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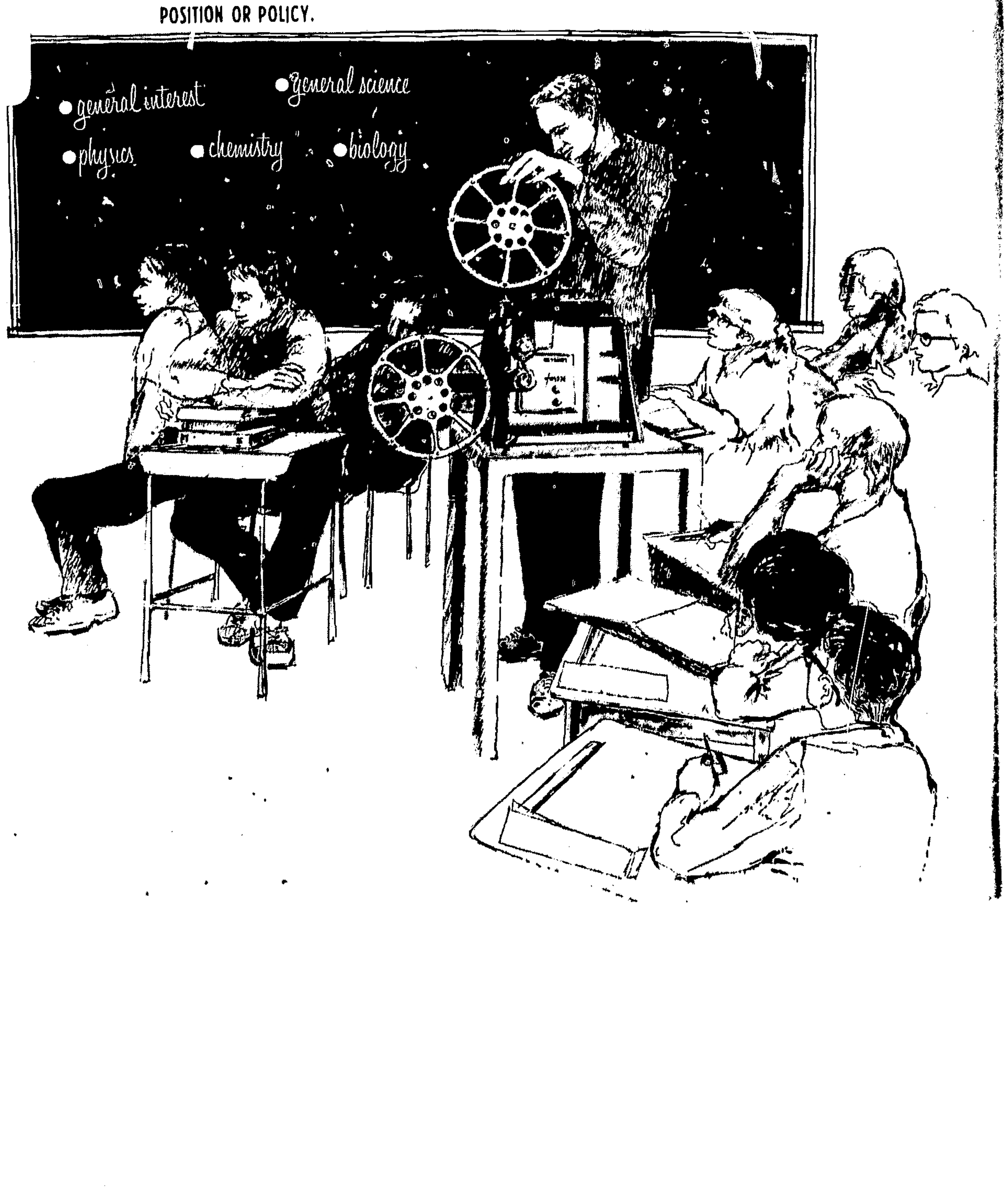
ABSTRACT

Fifty-seven selected 16mm films are listed under the headings: General Interest Films, General Science Films, Physics Films, Chemistry Films, and Biology Films. The listing of each film includes a brief description of content and recommended grade levels. References are given to booklets in The Atomic Energy Commission's "Understanding the Atom" series suitable for related reading assignments. Information is given on how to borrow films. An alphabetical list of the film titles and a complete list of "Understanding the Atom" Booklets are included. (EB)

U.S. Atomic Energy Commission

16 mm

classroom films on nuclear science



to the science teacher

The films in this catalog have been specially selected for their classroom and instructional value from among the more than 400 popular and professional-level motion pictures available for free loan through the U. S. Atomic Energy Commission's domestic film libraries.

To facilitate the matching of films to your teaching requirements in science courses at both the secondary-school and college levels, the films included in this catalog have been grouped under five main headings: general interest, general science, physics, chemistry, and biology.

Subheadings within each of these broad disciplinary classifications are intended, in turn, to assist you in selecting films that will best support the teaching of particular course units.

The listing of each film includes a brief description of its content and coverage, along with a recommendation as to the grade or course level to which it is best suited.

Where appropriate, listings also contain references to booklets in the Atomic Energy Commission's "Understanding the Atom" educational series which might be used as corollary reading for class or independent-study assignments. All of the titles in this series, and information on their availability, are included in the appendix to this catalog, along with an alphabetical index of the classroom film titles.

For those interested in a complete listing of Atomic Energy Commission films, the AEC Combined 16mm Film Catalog, including Education-Information, Technical-Professional, and Historical films, may be obtained without charge by writing to: Audio-Visual Branch, Division of Public Information, U. S. Atomic Energy Commission, Washington, D. C. 20545; the Division of Technical Information Extension, U. S. Atomic Energy Commission, P. O. Box 62, Oak Ridge, Tennessee 37830; or any of the AEC domestic film libraries listed in this catalog.

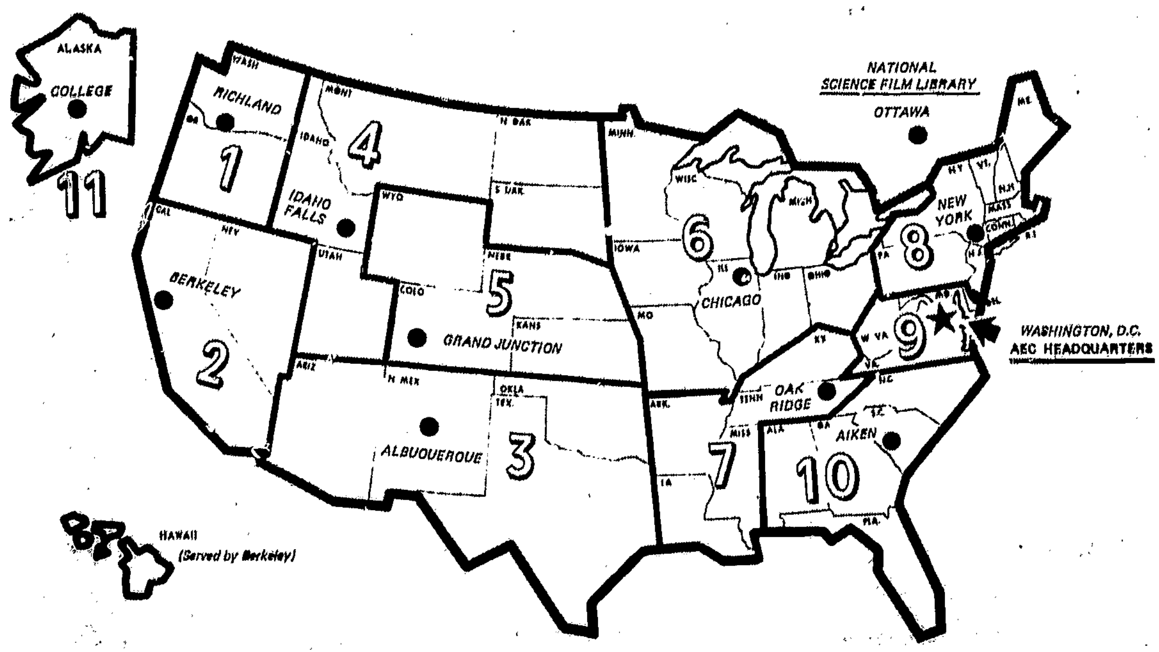
The AEC Division of Public Information expresses its appreciation to Lawrence K. Akers, chairman, and Troy Brannon, a member of the teaching staff, of the Special Training Division, Oak Ridge Associated Universities, for their review and selection of films in this catalog of "Classroom Films on Nuclear Science."

CLASSROOM FILMS ON NUCLEAR SCIENCE

Prepared for
Division of Public Information, U. S. Atomic Energy Commission
by
Special Training Division, Oak Ridge Associated Universities
Oak Ridge, Tennessee
September 1969

Prints of motion pictures listed in this catalog are available for free loan from the 11 domestic film libraries of the Atomic Energy Commission, which serve the areas indicated on the map below. Please address loan requests to the library assigned responsibility for your area, even if another library is nearer.

USAEC FILM LIBRARY LOCATIONS AND SERVICE AREAS



WHERE TO BORROW

If You Live In:	Service Area	Address Your Requests To:
Oregon, Washington	#1	Film Library Information Division U. S. Atomic Energy Commission P. O. Box 550 Richland, Washington 99352

California, Hawaii, Nevada	#2	Public Information Office U. S. Atomic Energy Commission 2111 Bancroft Way Berkeley, California 94704
Arizona, New Mexico Oklahoma, Texas	#3	Film Librarian Information Division U. S. Atomic Energy Commission P. O. Box 5400 Albuquerque, New Mexico 87115
Idaho, Montana, North Dakota, South Dakota, Utah	#4	Mack C. Corbett, Director Office of Information U. S. Atomic Energy Commission P. O. Box 2108 Idaho Falls, Idaho 83401
Colorado, Kansas, Nebraska, Wyoming	#5	Neilsen B. O'Rear, Director Information Division U. S. Atomic Energy Commission Grand Junction, Colorado 81502
Illinois, Indiana, Iowa, Michigan, Minnesota, Missouri, Ohio, Wisconsin	#6	Ruth Jones Information Office U. S. Atomic Energy Commission 9800 South Cass Avenue Argonne, Illinois 60439
Arkansas, Kentucky, Louisiana, Mississippi, Tennessee	#7	Peggy McConnell, Film Librarian Public Information Office U. S. Atomic Energy Commission P. O. Box E Oak Ridge, Tennessee 37830
Connecticut, Maine, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Vermont	#8	Barbara Bengston Public Information Service U. S. Atomic Energy Commission 376 Hudson Street New York, New York 10014
Delaware, District of Columbia, Maryland, Virginia, West Virginia, and Canada	#9	Sid L. Schwartz Audio-Visual Branch, Division of Public Information U. S. Atomic Energy Commission Washington, D. C. 20545
Alabama, Florida, Georgia, North Carolina, South Carolina	#10	Film Librarian U. S. Atomic Energy Commission P. O. Box A Aiken, South Carolina 29801
Alaska	#11	University of Alaska Film Library Special Atomic Energy Film Section Department of Audio-Visual Communications 109 Eielson Building College, Alaska 99701

FOR GENERAL AUDIENCES

General and Historical

THE DAY TOMORROW BEGAN

30 minutes, color (1967). Produced by AEC's Argonne National Laboratory. Recommended for grades 7 through college.

This historical film re-enacts the development of the first nuclear reactor, CP-1 (Chicago Pile-1), which was built by a team of scientists headed by Enrico Fermi under the football stadium (Stagg Field) at the University of Chicago. The film begins with the immigration of wartime scientists from Europe to the United States. With wartime Germany and the Third Reich struggling to produce an atomic weapon, the scientists in Chicago set to work producing the first controlled chain reaction. Through interviews, paintings, and historical film footage, the viewer sees the atomic pile being fabricated graphite brick by graphite brick until, on December 2, 1942, the first self-sustained nuclear reaction took place as control rods were withdrawn manually an inch at a time. Among those interviewed are John Wheeler, Glenn T. Seaborg, Leslie Groves, Mrs. Laura Fermi, Crawford Greenewalt, Frank Spedding, Walter Zinn, Herbert Anderson, Norman Hilberry, and Mrs. Leona Libby. Scientists working on the project who are shown in actual film or paintings include Enrico Fermi, Leo Szilard, James Conant, Vannevar Bush, Arthur Compton, and Ernest Lawrence.

Suggested reading†: *The First Reactor*

THE ATOM: YEAR OF PURPOSE

28 minutes, color (1969). Produced for the AEC by Argonne National Laboratory. Recommended for grades 7 through college.

This film summarizes the highlights of Atomic Energy Commission programs during the year 1968. Discussed are: electricity production

†All of the suggested readings in this catalog are booklets in the Atomic Energy Commission's "Understanding the Atom" educational series. The appendix provides a complete listing of these booklets and information on their availability.

from nuclear power plants; new reactor designs such as the zero-power plutonium reactor and molten salt reactor; the concept of future agro-industrial complexes, which will supply fresh water to grow abundant crops in arid waste lands and supply electricity at the same time for industrial applications; the Plowshare Program (peaceful use of nuclear explosives) and its applications; biological applications of atomic energy such as heart pacers and artificial kidneys; and high-energy physics research into the fundamental nature of matter. Of particular interest is the construction of a 12-foot diameter bubble chamber for nuclear-particle detection, which uses a superconducting magnet to maintain the necessary magnetic field.

Suggested reading: ***The USAEC, What It Is and What It Does***

GUARDIAN OF THE ATOM

28½ minutes, color (1967). Produced by the AEC. Recommended for grades 7 through college.

This film discusses the role of the Atomic Energy Commission and its national laboratories in developing the peaceful and national security uses of the atom. A detailed explanation is given of many of the uses to which the atom is being put today. Topics range from how the raw materials of atomic energy are mined and milled to the most recent development of nuclear propulsion for space exploration. Included are statements by Glenn T. Seaborg, chairman of the AEC and leader of the team that discovered plutonium, on the future of converter and breeder reactors for the production of electricity and the influence of atomic energy on science, industry, governments, and people.

Suggested reading: ***The USAEC, What It Is and What It Does***

THE MIGHTY ATOM

27 minutes, color (1968).* Produced as part of the CBS-News television series, "The 21st Century." Recommended for all age groups.

This summary of the peaceful uses of atomic energy today and in the future touches on the need for nuclear power and the fact that it

*Not Cleared for Television Use.

brings no air pollution; the nuclear merchant ship, the N. S. *Savannah*; nuclear propulsion for space rockets; SNAP (nuclear) generators which supply power for remote unmanned weather stations and off-shore oil rigs; use of the atom's energy to preserve foods by irradiation; nuclear medicine, the fight against cancer; nuclear-powered man-made hearts; the theory of atomic fission and the controlled nuclear reaction in a reactor; burial of atomic wastes; and the theory and operation of giant accelerators to smash atoms and study their sub-atomic particles. In an interview, Glenn T. Seaborg, chairman of the AEC, reports that today the U. S. is spending 50 percent of its nuclear budget on peaceful uses—with the percentage increasing every year. Following an explanation of the theory of breeder reactors, Dr. Seaborg speaks of the unlimited power that breeder reactors could bring for the desalting of hundreds of millions of gallons of seawater a day and, at the same time, producing millions of kilowatts of electricity. The breeders would be part of huge complexes that could manufacture fertilizer for growing vast amounts of food crops in surrounding areas.

Suggested reading: ***Our Atomic World***

Atomic Energy and Its Application

NO GREATER CHALLENGE

15 minutes, color (1969). Produced by AEC. Recommended for grades 7 through college.

Faced today with the challenge of combating global shortages of food and water, man is turning to nuclear energy for his answers. More than one-third of the earth is arid desert and wasteland. In the foreseeable future, man will establish large nuclear-powered, agro-industrial complexes close to the seas, which will use the heat produced by a nuclear reactor to desalt seawater, extract agricultural chemicals, produce electricity for industry, make aluminum sheets, and perform countless other tasks. It is estimated that one billion gallons of water a day might be produced from just one such complex. For man of today, there is, indeed, no greater challenge.

Suggested reading: *Nuclear Energy for Desalting*

PLOWSHARE

28 minutes, color (1965). Produced by AEC. Recommended for grades 9 through college.

By using motion pictures and animation to describe the Commission's program for the safe use of nuclear explosives for civilian applications, this film introduces the Plowshare program, presents the status of its development, and illustrates future goals. The film explains the various potential uses of nuclear explosives to perform tasks beneficial to mankind, including possible application to mining and petroleum exploration as well as massive earth-moving and excavation projects. Safety problems are briefly discussed. The main theme of the film is that the United States, through Plowshare, is offering all nations the potential of harnessing the energy of nuclear explosions for accomplishing peaceful tasks that would otherwise be impossible or impractical.

Suggested reading: *Plowshare*

ATOMIC MEDICINE

27 minutes, color (1968).* Produced as part of the CBS-News television series, "The 21st Century." Recommended for all age levels.

From this summary of the expanding applications of atomic energy for the diagnosis and treatment of disease, we learn that radioisotopes can be used for more than 70 diagnostic tests and that about 4,000 physicians diagnose and treat more than a million patients a year with radioisotopes. Shown are "scanners," which measure the radioactivity sent to the organs; gamma cameras, which determine if there is a cancerous brain tumor; and a radioactive-powered pacemaker which helps the action of the heart. The Medical Center at Brookhaven National Laboratory is shown as a prototype of atomic hospitals of tomorrow. Examples include research on treating leukemia (a type of blood cancer), in which the patient's blood is circulated and irradiated outside the patient's body, and the "stabbing" of a patient's cancerous

*Not Cleared for Television Use.

pituitary gland with a needle of radioactive strontium-90, which burns out the cancer. An interview with AEC Chairman Glenn T. Seaborg points out that 10,000 hospitals and clinics use more than 30 radioisotopes in various applications for diagnosis and therapy.

Suggested reading: *Radioisotopes In Medicine*

THE NUCLEAR WITNESS: ACTIVATION ANALYSIS IN CRIME INVESTIGATION

28 minutes, color (1966). Produced by the General Atomic Division of General Dynamics Corporation for the AEC. Recommended for high school through college.

The scientific crime investigator is ever seeking new and better techniques for examining physical evidence involved in crime investigations. This film describes, in fascinating non-technical detail, one of the most exciting new techniques in this field—a nuclear technique called "activation analysis." This powerful analytical technique, some 100 to 1,000 times more sensitive than methods currently available for the detection of most elements in the crime laboratory, has grown out of the study of peaceful uses of nuclear energy. It is a method of analyzing samples for various elements by bombarding them with neutrons to make some of the elements radioactive, and then identifying and measuring the induced radioactivities to complete the quantitative analysis. The film illustrates the application of activation analysis to the investigation of criminal cases involving murder, burglary, and narcotics peddling.

Suggested reading: *Neutron Activation Analysis*

A BEGINNING WITHOUT END

30 minutes color (1968). Produced by AEC's Lawrence Radiation Laboratory. Recommended for college level.

This is a non-technical summary of nuclear research and development at the Berkeley and Livermore sites of the AEC's Lawrence Radiation Laboratory. Stating that "To provide new foundations of knowledge, continued research into the sub-nuclear world is necessary, which evolves into a never-ending cycle of basic research which is truly 'A Beginning Without End,' " the film briefly covers the work of E. O.

Lawrence; the post-war work using particle accelerators to discover new elements; research into photosynthesis; the use of high energy particles for medical therapy; studies in superconductivity; the study of chemical processes during a nuclear explosion; work on the Plowshare Program; studies of radiation effects on man; work in underground nuclear testing; and research with the Bevatron under Edwin McMillan, director of Lawrence Radiation Laboratory.

Suggested reading: *Microstructure of Matter*

The Atom in Space

NUCLEAR PROPULSION IN SPACE

19 minutes, color (1969). Produced by National Aeronautics and Space Administration and the AEC. Recommended for grades 7 through college.

This film presents the story of the development of a nuclear rocket engine for space exploration. Conventional chemical rockets are compared with nuclear rockets through the use of graphs, charts, and animation which show that the nuclear rocket can be twice as efficient as its chemical counterpart. The film explains the principles and operating characteristics of a nuclear rocket and how its power and thrust will be controlled. Tests are shown of the KIWI reactor in Nevada and the NERVA (Nuclear Engine for Rocket Vehicle Application), which will complete the technology for a nuclear rocket engine application in space missions of the late 1970's and 1980's.

Suggested reading: ***Nuclear Propulsion for Space***

THE WEATHER EYE

14 minutes, color (1969). Produced by the AEC. Recommended for grades 7 through college.

This is the story of the plutonium-238 nuclear power source, SNAP-19, which will be utilized in the Nimbus "weather eye" satellite that monitors changing weather patterns in the atmosphere. The film

describes the design, fabrication, and testing of SNAP-19, which enables the satellite to operate in darkness or sunlight. Heat from plutonium-238 fission is converted directly to electricity by means of lead telluride thermocouples. SNAP-19 is capable of producing 50 watts of electrical power to operate transmitters and electronic equipment aboard the Nimbus.

Suggested readings: ***Direct Conversion of Energy*** **and** ***SNAP–Nuclear Space Reactors***

THE ATOM AND THE MAN ON THE MOON

13 minutes, color (1969). Produced by the General Electric Company for the AEC. Recommended for grades 7 through college.

This film describes SNAP-27 (Systems for Nuclear Auxiliary Power), its mission, and its role in the Apollo space program. When astronauts landed on the moon, they installed a small scientific laboratory to conduct lunar surface experiments. After they departed for earth, the laboratory—known as ALSEP (Apollo-Lunar Surface Packages)—remained to transmit data to stations on earth for several years. ALSEP is powered by electricity from a SNAP nuclear generator containing plutonium-238 as its fuel. The film describes the information the laboratory is transmitting to earth, how the generator is made, and the tests SNAP-27 has undergone to insure its operation in the lunar environment.

Suggested reading: ***SNAP–Nuclear Space Reactors***

GENERAL SCIENCE CURRICULUM
Atomic Concepts

A IS FOR ATOM

15 minutes, color (1964).* Pr~duced by the General Electric Company. Recommended for grades 7 through high school.

This non-technical, fully animated film explains the structure of the atom using an analogy to the solar system, discusses natural elements and artificially produced elements and how they are identified by number, describes stable and unstable atoms, and tells of the discovery of nuclear fission. It explains how a chain reaction is produced, describes the principles of a nuclear reactor and its application for electrical power and propulsion, and reviews the many applications of atomic radiation in industry, biology, medicine, and agriculture.

Suggested reading: ***Our Atomic World***

ALPHA, BETA, AND GAMMA

44 minutes, black and white (1962). Produced by the former New York University Television Center under the direction of the AEC. Recommended for grades 7 through 12.

This film shows how alpha, beta, and gamma radiations are formed within the nucleus. The potential energy well about the nucleus and the coulomb barrier model of the nucleus are introduced and then used as a frame of reference for other nuclear concepts. The development of the energy levels inside the nucleus follows, as well as the emission of alpha, beta, and gamma rays. The Gamow tunneling technique is introduced for alpha emission. Beta production is discussed in some detail and the nuclear well model is used for development of decay schemes. Gamma ray production is shown by use of the liquid drop model of the nucleus.

Suggested reading: ***Our Atomic World***

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*Not Cleared for Television Use.

NUCLEAR REACTIONS

29½ minutes, black and white (1963). Produced by the Educational Broadcasting Corporation, New York City, under the direction of the AEC. Recommended for high school or beginning college.

This is a further segment of the film Alpha, Beta, and Gamma, involving basic concepts of nuclear reactions. Neutron capture and particle emission processes are introduced and the concept of nuclear fission. The "activation" of one gram of gold by neutrons is described, showing that detection is possible even to as low a value as hundredths of a part per billion for some materials. The neutron activation equation is used to compute the amount of activity expected from the irradiation of the gold.

Suggested reading: ***Neutron Activation Analysis***

RADIATION AND MATTER

44 minutes, black and white (1962). Produced by the former New York University Television Center under the direction of the AEC. Recommended for high school through beginning college.

This film considers the interactions of radiation with matter and develops the various processes by which alpha, beta, and gamma radiations give up energy to their environments. Comparisons of alpha and beta ionizations are considered along with the similarities and differences. The density of orbital electrons is shown as a determining factor in the ionization process and the relation between the energy of particles and the number of ion pairs formed is explained. Electromagnetic radiation is then discussed and four types of interaction (excitation, photoelectric, Compton, and pair production) are shown. There is a probability that only one particular event will occur, depending upon the incident photon energy. This probability, expressed as the absorption coefficient, is then related to the four possibilities.

RADIATION DETECTION BY IONIZATION

30 minutes, black and white (1962). Produced by the Educational Broadcasting Corporation, New York City, under the direction of the AEC.

The basic principles of ionization detectors are described, including saturation voltage, gas amplification, and Geiger plateau region. Curves of pulse height vs. voltage are then shown to illustrate detection techniques. Cloud chambers, ion chambers, vibrating reed electrometers, pulse counters, and Geiger counters are demonstrated. The purpose and action of quenching gases are shown and explained. Then, a Geiger-Mueller detector and scaler system is shown in detail and explained by means of block diagrams and actual instrumentation.

RADIATION DETECTION BY SCINTILLATION

30 minutes, black and white (1962). Produced by the Educational Broadcasting Corporation, New York City, under the direction of the AEC. Recommended for high school or beginning college.

A short review of gamma interactions with matter is shown with particular reference to useful scintillation crystals. The scintillation process, the function of a phototube, and the efficiency of such a system are discussed. Solid and liquid scintillators are shown along with the special detection devices needed. The concept of pulse height, the operation of a pulse height analyzer, and the analysis of a spectrum obtained from such an instrument are demonstrated. The lecturer closes with a brief mention of semi-conductor (solid state) radiation detectors.

MAN AND RADIATION

28½ minutes, color (1963). Produced for the AEC by the Army Pictorial Center. Recommended for grades 7 through 12.

This film discusses a wide spectrum of the uses and applications of radiation in medicine, industry, agriculture, power production, and

research. After an animated sequence in which the origin of radiation is explained, complete with an historical presentation of its discovery, the film presents another animated sequence on the kinds and types of radiation. Radioisotope production techniques are explained and live action is used to demonstrate the location of a bone cancer by means of the calcium-45 isotope. Biological applications of radiation are presented in a sequence on the work of photosynthesis using radiochromatography, and industrial applications in the fields of food preservation and polymerization of wood-plastic alloy samples.

MAN AND THE ATOM

59 minutes, color (1965). **Produced by National Educational Television, Inc., with the technical assistance of the AEC. Recommended for all age levels.**

This film presents an overall picture of the AEC and its programs. An atomic power plant is shown in operation at Buchanan, New York, and candid conversations and interviews are presented with some of the people of the town concerning their feelings about the power plant. Overall, it is shown that the plant has caused very little, if any, interruption in the people's daily routines. There follows a short lecture of how the plant works. The film then presents some of the applications of atomic energy to the national defense. Also shown are prospecting, mining, and milling techniques in the production of uranium; peaceful applications of nuclear explosives in Project Sedan and Project Gnome; production of radioisotopes and their application in medicine to the study of Parkinson's disease; and agricultural benefits, such as sterilization by irradiation of the screw worm fly, which was a menace in the southeastern United States. Applications of the atom to food preservation, automated weather stations, and satellites are also presented.

Suggested reading: ***Nuclear Reactors***

Applications of Atomic Energy

INTRODUCING ATOMS AND NUCLEAR ENERGY

11 minutes, color (1963).* Produced by Coronet Instructional Films. Recommended through grade 9.

This film describes atomic structure, using models containing protons, neutrons, and electrons orbiting about the nucleus, and the origin of nuclear energy in the nucleus of unstable atoms, which may either lose or gain particles. As an example, radium decomposes (decays) to lead. Two of the ways to determine if decay is going on are shown: photographic film and the Geiger counter. The concepts of nuclear fission and chain reactions are introduced with models to illustrate the fission process. Nuclear reactors and the production of electricity are illustrated. The film ends with a discussion of fusion reactions on the sun and potential future uses of nuclear energy.

Suggested reading: ***The Microstructure of Matter***

BASIC PRINCIPLES OF POWER REACTORS

8½ minutes, color (1962). Produced for the AEC by the U. S. Air Force. Recommended for grades 7 through 12.

This animated film, produced to facilitate the understanding of nuclear-power reactors and how they produce steam for the generation of electricity, briefly describes fission, controlled chain reaction, and the function of basic reactor components (e.g., core, reactor vessel, shielding, moderators, coolants, and control rods). The boiling-water and pressurized-water reactor concepts are explained. Various types of fuel elements are described, such as rods, plates, and pellets.

Suggested reading: ***Nuclear Power Plants***

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*Not Cleared for Television Use.

CONTROLLING ATOMIC ENERGY

13½ minutes, color (1961).* Produced by United World Films. Recommended for grades 7 through 9.

This basic teaching film, based on a conversation between a science author and a young student, discusses radioactive atoms and what they are, detection and safety apparatus that is used in the safe handling of radioactivity, nuclear fission and chain reactions and the control of these reactions in nuclear reactors, production of electricity and propulsion from reactor fission, and the production of radioisotopes from reactors. The film ends with a discussion of the applications of nuclear energy in areas such as diagnosis and treatment of disease, food sterilization, biological applications, industrial uses, and production control.

Suggested reading: ***Research Reactors***

ATOMIC ENERGY FOR SPACE

17 minutes, color (1966).* Produced by the Handel Film Corporation with the cooperation of the AEC and the National Aeronautics and Space Administration. Recommended for grades 7 through 12.

The film explains why only atomic energy can satisfy some of the future power needs for exploration of deep space. Nuclear energy for space is being developed through two basic applications: nuclear rockets for space propulsion and isotopic or reactor power plants which can produce the electricity essential for spacecraft operations. It is explained that the nuclear rocket being developed jointly by the AEC and NASA under the Rover program will be essential for manned flights to the planets and beyond and will use a nuclear reactor, or "atomic furnace," to heat, vaporize, and expand liquid hydrogen and expel it from a nozzle to produce thrust. The film then turns to the SNAP (Systems for Nuclear Auxiliary Power) devices that supply electricity for all the various housekeeping and operational sub-systems of spacecraft and satellites (radio, TV, transmitters, computers, etc.). There are two types: isotopic generators (atomic

*Not Cleared for Television Use.

batteries) and the nuclear power reactor. The film shows the first isotopic space generator which went into orbit in a satellite in 1961. By animation, it is illustrated how the decay of radioisotopic materials produces heat which is converted directly to electricity by thermocouples.

Suggested readings: *Nuclear Propulsion for Space, SNAP—Nuclear Space Reactors,* and *Direct Conversion of Energy*

ATOMS FOR SPACE

28½ minutes, color (1962). Produced by Atomics International and the Martin Company for the AEC. Recommended for all age groups from junior high school up.

This film describes the development of SNAP (Systems for Nuclear Auxiliary Power) compact nuclear power sources for use on land, in the sea, and in space. Animation is used to describe the two basic designs of SNAP systems. In one, the heat generated when a radiation particle is emitted from a radioisotope is turned directly into electrical energy by means of thermocouples. These systems, known as isotopic generators, have no moving parts, so they are relatively maintenance-free. In the second design, heat from a compact nuclear fission reactor is used to generate electricity by means of a turbo-generator system. An explanation of the SNAP-4A (transit) satellite is given and how it will enable ships and aircraft to fix their positions within 0.1 mile.

Suggested readings: *SNAP—Nuclear Space Reactors* **and** *Direct Energy Conversion*

NUCLEAR REACTORS FOR SPACE

17 minutes, color (1961). Produced by Atomics International for the AEC. Recommended for grades 7 through college.

The SNAP (Systems for Nuclear Auxiliary Power) program to develop nuclear sources for electrical power generation in satellites and space vehicles is the subject of this film. The fabrication, testing, transport, installation, launching, and space use of the SNAP reactor

are described. Film sequences show the safety features that are built into the SNAP systems, including re-entry burn-up, and the various applications of SNAP in the space program are illustrated.

Suggested readings: ***SNAP—Nuclear Space Reactors*** **and** ***Direct Energy Conversion***

RADIATION IN BIOLOGY: AN INTRODUCTION

$13\frac{1}{2}$ minutes, color (1962).* Produced by Coronet Instructional Films. Recommended for grades 7 through college.

Dealing with radiation effects on living systems and the uses of radioisotopes in biology, this film reviews the different forms that radiation may take and demonstrates effects on plant growth, mutations produced by radiation damage, and effects of radiation on cells (bone marrow), intestinal villi, and chromosomes. Autoradiography is introduced and shown in detail along with other aspects of radioisotope use in the study of biology and biological systems.

Suggested reading: ***Your Body and Radiation***

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*Not Cleared for Television Use.

PHYSICS CURRICULUM
Radiation and Its Detection

RADIATION AND MATTER

(See page 12)

NUCLEAR REACTIONS

(See page 12)

PROPERTIES OF RADIATION

("Understanding the Atom" series)

30 minutes, black and white (1962). Produced by the Educational Broadcasting Corporation, New York City, under the direction of the AEC. Recommended for high school through beginning college.

This film describes the general concept of radioactive decay and develops the ideas of rates of decay and half-life for a radioactive entity. Statistical concepts are introduced and the basic notion of standard deviation is explained. The energy spectra of alpha and beta emitters and the concept of absorption methods to determine the maximum beta energy are discussed. The film ends with a discussion of self absorption, specific activity, and backscatter of radiation.

Suggested reading: ***The Microstructure of Matter***

RADIATION DETECTION BY IONIZATION

(See page 13)

RADIATION DETECTION BY SCINTILLATION

(See page 13)

THE ATOM IN PHYSICAL SCIENCE

26 minutes, black and white (1964). Produced by the Educational Broadcasting Corporation, New York City, under the direction of the AEC and the Oak Ridge Institute of Nuclear Studies. Recommended for high school level.

This film is a lecture by Glenn T. Seaborg, chairman of the Atomic Energy Commission and discoverer of plutonium, devoted almost entirely to the discovery and development of the transuranium elements, that is, all of the man-made elements beyond uranium on the periodic chart. Along with the discovery of these elements, Dr. Seaborg discusses the electronic equipment needed for the detection of the minute quantities of transuranium elements that were produced. He also introduces work being done with nuclear energy. The use of laboratory techniques such as isotope dilution and the use of carbon-14 in age determinations of archeological samples are presented. Dr. Seaborg closes by emphasizing the importance of good science training in the schools and the pressing need for more and better trained scientists for the future.

Suggested reading: *Synthetic Transuranium Elements*

Nuclear Physics

MAN AND RADIATION

(See page 13)

ATOMIC FURNACES ("Challenge" series)

29 minutes, black and white (1962). Produced for the National Educational Television and Radio Center, under a grant from AEC's Argonne National Laboratory. Recommended for high school level.

This film discusses the different types of nuclear reactors that have been developed, their operating principles, and scientific application. Among the reactors shown are the CP-1, which was the first

reactor built by Fermi and others beneath Stagg Field in Chicago, Hanford breeder reactors, Brookhaven research reactor, the water boiler reactor, and others. Types of research that reactors and associated equipment make possible are shown at length. The gamma-ray spectrometer, the neutron chopper, and new reactor designs are also discussed, along with the safety features that are built into each reactor.

Suggested reading: ***Research Reactors***

ATOMIC ENERGY FOR SPACE

(See page 16)

High Energy Physics

ATOM SMASHERS

12½ minutes, black and white (1954).* Produced by the Handel Film Corporation. Recommended for grades 9 through college.

This film deals with the sub-atomic particles produced when atoms are "smashed" and with the machines used to produce these nuclear reactions. Through animation, the film illustrates the atomic structure of matter and the basic principles involved in the operation of atom smashers. The film then switches to live action and shows the different types of atom smashers available at the present time, including the first four-inch cyclotron, the six billion volt Bevatron, the Cosmotron, and the 200 billion volt synchrotron now under construction. The film ends with the explanation that atom smashers are purely for research and that the immediate research is being pursued to discover what the "atomic glue" is that holds the nucleus together.

Suggested readings: ***Accelerators*** **and** ***The Microstructure of Matter***

*Not Cleared for Television Use.

THE WORLDS WITHIN

29 minutes, color (1963). Produced for the AEC by Stanford University. Recommended for grades 9 through college.

This nontechnical film describes the design, construction, and use of SLAC, the Stanford Linear Accelerator. A comparison is made of the various methods man uses to "see" particles of smaller and smaller dimensions—using the magnifying glass, the microscope, the electron microscope, and the electron linear accelerator. Scientists and engineers involved with SLAC discuss the theory of its operation and problems related to building and operating this huge instrument to explore the structure of the atom and discover new particles. The fabrication of the two-mile long copper tube, with a bore only one inch in diameter, through which atomic particles are fired is shown and explained in detail. The high power radio tubes called klystrons, used to project electrons down the tube at tremendous velocities, are shown being fabricated, set into the accelerator, and tested. Plans for and construction of the housing for SLAC are shown and discussed from both the architectural and safety standpoints.

Suggested reading: ***Accelerators***

THE MAGNETIC BOTTLE

10 minutes, color (1958). Produced by the U. S. Information Agency. Recommended for grades 10 through college.

This summary of one of the United States Sherwood programs describes experiments to harness the nuclear fusion reaction. Animation is used to show that the heats generated during the fusion process are so intense that they would melt any known container. As a result, scientists have to experiment with magnetic fields as a means to contain the hot plasma and keep it away from the walls of the container. Some of the techniques used to produce the fusion reaction are the compression method, pinch method, and ion ring method, all of which are explained in detail.

Suggested reading: ***Controlled Nuclear Fusion***

THE HIGH ENERGY PEOPLE

$5\frac{1}{4}$ minutes, color (1963). Produced by AEC's Argonne National Laboratory. Recommended for grades 10 through college.

This film offers a brief glimpse at the problems and tools of high energy physics. Shown in the film is the ZGS (Zero Gradient Synchrotron). Scientists who work with this machine describe the various aspects of the work that they do. After the ZGS, the film introduces the spark chamber, used to see the different particles as they pass through the chamber. Photographs of particles as they pass through bubble chambers are shown and explained.

Suggested reading: ***The Microstructure of Matter*** **and** ***Accelerators***

EXPLORING THE ATOMIC NUCLEUS

$13\frac{1}{2}$ minutes, color (1969).* Produced by Coronet Films. Recommended for grades 9 through college.

This film describes particle accelerators, the basic tools which high energy physics uses to explore the atomic nucleus, and brings up to date the new discoveries made by physicists concerning nuclear structure. Shown also are the instruments used, the data collected, and how these data are analyzed. In massive accelerators, particles are accelerated to almost the speed of light and then allowed to bombard the nuclei of various elements. From the collisions, new particles are created which are detected by the use of scintillation counters, Čerenkov counters, and bubble chambers. As scientists study these data, they constantly modify their ideas as to what the atomic nucleus is like and thus learn more about matter itself.

Suggested readings: ***The Microstructure of Matter*** **and** ***Accelerators***

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*Not Cleared for Television Use.

SUPERCONDUCTING MAGNETS

12½ minutes, color (1967). Produced by AEC's Argonne National Laboratory. Recommended for grades 10 through college.

This film is an introduction to the subject of superconducting magnets, which were discovered by the Dutch physicist, Kammerlingh Onnes, in 1911. Commercial materials for such magnets were not available, however, until 1961. The film discusses factors involved in the development of these super magnets and illustrates techniques which make it possible to produce completely stable magnets of very large size. Included are descriptions of the basic design, fabrication, and testing of Argonne National Laboratory's 67,000 gauss superconducting magnet.

Suggested reading: ***Cryogenics—The Uncommon Cold***

Radiation Safety

RADIATION SAFETY IN NUCLEAR ENERGY EXPLORATIONS

24 minutes, color (1962). Produced by the U. S. Public Health Service, in cooperation with the AEC. Recommended for high school and college levels.

This non-technical film describes the safety activities of the United States Public Health Service Division of Radiological Health. Various uses of atomic energy are presented along with the safety evaluations of different uses: nuclear explosives, aerospace, and seismic research in the detection of underground nuclear tests. The film stresses that, in each of these experiments, health physicists are present to monitor the amounts of contamination, if any, that have been produced. Samples of soil, air, water, milk, food samples, and other things are analyzed for any trace amounts of contamination.

RADIATION IN PERSPECTIVE

43 minutes, color (1963). Produced by the AEC. Recommended for grades 12 through college.

The film, a lecture by AEC Safety Engineer Francis L. Brannigan, presents the salient points of an approach to understanding the radiation problem. Since it is basic to the acceptance of any hazard that we expect to get some benefit from it, the lecture-film briefly summarizes some of the beneficial uses of radioactive materials—in medicine, agriculture, industry, systems for nuclear auxiliary power, food sterilization—that justify acceptance of the hazard. The lecturer then explains briefly the internal radiation problem and in detail the external radiation problem. Information is given on ionization, background levels of radiation, the roentgen, the various radiation levels required to produce immediate injury, and low-level radiation exposures over long periods of time. The lecturer points out that the question is not radiation versus no radiation, but rather how much more radiation exposure people can accept consistent with the other hazards of our environment—all balanced against the tremendous industrial, medical, and research benefits of the nuclear age.

Suggested reading: ***Atoms, Nature, and Man***

CHEMISTRY CURRICULUM

Introductory Concepts

ALPHA, BETA, AND GAMMA

(See page 11)

RADIATION AND MATTER

(See page 12)

RADIATION DETECTION BY IONIZATION

(See page 13)

RADIATION DETECTION BY SCINTILLATION

(See page 13)

NUCLEAR REACTIONS

(See page 12)

RADIOISOTOPE APPLICATIONS IN INDUSTRY

26½ minutes, black and white (1964). Produced by the Educational Broadcasting Corporation, New York City, under the direction of the AEC. Recommended for high school through college.

This film discusses uses of radioisotopes in industry. The late Paul C. Aebersold, former director, AEC Division of Isotope Development, is guest lecturer. Using radioisotope sources, Dr. Aebersold demonstrates the varying penetration powers of their radiations, the amounts of differing materials needed to stop the radiation, and the

detection techniques used. Among the industrial uses of radioisotopes introduced by Dr. Aebersold are quality control of products, measurement of fat contents in baby food, determination of the density of a roadbed under construction, flow meter measurements in a petroleum refinery, use of the autoradiography technique to detect flaws in welds in pipelines, and numerous other examples.

Suggested reading: *Radioisotopes In Industry*

Chemical Techniques and Procedures

INVISIBLE BULLETS

29 minutes, black and white (1962). Produced for the National Educational Television and Radio Center, under a grant from AEC's Argonne National Laboratory. Recommended for grades 7 through 12.

This film presents basic knowledge about radiation and methods for its detection. The meaning of radiation, its natural sources, the various forms it takes, how man may shield himself from it, and its use in research are shown. Differences between alpha and beta particles and between gamma- and x-rays are described. The film stresses that nuclear energy affects every part of our daily lives and that it is a very useful tool with which to work.

Suggested readings: ***Natural Radiation Environment*** **and**
The Microstructure of Matter

THE ART OF SEPARATION

29 minutes, black and white (1962). Produced for the National Educational Television and Radio Center, under a grant from AEC's Argonne National Laboratory. Recommended for grades 7 through 12.

This film, a tour of the Chemical Separations Laboratory at Argonne National Laboratory, explains in detail how different chromatographic methods are used to separate different chemical compounds. Also shown are various chromatographs, including one of powdered

sugar, and electro-chromatographs. Spectrophotometers are also shown and an explanation is given of how the instrument is used to determine the purity of the separated chromatographic constituents.

Suggested reading: ***Spectroscopy***

THE ALCHEMISTS' DREAM

29 minutes, black and white (1965). Produced for the National Educational Television and Radio Center, under a grant from AEC's Argonne National Laboratory. Recommended for grades 7 through 12.

This film is a tour of Argonne National Laboratory's Chemistry Division, where transmutation of metals, the dream of the alchemists in the Middle Ages, takes place. Shown is the production of a very small amount of the element berkelium from curium through bombardment by deuterons and its subsequent separation from curium behind the thick walls of a newly-constructed hot laboratory for research with man-made elements.

Suggested reading: ***Synthetic Transuranium Elements***

A CHEMICAL SOMERSAULT

29 minutes, black and white (1965). Produced for the National Educational Television and Radio Center, under a grant from AEC's Argonne National Laboratory. Recommended for grades 11 through college.

This film is the story of a new discovery made at Argonne National Laboratory in August 1962. A long-held scientific "axiom," that inert gases do not form any type of chemical compound, was found to be in error. Argonne scientists disproved this idea by making a number of fluoride compounds with xenon. Instruments and techniques involved in determining the structure of these fluoride compounds are shown. Three methods introduced for analyzing the chemical properties of the inert gas compounds are: time-of-flight mass spectrometer, tracer techniques coupled with chromatography, and nuclear magnetic resonance.

Suggested reading: ***The Chemistry of the Noble Gases***

Applications of Atomic Energy

PRINCIPLES OF THERMAL, FAST, AND BREEDER REACTORS

9 minutes, color (1963). Produced by AEC's Argonne National Laboratory. Recommended for grades 10 through 12.

Animation is used to explain the nuclear fission process, the sustaining of a chain reaction, and the concept of a critical mass. The parts of the reactor are introduced, including core, moderator, and reflector. The fast reactor is defined and film clips of the fast reactor at the Argonne National Laboratory are shown. The thermal reactor is also described and the use of moderators and control rods. Through animation the breeder reactor concept is illustrated and its production of plutonium-239 and thorium-232.

Suggested reading: ***Nuclear Reactors***

RETURN TO BIKINI

23½ minutes, color (1966). Produced for the AEC by the University of Washington. Recommended especially for grades 7 through 12.

This film deals with the return of scientists to the three Marshall Islands in the South Pacific to continue their observation of island ecology and the consequences of bomb tests conducted there in the past. Scientists collect samples to answer such questions as: What has happened to the biological processes after the tests? and What kind and how much radiation remains? On landing, the scientists discover that external radiation has been reduced to a level permissible for human habitation. They also find that lush vegetation has replaced the once-scorched earth and sand. Samples are again taken for careful analysis of radiation effects or damage. The only unsafe inhabitant is found to be the coconut crab, which absorbs strontium-90 while building its shell. Rats (the 25th generation) show no external or internal abnormalities due to radiation.

Suggested reading: ***Atoms, Nature, and Man***

BASIC PRINCIPLES OF POWER REACTORS

(See page 15)

ATOMIC POWER PRODUCTION

14 minutes, color (1964).* Produced by the Handel Film Corporation. Recommended for grades 7 through 12.

Opening with an explanation of the growing demand for electrical power, produced today primarily through hydro-electric means and the burning of fossil fuels (coal, gas, and oil), the film tells of the need for harnessing nuclear energy. With animation, an explanation is given of how the heat created by the controlled chain reaction of atomic fuel in a reactor is converted to electrical power. Several types of power reactors and their basic differences are discussed: the boiling water reactor, the pressurized water reactor, one using a liquid sodium coolant, and one using an organic coolant. The principle of the "breeder" reactor is explained and its importance stressed. The film also discusses the care and safety of design, construction, maintenance, and operation of atomic power plants.

Suggested reading: ***Nuclear Power Production***

PROJECT GNOME

29 minutes, color (1963). Produced by AEC's Lawrence Radiation Laboratory. Recommended for grades 7 through 12.

This film covers Project Gnome, a part of the Plowshare Program to develop nuclear explosives for peaceful purposes. Under the direction of the Lawrence Radiation Laboratory, Project Gnome involved the detonation of a three kiloton nuclear device in a man-made chamber in a salt bed some 1200 feet below the surface. The film stresses safety precautions and criteria for selecting a site. The force of the explosion created a large underground cavern which measured 170 feet across and

*Not Cleared for Television Use.

almost 90 feet high. Animation is used to show the step by step procedures which were used to obtain data on five major objectives of the test: (1) to determine physical effects of underground detonations in a salt medium; (2) to explore the feasibility of converting energy produced into electricity; (3) to make neutron cross-section measurements which would contribute to scientific knowledge; (4) to provide information on design of nuclear explosives for peaceful purposes; and, (5) to investigate the practicability of recovering useful radioisotopes.

Suggested reading: ***Plowshare***

PROJECT SEDAN

8 minutes, color (1962). Produced by AEC's Lawrence Radiation Laboratory. Recommended for grades 7 through 12.

Project Sedan was one of the nuclear explosions in the Plowshare Program, designed to determine the usefulness of nuclear explosives in excavation, mining, production of isotopes, and power production. Sedan was used to determine the cratering effects of nuclear explosions. To produce maximum crater size and the least amount of activity release to the atmosphere, it was determined that the 100 kiloton explosive should be placed at a depth of 635 feet in the desert alluvium. Site of the experiment was the Nevada test site facility. The detonation, which produced a crater measuring 1200 feet in diameter and 320 feet deep, is shown at different angles, using regular and slow motion films. It was concluded from Sedan that excavation using nuclear explosives was indeed possible and that off-site contamination due to the explosion was negligible.

Suggested reading: ***Plowshare***

Space Technology

ATOMIC ENERGY FOR SPACE

(See page 16)

POWER FOR PROPULSION

15 minutes, color (1965). Produced by the Aerojet-General Corporation. Recommended for grades 7 through college.

This film traces the history of power sources for propulsion from Watts' tea kettle to atomic rocket engines. The major advances are presented: Goddard's 1926 liquid propelled rocket, German V-2's, U. S. rockets, and the Soviet Sputnik (1957), followed by the first astronauts and then nuclear powered ships. Goddard's discovery and Fermi's atomic pile are discussed, showing the inevitable combination of the two into one massive propulsion system. Animated sequences demonstrate principles of rocketry, Newton's law of motion, and the operation of nuclear rocket engines. Development of NERVA (Nuclear Engine for Rocket Vehicle Application) is shown, including its test firing at AEC-NASA Nuclear Rocket Development Station, Jackass Flats, Nevada. The advantages of nuclear rocket propulsion are presented and their future application for deep space exploration.

Suggested reading: ***Nuclear Propulsion For Space***

BIOLOGY

Introductory Concepts

ALPHA, BETA, AND GAMMA

(See page 11)

INVISIBLE BULLETS

(See page 12)

RADIATION AND THE POPULATION

29 minutes, black and white (1962). Produced for the National Educational Television and Radio Center, under a grant from AEC's Argonne National Laboratory. Recommended for grades 10 through 12.

This film discusses the role of radiation in genetic damage studies. How does radiation damage cells and what are the long-term effects of such damage? These questions are discussed in the film, which explains how radiation causes mutations and how these mutations are passed on to succeeding generations. The effects of induced mutations are shown in work with successive generations of mice and fruit flies. Fallout and its effects are also discussed.

Suggested reading: ***Genetic Effects of Radiation***

MAN AND RADIATION

(See page 13)

RADIATION IN BIOLOGY: AN INTRODUCTION

(See page 18)

Biological Applications of Atomic Energy

THE ATOM AND BIOLOGICAL SCIENCE

12 minutes, black and white (1953).* Produced by Encyclopaedia Britannica Films. Recommended for grades 10 through college.

The science of radiation biology primarily concerns effects of alpha, beta, gamma, and neutron radiations on living matter. Gamma radiation is extremely useful in the study of living things. Irradiation is shown to reduce the number of their cell divisions in paramecia and to break the chromosomes and affect the genetic characteristic of plants; however, a new fungus-resisting strain of corn plants was produced as a result of the study. Biologists also are using radioactivity in tracer studies to determine the photosynthetic process in plants, in studies of sugar and iron uptake, and in cancer research. The film ends with an example of the measures taken to protect the investigating scientists.

Suggested reading: ***Radioisotopes and Life Processes***

RADIOISOTOPE APPLICATIONS IN MEDICINE

26 minutes, black and white (1964). Produced by the Educational Broadcasting Corporation, New York City, under the joint direction of the AEC and the Oak Ridge Institute of Nuclear Studies.

This filmed lecture by John A. D. Cooper, dean of sciences, Northwestern University, traces the development of radioisotope usage from the early work by Hevesy to the present, demonstrating in particular how radioisotopes have been used in medical research. Applications include studies of vitamin uptake in the body, establishment of the function of different organs of the body, determination of over- or under-active thyroid glands, discovery and localization of brain

*Not cleared for television use.

tumors, measurement of fluid capacities of organs of the body, and measurement of plasma volumes, which is extremely helpful to doctors who are determining the loss of blood due to a surgical operation or hemorrhage. Instruments for radiation detection, such as the pin-hole scintillation camera, are shown and demonstrated.

Suggested reading: *Radioisotopes In Medicine*

RADIOISOTOPE SCANNING IN MEDICINE

16 minutes, color (1965).* Produced by the Handel Film Corporation with the cooperation of the AEC and the Laboratory of Nuclear Medicine and Radiation Biology, UCLA. Recommended for grades 10 through college.

Development of scanning equipment in combination with new radioactive drugs has produced important advances in medical diagnosis. Radioactive tracers give off signals that can be converted into an image. Administered to patients, these radioactive materials, in effect, make pictures revealing valuable information about the size, shape, position, and functioning of lungs, thyroid glands, bones, liver, kidneys, heart, spleen, and brain. The signals emitted from the organ-selective atomic tracers are registered by a scintillation detector, which moves over the test area on the patient. The film explains the methods of organ scanning, and gives examples: thyroid and lung scanning with radioactive iodine. Scans are also shown of the chest, brain, liver, and kidneys. Visualization of the malfunctioning of human organs is produced in black and white or in color on paper and/or on photographic film. The radiation detection and printout devices are described.

Suggested reading: *Radioisotopes In Medicine*

RETURN TO BIKINI

(See page 29)

*Not cleared for television use.

TRACING LIVING CELLS

29 minutes, black and white (1962). Produced for the National Educational Television and Radio Center, under a grant from AEC's Argonne National Laboratory. Recommended for grades 9 through 12.

The use of radioactive isotopes in the study of cell division and in medical therapy has helped man to understand and combat disease. This film demonstrates some of the many helpful contributions of atomic energy, including use of radioactive tracers in blood and cancer research.

Suggested reading: ***Radioisotopes and Life Processes***

THE IMMUNE RESPONSE

29 minutes, black and white (1962). Produced for the National Educational Television and Radio Center, under a grant from AEC's Argonne National Laboratory. Recommended for grades 7 through college.

The mechanism of the immune response, that is, the formation of antibodies in mammals and how these antibody formations are affected by radiation exposure, is the subject of this film describing experiments with rabbits. Procedures are shown in detail, ending with a review of the antibody experiment showing that radiation does, indeed, slow down the rate of the immune response to foreign invaders in the body. A short discussion of future goals ends the presentation.

Suggested reading: ***Animals In Atomic Research***

THE RIDDLE OF PHOTOSYNTHESIS

14½ minutes, color (1965).* Produced by the Handel Film Corporation. Recommended for grades 9 through 12.

This non-technical film describes the role of photosynthesis in food production. For years, scientists have been trying to solve the question of how a plant takes light energy from the sun and carbon dioxide from the air and produces food. With the help of radioactive carbon-14 labeling techniques, scientists have begun to solve the riddle of photosynthesis. Shown is one experiment conducted to determine the photosynthetic process, along with the techniques involved in the detection of the tracer material. The film closes with a discussion of future plans of artificial food production to feed the hungry millions.

MOLECULAR BIOLOGY: AN INTRODUCTION

15 minutes, color (1969). Produced by AEC's Argonne National Laboratory. Recommended for grades 9 through college.

The new science of molecular biology has emerged to dominate the life sciences and open up new frontiers in biophysics and biochemical research. This exploration into the molecular and atomic levels of the cell has been made possible by new and more refined research tools and techniques: improved resolution of the electron microscope, isolation of cell parts by ultracentrifugation, separation capabilities of chromatography, localization of autoradiography, and the sensitivity of liquid scintillation counting. Past achievements using these tools strengthen the belief that an integrated understanding of the function and structure of the cell can be achieved. Used with radio-tracers, the new tools promise to contribute information basic to understanding the causes and cures of cancer and other diseases.

Suggested reading: *Radioisotopes and Life Processes*

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ALPHABETICAL INDEX OF CLASSROOM FILM TITLES

UNDERSTANDING THE ATOM

A Series of Educational Booklets Issued by the U. S. Atomic Energy Commission Division of Technical Information

General Interest and General Science

005 ATOMS AT THE SCIENCE FAIR. A practical exhibit guide, with ideas for nuclear projects. (E)

029 CAREERS IN ATOMIC ENERGY. Career opportunities for young people. (E)

014 THE CREATIVE SCIENTIST, HIS TRAINING AND HIS ROLE. An address by Dr. Glenn T. Seaborg, Chairman of the USAEC. (E)

163 NUCLEAR POWER AND MERCHANT SHIPPING. Describes the first nuclear powered merchant ship, the N. S. *Savannah*. (E)

110 NUCLEAR TERMS, A BRIEF GLOSSARY. Four hundred terms defined. (A)

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133 THE USAEC, WHAT IT IS AND WHAT IT DOES. The Atomic Energy Commission's organization and functions. (Many photos) (E)

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075 **THE CHEMISTRY OF THE NOBLE GASES.** Research that led to the startling ability of these six gases to form compounds. (A)

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077 **PLUTONIUM.** A man-made element with unusual properties. (A)

078 **RARE EARTHS, THE FRATERNAL FIFTEEN.** A fascinating family of chemical elements. (A)

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061 **SOURCES OF NUCLEAR FUEL.** Uranium mining, milling, and refining. (A)

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055 **RADIOACTIVE WASTES.** Disposal methods for wastes generated in the nuclear industry. (A)

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057 **ANIMALS IN ATOMIC RESEARCH.** Fascinating animals and how they help scientists. (E)

056 **THE ATOM AND THE OCEAN.** Nuclear energy applications in the oceans of the world. (E)

183 **ATOMIC POWER SAFETY.** The measures that make nuclear-electric power plants safe. (E)

192 **ATOMS IN AGRICULTURE.** To help develop new plants, wipe out insects and improve fertilization. (E)

058 **ATOMS, NATURE, AND MAN.** How man-made radiation affects natural environments, such as the Pacific testing areas. (A)

008 **FALLOUT FROM NUCLEAR TESTS.** Radioactive debris from atomic testing, its pathways to man, and its significance. (A)

189 **FOOD PRESERVATION BY IRRADIATION.** Use of radiation to preserve foodstuffs for an extended period without refrigeration. (A)

188 **GENETIC EFFECTS OF RADIATION.** The facts about radiation effects that can be transferred from parent to offspring. (A)

067 **NATURAL RADIATION ENVIRONMENT.** Cosmic and other radiation occurring naturally on earth. (A)

191 **RADIOISOTOPES AND LIFE PROCESSES.** How scientists use radioisotopic tracers in studying DNA, RNA, and proteins, and other biological research. (A)

112 **WHOLE BODY COUNTERS.** Ingenious instruments measure the radiation produced by our bodies. (A)

176 **YOUR BODY AND RADIATION** What happens when ionizing radiation meets living tissues, and the scientific information to explain these effects. (A)

193 **RADIOISOTOPES IN MEDICINE.** Radioisotopes in use for treatment and diagnosis of disease. (A)

Reading Levels: (E) Easy, (A) Advanced

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