIA UNIVERSITY-WIDE COMMITTEE ON RADIOLOGICAL SAFETY REPORT ON RADIATION SAFETY LEGISLATION¹

December 16, 1958

A radiation protection program for the State of California is necessary for the following reasons:

I—The use of ionizing radiation is increasing in the following fields:

- (a) Medical use.
 - 1. Clinical.
 - 2. Research.
 - 3. Educational.
- (b) Industrial use.
 - 1. Applied.
 - 2. Research.
 - 3. Educational.
- (c) Environmental Contamination.
 - 1. Weapon tests.
 - 2. Industrial wastes.
 - 3. Medical wastes.
- (d) AEC laboratory activities.

At this time the amount of exposure to ionizing radiation in many areas is based on estimates from a relatively few sample studies. Further, the amount of exposure is a variable quantity depending on geography, weather and population segments analyzed.

II—The people of California could be exposed to undesirable amounts of ionizing radiation if the present development of use is allowed to continue without knowledge and control as to the amount of exposure received by the people.

III—The present programs of Radiation Protection, nationally and within the State, have not been designed to meet the requirements of the people of the State of California.

Therefore, it is the unanimous recommendation of this Subcommittee that the State of California establish without delay a—

STATE OF CALIFORNIA RADIATION PROTECTION AGENCY

- 1. To be composed of a commission of experts and an executive staff.
- 2. To develop and recommend a program for radiation protection within the State (upon adoption of the program, the commis-

¹ At the time this report was submitted to the Assembly Interim Committee on Public Health, there had "not been sufficient time to present it for review and approval by the President and the Board of Regents. Accordingly, the program proposed in the report should be accepted only as a statement of recommendations to the university administration by a committee of experts in the field of radiation protection; and should not be looked upon as the official recommendations of the University of California." Letter to Committee from Richard J. Stull, Vice President, Medical and Health Sciences, University of California, December 4, 1958.

sion to be given the powers and responsibilities necessary to effectively coordinate radiation protection activities on a state-wide basis, to develop approximate radiation safety standards, and to provide information, advice and assistance to the various State departments and agencies concerned with radiation protection).

3. To prevent contradictory, conflicting or unduly restrictive regulations of the use of ionizing radiation.
4. To evaluate within reasonable limits the continuing exposure of the people of the State of California.
5. To establish what amounts of exposure will be deemed a hazard.
6. To recommend abatement of hazardous exposure conditions.
7. To discharge these responsibilities wherever possible through existing state departments according to their field of interest.
8. To do this in the most economical way possible.

It appears unlikely that any single existing department or staff could discharge the responsibilities of the proposed agency for the following reasons:

A—Radiation protection is required in fields of activity such as—

- a. Medical use.
- b. Industrial use and occupational health.
- c. Sanitation.
- d. Waste disposal.
 1. Water pollution.
 2. Air pollution.
- e. Agriculture.
- f. Microbiology.
- g. Animal husbandry.
- h. Fish and game.
- i. Educational and research use.
- j. AEC laboratory activities.
- k. Oceanography.
- l. Transportation.

This involvement requires specialized competence unavailable in any single person or department. Therefore, it is recommended that—

The responsibility to determine the program of radiation protection in the State of California be delegated to a commission of experts with interests and experience in the major fields of activities requiring radiation protection.

There should also be available consultants in the minor fields of activity. It is further recognized that the major fields of interest may change as the use of ionizing radiation progresses and the commission should reflect such change by increasing or changing the experts making up the commission.

The regulations pertaining to use of ionizing radiation will emanate from the departments according to their fields of responsibility, however, such proposed regulations must be submitted to or evolved in consultation with the Radiation Protection Agency before adoption.

The commission will have the responsibility of preventing conflicting or unduly restrictive regulations. To this end the agency will maintain

and publish the combined regulations pertaining to ionizing radiation gathered from all departments who so regulate.

The enforcement of issued regulations will be the responsibility of the department issuing the regulations.

The abatement of hazardous conditions shall be the duty of the existing departments according to their fields of responsibility upon violation of established regulations or upon advice from the state commission.

In order to discharge the responsibilities of the commission it is further recommended that the commission be furnished a *Staff Agency* of Radiation Protection to carry out the following activities and services:

1. To work with other state agencies to carry out for radiation protection the program adopted by the commission.
2. To avoid unnecessary duplication of—
 - a. Regulations,
 - b. Programs,
 - c. Instruments,
 - d. Personnel.
3. To carry out the program adopted by the commission.
4. To maintain a registry of all sources of ionizing radiation designated by the commission for registration.
5. To gather and centralize a continuing estimate of the exposure of the people of the State to ionizing radiation.
6. To assist state agencies with technically skilled personnel and equipment.
7. Maintain sufficient radiological laboratory facilities and instruments to discharge the duties and provide the services required by other state departments.
8. To act as the executive branch of the state commission.
9. To supply training and educational services to other state agencies.

We believe such a program and organization will best serve the needs of the people of the State of California. We believe it will be the most economical way of providing the program. It allows the flexibility needed in the future development of use of ionizing radiation.

We believe that due to the probable changes in the importance of sources of exposure (i.e., a bomb test ban would effect the exposure from fallout; the development of atomic power stations would effect the potential exposure from occupation; the development of atomic reactor merchant ships would effect the interest of harbors and docking departments) the program should be in a separate highly skilled agency subject to modification to suit the needs of the State. It should not be a part of any existing state department since no department can discharge fully the needs of the program and its own interest without prejudice, and participation may change quite rapidly its own interest as progress changes the source of exposure.

Therefore, we recommend the commission and its staff agency be a separate agency serving the State in the manner described.

In formulating the preceding recommendations the committee recognized the following pertinent information:

1. At the national level the National Bureau of Standards publishes a large series of handbooks setting forth recommendations for radiation protection. The AEC also published recommendations.

It has been found necessary to arrive at the content of these handbooks by means of committees for the same reasons set forth in our recommendations.

2. Recommendations of national and international bodies require interpretation and quantitative decisions. We believe this function can best be achieved by the recommended commission.
3. In the State of California the existing regulations of the Department of Industrial Safety have been reviewed and in one area critically examined by the chairman of the subcommittee in his particular field of interest.
4. This examination revealed examples of undue restriction and needless technical violation that could be prevented by changes in the orders that would fulfill the intent of the orders but remove in large measure their undesirable features.
5. The National Bureau of Standards handbooks were reviewed.
6. Previous proposed legislation in the State was reviewed.
7. Present and contemplated programs of existing departments were examined and discussed.
8. Fields of interest of various departments were reviewed taking into consideration the information published by the World Health Organization, the AEC, the U. S. Department of Health and Welfare, the National Bureau of Standards, plus various state organizations representing users and regulators of use.
9. The existing literature on the subject was reviewed.
10. The need for a superior, skilled agency staff is recognized, and the difficulty and expense of maintaining more than one skilled staff is emphasized.
11. Written recommendations of the subcommittee members were exchanged and recommendations of interested experts were reviewed.
12. Meetings were held to reconcile the differences and arrive at an acceptable proposal.
13. It was further recognized that radiation protection is divided into various categories requiring specialized skills and experience, namely—
 - a. Recognition and evaluation of the hazard when the exposure is known requires the skill of a person with training and experience in the reaction of humans to ionizing radiation.
 - b. Measurement of exposures requires a person skilled in the techniques and instruments required.
 - c. Engineering ability in the particular field of design applicable to maintaining standards set by No. 4 below.
 - d. The setting of standards of permissible exposure. Since there are no absolute standards these quantities remain matters of judgment and are best established by a commission made up of experts in the first three categories plus additional representatives from particular fields of major interest.

The recommendations submitted are now the unanimous opinion of the subcommittee as representing the best means of fulfilling the requirements of the people of the State of California and the interests of the various departments serving these requirements.

REYNOLD F. BROWN, M.D., Chairman

MR. NELSON GARDEN

DR. KENNETH SCOTT

DR. JOHN HESLEP

APPENDIX IV
REPORT OF THE GOVERNOR'S ADVISORY COMMITTEE ON
PEACETIME USE OF RADIOLOGICAL MATERIALS TO
GOVERNOR GOODWIN J. KNIGHT

December 11, 1958

The Governor's Advisory Committee on Peacetime Use of Radiological Materials met in Room 5100, State Capitol Annex, on December 9, 1958, at 10 a.m., for the purpose of reviewing the recommendations of the Staff Committee concerning necessary legislation to administer the radiation protection responsibilities of the several departments.

The committee considered in detail the report of its Staff Committee and adopted the following report which is herewith transmitted to you as a recommendation of your advisory committee.

1. For the most part department representatives on your committee felt there was little need for additions to or changes in the present statutes as applied to the programs of the specific departments at this time. Only the Departments of Public Health and Fish and Game have suggestions for possible additions to the statutes; these are discussed in paragraphs 4 and 5 below.

2. Your committee recognized the possible need or desirability of some legislation of a general type establishing policy in regard to radiation matters.

The committee felt that any such general legislation should embody the following principles:

- a. Retention of the authorities and responsibilities of state departments and agencies in such manner as these may be applicable to radiation matters.
- b. Provide for co-ordination of the activities of the several departments and agencies concerned in radiation matters.
- c. Provide for a representative advisory committee to the Governor on radiation matters.
- d. Provide for an interdepartmental advisory committee to the Governor.
- e. Provide a single point of contact in State Government for the Atomic Energy Commission of the United States Government.
- f. Provide for registration of all sources of ionizing radiation.

3. There was not unanimous agreement in the committee as to the mechanism for achieving these stated principles. The majority of the committee felt that there was not need to establish a special office, agency, or position to co-ordinate radiation activities of the several departments and agencies. The minority felt it desirable to provide for some such special mechanism.

Consequently, the committee wishes to submit alternate suggestions for proposed legislation for your consideration.

- a. *Attachment 1* is submitted as proposed legislation which does not establish a special mechanism for an Office of Co-ordinator.
- b. *Attachment 2* is submitted as proposed legislation, including provision for an Office of Co-ordinator.
- 4. *Attachment 3* is a suggested addition to the Health and Safety Code, outlining certain responsibilities of the State Department of Public Health. The department indicated that such legislation would be desirable if alternate No. 1 were adopted.
- 5. *Attachment 4* is a suggested addition to the Fish and Game Code. The Department of Fish and Game feels this proposed legislation is necessary whether or not general legislation is adopted. There has not yet been opportunity to work out in the staff committee all of the ramifications of this proposal, insofar as departments other than Fish and Game are concerned.

Attachment 1

An act to add Chapter 8 to Division 20 of the Health and Safety Code, relating to atomic energy and ionizing radiation

CHAPTER 8. ATOMIC ENERGY AND IONIZING RADIATION

2550. The Legislature recognizes that the production and utilization of ionizing radiation, including that from atomic energy applications, for peaceful purposes has already resulted in, and will necessarily continue to result in, conditions calling for changes in the laws of the State and rules and regulations issued thereunder with respect to, but not limited to, public health and safety, industrial safety, workman's compensation, transportation, public utilities, insurance, conservation of natural resources, including wildlife, protection of streams, rivers, lands, and space from contamination and pollution, agriculture, education, and others, and hereby declares the policy of the State is:

(a) To adapt its laws and regulations so as to encourage the development of beneficial uses of ionizing radiation and nuclear energy while at the same time protecting the public interest and the State's resources.

(b) To have State agencies retain their traditional authorities and responsibilities whenever possible.

(c) That the various departments and agencies of the State which are concerned with radiation and its various applications and uses shall develop programs designed to protect the people of the State from unnecessary exposure.

(d) To assure the co-ordination of the programs of the state agencies and the laws, rules and regulations incident thereto, and to insure co-ordination of these activities with the development and regulatory activities of local agencies, other states, and the Government of the United States.

25501. As used in this chapter, the following terms have the meanings described in this section:

(a) "State agency" means every state office, board, commission, authority, department, division and bureau, and is intended to be all-inclusive.

(b) "Atomic energy" means all forms of energy released in the course of nuclear transformation.

(c) "Byproduct material" means any radioactive materials (except special nuclear materials) yielded in or made radioactive by exposure to the radiation incident to the process of producing or utilizing special nuclear materials.

(d) "Production facility" means (1) any equipment or device capable of the production of special nuclear material in such quantity as to be of significance to the common defense and security, or in such manner as to affect the health and safety of the public; or (2) any important component part especially designed for such equipment or device.

(e) "Special nuclear material" means (1) plutonium and uranium enriched in the isotope 233 or in the isotope 235, and any other material which the Governor declares by order to be special nuclear material after the United States Atomic Energy Commission has determined the material to be such; or (2) any material artificially enriched by any of the foregoing.

(f) "Utilization facility" means (1) any equipment or device, except an atomic weapon, capable of making use of special nuclear materials in such quantity as to be of significance to the common defense and security, or in such manner as to affect the health and safety of the public, or peculiarly adapted for making use of atomic energy in such quantity as to be of significance to the common defense and security, or in such manner as to affect the health and safety of the public; or (2) any important component part especially designed for such equipment or device.

(g) "Ionizing radiation," or "radiation," as used in this chapter, means any or all of the following forms of ionizing radiation: alpha rays, beta rays, gamma rays, X-rays, neutrons, high-speed electrons, and other atomic particles, but not sound or radio waves, or visible, infrared, or ultraviolet light.

(h) "Radioactive material" means any compound or element which may emit any or all of the following: alpha and beta particles, electrons, protons, neutrons, and gamma and all other emissions which produce ionization directly or indirectly.

25502. The State Department of Public Health shall be the point of contact for the Atomic Energy Commission and with state governments in matters pertaining to atomic energy and ionizing radiation, except for those cases of disaster and extreme emergency covered by other regulations. This is not intended to prohibit such direct communication between agencies as might be required.

25503. It is unlawful for any person to manufacture, construct, produce, transfer, acquire, use or possess any special nuclear material, byproduct material, production facility, or utilization facility, or act as an operator of a production or utilization facility wholly within this State unless he shall have first obtained a license or permit for the activity in which he proposes to engage from the United States Atomic Energy Commission if the commission requires a license or permit to be obtained by persons proposing to engage in such activities. Violation of this section is a misdemeanor.

25504. There is hereby created an Advisory Conference on Atomic Energy and Ionizing Radiation, consisting of 15 members, including at least one representative each from industry, labor, medicine, science, education, law, local government, and State Government. The conference shall advise the Governor regarding developments and problems in the uses of atomic energy and ionizing radiation. Members of the conference shall be appointed by the Governor. Of the members first appointed, the Governor shall designate five to serve until October 1, 1960, five to serve until October 1, 1961, and five to serve until October 1, 1962. Thereafter all members shall be appointed for three-year terms, except that members appointed to fill vacancies occurring prior to the expiration of a term shall be appointed for the remainder of such term. The Governor shall annually on October 1st designate one member of the conference to serve as chairman, and the chairman shall call meetings of the conference at least twice each year. Conference members shall receive no compensation but shall be entitled to receive their actual and necessary travel and subsistence expenses while serving on business of the conference.

25505. There is hereby created the State Committee on Atomic Energy and Ionizing Radiation which shall consist of the heads of the following state departments and agencies, or the individual designated by the head of such department or agency to represent it: Public Health, Industrial Relations, Water Resources, Natural Resources, Fish and Game, State Water Pollution Control Board, Disaster Office, Attorney General, Agriculture, Education, Finance, University of California, Public Utilities Commission, and such other state departments or agencies as the Governor may indicate. The chairman of the committee shall be annually designated by the Governor. The committee may designate and appoint technical consultants to advise the committee in matters relating to ionizing radiation and atomic energy. The committee shall meet at least once every four months to co-ordinate the programs and activities of the respective state departments and agencies in matters pertaining to atomic energy and ionizing radiation, and to report to the Governor thereon.

25506. Any person possessing radioactive materials or machines producing, or capable of producing, radiation shall register this fact with the State Department of Public Health, in accordance with rules and regulations set forth by the Board of Public Health, and on forms prescribed and furnished by the department. Violation of this section will be a misdemeanor. The information obtained by such registration shall be available to all official agencies.

Attachment 2

An act to add Chapter 8 to Division 20 of the Health and Safety Code, relating to atomic energy and ionizing radiation.

CHAPTER 8. ATOMIC ENERGY AND IONIZING RADIATION

25500. The Legislature recognizes that the production and utilization of ionizing radiation, including that from atomic energy applications, for peaceful purposes has already resulted in, and will necessarily continue to result in, conditions calling for changes in the laws

of the State and rules and regulations issued thereunder with respect to, but not limited to, public health and safety, industrial safety, workman's compensation, transportation, public utilities, insurance, conservation of natural resources, including wildlife, protection of streams, rivers, lands, and space from contamination and pollution, agriculture, education, and others, and hereby declares the policy of the State is:

(a) To adapt its laws and regulations so as to encourage the development of beneficial uses of ionizing radiation and nuclear energy while at the same time protecting the public interest and the State's resources.

(b) To have State agencies retain their traditional authorities and responsibilities whenever possible.

(c) That the various departments and agencies of the State which are concerned with radiation and its various applications and use shall develop programs designed to protect the people of the State from unnecessary exposure.

(d) To assure the co-ordination of the programs of the state agencies and the laws, rules and regulations incident thereto, and to insure co-ordination of these activities with the development and regulatory activities of local agencies, other states, and the Government of the United States.

25501. As used in this chapter, the following terms have the meanings described in this section:

(a) "State agency" means every state office, board, commission, authority, department, division and bureau, and is intended to be all-inclusive.

(b) "Atomic energy" means all forms of energy released in the course of nuclear transformation.

(c) "Byproduct material" means any radioactive materials (except special nuclear materials) yielded in or made radioactive by exposure to the radiation incident to the process of producing or utilizing special nuclear materials.

(d) "Production facility" means (1) any equipment or device capable of the production of special nuclear material in such quantity as to be of significance to the common defense and security, or in such manner as to affect the health and safety of the public; or (2) any important component part especially designed for such equipment or device.

(e) "Special nuclear material" means (1) plutonium and uranium enriched in the isotope 233 or in the isotope 235, and any other material which the Governor declares by order to be special nuclear material after the United States Atomic Energy Commission has determined the material to be such; or (2) any material artificially enriched by any of the foregoing.

(f) "Utilization facility" means (1) any equipment or device, except an atomic weapon, capable of making use of special nuclear materials in such quantity as to be of significance to the common defense and security, or in such manner as to affect the health and safety of the public, or peculiarly adapted for making use of atomic energy in such quantity as to be of significance to the common defense and security, or

in such manner as to affect the health and safety of the public; or (2) any important component part especially designed for such equipment or device

(g) "Ionizing radiation," or "radiation," as used in this chapter, means any or all of the following forms of ionizing radiation: alpha rays, beta rays, gamma rays, X-rays, neutrons, high-speed electrons, and other atomic particles, but not sound or radio waves, or visible, infrared, or ultraviolet light.

(h) "Radioactive material" means any compound or element which may emit any or all of the following: alpha and beta particles, electrons, protons, neutrons, and gamma and all other emissions which produce ionization directly or indirectly.

25502. (a) There is hereby created in the Office of the Governor, the position of Co-ordinator of Radiation Protection and Atomic Energy Development. The co-ordinator and his staff shall be known as the Office of Atomic Energy Development. The co-ordinator shall be appointed by the Governor and his compensation shall be fixed by the Director of Finance. He shall be a full-time officer and shall serve as adviser to the Governor on the development of atomic energy and radiation protection in the State.

(b) The various departments and agencies of the State which are concerned with radiation and its various applications and use are directed to keep the co-ordinator currently informed as to their activities and programs as they relate to all forms of radiation.

(c) The co-ordinator shall keep current information on the licenses issued by the Atomic Energy Commission in the State and, in turn, transmit such information upon request to any state or local agency. The co-ordinator shall be the point of contact for the AEC with state governments in matters pertaining to atomic energy and ionizing radiation, except for those cases of disaster or extreme emergency covered by other regulations. This is not intended to prohibit such direct communication between agencies as might be required.

(d) The co-ordinator shall establish a system of registration of sources of radiation existing within the State, including promulgation of rules and regulations in accordance with administrative regulations. The co-ordinator may appoint an advisory committee of technically qualified persons, without compensation, to assist in the establishment of the system of registration and the types of sources to be registered.

Information concerning sources shall be made available to all public agencies and the public.

(e) No regulation or amendment to a regulation applying specifically to radiation, which any state agency may propose to adopt, unless it be an emergency, shall be noticed under the provisions of Section 11423 of the Government Code prior to 30 days after it has been transmitted to the Office of Atomic Energy Development.

(f) The co-ordinator shall keep the Governor and the various interested departments and agencies informed of the private and public activities affecting the peacetime uses of radiation, and shall enlist their co-operation in protecting the health, safety and general welfare of the people of the State.

(g) The co-ordinator shall submit a report to the Governor at a reasonable time prior to each general session of the Legislature, recommending such action and/or legislation as he deems desirable.

25503. It is unlawful for any person to manufacture, construct, produce, transfer, acquire, use or possess any special nuclear material, byproduct material, production facility, or utilization facility, or act as an operator of a production or utilization facility wholly within this State unless he shall have first obtained a license or permit for the activity in which he proposes to engage from the United States Atomic Energy Commission if the commission requires a license or permit to be obtained by persons proposing to engage in such activities. Violation of this section is a misdemeanor.

25504. There is hereby created an Advisory Conference on Atomic Energy and Ionizing Radiation, consisting of 15 members, including at least one representative each from industry, labor, medicine, science, education, law, local government, and State Government. The conference shall advise the Governor regarding developments and problems in the uses of atomic energy and ionizing radiation. Members of the conference shall be appointed by the Governor. Of the members first appointed, the Governor shall designate five to serve until October 1, 1960, five to serve until October 1, 1961, and five to serve until October 1, 1962. Thereafter all members shall be appointed for three-year terms, except that members appointed to fill vacancies occurring prior to the expiration of a term shall be appointed for the remainder of such term. The Governor shall annually on October 1st designate one member of the conference to serve as chairman, and the chairman shall call meetings of the conference at least twice each year. The co-ordinator shall serve as the secretary. Conference members shall receive no compensation but shall be entitled to receive their actual and necessary travel and subsistence expenses while serving on business of the conference.

25505. There is hereby created the State Committee on Atomic Energy and Ionizing Radiation which shall consist of the Atomic Energy Co-ordinator as chairman and the heads of the following state departments and agencies, or the individuals designated by the head of such department or agency to represent it: Public Health, Industrial Relations, Water Resources, Natural Resources, Fish and Game, State Water Pollution Control Board, Disaster Office, Attorney General, Agriculture, Education, Finance, University of California, Public Utilities Commission, and such other state departments or agencies as the Governor may indicate. The committee may designate and appoint technical consultants to advise the committee in matters relating to ionizing radiation and atomic energy. The committee shall meet at least every four months to assist in the co-ordination of the program and activities of the respective state departments and agencies in matters pertaining to atomic energy and ionizing radiation, and to report to the Governor thereon.

25506. There is hereby appropriated to the Office of Atomic Energy Development from the General Fund the sum of thirty thousand dollars (\$30,000) to carry out the provisions of this act during the 1959-60 Fiscal Year.

Attachment 3

Addition of Article 11 to Chapter 2, Part 1, Division 1 of the Health and Safety Code, 1957.

Article 11. Ionizing Radiation

428. The State Department of Public Health shall conduct and maintain a program of radiologic health, including but not limited to:

a. The conduct of studies to determine the health effects of ionizing radiation

b. The determination of biologic effects of ionizing radiation on plant and animal life.

c. Registration of all sources of ionizing radiation, including both radioactive materials and radiation-producing machines.

d. The continuous surveillance of air, water, food and other aspects of the environment to ascertain the amount and nature of the exposure of the public and individuals to ionizing radiation.

e. The development of administrative means of control for application in the event of radiation emergencies.

f. Assistance to local agencies in effecting all of the subdivisions of this section.

428.1. The department may enter into agreements with any public or private organization, agency, or individual to carry out its duties and responsibilities with respect to ionizing radiation.

Attachment 4

An act to add Article 3 (commencing at Section 5700) to Chapter 2 of Part 1 of Division 6, and to amend and renumber the heading of Article 3 (commencing at Section 5800) of Chapter 2 of Part 1 of Division 6 of the Fish and Game Code, relating to radioactive material.

The people of the State of California do enact as follows:

SECTION 1. Article 3 (commencing at Section 5700) is added to Chapter 2 of Part 1 of Division 6 of the Fish and Game Code, to read:

Article 3. Radioactive Material

5700. It is unlawful to deposit in, permit to pass into, or place where it can pass into the waters of this State any radioactive substance or material resulting in any concentration in the receiving waters or in the marine and aquatic organisms inhabiting such waters which exceeds the permissible concentrations in water or foodstuffs as set forth in the Federal Register Title 10—Atomic Energy, Part 20—Standards for Protection Against Radiation.

SECTION 2. The heading of Article 3 of said code is amended and renumbered, to read:

Article 3.1. Trinity and Klamath River Fish and Game District

APPENDIX V
INDUSTRY SUGGESTIONS AND RECOMMENDATIONS AS TO
STATE RADIATION LEGISLATION

GENERAL ELECTRIC COMPANY

Robert C. Thorburn, Consulting Health Physicist for the Atomic Power Equipment Department (June 9, 1958):

The company recommended that radiation protection laws and codes adopted by the State should be as uniform as possible with national agencies to avoid duplication of efforts of existing agencies or regulations. The company recommended the following items specifically.

1. Radiation protection laws, codes, or regulations should be stated in terms of objectives to be attained, leaving details and methods of obtaining the goals to administrative action.
2. State laws should be fitted into the existing governmental structure and operating practices of the State and Federal Government, and should set forth a means by which it will be administered and enforced. * * * It is not such a special problem that special agencies will be required to cope with the potential hazard.
3. Radiation control acts or codes should provide for the registration of potentially hazardous sources and their uses, with some provision for inspection of the sources. Enforcement of radiation standards can be simplified if provisions for registration are included.
4. Laws and codes should avoid making a manufacturer responsible for radiation damage that results from improper use of safe equipment by a customer. Equipment that is not safe should not be allowed.

PACIFIC GAS AND ELECTRIC COMPANY

C. C. Wheelchel, Chief Mechanical Engineer (June 9, 1958):

An adequate framework for effective control of radiation hazards from nuclear power plants, as well as from other sources, already exists in present state agencies. * * * It appears to us that there is a need in California for a technical radiological advisory service which can obtain and disseminate the information needed for the establishment of appropriate state regulation of radiation hazards. It also appears to us that some system of registration of radiation materials should be required. Both of these aims can we think be accomplished without setting up a new state agency. An appropriate place for administering the advisory service and the registration requirement would be the State Department of Public Health, inasmuch as decisions relating to radiation hazards involve predominantly medical considerations. * * * Through registration, all regulatory bodies in the State will be able to learn of possible radiation hazards and investigate them. The hazards would be investigated as a matter of course by the tech-

nical personnel in the Department of Public Health. The findings and safety recommendations of the technical personnel would be made available to all enforcement agencies in the State (e.g. the Departments of Agriculture, Industrial Relations, Natural Resources, Public Works, Fish and Game, California Highway Patrol, Water Resources, Public Utilities Commission, State Water Pollution Control Board, Department of Motor Vehicles, Harbor Commissioners, Regional Air Pollution Control Boards, Regional Water Pollution Control Boards, County and City Governments, local Planning and Zoning Commissions, Building Inspectors, local health authorities, etc.).

The enforcement agencies would then make up and enforce with their own personnel whatever requirements they deem necessary in view of the information provided them by the technical personnel in the Department of Public Health.

To eliminate any question of the authority of the Department of Public Health to administer the program of registration and technical assistance, it seems desirable that enabling legislation be passed. This legislation should also make clear that it does not in any way diminish any existing jurisdiction of other regulatory agencies of the State. Thus an agency with a great need for constant technical assistance in radiation hazards, such as would seem to be the case with the Division of Industrial Safety, would be free to employ radiological experts of its own on a full-time basis as the need developed. As we visualize it, this pattern of regulation would be in conformity with that already established in California and this would make for easy, flexible growth in the regulation of radiation hazards, as the need appeared, in the same fashion as regulation generally has been developed in California.

**STANDARD OIL COMPANY OF CALIFORNIA,
CALIFORNIA RESEARCH CORPORATION**

Dr. Donald E. Hull (June 9, 1958):

Occupational hazards from industrial uses of isotopes are adequately controlled by the State Industrial Safety Division's Orders on Radioactivity and Ionizing Radiation. But the company believes it would be in the public interest for the Department of Public Health to adopt regulations setting maximum limits on radioactivity in air and water in the public environment, based on the recommendations of the National Committee on Radiation Protection. Our own operations have always been conducted strictly within these limits, and we believe that many valuable uses of isotopes can be developed within these boundaries.

CALIFORNIA MANUFACTURERS' ASSOCIATION

T. F. Knight, Jr. (June 9, 1958):

1. A regulatory agency, if created, should be separate and apart from existing state agencies. It should not be a part of the Department of Public Health nor a part of the Department of Industrial Welfare, but should be a separate Radiation Safety Commission composed of five qualified experts.
2. The commission should have veto power over all other state agencies' rules and regulations. If a rule or regulation proposed by a

state agency is not approved by the commission, it should not go into effect.

3. There is no need for additional capital outlay for laboratory facilities. The State should use those facilities it presently has and contract with existing private laboratories as needed.
4. The least amount of regulatory control should be the starting point.

LOCKHEED AIRCRAFT CORPORATION, MISSILE SYSTEMS DIVISION

H. J. Stone, Safety Co-ordinator (June 10, 1958, and October 27, 1958):

The goals of legislation should be simplification, co-ordination and uniform application. To meet the goals the following recommendations were made.

(Although) various agencies have jurisdiction in the field of radiation protection, we do *not* necessarily mean that they can supply complete coverage * * * what we *are* saying is that responsibility and authority for covering radiation work seems to exist within the present administrative framework. Thus radiation exposure can apparently be controlled by existing state agencies, with an increase in staffing if it is found to be necessary.

Legislation should encourage co-operation among all regulatory agencies, assign jurisdictions for state agencies, and simplify and unify the regulations. Any legislation proposed should be as simple, objective, and flexible as possible, setting up the goals to be attained rather than the detailed specifications for performance. The administrative codes of the organizations specified in the act should be sufficient to take care of these details.

A technical advisory board on radiation control would offer definite advantages. Having no operational responsibilities, it could prepare and keep up to date those portions of administrative codes relating to radiation, prepare standards for selection of professional and inspectional personnel, and make sure that the various codes provided for co-ordination and co-operation among the regulatory agencies.

Any inspection program must have competent personnel as inspectors. Failing this, we can easily defeat our purposes by lax or over zealous enforcement of regulations. An extreme example of this would be the folly of trying to apply radiation dose limits and other restrictions applicable in industry to a physician administering radiation therapy.

We have heard some comment that a radiation protection agency should be set up in the state having exclusive jurisdiction over radiation work. The operational functions of such an agency are already within the functions and responsibilities of existing state organizations. Also we now have administrative codes, procedures, and lines of communication in use which have stood the test of time. Any reorganization of functions would be likely to cause a transition period in which confusion would reign as responsibilities and jurisdictions were changed, codes were revised, new lines of communication were established, and personnel became familiar with their jobs. * * * Instead of splitting off radiation control responsibilities from all these agencies and setting up

another agency with duplication of many functions, it would seem to be easier to have an adequate number of competent personnel in these agencies to fully carry out the functions in their areas of responsibility. Unless there was promise of a significant improvement of radiation control more simply, uniformly, and economically than by using existing agencies, establishing a new agency would not seem to benefit either the state or the radiation user. Laboratory analytical services are needed to support any radiation control program. A study should be made to determine whether or not the state could contract some of this work out to existing private laboratories or whether it would be more economical in the long run to establish a state laboratory.

The use of radiation and radioactive materials does offer some problems in the protection of personnel and property but we do not think they are unsurmountable. We feel they could be handled by existing state agencies, though this might require the use of additional competent personnel and commercial services where necessary.

The goal should be the elimination of all unnecessary exposure to radiation and this should be made clear in the code. "Permissible" limits should be regarded as "upper" limits.

TRACERLAB, INC.

Loren J. Beaufait, Chief, Radiochemistry Division (June 10, 1958):

There should be assigned to one specific group the responsibility for co-ordinating all matters pertaining to the control and regulation of radiation and radioactive materials within the state. * * * The background of technical information which must be understood and the relatively sophisticated and expensive measurement techniques which must be employed in assessing the hazards from a particular situation are such that it would be prohibitive for a number of groups each to provide themselves with the necessary trained manpower and costly equipment to deal adequately with their particular interests in any given problem. * * * A co-ordinated effort by one central group with appropriate advisory support would deal more directly and quickly with the mushrooming problems of the radiation era and at the same time could keep the various other interested groups apprised in detail so that they would be enabled to discharge the obligations in their special field.

Preventive measures require the enactment of sound regulations and dissemination of these regulations to all groups involved in the use of radioactivity or radiation machines. (A sound basis for these regulations are those regulations now used by the AEC and recommended by the NCRP.) Provision must be made for the intelligent and adequate policing of these regulations to insure that organizations comply.

It is mandatory for state and local groups to have sufficient data in an understandable form on the amount of radioactive fallout. * * * It may require several years of careful evaluations of thousands of samples from every part of the California environment to prepare the needed foundation of information. * * * It

may be unnecessary for the State to set up its own laboratory if adequate services and facilities are available professionally. The State could perhaps accelerate its own program by making use of these services at least on an interim basis.

One of the important responsibilities of the group selected to co-ordinate the state radioactivity program should be that of disseminating information to the public on the benefits of atomic industry and the true facts of the hazards of any particular situation

GENERAL DYNAMICS, GENERAL ATOMIC DIVISION

William H. Ray, Health Physicist (October 27, 1958):

The Atomic Energy Commission program containing regulations to assure radiological safety of all AEC licensees is, we feel, a very thorough and effective one. Much in it could well be copied. As licensees of the Commission, we find that we can live with this type of an operation and those in a state who do operate under such licenses would perhaps not find a great deal additional benefit from additional state legislation. There would be a problem of duplication if there were conflicts in regulations issued by the AEC and those which might be issued by other agencies.

There is a realm however which perhaps includes even more radiation sources (than those licensed by the AEC), e.g., the realm of radiation-producing machines and radium, X-rays, and many other things in modern technology which deserve attention.

What is needed is unified effective administration without overlapping responsibility. * * * I believe the feeling of industry would be to want a minimum of agencies to have to account to and a maximum amount of unification in whatever program is established.

ISOTOPES SPECIALTIES COMPANY

R. N. Donelson (October 27, 1958):

As a licensee of the Atomic Energy Commission, we operate under its regulations. At the present time, we see no way in which these are inadequate. However it seems somewhat dubious that the Federal Government can continue to keep abreast of the expanding use of these materials.

Any legislation which might be enacted by the State should be flexible and as simple as possible. It should be as consistent as possible with the federal legislation and with other state legislation if this is at all practicable. It should not be made overly restrictive. Enforcement of any legislation is the prime requisite. Poor enforcement would be worse than no regulations.

The question of a single agency or duplication of efforts has been raised. From industry's standpoint, again we would much prefer to deal with a single agency. However, there are certainly several agencies in the State which would probably be involved in the enforcement of regulations. We feel quite strongly that there should be a co-ordinating body whether this is the present Governor's Advisory Committee or some other agency that would co-ordinate the overall activities for the State especially in dealing with federal regulations and in dealing with other states.

APPENDIX VI
PROPOSED PROGRAM OF SURVEILLANCE OF THE
ENVIRONMENT WITH RESPECT TO RADIATION

State Department of Public Health
September 1, 1958

ENVIRONMENTAL RADIATION SURVEILLANCE PROGRAM

A. Objective of the Program

1. To detect, measure, record, and evaluate the total radiation exposure to the population of this state.
2. To enable official agencies to take necessary action to protect the population during periods of increased intensity of radiation incident to industrial accidents, radioactive fallout, etc.
3. To provide advice and consultation to agencies, communities and individuals, concerning radiological health problems.
4. To furnish to official agencies certain information for the development of long-range programs to minimize radiation exposure of the population.
5. To continually provide the public with factual information and authoritative interpretation of data concerning radiological health.

B. Agencies Involved in Program

The surveillance program will be statewide, will be a co-operative program of collecting, evaluating, and distributing information, with the information and evaluations being made available to all interested agencies. The agencies will include federal agencies, city and county health departments; and such state agencies as the State Department of Water Resources, Agriculture, Fish and Game, Public Health, Industrial Relations, the Water Pollution Control Boards, the Radiological Division of the State Disaster Office, and others.

C. Interpretation of Radiation Levels

1. Radiation hazards to the population can be either somatic or genetic. Somatic hazard implies a hazard to the physical well-being of the individual exposed to radiation, consisting principally of damaging "internal radiation" secondary to the deposition of radioactive substances in human tissues, such as the deposition of Sr^{90} in bones. Genetic hazard implies a hazard to future generations due to the radiation damage to the reproductive cells, consisting of an increased incidence of harmful mutations in future generations. Generally speaking, genetic hazard arises from "external radiation" in the form of natural background radiation, exposure to industrial or medical X-ray, etc.

2. The time-intensity relationship is important. There has been established by competent agencies a concept of a maximum permissible dose of (MPD) ionizing radiation. This is expressed as a certain dose of radiation in a specified period of time, such as 0.01 roentgenequivalentman (rem) per week or equally as 0.52 rem per year. Generally, for small amounts of radiation in this range, it is immaterial whether the total dose of 0.52 rem is received on one single day during the year, or whether it is received in the form of $\frac{0.52}{365}$ rem doses each day of the year.

It is not feasible to anticipate that radiation exposures involving either somatic or genetic hazards can be kept *continuously* below the safe *lifetime* rate of intensity. Radiation exposures inevitably come in short bursts of relatively higher intensity superimposed upon a continuous relatively low uniform background level. Consequently, it is necessary to evaluate exposures in terms of dose over a given period of time. Since most of the environmental media relating to radioactivity, such as rain, snow, growing crops, water runoff, are seasonal, a year is a convenient unit of time to use. The problem then consists of measuring and evaluating the total dose of radiation, both somatic and genetic, to which each important population segment in California is exposed on an annual basis.

3. The concept of "critical organ" arises from the fact that exposure to radiation is seldom uniform throughout the body, and that different organs of the body vary widely in their vulnerability to damage from radiation. It therefore is necessary to determine or estimate separately the dose to the reproductive organs, the bones, the blood, etc., in order to determine the total radiation damage.
4. The normal pattern of cycle of radioactivity in the environment must be considered in any surveillance program. Radioactivity due to the presence of radioactive chemical substances tends to cycle through the environment rather than remain static. This is best visualized by starting the cycle with radioactivity in air (fall out) which is rapidly transferred (through rain) to soil, streams, and ocean. It then proceeds up the food chains on land and sea through plants and animals to man.
5. Frequently, as in the case of fallout, man's exposure to radiation is not to a single isotope but to a mixture of isotopes of widely varying half life. While this presents no obstacle to the measurement of the instantaneous rate of exposure, it prevents the prediction of the dose over a measured time. Consequently, when the instantaneous rate of exposure exceeds the safe long-time rate of exposure of the most hazardous isotope likely to be present, it is necessary to determine the amount of each significant component of the mixture and make the evaluation of hazard by considering the action of each and combining those dosages which apply to the same part of the body, i.e., the dosages to the bone, the blood, the gonads, etc. Obviously the further one goes in this specific type of identification the more

time consuming the laboratory work. Consequently, the most expeditious procedure is to start with gross measurements and proceed to specific measurements only when the gross figures indicate a possible danger.

SURVEILLANCE OF AIR, RAIN AND AMBIENT RADIATION

A. Monitoring of Air and Rain

The routine monitoring of air and rain furnishes early information of the occurrence of a significant amount of radiological fallout, particularly that resulting from the testing of atomic weapons.

The combined data on radioactive levels in air and rain (or snow) permit the making of working estimates of the total amount of activity reaching the soil in areas of food production, as well as in areas of habitation. Although decided fluctuations may occur over short geographic distances as a result of rainfall patterns, usable approximations of total fallout may be achieved by monitoring on a regional basis; that is, for major metropolitan areas, and for extensive agricultural regions such as the Sacramento or San Joaquin valleys.

The purpose of monitoring air and rain is partly to estimate the health effects of direct exposure of the population through inhalation, but particularly to indicate the need for immediate sampling of field crops and water supplies, as well as the measurement of ambient radiation.

It is desirable to locate the sampling stations for the monitoring of air and rain so as to produce data representative individually of the major metropolitan areas and the major food production areas; consequently, monitoring stations will be located in each of the three major metropolitan areas and in each of the major agricultural areas. This will require monitoring stations in Los Angeles, San Francisco Bay area, San Diego, Eureka, Sacramento, Fresno, Bakersfield, Salinas and El Centro.

Air samples will be collected daily or composite samples collected over a period of a few days. Daily catchments of rainfall will be made at each station whenever precipitation occurs. Augmenting the normal sampling program, supplementary collections of rainfall will be made at convenient points throughout the State when this need is indicated by the levels of radioactivity found at the regular stations or by the occurrence of unusually heavy precipitation. Open containers will also be used at each station to collect the total fallout reaching the surface of the earth.

The standard method for collection of air samples will be the high volume filter sampler now used for the collection of particulate material in connection with the statewide air pollution control program. Rain will be collected in standard rain gauges, or in clean, open containers, properly calibrated, and placed so as to collect a representative sample over a 24-hour period without undue influence from buildings or other nearby structures. Surface drainage or runoff from impervious surfaces will not be used for the measurement of radioactivity in rainfall, since such surfaces will have been previously contaminated by dry fallout.

Gross beta and gamma activities will be measured on all samples. When this activity exceeds values usually experienced or when the activity is considered to be high, additional analysis will be made to identify the nature of the radioactive material. These analyses may include an estimation of the age of fission products, alpha activity and identification of specific isotopes.

Table 1 contains an estimate of the proposed measurement program for air and rain.

Table 1
Proposed Measurement Program

<i>Medium</i>	<i>Locations</i>	<i>Samples per month</i> ¹	<i>Laboratory analyses Total radiation</i>	<i>Specific analyses</i> ³
Air				
Daily	LA-SF-SD -----	90	90	6
2 per week	Sacto-Fresno-Bksf- Salinas-Imperial V., Eureka -----	50	50	6
Rain				
Each rainfall	(As above) -----	75 ²	75	20

¹ Samples during any one month. These numbers will vary according to season and occurrence of fallout incidents.

² During winter.

³ Estimated number of samples that might require specific analyses.

B. Monitoring Ambient Radiation

Measurements of ambient radiation are for the purpose of determining the exposure of inhabitants of an area to external beta and gamma radiation. Measurements are made three feet above ground surface, with equipment sensitive to at least .01 milliroentgen per hour.

Normal levels of ambient radiation in California during the past two years approximate from .01 to .02 milliroentgen per hour. An increase to .05 milliroentgen per hour would be considered a threshold of public health concern, if it were to persist for more than a short period of time.

C. Point Source Program

A considerable number of industries and research agencies have in their possession quantities of radioactive material which could become hazardous to the public if dispersed in the air environment. In addition, there is a growing number of licensed power reactors having a capability of potential emission of large quantities of radioactive material to the environment in case of faulty operation or accident. It is customary in such cases, particularly power reactors, for the industry or agency in charge to carry out environmental monitoring routinely, in the vicinity of its operation. Such monitoring usually consists of continuous measurement of liquid or gaseous effluents, and the periodic collection and radiological assay of samples of air, soil, vegetation, etc., in the vicinity.

It is not proposed that the State duplicate such activities, except for the collection of occasional samples to verify the results of measurements of the operating agency. Instead, arrangements will be made for regular receipt by the State of results of measurements made by isotope users and operators of power reactors.

In the future it may be necessary for the State to stipulate by regulation the scope and nature of monitoring to be carried out by such industries and users of radioactive material.

D. Evaluation of Measurement Data

In evaluating results of measurement of radioactivity in air and rain, interpretation will be based upon the recommended permissible levels of radioactivity in air, water and food of the National Committee on Radiation Protection and Measurement. The recommended permissible level for continuous inhalation of unidentified fission products is 1×10^{-9} uc/ml of air.

In the past fallout episodes in California the highest levels measured have been approximately one-twentieth of this value. The dose to humans is determined by the duration of exposure as well as the level of activity. Since occasional high levels of activity can be experienced for short periods without a marked increase in dose there is a need for establishing levels of radioactivity in air which can be used as guides in calling for some type of action to protect the public health. The following table indicates the kinds of levels that might be used, where X is a value yet to be selected.

- (a) Monthly
average exceeding (λ) times the recommended permissible levels for continuous inhalation
- (b) Weekly
average exceeding (10λ) the recommended permissible levels for continuous inhalation.
- (c) Daily
average exceeding (35λ) the recommended permissible levels for continuous inhalation.

Levels of radioactivity in rainfall can only be appraised from the standpoint of safety by taking into account the method by which human beings may become affected; that is, by contamination of drinking water, food or surfaces.

At the present time, no permissible level for rain, as such, can be stated. When levels of radioactivity in rainfall exceed the standard recommended for drinking water, namely 1×10^{-7} uc/ml, it is necessary to direct attention immediately to exposed field crops and sources of drinking water supply. General guides can be developed for levels of activity in rain, where resulting radioactivity in crops and drinking water will be of immediate concern to the public health.

SURVEILLANCE OF FALLEN SNOW, SURFACE WATERS AND DOMESTIC WATER SUPPLIES

A. Fallen Snow

The determination of radioactivity in fallen snow is subject to a number of factors which make interpretation of the monitoring results complicated. To begin with, the snow pack is composed of successive layers representing different storms. Between storms, the snow pack may diminish both by evaporation, which has the effect of removing the most recently deposited layers, and by melting, which results in the mixing of successive layers. Shrinkage of the snow pack, in addition, will entail

the concentration of dirt and other impurities on the surface. The result of these factors is that radioactivity in surface samples from the snow pack does not diminish in accordance with the decay curve of radioactive components. On the contrary, in a succession of samples from the same snowbank, later samples may actually show a higher exposure level of radioactivity than the original ones.

On the other hand, in the higher altitudes, the snow pack may contain a substantial portion of the total radioactive fallout for a year.

For these reasons, it is imperative to monitor the snow pack, particularly during the months when snowfall occurs. Because of the factors affecting distribution of radioactivity within the snow pack, it is desirable that core samples for the full depth of the snow pack be collected.

The Department of Water Resources maintains a program of gauging of snow pack at approximately fifty stations under contract. It is proposed that monthly samples for radioactivity be collected at each of these stations during the winter months.

B. Surface Waters

Since 1950, semiannual measurements of radioactivity have been made of the principal fresh water streams of the State, at a network of approximately 150 stations. This activity has been carried out under contract by the Department of Water Resources for the State Water Pollution Control Board as part of a comprehensive stream sampling program. Measurements have been made by the Radiological Division of the California Disaster Office.

Inasmuch as this program commenced several years before the first testing of nuclear weapons in this country, the first results reflected natural radioactivity resulting primarily from mineral deposits in the mountains. Samples from the official Stream Sampling Stations in recent years have not shown significant increase in radioactivity resulting from fallout. Consequently, the results of this stream sampling program still represent natural background radioactivity in California waters.

The program, without question, should be continued. Unless results of sampling begin to show significant increase, it should not be necessary to increase the scope of this program.

C. Domestic Water Supplies

Most of California's domestic water supplies come from surface sources. Radioactivity in such water supplies consists of the natural radioactivity in the surface streams, plus radioactivity added by the discharge of sewage or industrial waste effluent to the streams, plus the results of fallout, particularly into open, terminal or distribution reservoirs.

Consequently, domestic water supplies must be monitored on a continuous basis, since it is impossible to forecast levels of radioactivity on the basis of radioactivity in rain, snow, or surface streams.

Furthermore, the recommended permissible level of radioactivity in water, namely, 1×10^{-7} uc/ml, applies only to drinking water itself.

Several of the large metropolitan water companies have facilities for measuring gross beta and gamma activity in their own water supplies. The routine monitoring of the major water supplies in the State, exclusive of the Metropolitan Water District of Southern California, the Los Angeles City Water Department, and the East Bay Municipal Utility District water supply, requires a minimum of 30 monthly source samples throughout the year, greatly augmented at times of high radioactive rainfall; and supplementing the above through a field appraisal of potential public health hazards.

Emergency Action

1. With respect to activity resulting from fallout, the departmental action will be as follows:
 - a. If activity is below 10^{-7} uc/ml, no action will be taken.
 - b. If activity is between 10^{-7} and 10^{-6} uc/ml, the public may be told that the water may be used for a limited time (up to two months) without unreasonable hazard. Further check will be made for decay rate and for specific nuclides.
 - c. If activity is between 10^{-6} and 10^{-5} uc/ml, the department will immediately notify the USPHS. Further checks will then be made to see if the decay rate is typical for fresh mixed fission products in fallout, and, if so, we will follow the procedure described in (b) above.
 - d. If activity is in excess of 10^{-5} uc/ml, the department may direct that bottled water or an alternate supply of safe water, if available, be used by the public; and an immediate report will be made to the Civil Defense authorities.
2. The same general policies will be followed on nonfallout conditions.

SURVEILLANCE OF WASTE DISPOSAL

A planned disposal of radioactive wastes is accomplished in two basic ways: by discharge to the public sewers and by burial in the ocean or on land. In addition, radioactive waste disposal problems may be alleviated by storage of waste until levels of radioactivity have decreased through normal decay.

Monitoring through the collection of environmental samples is necessary for radioactive discharge to the sewers and burial in the ocean. Sewage is most economically monitored as it reaches a treatment plant, because in this manner a single sample reflects the loading discharged to the entire sewer system.

Unusually high values encountered in such monitoring point up the need for intensive investigations to discover the sources. It is advisable to monitor not only raw sewage, but also treated sewage effluent and sewage sludge, particularly when these are reused and may be recycled in the food chain. Monitoring of ocean waters in areas where radioactive wastes are buried is for the purpose of discovering improper practices where package wastes are dumped, since, barring mishap or faulty practice, no escape of radioactivity to the ocean waters should occur.

The proposed schedule of monitoring in ocean waters is based on the assumption that all wastes will be packaged, and no bulk solids or liquids will be discharged directly to the ocean waters.

Routine monitoring will involve a sampling schedule as shown in the following Table 2.

Table 2
Surveillance of Water and Wastes

	<i>Samples per month</i>	<i>Total radiation</i>	<i>Specific analyses</i>
Ground waters ¹ -----	1	1	--
Surface sources ² -----	55	55	1
Sewage-industrial wastes ³ -----	27	27	1
Sludge ³ -----	15	15	10
Salt waters ⁴ -----	2	2	2
Fallen snow and melt -----	75	75	18
Totals -----	175	175	32

¹ Does not include needs of Department Water Resources, Water Pollution Boards, etc

² Includes State Stream Sampling Program but not the needs of WPC Boards, Fish and Game, Department Water Resources, etc

³ Includes only WPC Board No. 4's Hyperion Monitoring and Department Public Health's needs

⁴ Does not include needs of Department of Fish and Game, WPC Boards, etc

In addition to collection of samples, surveillance of waste disposal operations will be accomplished by inspection and review of facilities and operations

The principal characteristics of the proposed waste disposal surveillance program will be as follows:

A. Monitoring

1. Samples of sanitary sewage effluents and sludges will be submitted on a monthly basis by the major sewage works operators. The number may approximate 10 plants or 20 samples per month. Should any effluent sample exceed $10 \times \text{MPC}$, additional samples will be taken and, if still high, an attempt will be made to locate sources of radioactivity and further appraise the hazards of effluent disposal.
2. Review of waste monitoring data being collected by reactor operators, waste disposal companies and isotope users will be made periodically. Occasional check samples will be run; these may be on the order of two analyses per month.
3. Special surveys and sampling for local agencies will be carried out on request if feasible

B. Inspection and Review of Facilities and Operations

1. Periodic inspections will be made of facilities and operators which handle or could produce appreciable quantities of radioactive wastes, except medical isotope use by individual physicians, and sealed sources. The term "appreciable quantities" is difficult to define because of the variation in hazard potential, isotope, and qualification of use. An estimated 10 samples per month will be analyzed.
2. Develop through liaison with AEC, industry et al., an opportunity to participate in site selection in the absence of a state licensing or permit procedure.
3. Evaluate the public health hazards of any proposal to dispose of wastes or to use isotopes as tracers whereby such tracers are deliberately introduced into the environment and reach the waters of the State, directly or indirectly.

SURVEILLANCE OF FOOD

Surveillance of the food supply is based upon the concept of the cycling of radioactivity through the food chain in one of several ways.

Probably the principal manner is the transfer of radioactivity from the soil into growing plants, thence into animal products, and finally to man.

A second, and shorter route is the direct contamination of growing field crops by radioactive rain.

A third route is the development of low levels of radioactivity in ocean water which would be entirely insignificant to humans were it not for the fact that plankton and other marine organisms are capable of reconcentration of radioactive isotopes many thousandfold. It is believed that with respect to the food chain on land, it should be possible to establish reliable relationships between the concentration of significant isotopes (such as Strontium 90) in soil, in plants, in animals and in man, which would enable monitoring to be accomplished by measurement of radioactivity in only one of these links in the food chain.

With this in mind, it is proposed that for the first few years, all elements in the food chain be monitored so that this relationship may be established.

Monitoring of food on land has been planned on a regular basis with measurements being made in each of the following five food raising areas:

1. Sacramento Valley
2. Delta Area
3. San Joaquin Valley
4. Salinas Valley
5. Imperial Valley

In each of these locations, samples will be collected systematically of soil, representative fruit and vegetable crops, beef, milk, and bone.

With respect to the ocean food chain, systematic sampling will be carried out in two locations of the State on ocean water shellfish and skeletal fish.

In planning the frequency of sampling, account will be taken of the fact that radioactivity in soil changes very slowly and that a soil sample gives an integrated value representing several years of exposure; while a food commodity, like milk, gives an integrated value over a period of several weeks.

The proposed sampling schedule is as outlined in Table 3.

TABLE 3
SURVEILLANCE OF FOOD
Sampling Schedule

<i>Commodity</i>	<i>Sampling Schedule</i>	<i>Samples per year</i>	
		<i>Total radiation</i>	<i>Specific analysis *</i>
Representative leafy vegetables	Once/crop	120	120
Representative root plants	Once/crop	120	120
Processed fruits and vegetables	5 products	120	120
Fresh milk	Monthly	48	48
Condensed milk	Twice/yr.	8	8
Dried milk	Twice/yr.	8	8
Beef (domestic)	Twice/yr.	12	12
Beef (imported)	Twice/yr.	12	12
Animal bone	Once/yr	12	12
Poultry	Twice/yr.	12	12
Eggs	Twice/yr.	12	12
Sardines	Twice/yr.	12	12
Tuna	Twice/yr.	12	12
Shellfish		24	80

* Specific analyses may be limited to the determination of Potassium 40, may include only Strontium 90, or more complete isotopic analysis

**SURVEILLANCE OF MEDICAL, INDUSTRIAL, AND COMMERCIAL
USES OF RADIATION**

- A. The medical and allied professions contribute a substantial portion of the total radiation to the population in the form of x-ray, fluoroscopy, and the use of radioactive isotopes. The general industrial safety orders of the State Division of Industrial Safety deal with the protection of employees exposed to potentially dangerous levels of radiation. These orders are occupational in character, and permit an occupational maximum permissible dose of radiation which is 10 x the maximum dose permitted to the population as a whole. These orders extend to the protection of the public only incidentally. There is now almost complete agreement that the same kind of protective action should be extended to patients and to casuals. Generally, there is no regulation elsewhere of the medical and allied professional use of radiation for diagnostic or therapeutic purposes, except for the federal regulations applying to licensees of the Atomic Energy Commission in the uses of radioactive materials. Surveillance of radiation activities relating to the medical and allied professions is a proper concern not only of public health agencies, but also the professional societies and the individual prescribers and users of radiation, as all are equally obligated to guard the public against any unnecessary exposure. Controls must not limit the intentional exposure of patients to radiation for the purpose of diagnosis, therapy, or research as authorized by law. However, radiation in the above instances should be used only where clinically indicated and with proper and expert supervision and operating conditions. The benefits must continually be evaluated in terms of the hazards involved. Controls relating to these uses of radiation must be broad in scope, with provision for revision as required. The success of any control program relating to medical uses will depend almost entirely on the active support, co-operative effort, and self-discipline of the entire medical and allied professions of the State.

- B. The industrial and commercial uses of radiation in California have progressed to such an extent that this State is now one of the primary areas of nuclear development. In order to encourage continued and optimum progress in the future, the State must initiate action to develop the necessary regulatory framework, standards and controls. This must be supported by an effective program of public information and education to insure effective and co-operative effort based on a realistic appraisal not only of the potential hazards but also the great social and economic benefits of atomic energy.
- C. A radiation surveillance program can be evaluated only on the basis of thorough understanding and appreciation of the many facets of radiation. The more important of these are the concept of somatic hazard to the individual as compared to the genetic hazard to the population as a whole; the concept of a natural background radiation as compared to the added radiation from man-made sources and procedures; and the obvious benefits of radiation to mankind in the form of medical uses, research and atomic energy as compared to the hazards.
- D. Surveillance activities relating to medical, industrial, and commercial uses include the following:
 - 1. Registration of sources of radiation
(with exceptions based on nature of materials and magnitude of activity)
 - a. Information concerning location, nature, magnitude, form, use.
 - b. Freedom of access to further information.
 - c. Notice of accident or unusual occurrence.
 - 2. Development of standards of machines, facilities, and installations, with provision for inspection.
 - 3. Development of standards of good operating practice, with provision for inspection.
 - 4. Measurement and assessment of the total population exposure.

PROPOSED LABORATORY FOR RADIOLOGICAL SURVEILLANCE PROGRAM

The foundation of a sound program of evaluating radiological hazards in the environment is an adequate laboratory. It is believed that a single laboratory closely associated both with the sampling program and with the interpretation of analytical results can most efficiently and economically serve the needs of the program. The following evaluation of laboratory requirements is predicated on one such laboratory.

A. Sampling Program

Type of sample	Laboratory analyses/month	
	Gross beta-gamma measurement	Specific analyses ^a
Air	140	12
Rain	75	18
Snow	75	18
Water, fresh	56	1
Water, saline	2	2
Sewage and industrial wastes	27	1
Sewage sludge	15	10
Food, plants	30	30
Food, milk	6	6
Food, meat	2	2
Food, bone	1	1
Food, fish	2	2
Food, shellfish	2	4
Food, poultry and eggs	2	2
Soil	1	1
Totals	436	110

^a Specific analyses may vary from relatively simple decay measurements to complex, time-consuming isotopic analyses

B. Cross Beta-Gamma Measurement

Sample		Man-hours	Total	Instrument-	Total
Type	No./month	per sample	man-hours per month	hours per sample	instrument-hours per month
Air	140	0.3	42	0.7	98
Rain, snow, fresh water	206	0.5	97	0.7	135
Sewage	27	1.0	27	0.7	19
Sewage sludge, food, soil, salt water	63	1.3	82	0.7	44
Totals	436		248		296

C. Specific Analysis

On all samples for which specific analyses are indicated, the rate of decay shall be measured. If additional analyses, especially isotopic analyses, are required, it is impossible to predict accurately the time requirements. On the basis of past experience it seems reasonable to assume an average of 12 man-hours per sample for specific analyses exclusive of decay measurements.*

1. Decay measurements:

The man-hours and instrument-hours are the same for all samples, respectively, 0.5 and 2.7. Thus, for 110 samples, a total of 55 man-hours and 297 instrument-hours are required.

2. Isotopic analysis:

As indicated above, 12 man-hours per sample may be used as an average (but probably minimum) value. Thus, for 110 samples, 1,320 man-hours are required.

D. Personnel Requirements**1. Gross counting and decay:**

Three hundred and three (303) man-hours or 1.8 men. It is suggested that an electronics technician and a chemist with an

* Of necessity, the relative newness of the field will require some time to be devoted to methods development. An allowance for this time is included in the 12 man-hour per sample figure. An allowance for time lost due to vacations and holidays is likewise included.

electronics background be used. Since two people are suggested, there will be adequate time allowed for equipment maintenance and repair (as well as actual sample counting) by the electronics technician. The electronics technician will also service all other laboratory and field equipment.

2. Isotopic analysis:

1,320 man-hours (minimum) or 7.8 men (minimum). It is suggested that six public health chemists and two laboratory assistants be used.

3. Calibration and maintenance of field equipment:

It is suggested that one chemist, with the part-time assistance of the electronics technician, will be able to handle this.

4. Clerical:

One clerk to handle routine office procedures; one clerk to handle data produced by the laboratory.

E. Equipment Requirements

1. All gross beta-gamma measurements, including decay, on unseparated isotopes shall be made with a proportional gas flow counter. A single automatic sample changer counting assembly together with three manual gas flow counters will be minimal for these measurements (the down time on this equipment was taken to be 25%).
2. Measurement of separated isotopes may be made with a scintillation detector (gamma sensitive) or with a Geiger-Muller counter. Both types of counting equipment are needed. A Geiger-Muller counter will be especially valuable in making absorption studies.
3. Measurement of unknown mixtures of isotopes for which rapid evaluation is desired can be facilitated by the use of a gamma ray spectrometer. This would be especially valuable in dealing with atomic accidents. It is suggested that for the present a single channel spectrometer is needed. Future needs may, however, dictate use of a multichannel (100 or more) spectrometer.
4. Accessory laboratory equipment must include: fume hood, large capacity balance, analytical balance (preferably single pan), large capacity muffle furnace, one or more centrifuges, oscilloscope, pulse generator, vacuum tube voltmeter, tube tester, spare tubes, tools, etc.

F. Training

An adequate training program must be established to:

1. Provide chemists with specific knowledge in the field of radioactivity and its measurement, and
2. Provide chemists with specific knowledge of radiochemical techniques.

G. Space Requirements

It is roughly estimated that adequate hood and bench space will require about 3500 sq. ft. of floor space for the personnel and equipment noted above.

APPENDIX VII

**WITNESSES TESTIFYING BEFORE THE SUBCOMMITTEE ON
AIR POLLUTION AND RADIATION PROTECTION**

(Public Hearings: February 25, June 9 and 10, October 27, 1958)

ATOMIC ENERGY COMMISSION

Robert Lowenstein, Office of the General Counsel, Washington
G. W. Morgan, Division of Licensing and Regulation, Washington
R. W. Smith, Director of Inspection, San Francisco

U. S. DEPARTMENT OF HEALTH, EDUCATION AND WELFARE

R. W. Hart, Regional Engineer

STATE DEPARTMENT OF PUBLIC HEALTH

Dr. Malcolm Merrill, Director
Frederic M. Kriete, M.D., Deputy Director
Robert Dyar, M.D., Chief, Division of Industrial Safety
William H. Clark, M.D., Division of Preventive Medical Services

STATE DEPARTMENT OF INDUSTRIAL RELATIONS

Edward P. Park, Director
A. C. Blackman, Chief, Division of Industrial Safety

CALIFORNIA DISASTER OFFICE

Charles T. Rainey, Chief, Division of Radiological Safety

STATE DEPARTMENT OF AGRICULTURE

Charles V. Dick, Assistant Director

STATE DEPARTMENT OF FISH AND GAME

Phil M. Roedel
William E. Ripley

STATE DEPARTMENT OF NATURAL RESOURCES

Bennie Troxel, Division of Mines

CALIFORNIA PUBLIC UTILITIES COMMISSION

John J. Doran, Jr., Electrical Engineer

STATE DEPARTMENT OF PUBLIC WORKS

John Matheny, Division of Highways

STATE DEPARTMENT OF WATER RESOURCES

Meyer Krausky

STATE OF CALIFORNIA, LEGISLATIVE ANALYST

A. Alan Post

STATE DEPARTMENT OF FINANCE

Robert L. Harkness

CITY OF LOS ANGELES

Col. Richard F. Lynch, Director, Office of Civil Defense
Jack C. Rogers, Health Department

COUNTY OF LOS ANGELES

John Vaden, Health Department

LOS ANGELES AIR POLLUTION CONTROL DISTRICT

Adam Wiley, Radiological Co-ordinator

BAY AREA POLLUTION CONTROL DISTRICT

Benjamin Linsky

Honorable Chet Holifield, Congressman from California

Dr. Albert W. Bellamy, Department of Biophysics
University of California at Los Angeles

Dr. John W. Gofman, Professor of Medical Physics
University of California at Berkeley
Dr. Curt Stern, Professor of Genetics
University of California at Berkeley
Dr. Robert R. Newell, Professor Emeritus
Stanford University
John M. Heslep, Chief Radiological Safety Engineer
University of California
Dr. Herbert R. Packard
California State Dental Association
Dr. Harold A. Hill
Pacific Roentgen Society
Dr. Geoffrey A. Fricker
Radiologist
Dr. George Jacobson, Chairman, Department of Radiology, School of Medicine
University of Southern California
Lee H. Norcross, D.C., Executive Secretary
California Chiropractic Association
Robert C. Thorburn, Health Physicist
General Electric Company, San Jose
C. C. Wheelchel, Chief Mechanical Engineer
Pacific Gas and Electric Company
Dr. Donald E. Hull, California Research Corporation
Standard Oil Company of California
T. F. Knight, Jr.
California Manufacturers' Association
H. J. Stone, Safety Co-ordinator, Missile Systems Division
Lockheed Aircraft Corporation
William H. Ray, Health Physicist, General Atomic Division
General Dynamics, San Diego
R. N. Donaldson, Isotopes Specialties Company
Burbank
Loren J. Beaufait
Tracerlab, Inc., Richmond
Walter W. Offner
X-ray International, San Francisco
Richard Cartwright, Educational Representative
United Automobile and Aircraft Workers of the U. A. W.
Leo Goodman, Atomic Energy Advisor to the U. A. W.
Mrs. Viola Beeson
Local 1100, A. F. of L.
Stanley E. Brown, Consumers Co-operative of Berkeley, Inc.
Fritz Mangold, Executive Secretary of Sports Council
Southern California Council of Conservations Clubs
Mrs. Effie Schwarzschild
San Francisco
Mrs. Rita Schaffer
Mrs. Ida Hoos
Berkeley
Mrs. L. Kelley Mayhew
James Dunlap

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