

457435

R

REPORT TO THE

# SURGEON GENERAL

U.S. PUBLIC HEALTH SERVICE

— on —

## THE CONTROL OF RADIATION HAZARDS IN THE UNITED STATES

Prepared by

The National Advisory Committee on Radiation

March, 1959

REPORT TO THE JOINT CHIEFS OF STAFF

U. S. PUBLIC AFFAIRS SERVICE

(C)

THE CONTROL OF READING MATTER IN THE UNITED STATES

PREPARED BY

THE NATIONAL ADVISORY COMMITTEE ON READING

MARCH, 1954

CONFIDENTIAL - RICHMOND, VIRGINIA

NATIONAL ADVISORY COMMITTEE ON HEALTH PHYSICS

Dr. Vincent N. Margolis, Chairman  
Professor of Biology  
Bureau of Plant and Animal Industry  
Washington, Maryland

Dr. Victor P. Bond  
Medical Department  
Brookhaven National Laboratory  
Upton, Long Island, New York

Dr. Harvey G. Miller  
Executive Director  
American Public Health Association  
New York, New York

Dr. Richard H. Chamberlain  
Professor of Radiology  
University of Pennsylvania Hospital  
Philadelphia, Pennsylvania

Dr. Lawrence C. Trevino  
Associate Professor of Biology  
National Bureau of Standards  
Washington, D. C.

Dr. James F. Crow  
Professor of Genetics  
University of Wisconsin  
Madison, Wisconsin

Dr. George W. Latham  
Physiologist  
University of Pennsylvania  
Philadelphia, Pennsylvania

Dr. Herman F. Helleboe  
Commissioner of Health  
State Department of Health  
Albany, New York

Dr. Ann Wolcott  
Professor of Anatomy  
Johns Hopkins University  
Baltimore, Maryland

Dr. Hardin B. Jones  
Donner Laboratory  
University of California  
Berkeley, California

Dr. Arthur J. Gosselin  
Professor of Biology  
University of Alabama  
Tuscaloosa, Alabama

Dr. Edward B. Lewis  
Professor of Biology  
California Institute of Technology  
Pasadena, California

REPRODUCED AT THE DWIGHT D. EISENHOWER LIBRARY

## I. FOREWORD

The National Academy of Sciences on Health and Environment, 1954, was established by the Surgeon General of the United States Department of Health, Education and Welfare in response to the guidance in matters pertaining to the control of radiation hazards in the United States. Among the many assignments which have been given to the Committee since its inception, one has been the task of examining the progress of research followed in this country to protect the health and safety of the people from the hazards of ionizing radiation. This report presents the conclusions reached by the Committee after its study of the progress of research.

## II. RADIATION HAZARD, A PUBLIC HEALTH PROBLEM

During the past several years, a number of reports have been published, including the National Academy of Sciences of the United States (1954), the United Nations Scientific Committee on the Effects of Atomic Radiation (1955), and the report reported extensively on the incidence of leukemia and other diseases. From these reports it is evident that radiation production, which is caused by undue radiation exposure and that it is possible to establish a safe limit such exposure both for the individual and for the population as a whole.

The principal sources of ionizing radiation which have been discovered or developed by man include x-rays and gamma rays, radium, thorium, and isotopic byproducts, high-energy particles, and other forms of concentrated forms of naturally occurring substances, such as radon, and fallout constituents. The clear evidence is that the radiation hazards from reactors, their fuels, their wastes, and their byproducts, and the radioactive wastes have been placed under control. It is possible to control the radiation their influence on health and safety, and to avoid the radiation hazards.

extensive studies have revealed that most of the ionizing radiation exposure by the population today, other than that received from natural sources, derives from the x-ray machines employed by health care practitioners. Effort is now being applied by the profession to reduce the exposure of individuals undergoing x-ray diagnosis. However, so, the absence of a comprehensive program of regulation which takes into account of all sources of ionizing radiation, including those from consumer products, has led to this Committee to be an important part of the effort to ensure radiation safety.

A comprehensive program of radiation control is particularly important at this time in view of the increasing number of homes in which where ionizing radiation is a significant health hazard. X-ray machines are now used extensively in industry as well as in medicine. Radioactive isotopes are finding applications in a variety of scientific and domestic plants, universities, and research laboratories. And nuclear reactors are being developed and operated at an increasing pace. Few areas of human activity are free from the potential of ionizing radiation do not find some practical application.

Since the discovery of x-rays in 1895, the cumulative exposure of the population has been gradually increasing. It is shown in Table 1 that the annual whole-body dose of radiation received by the average individual of the United States from man-made sources has increased by 100 percent for the period from 1925 to 1955. This increase is reflected in the data included in the report of the United States National Commission on the

TABLE 1  
 Annual Whole-Body Dose of Radiation Received by the Average Individual of the United States from Man-Made Sources, 1925-1955  
 1925 0.0001  
 1935 0.0002  
 1945 0.0005  
 1955 0.0010  
 1961 0.0015  
 1965 0.0020  
 1970 0.0025  
 1975 0.0030  
 1980 0.0035  
 1985 0.0040  
 1990 0.0045  
 1995 0.0050  
 2000 0.0055  
 2005 0.0060  
 2010 0.0065  
 2015 0.0070  
 2020 0.0075  
 2025 0.0080  
 2030 0.0085  
 2035 0.0090  
 2040 0.0095  
 2045 0.0100  
 2050 0.0105  
 2055 0.0110  
 2060 0.0115  
 2065 0.0120  
 2070 0.0125  
 2075 0.0130  
 2080 0.0135  
 2085 0.0140  
 2090 0.0145  
 2095 0.0150  
 2100 0.0155

calculations based on estimates of the average concentration of the radionuclides during this time period<sup>(15, 16)</sup>. The country depicted in the accompanying x-ray data suggests the likelihood that the external exposure of the population from x-ray apparatus may be in excess of the control measures for the use of these control measures are systematically applied.

TABLE I. Estimated Annual Whole-body Dose to Millions of People Externally from Natural and Man-made Sources.

YEAR	NATURAL SOURCE (R)	MAN-MADE SOURCE (R)
1925	100	0
1935	100	50
1945	100	75
1955	100	120

The radiation exposure received from these sources is likely to increase with the passage of time, as shown in Table II, where the national growth rate is projected to be in the years 1965 through 1995. It is believed that the accumulated volume of radioactive waste which may be expected to result from this nuclear power development<sup>(17)</sup>.

TABLE II. Predicted Power Capacity and Volume of Radioactive Waste Resulting from Development of the Nuclear Power Industry.

Year	Power Capacity (in Gwatts)	Total Radioactive Waste Produced (in Gwatts)
1965	$1.1 \times 10^2$	$1.5 \times 10^2$
1975	$8 \times 10^2$	$2 \times 10^2$
1985	$2 \times 10^3$	$1 \times 10^3$
1995	$1.5 \times 10^4$	$2 \times 10^3$

Another measure of the growth to be anticipated in the field of atomic energy may be made from a comparison of the total power output that has taken place during the last few years in the area of radioisotopes in the United States. This is shown by Table III, which shows the quantities of radioisotopes shipped from the Oak Ridge National Laboratory from 1952 to 1958 and the number of medical uses of radioisotopes in the United States in a similar period are tabulated.

Table III. Curies of Radioisotopes Shipped by Oak Ridge National Laboratory and Number of Medical Uses of Radioisotopes in the United States

YEAR	Curies	Number of Uses
1952	17,000	272
1954	30,100	370
1956	102,100	675
1958	230,100	1,981

In addition to the rapid, anticipated growth in the use of radioisotopes and products which produce ionizing radiation, there is considerable evidence which urgently points to the national need for a coordinated health program to protect the public health aspects of this growth. This is the case as reported in the report given by scientists to radiation experts in the summer of 1958. The report, "Forward Revision" made by the panel of the National Academy of Sciences, "Levels of Ionizing Radiation Recommended by the National Commission on Radiation Protection and Control," (1958) (1).

which shows

the production

of radioisotopes

in

1958

1957

1956

1955

10,000,000

includes also

production of

radioisotopes

and other

radioisotopes

available from

the production

of radioisotopes



The enforcement of health regulations by a controlling agency involves the adoption of specific procedures designed to insure that the agency's standards are honored. In a *field of regulatory control*, these procedures include, among others, the establishment of procedures for the registration of radiation sources, the acquisition of operating licenses for them, and the periodic inspection of these facilities.

It may be worthwhile at this time to describe briefly the methods currently used in the United States for the enforcement of standards of radiation protection. In regard to standards, the knowledge available in the fields of biology, chemistry and physics is extended by the use of mathematical knowledge needed for standard development. This research is supported by the Division of Biology and Medicine of the Atomic Energy Commission and the National Institutes of Health of the Department of Health, Education and other governmental and non-governmental agencies. Although the results of this research are substantial, a number of important areas still require quantitative data. In addition, there are many areas where data are lacking. gaps exist within these data. The need for more quantitative data in the establishment of many standards is obvious. It is important to have a solid basis. Since standards of radiation protection are of high priority in many to programs of radiation control, it is important to the Commission that a greater emphasis must be placed on the collection of data in the future. This is particularly so in the case of the health effects of low level exposure of data for standards development. In addition, the development of standards is an important component of the radiation control program and the success of development by the Public Health Service.

the same  
by a public  
standard  
radiation  
American  
by the Public  
the number  
regarding  
radiation  
standards  
officially  
however,  
the present  
support of  
the need of  
W. 1972  
subject of  
believe the  
radiation  
the effect

Reproduction as authorized by the Public Health Service

Much of the responsibility for the evaluation of such data and the subsequent preparation of regulatory standards has been borne by the National Council on Radiation Protection, a private, non-profit group of biologists, physicists, American and Canadian scientists, which is currently supported financially by the Department of Commerce. The organization has distinguished itself by the untiring effort it has given to the development of radiation protection standards.

From time to time, a number of individuals have suggested that the NCRP should be made a permanent governmental agency. They believe that, under such circumstances, the standards would gain stature and its recommendations would be given the official status given them. The National Academy of Sciences, however, believes that there is no need of such independent agency which the NCRP enjoys. In such a climate, the status of the NCRP is a singularly fortuitous and desirable one. It is not clear what would be the result if these characteristics were changed.

#### IV. STATE VS. FEDERAL RESPONSIBILITY IN RADIATION PROTECTION

The enforcement of radiation protection standards has been the subject of considerable controversy in recent years. There are those who believe that the dangers of ionizing radiation are so great and the nature of radiation hazards so complex that regulatory responsibility should be placed primarily at the federal level. Others have argued that regulatory functions should



are sufficiently far from a solution in the present state that they may be expected to elapse before they have been resolved.

The dual role of the Atomic Energy Commission, as agency of the Government and development of atomic energy, on the one hand and the responsibility of the Commission for safety on the other is an interesting one. It is generally recognized that it is unwise and may be expected to result in a number of failures during the lifetime, the Atomic Energy Commission has been criticized for seeming to subordinate safety to the interests of the economy when several of its projects have been abandoned. It is also, a number of individuals and groups have expressed concern over the establishment of large reactors and the possibility of accidents. Although these criticisms have been justified in part, it is noteworthy that the responsibility of the Commission has been misunderstood and this may be expected to decrease as the Commission as more and more participants in the development of atomic energy take their place.

The question may be raised as to why the development of atomic energy of promotion and regulation of atomic energy was placed in a single governmental agency when the situation is so complex and the responsibility so great. The reasons for this may be found in the history of the development of atomic energy. Nuclear science began to exist in a form which is now familiar only at the time of World War II. It was the result of a concerted effort directed toward the development of atomic energy for military purposes. The effort wholly concerned with the military establishment of atomic energy.

REFRONTIONED AP 41116 DWICHTP D. PTCFNNOMFPP TRRANV

Progress toward the production of practical atomic weapons was retarded by the need for the rapid development of regulations for the protection of the safety and, because of security, it was considered to develop such regulations in a regulatory body widely independent of the production program. Thus, the functions of weapons development and production regulation were separated by a single agency, the Manhattan Engineering District.

After the completion of World War II, the Atomic Energy Commission was established by the Atomic Energy Act of 1946<sup>(1)</sup>. The functions of the Commission, initially, were almost entirely governmental and only relatively minor private participation in the field of nuclear energy was contemplated. In view of this, the activities of the Manhattan Engineering District were transferred to the new Atomic Energy Commission and the dual responsibilities of production and regulation were placed essentially unchanged to the new organization.

When the Atomic Energy Act of 1954 was written, regulations for radiation protection were made the responsibility of the Commission in the atomic energy field. However, the regulations to be developed by more complex and difficult basic research which will be conducted by a vigorous role in the development of nuclear energy.

The priorities of the Atomic Energy Commission have been shifted to regulatory functions to protect the safety of the community by a wide range of groups which believe that such a range of duties is best handled by several agencies, rather than by a centralized government<sup>(2)</sup>. This, incidentally, is not the result of any deliberate proposal which has been

regulation  
national  
and a  
energy  
frequently  
boundary  
not possible  
radiation  
to develop  
interest  
has been  
Atomic  
necessary  
concluded  
occurred  
of the  
separation  
regulatory  
local health  
problems  
believed  
by the

REPRODUCED AT THE DWIGHT D. EISENHOWER LIBRARY

regulatory power has present and future, on the very high degree of  
national interest was at stake. (11)

It is not difficult to suppose that when a State's interests are  
not be well served if regulation of such things as production of the following  
energy were delegated entirely to the State and local authorities, especially  
frequently occur where radiation safety and respect of the boundaries  
boundaries and serious danger may be involved in the development of  
not provided. Furthermore, the development of a variety of local and State  
radiation protection codes which will be necessary to meet the needs of the  
development of atomic machinery for the production of electric power and  
interest might well be severely hampered. The very high level of temperature  
has been achieved by scientists and engineers and the Atomic Energy  
Atomic Energy Commission and the ability to provide the facilities and  
necessary for the execution of such projects has been demonstrated  
substantial. Indeed, the performance of these various projects is a  
record of which the AEC may be justly proud. At the same time, however,  
on the other hand, such non-ferrous materials are being used in the

In spite of the foregoing, the responsibility for the regulation of  
regulation of radiation safety is not entirely on the Federal Government. Although  
competence in radiation safety has been established by the Federal Government  
local health departments and health agencies are also involved in many  
problems, intensive efforts are being made to coordinate the various  
Evidence of this may be found in the various reports of the Atomic Energy  
by the Public Health Service, which have been published in the past few years.

REPRODUCED AT THE NATIONAL ARCHIVES AT COLLEGE PARK, MARYLAND

and technical assistants are currently involved in the field of radiation control in the health departments of the States. Although history gives strong support to the concept that where regulatory control is needed for the safety of a community, these controls may in better effect be exercised where the responsibility for control is not far removed from the program to be controlled. This concept is likely to prove equally valid in the field of atomic energy, particularly many radioactive materials use in medicine and industry, and those which are regulated, eventually become a part of civilian medical and industrial activities. The necessity must be evaluated at the point of basic experiments and prior to the start of health assessment program. Finally, any state and local government which have demonstrated over long periods of time that they are capable of operating an effective control program in the past, and have a strong record of health and safety, and a good record of public health authorities should be considered for inclusion in the field of sanitation.

After careful consideration of the problem of effective control of radiation safety, the Commission believes that many of the regulatory enforcement functions of the Federal control program may be discharged effectively by state and local government agencies. Thus, the Commission believes it is wise to continue the program, but to place the emphasis over the public health aspects of the program in the States, since the States are a prime interest in the protection of the health of the people. The Commission is anxious to have the responsibility of the Atomic Energy Commission primarily with respect to the program which it is authorized to be fundamentally sound. Furthermore, the Commission believes that the

But the  
for the  
and the  
discovery  
many of  
is provided  
primary  
where the  
development  
responsibility  
and protection  
it, it, and  
V. RADIATION  
protection  
there are  
radiation  
operation  
are a part  
of the  
of the  
employed  
that, that,

REPRODUCTION OF THIS DOCUMENT IS PROHIBITED BY LAW

that the AEC should not continue to perform its regulatory functions in cooperation for the control of hazards to the general public in the interests of the public and licensees. Indeed, in the past, the Commission has been unable to do so. In this respect, the position of the Commission is clearly stated in many of our nation's newspapers and magazines. It is the conviction of a broad range of safety professionals and others of the regulatory community who have primary authority over the nuclear industry, that the Commission should where the ultimate authority should be the Federal Government, particularly involving the protection of the public from the potential hazards of the Commission believes this authority should be given to the Atomic Energy Commission and preferably to the U. S. Public Health Service.

V. RADIATION SAFETY PROGRAM

The increasing number of nuclear power plants in operation in the United States has created a need for a comprehensive program for the protection of the public from the hazards of radiation. It is the conviction of the Commission that there be available an adequate number of individuals with the necessary radiation control knowledge, with whom the Commission, the Federal Government and other agencies may cooperate in the regulation of radiation. The type of individuals who are needed fall into two general categories:

- (1) individuals with professional qualifications;
- (2) individuals with practical experience.

\* These individuals are not to be confused with health physics personnel employed primarily in industry to protect and supervise the operation of the protection operations of the plants in which they are working.

REPRODUCED AT THE DWIGHT D. EISENHOWER LIBRARY

By the term, "radiation health physicist," it is meant a person trained to the level of a master's or doctorate degree in the radiation sciences for protection and capable of assuming responsibility for the design and execution of radiation control programs. This term should include individuals with backgrounds in physics and the allied basic sciences, physical biological subjects such as genetics, radiobiology, and immunology and occupational exposure assessment, laboratory and field problems. By the term, "radiation health physicist," it is meant an individual trained to operate and develop equipment and to conduct technical work under the supervision of a radiation health physicist.

At this time, the need for such health physicist personnel should be most critical. Until such personnel are available in sufficient numbers, programs in radiation control cannot be considered fully effective at any governmental level. Inadequately trained individuals will be unable to make the necessary judgments nor perform the complex technical operations which will be required of them.

From studies made by the Committee, it appears that the following constitute the personnel needs of the United States for the field of radiation control through the year 1970:

- (a) radiation health physicists ..... 1,200
- (b) radiological technologists ..... 3,000

These estimates are based upon the belief that approximately three to four technicians will be required for each health physicist in a nominal control program and that approximately one radiation health physicist specialist will be necessary for each 200,000 of the population in the United States.

energy of  
 after the  
 they are  
 present  
 need to  
 radiation  
 have exp  
 by 1970,  
 activities  
 conduct  
 VI, 1961.  
 radiation  
 most of  
 the need  
 The prov  
 However,  
 provided  
 the data  
 an impr  
 create the  
 amount  
 and the

REPRODUCED AT THE DWIGHT D. EISENHOWER LIBRARY

energy industry approaches full development. These conditions may, of course, alter these values.

It is anticipated that the number of radiation health specialists will increase progressively as state-of-the-art diagnostic procedures. At the present time the Public Health Service and state health departments need at least need for 150 specialists who have completed full programs of training in radiation protection. By the year 1970, it is anticipated that the number of specialists have expanded to the point where additional specialists will probably be needed. By 1970, it is estimated that 1,200 will be required. These figures are well and above those currently needed by the Atomic Energy Commission for the conduct of its safety program.

#### VI. COMMENT AND RECOMMENDATIONS

It is evident from the discussion of the preceding sections that radiation hazards constitute a major public health problem. In addition, more, it is more than likely that this condition will become a major public health problem in the next few years.

A great deal of progress has been made in the past few years toward the development of regulatory programs for the control of radiation hazards. However, even today, a number of major areas remain to be developed. These include the absence of uniform regulatory standards, the need for more research, an insufficient quantity of scientific data for the development of radiation protection standards, the dual responsibility for protection of radiation from atomic energy sources currently vested in both state and federal governments, and the shortage of trained personnel who will be needed to carry out these programs.

programs may be carried out. It is a first step to correct the existing situation, more important, to improve the standard of the radiation protection measures of the United States, the Committee recommends the following paragraphs to the

Surgeon General or review and approval of the Federal Register, the

Committee recommends that:

1. Primary responsibility for the control of radiation hazards be established in a single agency of the Federal Government. The Committee believes that the agency should be placed in the Department of Health, Education and Welfare. Immediate legislation to achieve this objective.

2. The agency be given authority for broad planning for the field of radiation control. Such planning should include the coordination of Federal and local regulatory programs with the voluntary operation of Federal and State groups in a manner which will provide a coordinated approach to be followed with the control of radiation hazards.

3. This agency be given authority to develop a comprehensive program of control for all sources of radiation. In this connection, the Committee wishes to call attention to the following paragraphs of its recommendations:

- (a) Radiating generation of nuclear power plants, of broad spectrum radiation, and of radioactive control agencies and of appropriate international boundaries in order to protect the population. Also, the Federal Government of nuclear power

in a secondary manner to the development of the  
development of a uniform code of ethics which  
apply to all parts of the industry

Therefore, the Commission has determined that the  
agency be held responsible for the responsibility of  
promulgating and enforcing uniform codes of ethics for the  
profession. It is the duty of the Commission to the  
agency should the code be adopted by the public  
provided by the Department of the Commission on the  
Protection and by other agencies and of the  
character of the industry. The Commission should  
that the agency is provided authority for the  
intensive or other programs that are necessary for the  
provision of the code of ethics. It is the duty of the  
improvement of the industry and the public.

- (b) The Commission should report to the public and  
and will be held responsible for the enforcement of  
the responsibility of the industry and the  
agency. It is the duty of the Commission to the  
reasons why such a code should not be adopted and  
responsibility for the enforcement of the code of ethics  
associated with the industry.

The Commission should also report to the public  
much regarding the responsibility of the industry

within state and local governments in the field of radiation protection. It may be ordered that the agency may be assured of certain specific responsibilities to the nation to include, the Commission recommends that the agency be granted such authority in those areas of radiation which are not regulated seems more appropriate. It also seems that this authority may be given them in those areas where a state or local government finds it difficult to meet its obligations.

Essentially, it is desired that state and local governments may discharge their responsibilities in the protection effectiveness, the Commission recommends that the agency be granted authority to provide financial assistance to such governments for their public health programs.

- (c) The training of professional and technical personnel which to meet federal, state and local requirements over the years, in a variety of national requirements. Hence, the Commission recommends that the agency be granted authority to provide financial support of training programs which will meet the needs of state and local needs for personnel in radiation protection will be satisfied by the

VII. 1950  
control of  
with a  
The Commission  
perhaps  
in regard  
and  
supported  
future  
situation  
principles  
with the

VII. PROGRAM BUDGET

It is anticipated that the cost of a complete program of population control which includes the establishment of family planning centers will reach a level of approximately \$500,000,000 in a period of 25 years. The Committee recommends, however, that the program be staged gradually, perhaps at a level of approximately \$1,000,000 to \$1,500,000 annually, and increasing in magnitude until the program is completed in 1975. Even with such progressive staging, the program will constitute a substantial one. However, the Director of Health and Human Resources before the Committee in his testimony, while recognizing the present situation calls for bold and deliberate action. With a high priority principle, the Committee believes that the program can be carried out with all deliberate speed.

Approved: Edwin E. Brown, Jr., Chairman

- Walter C. Wood
- Richard L. Anderson
- James P. Gray
- Demetrius M. Jones
- Harold H. Jones
- Edward E. Jones
- Bernard M. Weiss
- Russell E. Murray, Jr.
- Samuel L. Brown
- George W. Flinn
- Chas. W. Smith
- Arthur B. Spivey

REPRODUCED AT THE DWIGHT D. EISENHOWER LIBRARY

BIBLIOGRAPHY

1. "The Biological Effects of Radiation," Report to the United Nations Academy of Sciences - National Institute of General Health, 1956.
2. "Report of the United Nations Scientific Committee on the Effects of Atomic Radiation", United Nations General Assembly, Official Records, Thirteenth Session, Supplement No. 1 (1958), New York, 1958.
3. United States Dept. of Commerce, *Atomic Energy Act*, Sept. 1954.
4. *Ibid.*, Memo MC-38-215, May, 1956.
5. Bruce, F.P.: "Radioactive Waste Disposal," Hearings, U.S. Commission on Atomic Energy, 86th Congress, 1st Sess., U.S. Gov. Printing Office, Wash., D.C., 1959.
6. Report of Isotope Prod. and Rad. Energy, Office of Isotopes, U.S. A. E. C., Washington, 1956.
7. "Nature of Radioactive Pollution in the Environment," Report of the Comm. on Atomic Energy, 87th Congress, 1st Sess., U.S. Gov. Printing Office, May, 1957.
8. Nat. Advisory Commission on Energy and Power, *Energy Conservation*, HB-15 (1931).
9. *Ibid.*, NBS Handbook, HB-20 (1934).
10. Nat. Comm. on Radiation Protection, *Energy Conservation*, HB-59 (1957).
11. *Ibid.*, Insert to HB-59 (1957).
12. *Ibid.*, Addendum to HB-59 (1957).
13. 68 Stat. 913, 42 U.S.C., pp. 1601-278 (1954).
14. 60 Stat. 755, as amended, 42 U.S.C., pp. 2001-2008 (1946).
15. "The Feasibility of an Atomic Energy Program for the Development of the Southwest," *Southwest Legal Quarterly*, Vol. 10, No. 3, 1958, pp. 211-214, September, 1958.
16. Frampton, G. T.: "Radiation Liability - The Need for a Federal Program," *Stanford Law Rev.*, 19(7-8), 1957.