NUCLEAR SCIENCE IN ENGINEERING EDUCATION
A Selected List of References for Instructors
First Revision

Compiled by
Simone B. Schwind

September 1952
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INTRODUCTION

This revised version of TID-3011 contains pertinent entries from the first version as well as new references selected from the considerable bulk of material of interest to engineers which has appeared recently. Some entries from the original version were not included in the present one, either because more up-to-date material covering the topic was located, or because the documents were no longer available.

The bibliography covers reports of the U. S. Atomic Energy Commission and its contractors, the journal literature, textbooks, and reference books. Additional references may be found by consulting the current issues of Nuclear Science Abstracts. This semimonthly journal, prepared by the Atomic Energy Commission, covers reports and journal literature. In addition, each issue carries a summary of new nuclear data, which is prepared in collaboration with the National Bureau of Standards, and keeps up-to-date the data contained in NBS Circular 499 and its supplements. Quarterly cumulations appear in the Index Issues of NSA.

The references in the bibliography are listed by title under the headings listed below. When a reference covers one or more subjects it is listed only once, either under General or under the major subject. An author index and a report number index are found at the end of the listings.

Published reports should be sought in the journals or books cited in the references. The code numbers of such reports are given for information only; they do not indicate availability from the AEC.

The non-published reports are available at the AEC depository libraries. A list of these libraries is found following the indexes.

When a price is given at the end of a reference, that report may be purchased from the Office of Technical Services
Department of Commerce
Washington 25, D. C.
REFERENCES

GENERAL PAPERS

Descriptions and illustrations of the use of radioisotopes in the field of research, biology, medicine, agriculture and industry. Brief chapters on nuclear physics and nuclear reactors, preparation and distribution of radioisotopes, legal aspects of atomic energy, and difficulties of international control are included.

A detailed description.

Problems of reactor technology and what the British are doing about them.

Report of the first conference held to investigate the possibilities of finding commercial use for fission products.

5 DESIGN AND CONSTRUCTION OF RADIOCHEMICAL LABORATORIES; A SELECTED LIST OF UNCLASSIFIED REFERENCES. Technical Information Service, AEC. Oct. 1, 1951. 5p. (TID-3013) $0.10
A selective bibliography containing 83 references to reports and journal articles, with brief annotations.

Reasons for the lack of participation by industry in the development of atomic energy are discussed.

7 ENGINEERING IN THE ATOMIC AGE. W. E. Kelley. Nucleonics 7, 5-8(1950) July
Stresses the need for engineers with thorough grounding in their own field rather than for nuclear engineering specialists, and for closer collaboration between engineers and scientists.

Attention is called to the various factors and requisites which should be considered in the application of isotopes to industrial fields.

The factors which help determine the over-all size of the program, future expansion, and problems of materials, power and men are discussed.

The use of atomic energy for production of heat and electrical power, the use of atomic radiation and atomic heat to induce chemical and physical changes, applications of results of researches in atomic science to other fields, and the application of radioactive isotopes for tracing atoms and other unique purposes are discussed. Present uses of radioisotopes in medicine, agriculture, the basic sciences, and industry are summarized.

A discussion of atomic bombs in terms of engineering, mathematics, and physics.

A collection of papers given at a conference sponsored jointly by the Atomic Energy Commission and New York University’s Division of General Education. Technological problems and dangers peculiar to the development of atomic power, exclusive of nuclear reactors, are discussed.

Technical, engineering, and economic considerations are covered, and a variety of possible industrial uses for fission products are discussed.

14 INDUSTRY'S ROLE IN ATOMIC ENERGY. Nucleonics 10, 93-108(1952) June
Details of the impact of the atomic energy program on industry.

A discussion of some aspects of the present and future role of industry and business in the atomic energy program.

Discussion of properties and production of isotopes; radioisotope measurement; facilities and safety precautions; basis for isotope application; illustrations of applications of radioisotopes and stable isotopes.
Laboratory layout and construction, shielding, surfaces and finishes, air supply and exhaust, and waste disposal are discussed. Illustrated. Also contains a bibliography and glossary of nuclear terms.

Samples up to 100 curies, 1 Mev gamma can be handled with safety, and a wide variety of physical-property measurements can be made by remote control. The master-slave manipulator is briefly described and illustrated, and the new transparent shielding windows are discussed.

A commentary on the development of the graduate course, with course outline.

An educator’s judgment on the future demands nuclear technology will make on scientific personnel and how the engineering school can best prepare its students to meet them.

The American program for development of atomic energy is reviewed; the organization and functions of the AEC and its contractors are outlined; personnel requirements, opportunities, and average salaries are listed.

PHYSICS IN THE ATOMIC ENERGY PROGRAM; T. H. Johnson. Division of Research, AEC. Dec. 27, 1951. 13p. (WASH-72)
The role of physicists in the Atomic Energy programs, the setup of the Commission’s research program including the National Laboratories and research project in university and industrial laboratories, and the criteria for effective administration of research contracts are discussed.

A brief but authoritative discussion of the problems involved in setting up an isotope program. Several sources of reliable information on the safe handling and use of radiomaterial, relative costs of the major items required in a radioisotope laboratory, an outline of the waste disposal problem, and examples of some of the cooperative programs in this field are given. The essentiality of adequate preliminary training is stressed.

Discusses problems in the design of installations; describes structures in use at ORNL; and some of the latest designs suggested for new process development facilities.

A general review of the development of nuclear energy.

The following topics are discussed: problems of reactor development, with U235 and plutonium as fuels, and analogies to a coal-fired boiler; the reactor development program with reference to four types of reactors for (1) materials testing, (2) use in propelling naval vessels, (3) breeding, and (4) electric power; industrial effects of atomic power, relating the discussion to present costs and uses of electric power; and atomic power and the coal industry.

Laboratory equipment and facilities for the medium-sized organization of Technical Development Services, Savannah, Ga., are described.

RADIOISOTOPE APPLICATIONS OF INDUSTRIAL SIGNIFICANCE; AS LISTED IN “ISO TOPE A FIVE-YEAR SUMMARY OF U. S. DISTRIBUTION.” Technical Information Service, AEC. April 1952. 89p. (TID-5078) $0.30
Includes radioactive isotope allocations made from Aug. 2, 1946 through June 30, 1951. Institution, investigator, isotope, project, and status or journal reference are given for each. A subject index is included.

Basic ideas involved in the use of radioisotopes and their application in industry.

THE ROLE OF ENGINEERING IN NUCLEAR ENERGY DEVELOPMENT; THIRD ANNUAL OAK RIDGE SUMMER SYMPOSIUM; AUGUST 27 TO SEPTEMBER 7, 1951; N. F. Lansing, comp., Oak Ridge National Laboratory and Oak Ridge Institute of Nuclear Studies. Dec. 1951. 516p. (TID-5031) $1.40
A complete record of the proceedings is presented. Part I contains several discussions of general interest; Part II is concerned with the scientific background of nuclear energy; Part III contains several papers on various engineering topics related to reactor design; Part IV is a record of the panel on “Nuclear Engineering Education”.

Discusses whether we can effectively compete in the world atomic race unless we let down the barriers of secrecy.

SYMPOSIUM ON NUCLEAR ENGINEERING. J. Eng. Education 41, No. 7, 382-82(1951)

The curriculum provides a sequence of basic courses in the field of nuclear engineering integrated with and interspersed among the usual courses in fundamental science and engineering.

A description of procedures used at the Monticello mill for the treatment of carnottite ores.

The theoretical requirements of the vacuum system of the Birmingham 1.3 x 10^6 ev proton synchrotron are considered, and the design and development work performed to satisfy these requirements is described in some detail.

WANTED: REACTOR ENGINEERS. Nucleonics 10, 10-13(1952) Feb.
A brief description of facilities and curriculum of the Oak Ridge School of Reactor Technology and report of a survey showing how industry is using graduates from the school.

A non-technical presentation of the nature of stable isotopes; background of the AEC stable isotope program; important applications of stable isotopes.

ELEMENTARY NUCLEAR SCIENCE

Physical constants data for all experimentally identified nuclides from information available to December 1949.

A series of lectures on the various cyclotrons and other ion accelerators in use at the Radiation Laboratory.

NEUTRON CROSS SECTIONS. Neutron Cross Sections Advisory Group, AEC. May 15, 1952. 203p. (AECU-2040) $1.00
A compilation in tabular and graphic form of neutron cross section data based on all published values together with unpublished values available to the Advisory Group. Included are several pages of the thermal cross section tables and 184 graphs containing curves showing the variation of cross sections with energy. Each graph is printed full size, regardless of the amount of data available, so that the book may be used as a reference volume and work book.

Covers neutron sources; collisions of neutrons with nuclei; stable isotope chart and reactions involving neutrons; models of nuclei reactions; scattering of neutrons; slowing down of neutrons; distribution of slow neutrons in a medium; nuclear fission.

A collection of experimental values of half-lives, radiation energies, relative isotopic abundances, nuclear moments, and cross sections, with each value documented.

Additional information on data listed in Circular 499 and tabulation of new types of data including: nuclear scattering lengths, packing fractions and mass differences; notes on isotope shifts; ranges of α particles in photographic emulsions; information on nuclear reactions in the light elements, Z ≤ 20.

The only major class of new information included in this supplement is a year’s list of fission and spallation papers.

This supplement is the last which will be issued in conjunction with NBS Circular 499. Current nuclear data, collected by the NBS Nuclear Data Group, are published regularly in Nuclear Science Abstracts, beginning with Vol. 6, No. 1, dated January 15, 1952. Quarterly cumulations appear in the Index Issues.

NUCLEAR DATA FOR LOW-POWER REACTORS. Nucleonics 8, 78(1951) Jan. (TID-235)
Data released by Canadian, British and United States authorities on nuclear properties of importance in the design and operation of low-power research reactors.

A complete list of all artificial and naturally radioactive and stable isotopes known to date together with a number of important features covering information available by Oct. 1946; extensive references.

The systematics of and physical constants data for all experimentally identified nuclides from information available to June 1949.

REACTOR THEORY

CALCULATION OF SHIELDING PROPERTIES OF WATER FOR HIGH ENERGY NEUTRONS. C. P. Hammer. Los
Alamos Scientific Laboratory. [nd] 4p. (AECU-630; LADC-717) $0.05

Formulation of the problem of determining the shielding effectiveness of a 100 cm thick wall of water to 14 Mev neutrons normally incident upon it.


Description of a reactor design with arbitrary constants: an experimental nuclear reactor which will be a pilot plant for a reactor for a power plant producing 10,000 kw of electricity.

51 THE ELEMENTS OF NUCLEAR THEORY. S. Glasstone and M. C. Edlund. New York, D. Van Nostrand Co., Inc. (Scheduled for publication in Nov. 1952)

Treatement of nuclear structure and nuclear reactions, dealing with neutron reactions, the properties of neutrons and the relationships that have been worked out to determine the various nuclear reaction rates and products; theory of nuclear reactors of various types, their control and behavior.


Experimental reactivity curves of the Châtillon D 2 0-moderated natural-U reactor are shown. A linear expression for the change in reactivity as a function of three parameters (heavy-water level, position of control rods, and temperature) is given.


Data are provided for computing gamma-ray attenuation through medium and heavy shields of lead, iron, or concrete.

54 AN INTRODUCTION TO HIGH VACUA IN NUCLEAR PHYSICS. A. S. Baxter. Vacuum 1, 185-190(1951)

An outline of the needs for high vacuums in the study of nuclear physics and the consequent parallel developments within these subjects.


Brief explanations of some of the theoretical calculation methods used for computing properties of assemblies of fissionable material.


Method using calibration of control rods displacement.


Theoretical results and numerical calculations of neutron slowing down and penetration to fairly large distances from the source, assuming constant mean free path and no absorption.

58 REACTOR TECHNOLOGY

ATOMIC CONTROL OF POWER REACTORS. M. A. Schultz. Westinghouse Atomic Power Division. Declassified May 24, 1951. 45p. (AECU-3163) $0.20

The use of automatic controls for power producing reactors is discussed with reference to start-up, operating, and shut-down problems.

59 ATOMIC RESEARCH FOR PEACE. Refrig. Eng., 1064-65, 1114(1950)

A description of the Brookhaven reactor with special reference to the cooling system and the many air-conditioning and refrigeration applications in the various Brookhaven laboratories.

60 AUTOMATIC CONTROL REDUCES ATOMIC-ENERGY PLANT HAZARDS. Instruments 24, 200-2(1951) Feb.

Brief descriptions of automatic temperature, humidity, static-pressure and air-velocity controls used to minimize the hazards in atomic energy plants.

61 REPO: BRITISH EXPERIMENTAL PILE. Nucleonics 8, 36-7(1951) June.

Construction details for the larger of the two Harwell piles.


A brief description of the air-cooled, graphite-moderated nuclear reactor at Brookhaven National Laboratory with its laboratory facilities, planned research programs, and accessibility for unclassified research.

63 CRITICALITY OF THE WATER BOILER AND EFFECTIVE NUMBER OF DELAYED NEUTRONS. F. de Hoffmann. Los Alamos Scientific Laboratory. Dec. 8, 1944. Declassified Jan. 30, 1951. 27p. (AECU-3051; LADC-816) $0.15

Calibration of the water boiler made in such a way as to refer eventually to the multiplication of the primary-neutron source.


A semithoretical determination of the percentage change in reactivity of the water boiler per gram of U 235 removed from the sphere.


The components of the heavy water pile at Châtillon are described, dimensions are given, and starting, operation, criticality conditions, and power level are discussed.


Part 1 describes the neutron-distribution measurements made with U 235 and U 238 fission detectors and with manganese foils. Part 2 compares the foil-distribution measurements with the predictions of the reactor radius of an equivalent untamped sphere.
and the neutron age for the boiler is calculated. Part 3 deals with detector-efficiency measurements and determinations of the power from the boiler.

67


Discusses basic components of the pile; factors influencing size and shape of different types of pile; nuclear fuel; structure and composition of radiation shields; construction details; application of pile heat to gas turbines, ramjets and rockets in relation to the whole system.

68


The construction, operation, and performance of the low power and high power versions of the Los Alamos reactor known as the “Water Boiler.”

69

EXPERIMENTAL PRODUCTION OF A DIVERGENT CHAIN REACTION, by E. Fermi. [Chicago Univ.] Declassified Nov. 7, 1951. 48p. (AECD-3289; CP-413; A-459)

Details to construction and operation of the first chain-reacting pile constructed in the West Stands Laboratory, University of Chicago, in 1942. 18 figures.

70


Story of the first self-sustaining nuclear chain reaction; drawings of the first pile are appended.

71


Description of the equipment and initial tests of a recombination system installed on the reactor.

72


A detailed report on the graphite low-energy experimental pile at Harwell.

73


A detailed description of the design and construction of the 5.5 kw water boiler at Los Alamos is given. The operation and performance of the boiler are described. 34 figures.

74

HOW TO LOAD A REACTOR. Nucleonics 10, 24-5(1952) Feb.

A brief description of the reactor at Oak Ridge National Laboratory accompanied by pictures showing how the uranium plugs are loaded into it.

75


Discussion of some of the problems involved in the application of instruments in an atomic power plant.

76


Extensive modifications on the Los Alamos Hypo model “water boiler” have resulted in a new model, Supo. The new reactor is described and illustrated.

77


The Oak Ridge School of Reactor Technology (ORSORT) pile is described in some detail. Results are presented of measurements made on the neutron flux distribution and the Laplacian of the pile.

78


The mechanical design of the shielding facility at Brookhaven National Laboratory reactor is reported. The facility is broken up into several major components and the design, special problems, and testing of each are described. A schematic diagram and photographs are included.

79


Review of research work on the atomic piles in Italy, Germany and France; description and operation of the first French pile.

80


Design and construction of Norway’s nuclear reactor, known as the JEEP.

81


Cost and design features of a practical low-power, multi-purpose reactor designed by North American Aviation, Inc., and particularly suited for use in industrial and institutional research, and for training of scientists and engineers in reactor operation.

82


The neutron flux, structure, and control system of the NRX pile are discussed. Isotope production in the pile, facilities provided for irradiation of samples, and several research projects utilizing the high flux of thermal neutrons are described.

83


Concise tabulation of declassified details of reactors already in operation and those in advanced stages of design and construction.

84


Released information on design, construction, and operation of specified low-power reactors used for research.

A brief statement of the reactor project objectives and administrative procedure is made in this report. The main body of the report concerns the general design and arrangement of the proposed "water-boiler" reactor.


The structural features of the uranyl sulfate water boiler (LOPO) in use at Los Alamos are given in detail with a full account of the safety features.

REACTOR CONSTRUCTION MATERIALS


BARYTES AGGREGATES MAKE HEAVY CONCRETE FOR SHIELDING. E. G. Tirpak. Civil Eng. 21, 453-6(1951) Aug. (AECD-3134; ORNL-667)

Shielding properties, recommended specifications, and cost of production are given.


The fatigue properties of grade AUF graphite were investigated at ambient and elevated temperatures.


Investigation of cements having a wide range of water contents.


Experimental evidence for changes in properties of metals produced by exposure to nuclear reactor radiation.


Changes in tensile strength and electrical resistivity as a result of beta and gamma irradiation are presented for 25 different plastics and synthetic rubbers.

EFFECTS OF RADIATION ON MATERIALS. A. O. Allen. Clinton Laboratories. Declassified May 20, 1947. 17p. (MDDC-928) $0.10

Effects of radiation on different types of chemical bonds, simple gases, organic solids, water and aqueous solutions, metallic corrosion, and in solids.


Results of tests to determine the effect of heat on the compressive strength and moisture content of the high-density concrete used in shielding.


Absorption curves for neutrons and γ-radiation produced by 16-Mev protons on beryllium were measured in absorber blocks of various concrete mixtures to obtain information on their shielding properties.


The advantages and limitations of penetrating radiation methods for nondestructive testing of engineering materials are discussed.


Describes the composition and properties of a phosphate glass to be used for shielding against x- and gamma-radiation.

PHYSICAL PROPERTIES OF IRRADIATED PLASTICS. O. Sisman and C. D. Bopp. Oak Ridge National Laboratory. June 29, 1951. 226p. (ORNL-928) $0.65

Detailed results of tests conducted on thirty-three plastic materials to determine changes in the physical properties when subjected to pile radiation.


Data on the powder metallurgy of beryllium; evaporation during sintering in high vacuum; further data on some properties of the material in various stages, such as electrical resistivity, hardness, and other physical properties.


Tabular data and descriptive material concerning the resistance of materials to attack by Na and Na-K alloys, Li, Mg, Pb, Bi, alloys of Pb and Bi, Cd, TI, In, Ga, Al, Sn, Zn, and Sn.


The short-time tensile breaking strength of various grades of graphite was measured as a function of temperature from room temperature to the sublimation point.

The physical properties of twenty-four ceramic materials are tabulated and discussed, with special emphasis on properties of interest in nuclear engineering.


Progress made on the development of dense concrete for γ-ray shielding, using steel punchings as aggregate.


A brief review of the information contained in the papers presented at the Oak Ridge Summer Symposium on metallurgy on the properties required in reactor construction materials and reactor coolants.


A discussion of problems arising from the use of water as a pile coolant; consideration of all elements of pile structure and auxiliary equipment.

ZIRCONIUM. S. M. Shelton. Sci. Am. 184, No. 6, 18-21 (1951)

A review of the history, physical properties, and industrial development; applicability to nuclear reactors and jet engines is stressed.

POWER FROM NUCLEAR REACTORS

ATOMIC CENTRAL HEATING SYSTEM AT HARWELL. Engineer 122, 689 (1951)

Outline and diagram of the first atomic central heating plant inaugurated at AERE, Harwell, where a building containing eighty offices draws heat directly from BEPO.


A comprehensive exploratory study of the economic feasibility of atomic power undertaken for the Cowles Commission for Research in Economics.


Discusses the potential usefulness of nuclear fuels in various industries and many parts of the world.


An analysis in terms of cost of optimum steam temperatures for use in electric power stations.

NUCLEAR ENERGY FOR POWER PRODUCTION. W. F. Davidson. Atomics (London) 1, 320-27 (1950)

In this paper, read before the Fourth World Power Conference, the general engineering problems needing solution before nuclear power can be practicable are discussed. Materials, heat transfer, neutron economy, control, and shielding are briefly considered.


Describes the analytical methods developed to meet the precise analytical requirements of the atomic energy program.


A comprehensive, annotated bibliography; covers the period 1816-1950.


A series of lectures on all phases of nuclear chemistry, including chemical problems of piles and applications of nuclear techniques to chemical problems.


A collection of 536 research papers from the research program on the radiochemistry of fission products carried out on the Plutonium Project from May 1942 to June 1946.


A collection of over 150 original papers with brief historical surveys.

SEPARATION PROCESSES


It is shown that the mathematical treatment of a gaseous diffusion cascade with identical stages is equivalent to the treatment of a fractional distillation column; the stage separation factor is analogous to the relative volatility in fractional distillation.


A brief discussion of problems encountered in the electromagnetic separation of naturally occurring isotopes other than uranium.

Covers special plant instruments and devices; vacuum engineering; development of heat transfer equipment; absorption of \( \text{UF}_6 \) and fluorine.

Specific separations of the fission product radioisotopes, including the individual species, by ion exchange columns.


Discusses equipment for separation of gas mixtures by column or stage type of mass diffusion process; theory of separation of isotopic mixtures by a cascade of mass diffusion columns; separation of isotopic mixtures by a cascade of mass diffusion stage; extraction of hydrogen from gas mixtures by mass diffusion column and mass diffusion stage.

In this volume centrifuges, electromagnetic methods, electrolysis, chemical exchange, thermal diffusion, and distillation are considered.

Compilation of observations made in the course of developing high-vacuum equipment suitable for use in electromagnetic separation plants.

Compilation of a table of absorption coefficients as a function of the \( \gamma \)-ray energy and atomic number for \( \text{Al} \), \( \text{Fe} \), \( \text{Cu} \), \( \text{Ag} \), \( \text{Sn} \), \( \text{Ta} \), \( \text{Pb} \), and \( \text{U} \); estimates of the accuracy of the values presented and theoretical considerations on the photoelectric effect, Compton effect and pair production effect on \( \gamma \)-ray absorption.

Description of the procedure used at the Brookhaven monitoring stations.

External and internal radiation hazards and methods of protection against them are discussed.

Discussions on crystal and fast Geiger counters; multipliers and secondary emission phenomena; Cerenkov counters; coincidence techniques; broad band amplifiers.

151 CHALK RIVER CONFERENCE RECOMMENDS TOLERANCE VALUES. Nucleonics 6, 83(1950) Feb.
Various values for maximum permissible exposures and concentrations recommended at the Chalk River, Ontario, conference of the radiation protection committees of the United States, Great Britain, and Canada are given in tabular form.

152 THE CONCEPT OF A MAXIMUM PERMISSIBLE EXPOSURE. R. S. Stone. Radiology 58, 639-661(1952)
Biological effects of radiation are reviewed and a concept is presented for establishing maximum permissible exposure limits which is based on a large number of experiments and observations.

The susceptibility of 50 different materials to contamination by fission products, their subsequent ease of decontamination with various reagent washes, and resistance to common laboratory reagents are described.

154 DESIGNING VENTILATION AND AIR-CONDITIONING FOR SAFETY IN AN ATOMIC ENERGY RESEARCH PROJECT. R. E. Holmes. Refrig. Eng. 59, 755-9, 808-10(1951) (AECU-1432)
Ventilation principles in an atomic energy project, ventilated bench hoods, ventilated dry boxes, caves, filter systems, and hood air-velocity control problems are discussed in a general and nontechnical manner. 10 figures.

Information on removing particulate matter from gases and criteria for judging their effectiveness.

Twelve papers covering all phases of radiation protection; includes background material.

The results of practical experience in dust collection at one atomic energy installation are presented. Data are given for applications involving medium and high grain loadings where the air-filter type of equipment would not be suitable. Other types of dust collectors are discussed.


Results of a major survey project using several techniques.


Part I contains a discussion of the physical principles basic to the operation of ionization chambers and counters. Part II deals with the various detectors developed by the authors and other scientists at Los Alamos.

LECTURE NOTES; HEALTH PHYSICS TRAINING LECTURES, 1948-1949. Oak Ridge National Laboratory. Sept. 29, 1950. 102p. (AECU-817) $0.35

A series of lecture notes, issued in conjunction with lectures given during the fall of 1948 to persons working in the field of health physics at the Oak Ridge National Laboratory.

MAXIMUM PERMISSIBLE AMOUNTS OF RADIOISOTOPES. Nucleonics 8, 70-5(1951) Feb.

The International Commission on Radiological Protection draws attention to the data on maximum permissible exposures.

NEW LABORATORY FUME HOODS CUT AIR CONDITIONING LOAD. J. F. Turner. Heating, Piping Air Conditioning 23, 113-16(1951)

Besides cutting air conditioning load these new hoods are safer to use for they permit lower face velocities and less interior turbulence.


NOMOGRAMS for calculation of shielding required for gamma-ray sources at the geometries most commonly encountered.


Factors determining radiation damage to man, methods of calculating external exposure, establishment of maximum permissible levels, hazards of internal radiation exposure, methods by which radioisotopes enter the body, and factors that determine damage are summarized.

RADIOACTIVE DUST SEPARATION EQUIPMENT. I. A. L. Bralove. Nucleonics 8, 37-50(April); 60-7(May); 15-23, 33 (June) (1951).

A discussion of the practical and theoretical factors affecting separation equipment design, and a survey of methods used to remove radioactive particles from gases.

RADIOACTIVITY MEASUREMENT TECHNIQUES. J. H. Pannell. Massachusetts Institute of Technology. Declassified Nov. 13, 1947. 10p. (AEC-2370) $0.15

Techniques and instruments discussed include autoradiographic methods using photographic emulsions, the electromicroscope, scintillation methods by a particle impact, ionization chambers, and geiger counters.


General recommendations suitable for typical laboratory or small industrial operations.


Basic considerations and nature of additional research needed are discussed.

SOME PRACTICAL CONSIDERATIONS IN RADIATION SHIELDING. G. W. Morgan. Isotopes Division, ORO, AEC. November 1948. 24p. (Isotopes Division Circular B-4) gratis.

Basic formulas for determining dosage rates for γ radiation and shielding values for both β and γ radiations; derivations of formulas; data in tabular and graphic form on the shielding values of the most commonly used shielding materials.


A discussion on sonic precipitation theory, collision mechanism, historical background, use in smoke abatement, patents, and future utility including 48 references.

SPECIFICATIONS FOR THE CONSTRUCTION OF LOCAL EXHAUST SYSTEMS. W. B. Harris. Health and Safety Div., NYO. June 15, 1949. 11p. (NYO-1532) $0.10

Materials, construction, design, and methods of measurement of air velocity and flow are covered.


A review, including consideration of particle conditioning, separation by inertial forces, gas filtration, wet scrubbers, electrostatic precipitation, and gas-cleaning problems.

TOLERANCE CONCENTRATION OF RADIOACTIVE GASES IN AIR. G. Failla. Argonne National Laboratory. November 1942. Declassified Oct. 28, 1948. 11p. (AEC-2382; CH-1347; A-1897) $0.10

General discussion of the production of lung cancer by radiation including x-rays and those from radioactive gases; theoretical development of a tolerance rate for the inhalation of radioactive gases.

VENTILATION REQUIREMENTS FOR POWER REACTOR COMPARTMENTS. W. O. Passarelli, Jr. Nucleonics 10, 46-9(1952) June (AEC-3226)

Deals with the problem of determining the ventilation requirements so that operating personnel will be protected from breathing more than a tolerable amount of radioactively contaminated air.
RADIOACTIVE WASTE AND CHEMICAL PROCESSING

175
Symposium on the problems and treatment on radioactive wastes; liquids and gases are considered.

176
BROOKHAVEN NATIONAL LABORATORY WASTE PROBLEMS; SECTION I: CONFERENCE ON WASTE PROCESSING; MEETING OF U.S. ATOMIC ENERGY COMMISSION WASTE PROCESSING COMMITTEE; MARCH 27-28, 1950.
J. H. Hayner and B. Manowitz. Brookhaven National Laboratory. 24p. (BNL-58) $0.20
Brief reports on the geological, meteorological, and area surveys; low level monitoring; liquid waste handling and treatment; permanent disposal of radioactive waste.

177
Type of wastes (gases, liquids, and solids) to be expected from the operation of an atomic research and development laboratory; equipment needed, operating data, costs, and systems adopted for handling these wastes.

178
The operation of the disposal system installed at Argonne National Laboratory for the control of radioactive effluents is described.

179
DECONTAMINATION OF RADIOACTIVE WASTE AIR I. R. P. Hammond. Los Alamos Scientific Laboratory. [June 1949]. Declassified Oct. 3, 1949. 20p. (AEC-D-2711; LAMS-911; LADC-802) $0.10
Three-stage treatment of contaminated waste air with a baffle-plate scrubbing tower of 42 plates.

180
FINAL REPORT ON EVALUATION OF PROCESS DESIGNS FOR THE BNL WASTE CONCENTRATION PLANT. B. Manowitz, R. V. Horrigan, and H. Fried. Brookhaven National Laboratory. May 28, 1951. 18p. (BNL-112) $0.10
Five process designs of 600-gph evaporation units for concentrating dilute radioactive liquid wastes are discussed in reference to their probable engineering feasibility, maintenance problems, ease of operation, and relative costs.

181
Separation of the wastes into their liquid and solid fractions, concentration of the radioactive fraction into a smaller volume to permit disposal either as a sludge or a slurry, incineration, and burial are discussed.

182
RADIOACTIVE WASTE DISPOSAL. J. A. Ayres. Ind. Eng. Chem. 43, 1526-31 (1951) (AEC-D-2802)
The use of ion exchange resins for the effective removal of radioactive materials from waste solutions.

183
RADIOACTIVE WASTE DISPOSAL: A BIBLIOGRAPHY OF UNCLASSIFIED LITERATURE. Technical Information Division, ORE, AEC. 8p. (TID-375) $0.10
Highly selective bibliography of 49 references containing information on various processes and methods of waste disposal.

184
A study undertaken to obtain information for pilot plant design in order to remove Pu from waste materials; methods investigated include coprecipitation; adsorption and activated sludge.

185
REPORT OF DESIGN FOR VOLUME PRODUCTION OF COMBUSTIBLE RADIOACTIVE WASTES BY INCINERATION. Arthur D. Little, Inc. June 30, 1950. 187p. (ALL-C-57607)
This report includes design drawings, specifications, heat and material balances, process description, operating information, and cost estimates sufficiently detailed to permit contract negotiations for the construction of a radioactive-waste incinerator. Experimental work carried out on the choice of scrubbing solution, various methods of dust collection and their efficiencies, and the settling of incinerator ash are described.

186
A statistical criterion for the detectability of radioactivity in waste liquids is stated and applied, by way of example, to evaluation of minimum detectable concentrations for the effluent from Brookhaven's sewage-processing plant.

187
A review of the problems of disposal of waste containing radioactive materials with emphasis upon the biologic concentration of radioactive materials by algae, and the removal of radioactive materials from stack gases.

TEXTBOOKS AND REFERENCE TOOLS

188
This review, published by Annual Reviews, Inc., in cooperation with the National Research Council of the National Academy of Sciences, is the first in a series planned to cover the most important developments in the various fields of nuclear research each year. The present volume covers developments during 1950.

189
Presentation of many phases of nuclear science, with emphasis on technical aspect; third or fourth year college level.

190
BIBLIOGRAPHY OF PARTICLE ACCELERATORS; JULY 1948 TO DECEMBER 1950. B. E. Cushman. Radiation Laboratory, Univ. of Calif. Mar. 1951. 56p. (UCRL-1238) $0.25
Included are about 380 references, a table of particle accelerators in the United States, and one of foreign accelerators.
BIBLIOGRAPHY OF PUBLISHED LITERATURE ON THE PREPARATION OF RADIOACTIVE NEUTRON SOURCES. F. E. Croxton. Mar. 3, 1950. 45p. (TID-295) $0.25
Annotated bibliography listing all important papers published during the period 1937 through 1949.

A bibliography of approximately 1900 references on properties, preparation and formation, coagulation, determination, collection, pollution, and meteorology culled from the literature dealing with aerosols and related systems.

Extensive summation of pertinent facts regarding the theory of discharge mechanisms and practical operation of various types of counters; 3rd or 4th year college level; assumes grounding in atomic physics; valuable as a reference book.

Basic principles of pile physics; assumes knowledge of higher mathematics, but not of quantum mechanics; good introduction to technical papers; third or fourth year college level.

A history of physics, and of mathematical techniques and formulas are included; problems of atomic and nuclear structures are discussed, and the quantitative relations involved are explained; recent developments concerning nuclear phenomena, atomic energy and the production of high-voltage particle accelerators are particularly noted.

Scientific and technical development of the Atomic Energy Program; a requisite for any uniformed person entering the nuclear energy field.


Basic discussions and descriptions of theoretical and experimental importance in the field of aerosols.

Detailed study of theory and mechanism of heat transfer; presents a comprehensive discussion of the mechanism of boiling and condensation; textbook for the research worker or advanced student.

Most complete text on theory and design information for a great variety of heat transfer problems; 4th year or graduate level.

A complete review of the literature to 1949; 24,282 references.

Graduate or 4th year college level; written for chemists; assumes good grounding in physics.

Senior or first year graduate level.

First year graduate or senior level; assumes grounding in atomic physics; valuable as source book in experimental methods.

Tables, graphs, and formulas, supplemented by extensive textual material and liberal references to the original literature; primarily a reference book for research workers.

Essentially nonmathematical approach; suitable for use in a survey course; third or fourth year college level.

A comprehensive collection of brief explanations and definitions of concepts in the field of nuclear physics and atomic energy.

Third or fourth year college level, assumes grounding in elementary physical chemistry.

Seminars on nuclear physics; elementary pile theory; design of nuclear reactors.

Detailed information on reactor theory and design; other
seminars dealing with engineering aspects of nuclear energy.

SELECTED UNCLASSIFIED REFERENCES ON NUCLEAR REACTORS. TIS Staff. Technical Information Service, AEC. June 7, 1951. 11p. (TID-3006)

References selected to supply background and survey information on nuclear reactors without the details necessary for a specialized study.


Presentation of important facts about past history, present status and possible future of atomic science; valuable as a reference book.
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