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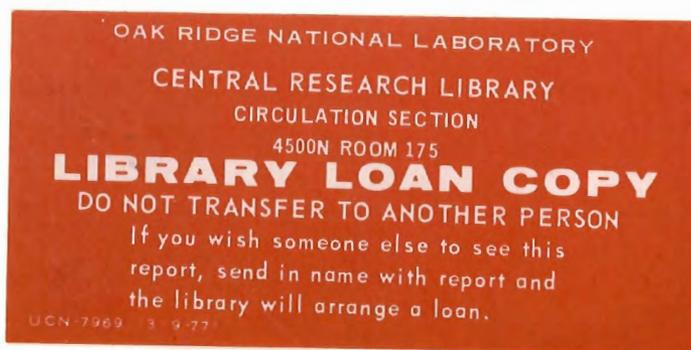
ORNL/NSIC-198

(Revision to ORNL/NUREG/NSIC-186)

Index to
NUCLEAR SAFETY
A Technical Progress Review
by
Chronology, Permuted Title, and Author
Vol. 18 (1) through Vol. 22(6)

Wm. B. Cottrell

Margaret Passiakos



NUCLEAR SAFETY INFORMATION CENTER

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145	Bibliography of Reports on Research Sponsored by the NRC Office of Nuclear Regulatory Research - July-Dec. 1977, J. R. Buchanan, April 1978	\$ 6.50
146	Reports Distributed in 1977 Under the NRC Light-Water Reactor Safety Technical Exchange, Wm. B. Cottrell and D. S. Sharp, June 1978	\$ 5.25
147	Index to <i>Nuclear Safety</i> , A Technical Progress Review by Chronology, Permuted Title, and Author, Vol. 11, No. 1 Through Vol. 18, No. 6, Wm. B. Cottrell and Ann Klein, May 1978	\$ 7.25
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Nuclear Safety Information Center

INDEX TO

NUCLEAR SAFETY

A TECHNICAL PROGRESS REVIEW

BY

CHRONOLOGY, PERMUTED TITLE, AND AUTHOR

VOL. 18(1) THROUGH VOL. 22(6)

Wm. B. Cottrell
Engineering Technology Division

Margaret Passiakos
Information Division

Date Published - June 1982

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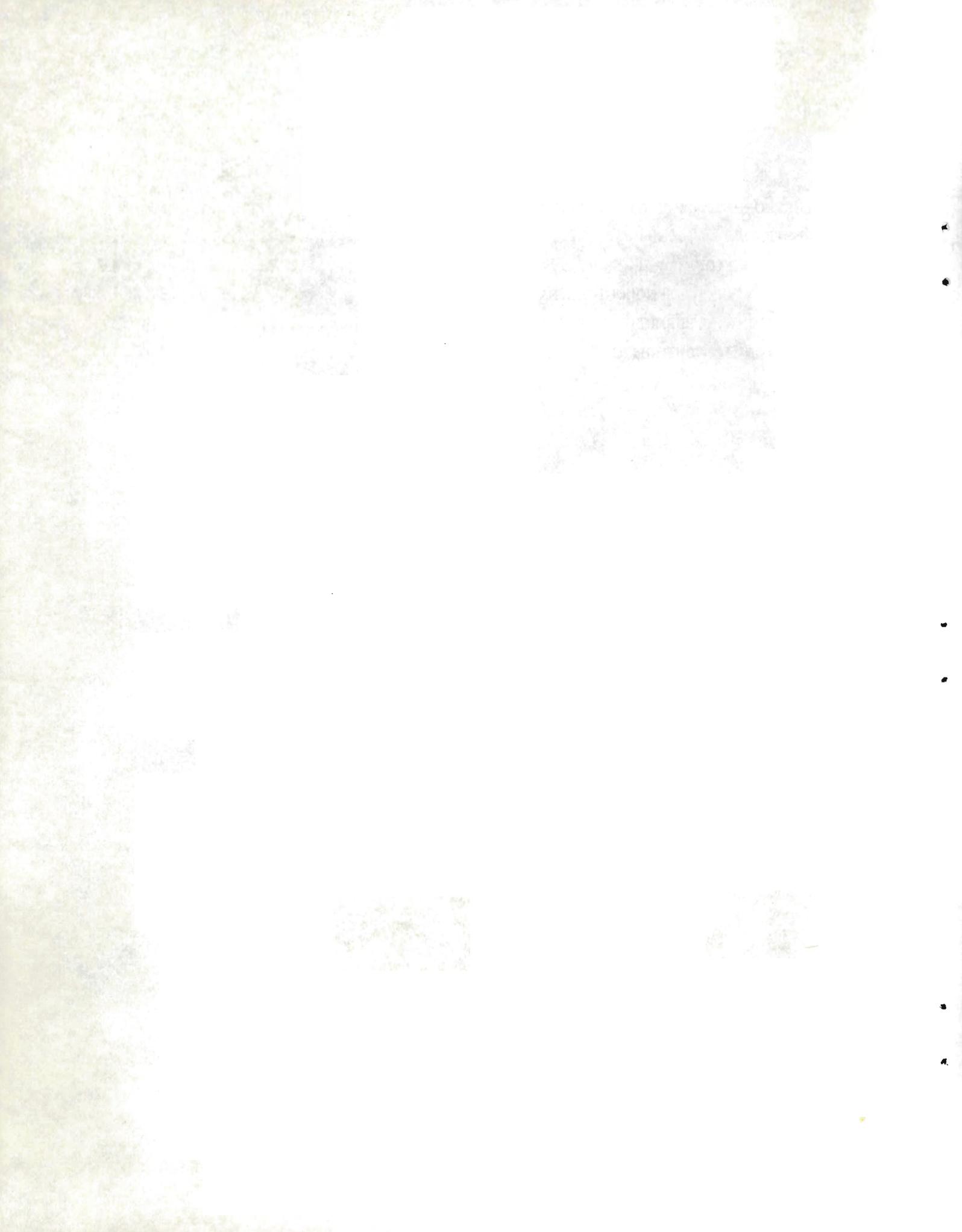


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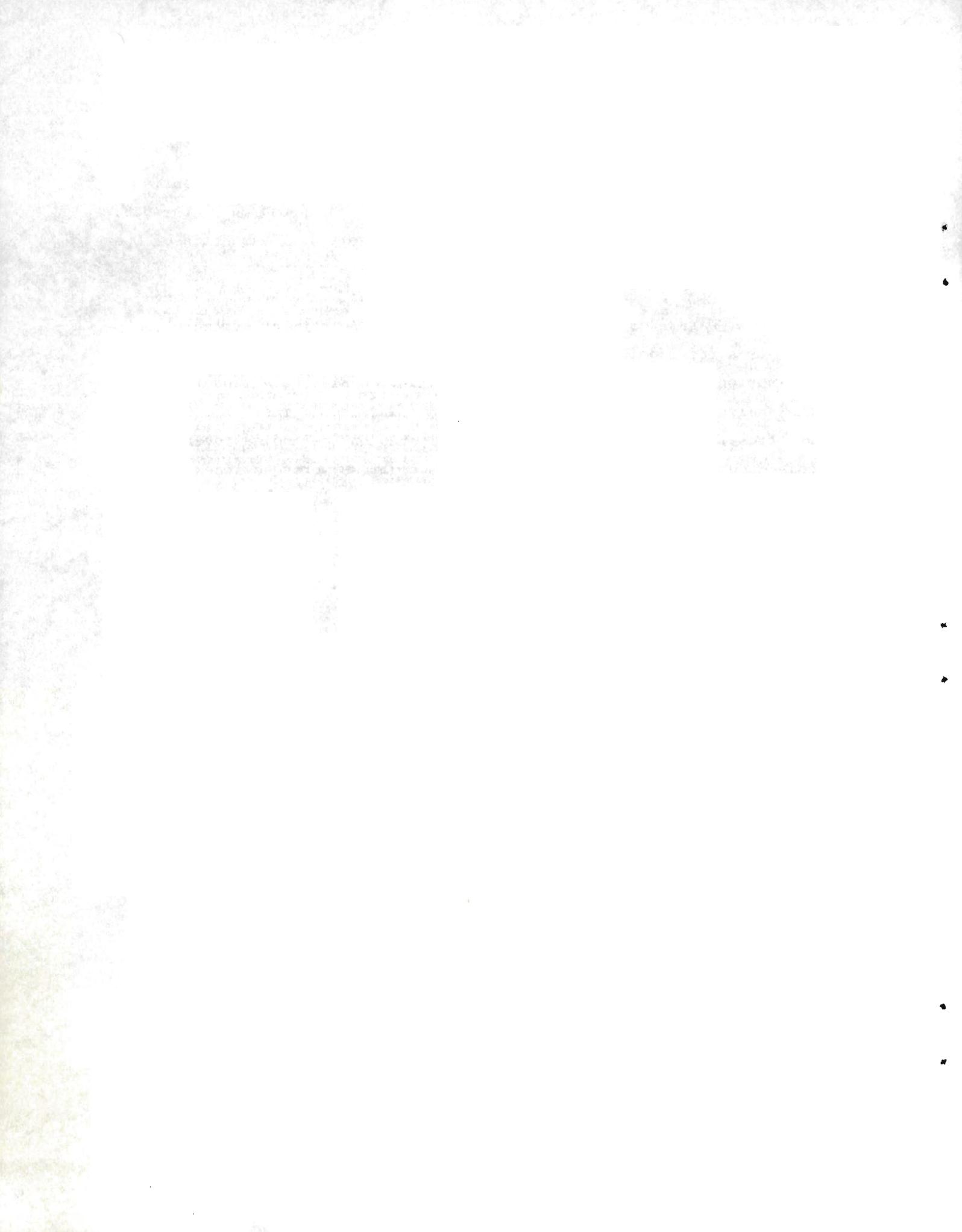
FOREWORD

The Nuclear Safety Information Center (NSIC), which was established in March 1963 at Oak Ridge National Laboratory, is sponsored by the U.S. Nuclear Regulatory Commission's Office of Analysis and Evaluation of Operational Data. Support for the technical progress review *Nuclear Safety* (see last page of this report) is provided by both the Breeder Reactor and Light-Water-Reactor Safety Programs of the Department of Energy. NSIC is a focal point for the collection, storage, evaluation, and dissemination of operational safety information to aid those concerned with the analysis, design, and operation of nuclear facilities. The Center prepares reports and bibliographies as listed on the inside covers of this document. NSIC has developed a system of keywords to index the information it catalogs. The title, author, installation, abstract, and keywords for each document reviewed are recorded at the central computing facility in Oak Ridge.

Computer programs have been developed that enable NSIC to (1) prepare monthly reports with indexed summaries of Licensee Event Reports, (2) make retrospective searches of the stored references, and (3) produce topical indexed bibliographies. In addition, the Center Staff is available for consultation, and the document literature at NSIC is available for examination. NSIC reports (i.e., those with ORNL/NSIC and ORNL/NUREG/NSIC numbers) may be purchased from the National Technical Information Service (see inside front cover). All of the above services are available free of charge to U.S. Government organizations as well as their direct contractors. Persons interested in any of the services offered by NSIC should address inquiries to:

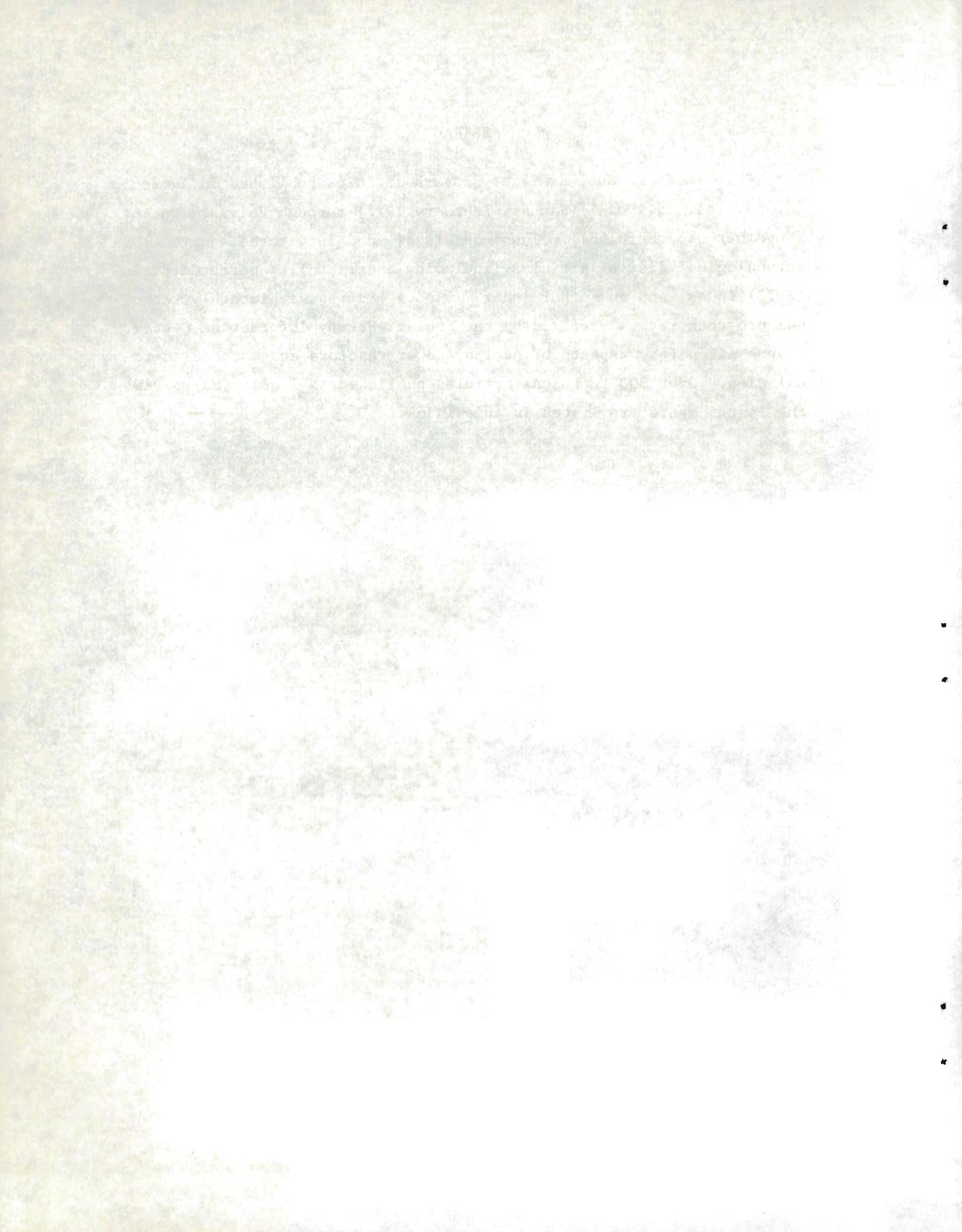
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ABSTRACT

This index to Nuclear Safety covers articles published in *Nuclear Safety*, Vol. 18, No. 1 (January–February 1977) through Vol. 22, No. 6 (November–December 1981). The index is divided into three sections: a chronological list of articles (including abstracts), a permuted-title (KWIC) index, and an author index. *Nuclear Safety*, a bimonthly technical progress review prepared by the Nuclear Safety Information Center, covers all safety aspects of nuclear power reactors and associated facilities. Over 300 technical articles published in *Nuclear Safety* in the last 5 years are listed in this index.



INTRODUCTION

Nuclear Safety, a bimonthly technical progress review, is prepared by the Oak Ridge National Laboratory and is sponsored by the Department of Energy. The technical articles (i.e., excluding special reviews and features) are refereed and cover all topics relevant to the safe design, construction, and operation of nuclear facilities. In addition to that primary emphasis on power reactors, safety considerations in reactor fuel fabrication, spent-fuel processing, nuclear waste disposal, handling of radioactive materials, and the environmental effects of these operations are also treated.

Cumulative indexes of *Nuclear Safety* have been prepared annually since 1967. Each annual index through 1973 included all previous material. Then starting in 1974 and continuing through 1980, the coverage in each annual index extended back to 1970 (Vol. 11). However, starting with this issue the indexes cover the previous five years. Thus, this issue of the *Index to Nuclear Safety* covers articles included in *Nuclear Safety*, Vol. 18, No. 1, through Vol. 22, No. 6. Persons interested in an index to earlier *Nuclear Safety* volumes should purchase either ORNL/NSIC-107 (Vol. 1-13) or ORNL/NUREG/NSIC-186 (Vol. 11-21) (see inside front cover).

This index is presented in three sections as follows:

Section 1 (orange) — Chronological List of Articles by Volume

Section 2 (white) — Permuted-Title (KWIC) Index

Section 3 (green) — Author Index

A KWIC (KeyWord in Context) index is one in which article titles are permuted around the various significant words contained therein. For example, the title, "Design Basis for Nuclear Power Plant Protection Systems," is indexed under the words Design, Nuclear, Power, Plant, and Protection. As may be seen by reference to Section 2 (white) of this report, the index words are arranged alphabetically in a column in the center of the page, with the titles permuted around them. In some cases, additional significant words in parentheses have been added to the title by the editors to allow more precise indexing. The location of the indexed articles in *Nuclear Safety* is indicated by the seven-digit numbers in the column to the right of the page, as described below. The KWIC

code was developed by IBM and has proved to be a useful tool for the preparation of indexes for many different purposes.

Early issues of the index were used primarily for the benefit of the *Nuclear Safety* editors. However, it has been so helpful that it is now prepared and distributed as an NSIC report. The index is published annually following the close of each *Nuclear Safety* volume year.

The seven-digit index number given in all three sections is divided into four parts (00-0-0-000) which stand, respectively, for volume-number-section-page. It provides ready entry from the permuted-title (KWIC) index (white) and author index (green) to the main index (orange), which gives title, author, and abstract when available. Corporate affiliation is given in the orange section for all authors. Abstracts are also included for those articles that contained one. Volume 18 corresponds to 1977; Volume 19, 1978; Volume 20, 1979; Volume 21, 1980; and Volume 22, 1981.

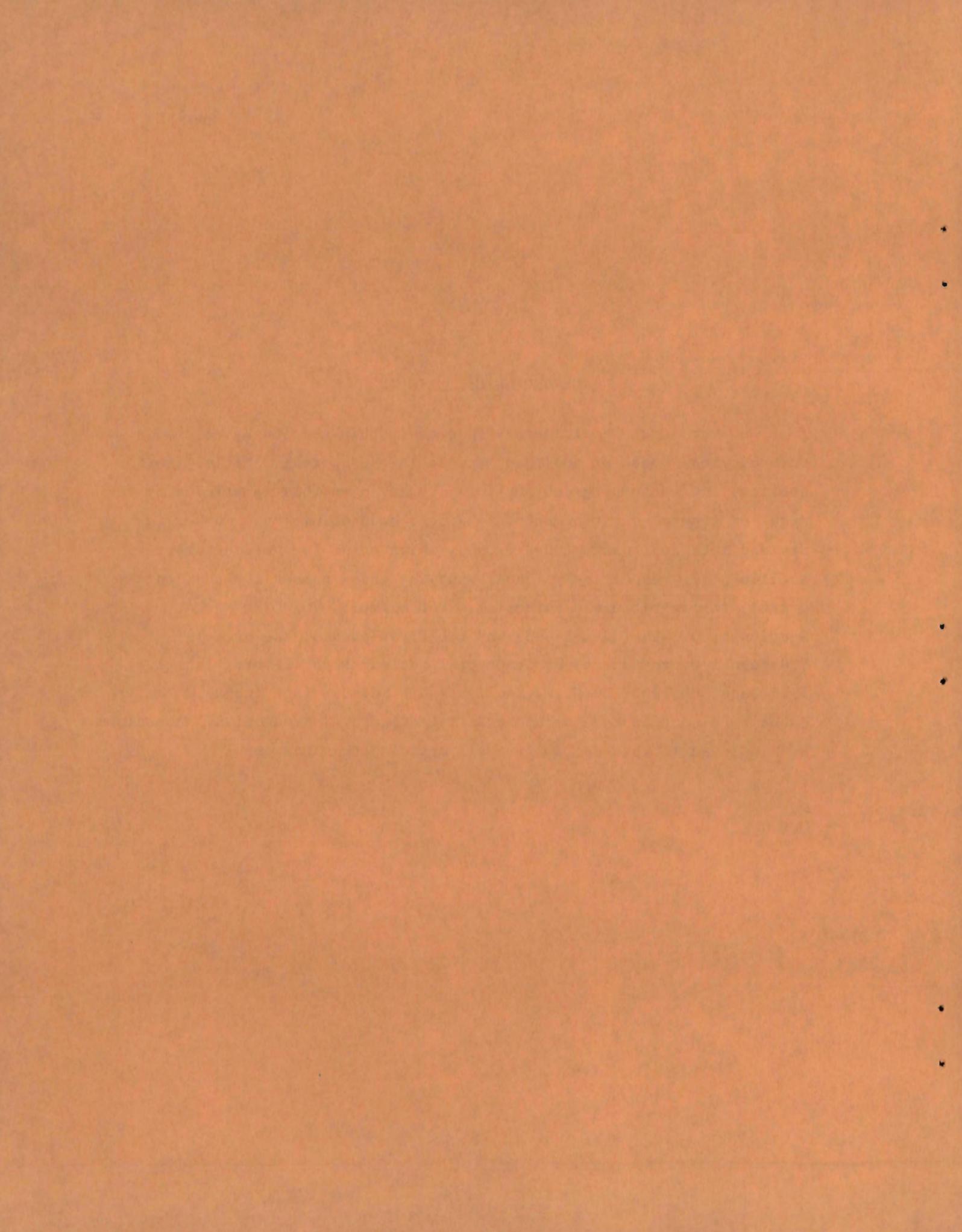
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7. Current Events
Wm. B. Cottrell

Section 1

CHRONOLOGICAL MAIN INDEX

Nuclear Safety articles are indexed in this section by volume in chronological order of their appearance in the journal. Titles (white section) and authors (green section) are keyed to this main index by means of a seven-digit number in the left-hand column; the number is divided into four parts (00-0-0-000), which stand for volume-number-section-page, respectively. Following the index number are the appropriate article title and author(s). For example, Vol. 22, No. 4, Section 5, p. 498 (22-4-5-498) was the first page of the article "Personnel Overexposures at Commercial Nuclear Power Plants, Jan. 1, 1976-June 30, 1980" by D. W. Moeller and L. C. Sun (see index). The dates pertinent to each volume are listed in the introduction. Abstracts are included in this section for all articles that had one.



BIBLIOGRAPHY

- 18-1-1-1 NRC WATER REACTOR SAFETY RESEARCH PROGRAM
TONG, L. S. + BENNETT, G. L.
U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, D.C.
THE WATER REACTOR SAFETY RESEARCH PROGRAM OF THE NUCLEAR REGULATORY COMMISSION IS DESCRIBED, AND THE BASIC RESULTS ARE PRESENTED. THE PROGRAM CONSISTS OF FIVE BASIC RESEARCH AREAS - INTEGRITY OF VESSEL AND PIPING, THERMAL HYDRAULIC TESTS, FUEL ROD BEHAVIOR, CODE DEVELOPMENT AND VERIFICATION, AND REACTOR OPERATIONAL SAFETY. RESULTS FROM THE VESSEL AND PIPING INTEGRITY RESEARCH HAVE DEMONSTRATED THE HIGH SAFETY MARGINS IN SCALED VESSELS AND THE ANALYTICAL PROCEDURES FOR CALCULATING VESSEL BEHAVIOR UNDER PRESSURE. NONDESTRUCTIVE EXAMINATION TECHNIQUES ARE BEING IMPROVED. WORK IS ALSO PROCEEDING TO DEFINE THE MATERIAL CONSTITUENTS WITH WHICH TO REDUCE THE SUSCEPTIBILITY OF COMPONENTS AND STRUCTURES TO IRRADIATION EMBRITTLEMENT AND STRESS CORROSION CRACKING. THE THERMAL HYDRAULIC TESTS HAVE COVERED THE VARIOUS PHASES OF A HYPOTHETICAL LOSS OF COOLANT ACCIDENT AND ACTIVATION OF THE EMERGENCY CORE COOLING SYSTEM. THESE TESTS HAVE LED TO THE DEVELOPMENT OF MORE REALISTIC ENGINEERING CORRELATIONS TO DESCRIBE THE PHENOMENA IN ORDER TO FURTHER QUANTIFY THE SAFETY MARGINS IN COMMERCIAL NUCLEAR POWER PLANTS. THE FUEL BEHAVIOR RESEARCH HAS PROVIDED VALUABLE INFORMATION ON DECAY HEAT, CLADDING OXIDATION, FUEL ROD BEHAVIOR, AND FUEL MELTING. BOTH THE DECAY HEAT AND THE CLADDING OXIDATION HAVE BEEN SHOWN TO BE LOWER THAN ASSUMED IN THE LICENSING EVALUATIONS. THE REACTOR OPERATIONAL SAFETY RESEARCH IS JUST STARTING - INITIALLY IT ADDRESSES FIRE PROTECTION, COMPONENT AGING, AND HUMAN ENGINEERING. TO DATE, THE NRC WATER REACTOR SAFETY RESEARCH PROGRAM HAS GREATLY EXPANDED THE SAFETY DATA BASE, WHICH IN TURN IS USED FOR FURTHER QUANTIFICATION OF THE INHERENT SAFETY MARGINS IN NUCLEAR POWER PLANTS.
- 18-1-2-45 REFLECTIONS ON THE RECRITICALITY CONFERENCE AT ARGONNE NATIONAL LABORATORY
GRIFFITH, J. D.
U.S. ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION, WASHINGTON, D.C.
THE CONSENSUS OF THE RECRITICALITY CONFERENCE AT ARGONNE NATIONAL LABORATORY WAS THAT THE ENERGETIC RECRITICALITY ACCIDENT IS A HIGHLY IMPROBABLE EVENT BUT THAT PROOF OF ITS IMPOSSIBILITY IS NOT YET FULLY CONVINCING TO THE INTERESTED SCIENTIFIC COMMUNITY. THE AUTHOR EXTENDS THE DISCUSSION AND SUGGESTS THAT AN ENDLESS EFFORT TO ESTABLISH THE EXISTENCE OF VERY LOW PROBABILITY EVENTS OR TO PROVE THE IMPOSSIBILITY OF SOME POSTULATED EVENTS WOULD BE A FRUITLESS ENDEAVOR. IT IS CONCLUDED THAT THE EMPHASIS SHOULD BE SHIFTED FROM A SEARCH FOR GREATER ASSURANCE OF THE NONEXISTENCE OF LOW PROBABILITY EVENTS TO THE UNDERSTANDING OF REAL PHENOMENA AT THE VARIOUS NATURAL LINES OF ASSURANCE THAT EXIST FOR A LIQUID METAL COOLED FAST BREEDER REACTOR. THE AUTHOR PROPOSES THAT THIS BE DONE WITH AN APPROPRIATE RISK CURVE INCORPORATING THE LINES OF ASSURANCE AND A PROPOSED CRITERION. THE CRITERION PROPOSED IS THAT PHENOMENA THAT CAN BE MADE TO OCCUR EXPERIMENTALLY UNDER REALISTIC REACTOR CONDITIONS BE STUDIED AND UNDERSTOOD AND PHENOMENA THAT CANNOT BE MADE TO HAPPEN EXPERIMENTALLY BE ASSUMED TO HAVE A PROBABILITY OF OCCURRENCE LOWER BY A FACTOR OF $10(\text{EXP}-2)$ TO $10(\text{EXP}-3)$ AND THE CONSEQUENCES OF THESE LOWER-PROBABILITY EVENTS BE STUDIED AT THE NEXT LINE OF ASSURANCE.
- 18-1-3-53 LOSS OF ELECTRIC POWER COINCIDENT WITH LOCA
NUCLEAR SAFETY STAFF
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENN.
THE ANALYSIS CONDUCTED IN THE REACTOR SAFETY STUDY (WASH-1400) PRESENTS A METHOD FOR ESTABLISHING A RISK PROBABILITY FOR POSTULATED ACCIDENT CIRCUMSTANCES. SINCE THESE PROBABILITIES PROVIDE A MEANS FOR PLACING EVENTS INTO A RELATIVE PERSPECTIVE, THE EDITOR HAS PREPARED THAT PORTION OF THE STUDY CONCERNED WITH AND ENTITLED 'TOTAL LOSS OF ELECTRIC POWER' FOR REPUBLICATION HERE FOR A BROADER AUDIENCE. THE STUDY CONCLUDED THAT THE PROBABILITY OF THE TOTAL LOSS OF ELECTRIC POWER WAS $10(\text{EXP}-5)$ AT THE TIME OF A LOSS OF COOLANT ACCIDENT (LOCA) AND RANGED FROM ABOUT $10(\text{EXP}-4)$ TO $10(\text{EXP}-8)$ FOR VARIOUS TIMES AND CONFIDENCE LEVELS FOLLOWING A LOCA. THE 'EDITOR'S POSTSCRIPT' TO THIS EDITED VERSION OF THE RISK ASSESSMENT ANALYSIS IS A STATEMENT OF THE PRIMARY PURPOSE AND FUNCTION OF THE TWO ELECTRIC POWER SYSTEMS ASSOCIATED WITH NUCLEAR POWER PLANTS. SOME ACTUAL PLANT OPERATING DATA AND BLACKOUT EXPERIENCES ARE PRESENTED FOR RELEVANCE AND TO SUPPLEMENT THE LIMITED DATA BASE CHOSEN FOR THE STUDY. THE REFERENCE LIST GIVEN IN THE REPORT IS ALSO INCLUDED AND IS SUPPLEMENTED BY REFERENCES THAT ARE CITED IN THE POSTSCRIPT. A SHORT BIBLIOGRAPHY IS APPENDED.
- 18-1-4-60 PHENOMENOLOGICAL INVESTIGATION OF POSTULATED MELTDOWN ACCIDENTS IN LIGHT WATER REACTORS
D'ISALVO, F.
U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, D.C.
RENEWED INTEREST HAS RECENTLY DEVELOPED IN ANALYZING THE COURSE AND CONSEQUENCES OF HIGHLY IMPROBABLE, HYPOTHETICAL ACCIDENTS

THAT INVOLVE MELTING OF A SIGNIFICANT PORTION OF THE FUEL IN LIGHT WATER REACTORS. PHYSICAL PHENOMENA ASSOCIATED WITH SUCH ACCIDENTS AND CURRENT TRENDS IN SAFETY RESEARCH APPLICABLE TO THEIR ANALYSIS ARE REVIEWED. THE OBJECTIVES, TECHNICAL APPROACHES, AND RECENT FINDINGS OF SELECTED PROGRAMS IN THE UNITED STATES AND THE FEDERAL REPUBLIC OF GERMANY ARE SUMMARIZED.

- 18-1-6-79 RADIOACTIVE MATERIAL RELEASED FROM NUCLEAR POWER PLANTS IN 1974
NUCLEAR SAFETY STAFF
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENN.
MEASURED RELEASES OF RADIOACTIVE MATERIALS IN AIRBORNE AND LIQUID EFFLUENTS AND SOLID WASTE FROM NUCLEAR POWER PLANTS DURING 1974 ARE SUMMARIZED AND COMPARED TO FORMER YEARS. THIS REPORT SUPPLEMENTS THE EARLIER ANNUAL REPORTS ISSUED BY THE ATOMIC ENERGY COMMISSION AND THE NUCLEAR REGULATORY COMMISSION. ALTHOUGH THE 1974 RELEASES WERE IN ALL CASES BELOW THE LIMITS SET FORTH IN APPLICABLE REGULATIONS, THE AIRBORNE EFFLUENTS INCREASED ABOUT 2 PERCENT AND THE LIQUID EFFLUENTS DECREASED ABOUT 6 PERCENT IN 1974 AS COMPARED TO 1973.
- 18-2-1-127 LEGAL AND INSTITUTIONAL PROBLEMS IN POWER PLANT SITING
BORCKO, B. + JUST, J. E.
MITRE CORPORATION, MCLEAN, VA.
UNCERTAIN LONG RANGE DEMAND, RISING POWER PLANT CAPITAL AND OPERATING COSTS, INCREASING CONSTRUCTION TIME, AND THE IMPOSITION OF MORE STRINGENT REGULATORY REQUIREMENTS FOR NEW POWER PLANTS HAVE RESULTED IN AN INCREASINGLY COMPLEX PROCESS FOR SITING NEW ELECTRIC GENERATING CAPACITY. MAJOR LEGAL AND INSTITUTIONAL IMPEDIMENTS TO A MORE EXPEDITIOUS SITING PROCESS INCLUDE THE NEED FOR ENUNCIATED NATIONAL STRATEGIES ON SUCH ISSUES AS SAFETY STANDARDS, THE NUCLEAR FUEL CYCLE, AND COMMITMENT TO CONSERVATION, THE LACK OF A DEFINITIVE MECHANISM ASSIGNING SPECIFIC RESPONSIBILITY FOR SITE SELECTION, AND THE FACT THAT PUBLIC ACCESS TO SITING DECISIONS IS FIRST PROVIDED AT A LATE STAGE IN THE DECISION PROCESS.
- 18-2-1-133 FOURTH WATER REACTOR SAFETY RESEARCH INFORMATION MEETING
COTTRELL, W. B.
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENN.
THIS ARTICLE IS A REVIEW OF THE FOURTH WATER REACTOR SAFETY RESEARCH INFORMATION MEETING, SPONSORED BY THE NUCLEAR REGULATORY COMMISSION'S (NRC'S) DIVISION OF REACTOR SAFETY RESEARCH, HELD AT THE NATIONAL BUREAU OF STANDARDS, GAITHERSBURG, MD., SEPT. 27-30, 1976. THIS MEETING CONSISTED OF PARALLEL TECHNICAL PRESENTATIONS IN THE MORNING, FOLLOWED BY SEVERAL SMALLER WORKSHOPS OR DISCUSSION SESSIONS IN THE AFTERNOON. THE TECHNICAL SESSIONS WERE (1) LOSS OF COOLANT ACCIDENT STUDIES, (2) ANALYSIS DEVELOPMENT PROGRAM, (3) METALLURGY AND MATERIALS RESEARCH PROGRAM, AND (4) FUEL BEHAVIOR RESEARCH PROGRAM. SUMMARIES OF THE WORK IN EACH OF THESE FOUR MAJOR AREAS ARE PRESENTED HERE. OVER 635 PERSONS, INCLUDING SOME 126 FOREIGN VISITORS FROM 14 COUNTRIES, ATTENDED THE MEETING. IN ADDITION TO THE REVIEW OF NRC-SPONSORED WATER REACTOR SAFETY RESEARCH PROGRAMS, THE MEETING INCLUDED PRESENTATIONS ON SEVERAL FOREIGN REACTOR SAFETY PROGRAMS AS WELL AS ONE AFTERNOON SESSION DEVOTED TO RESEARCH SPONSORED BY THE ELECTRIC POWER RESEARCH INSTITUTE. THE MEETING WAS NOTABLE FOR THE WEALTH OF TECHNICAL DATA AND EXPERIMENTAL RESULTS THAT WERE REPORTED. MANY TOPICS WERE DISCUSSED, AND MUCH WAS LEARNED. IT IS REASSURING THAT THESE RESEARCH RESULTS CONTINUE TO SUBSTANTIATE OUR UNDERSTANDING OF REACTOR SAFETY.
- 18-2-2-154 BURNOUT IN BOILING HEAT TRANSFER II. SUBCOOLED AND LOW QUALITY FORCED CONVECTION SYSTEMS
BERGLES, A. E.
IOWA STATE UNIVERSITY, AMES, IOWA
RECENT EXPERIMENTAL AND ANALYTICAL DEVELOPMENTS REGARDING BURNOUT IN SUBCOOLED AND LOW QUALITY FORCED CONVECTION SYSTEMS ARE REVIEWED. MANY DATA HAVE BEEN ACCUMULATED WHICH CLARIFY THE PARAMETRIC TRENDS AND LEAD TO NEW DESIGN CORRELATIONS FOR WATER AND A VARIETY OF OTHER COOLANTS IN BOTH SIMPLE AND COMPLEX GEOMETRIES. A NUMBER OF CRITICAL EXPERIMENTS AND MODELS HAVE BEEN DEVELOPED TO ATTEMPT TO CLARIFY THE BURNOUT MECHANISM(S) IN SIMPLER GEOMETRIES. OTHER TOPICS DISCUSSED INCLUDE BURNOUT WITH POWER TRANSIENTS AND TECHNIQUES TO AUGMENT BURNOUT.
- 18-2-3-168 ASSESSMENT OF A HIGH INTEGRITY PROTECTIVE SYSTEM FOR LOSS OF ELECTRIC POWER
AITKEN, A.
UNITED KINGDOM ATOMIC ENERGY AUTHORITY, GREAT BRITAIN
THIS ARTICLE OUTLINES THE PROBLEM AND THE PROBLEM AREAS AS OBSERVED IN A RECENT ASSESSMENT OF A HIGH INTEGRITY PROTECTIVE SYSTEM FOR THE PROTOTYPE FAST REACTOR, A LIQUID METAL COOLED FAST BREEDER REACTOR AT DOGNREAY. TARGETS FOR RELIABILITY IN INDIVIDUAL MEASUREMENTS, SAFETY CIRCUITS, AND SHUTDOWN DEVICES ARE DETERMINED BY RELIABILITY APPORTIONMENT WITHIN THE DIVERSE SYSTEM THAT WAS DESIGNED TO MEET WELL-RECOGNIZED BASIC PRECEPTS. SOME COMMENTS ARE MADE ON OPERATING EXPERIENCE IN RELATION TO THE HIGH REQUIREMENTS.

- 18-2-4-174 THE FOURTEENTH ERDA AIR CLEANING CONFERENCE
 MOELLER, D. W. + UNDERHILL, D. W. + FIEST, M. W.
 HARVARD UNIVERSITY, BOSTON, MASS.
 THE FOURTEENTH ERDA AIR-CLEANING CONFERENCE WAS HELD AUG. 2-4, 1976, IN SUN VALLEY, IDAHO. THE 324 ATTENDEES INCLUDED REPRESENTATIVES FROM 13 FOREIGN COUNTRIES AND AIR CLEANING SPECIALISTS FROM ESSENTIALLY ALL FACETS OF INDUSTRY, FROM GOVERNMENTAL AGENCIES, AND FROM EDUCATIONAL INSTITUTIONS. MAJOR TOPICS WERE RADIOIODINE SAMPLING, REMOVAL, AND RETENTION, THE CONCENTRATION AND STORAGE OF NOBLE GASES, TRITIUM, AND CARBON-14, PARTICULATE COLLECTORS, SYSTEMS PROTECTION FROM FIRES, EXPLOSIONS, AND NATURAL DISASTERS, SAMPLING AND MONITORING, AIR CLEANING AND VENTILATION SYSTEM DESIGN, AIR CLEANING PROBLEMS ASSOCIATED WITH THE TREATMENT OF RADIOACTIVE WASTES, AIR CLEANING SYSTEMS FOR THE LIQUID METAL COOLED FAST BREEDER REACTOR, AND THE REGULATORY ASPECTS OF THE AIR CLEANING FIELD. AN INTERESTING ASPECT OF THE CONFERENCE WAS THE DEGREE TO WHICH PROBLEMS ASSOCIATED WITH RADIOIODINE STILL MAINTAIN A PROMINENT PLACE IN AIR CLEANING RESEARCH AND DEVELOPMENT. NEWER CHALLENGES BECAME EVIDENT FROM THE BROWNS FERRY FIRE, WHICH REVEALED WEAKNESSES IN AIR CLEANING AND VENTILATION SYSTEMS IN NUCLEAR POWER PLANTS, AND FROM THE REACTOR SAFETY STUDY, WHICH SHOWED A NEED TO DEVELOP ADDITIONAL DATA ON THE RELIABILITY OF SUCH SYSTEMS, PARTICULARLY UNDER EMERGENCY CONDITIONS. ASSESSMENTS OF THE DEGREE TO WHICH ENGINEERED SAFETY FEATURES CAN BE USED TO COMPENSATE FOR SPECIFIC DEFICIENCIES IN NUCLEAR FACILITY SITES ALSO CONTINUE TO CHALLENGE THOSE INVOLVED IN RISK-BENEFIT EVALUATIONS.
- 18-2-4-189 TRENDS IN THE DESIGN OF PRESSURIZED WATER REACTOR CONTAINMENT STRUCTURES AND SYSTEMS
 MEHTA, D. S. + OSGOOD, H. W. + BINGAMAN, A. J.
 BUCHERT, K. P.
 BECHTEL POWER CORPORATION, GATHERSBURG, MD.
 THIS ARTICLE TRACES THE EVOLUTION OF PRESSURIZED WATER REACTOR (PWR) CONTAINMENT DESIGN REQUIREMENTS AND CONCEPTS SINCE THE MID-1960S, DISCUSSES THE STRUCTURES AND SYSTEMS CURRENTLY BEING USED FOR NEW PLANTS, AND PRESENTS TABULATED DATA CONCERNING SIZE AND TYPE OF CONTAINMENT STRUCTURE, INTERNAL DESIGN PRESSURE, AND SAFE SHUTDOWN GROUND ACCELERATION VALUES FOR 127 NUCLEAR POWER PLANTS. IN ADDITION, VARIOUS CONTAINMENT SYSTEMS, SUCH AS FISSION-PRODUCT REMOVAL, HEAT REMOVAL, COMBUSTIBLE GAS CONTROL, AND PURGE, ARE BRIEFLY REVIEWED.
- 18-2-5-203 RADIOLOGICAL AND ENVIRONMENTAL ASPECTS OF FUSION POWER
 EASTERLY, C. E. + SHANK, K. E. + SHOUP, R. L.
 OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENN.
 FUSION REACTOR TECHNOLOGY IS PRESENTLY IN CONCEPTUAL AND EARLY DEVELOPMENTAL STAGES. CONCOMITANT WITH HARDWARE DEVELOPMENT, POTENTIAL HEALTH AND ENVIRONMENTAL IMPACTS MUST BE EVALUATED TO ENSURE THAT TECHNOLOGISTS HAVE PERTINENT INFORMATION AVAILABLE SO THAT ADEQUATE CONSIDERATION MAY BE GIVEN TO HEALTH AND ENVIRONMENTAL PROBLEMS. THIS ARTICLE DISCUSSES PROBLEM AREAS ATTENDANT TO TRITIUM, ACTIVATION PRODUCTS, AND MAGNETIC FIELDS ASSOCIATED WITH FUSION REACTOR SYSTEMS.
- 18-2-5-215 RADIOLOGICAL QUALITY OF THE ENVIRONMENT
 NUCLEAR SAFETY STAFF
 OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENN.
 THIS REPORT IS PART OF THE U.S. ENVIRONMENTAL PROTECTION AGENCY'S DOSE ASSESSMENT PROGRAM FOR EVALUATING THE RADIOLOGICAL QUALITY OF THE ENVIRONMENT. ITS PUBLICATION HERE DOES NOT CONSTITUTE ENDORSEMENT OF THE ORIGINAL REPORT BY THE NUCLEAR REGULATORY COMMISSION, RATHER, THE EDITORS OF NUCLEAR SAFETY BELIEVE THE AUTHORS HAVE BROUGHT TOGETHER A WEALTH OF DATA AND EXTENSIVE REFERENCES TO THE CURRENT LITERATURE, BOTH OF WHICH SHOULD BE USEFUL TO THE GENERALIST AND SPECIALIST ALIKE. THE REPORT RECOGNIZES THE NEED FOR ADDITIONAL INFORMATION, AND THE INTERESTED READER IS URGED TO CONSULT THE ORIGINAL REPORT FOR ADDITIONAL DETAILS, QUALIFICATIONS, AND SOURCES PERTINENT TO ALL OF THE DATA. AS A PROTOTYPE EFFORT, THIS REPORT IS INTENDED ONLY TO SUMMARIZE INFORMATION AVAILABLE IN THE OPEN LITERATURE. SPECIAL EMPHASIS WAS PLACED ON ACQUIRING RECENT DOSE DATA. FOR SOME SOURCE CATEGORIES, DOSE INFORMATION WAS AVAILABLE FOR CALENDAR YEAR 1975, WHEREAS FOR OTHER CATEGORIES THE MOST RECENT DATA GO BACK TO THE EARLY 1970S. IT IS NOT INTENDED IN THIS INITIAL EFFORT TO CALCULATE OR EXTRAPOLATE FROM EXISTING DATA TO SUPPLY MISSING DOSE INFORMATION. INSTEAD, THE CONCERN IS TO REVIEW THE AVAILABLE DATA AND TO DETERMINE WHAT THE EXISTING DATA PROVIDE FOR INDIVIDUAL AND POPULATION DOSE INFORMATION. SINGLE COPIES OF THE REPORT MAY BE OBTAINED FROM THE OFFICE OF RADIATION PROGRAMS, U.S. ENVIRONMENTAL PROTECTION AGENCY, WASHINGTON, D.C. 20460. IT WAS CONCLUDED, ON THE BASIS OF THE POPULATION DOSE DATA ACQUIRED IN THIS REPORT, THAT THE THREE MAJOR SOURCE CATEGORIES OF RADIATION DOSE IN THE U.S. POPULATION ARE (1) AMBIENT IONIZING RADIATION, (2) THE APPLICATION OF RADIOPHARMACEUTICALS IN MEDICINE, AND (3) TECHNOLOGICALLY ENHANCED NATURAL RADIATION.

- 18-2-6-223 HUMAN ENGINEERING - AIDS TO SMOOTH OPERATION
MANZ, G. W.
U. S. NUCLEAR REGULATORY COMMISSION, BETHESDA, MD.
NUCLEAR PLANT CONTROL CONSOLES ARE HUGE, COMPLEX, AND SOMETIMES CONFUSING. SURPRISINGLY, LITTLE ATTENTION TO DATE HAS BEEN PAID TO THE HUMAN ENGINEERING PRACTICES THAT MAXIMIZE RELIABLE HUMAN PERFORMANCE. MAJOR MODIFICATIONS ARE PROHIBITIVE BY COSTS AND PLANT AVAILABILITY, BUT THERE IS MUCH THE OPERATOR CAN DO TO BACKFIT OPERATOR AIDS. THIS ARTICLE PRESENTS NUMEROUS PRACTICAL APPLICATIONS OF INNOVATIVE IDEAS TO AID THE OPERATOR, INCLUDING SOME THAT ARE ALREADY IN USE AT VARIOUS NUCLEAR PLANTS. THESE INNOVATIONS ARE INTENDED TO ASSIST IN LOCATING CONSOLE COMPONENTS, TO SUPPLY ADDITIONAL OPERATING INFORMATION, TO IMPROVE THE USE OF PROCEDURES, AND TO PROTECT VITAL CONTROLS. IF PROPERLY APPLIED, THESE AIDS SHOULD IMPROVE THE SAFETY AND EFFICIENCY OF THE NUCLEAR POWER PLANT.
- 18-3-1-281 THE REACTOR LICENSING PROCESS - A STATUS REPORT
LONG, J. A.
U. S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, D.C.
THE NUCLEAR REGULATORY COMMISSION (NRC), IN ITS REVIEW OF APPLICATIONS FOR LICENSES TO CONSTRUCT AND OPERATE NUCLEAR POWER PLANTS, IS REQUIRED TO CONSIDER THOSE MEASURES NECESSARY TO ENSURE THE PROTECTION OF THE HEALTH AND SAFETY OF THE PUBLIC AND THE ENVIRONMENT. THIS ARTICLE DISCUSSES THE NRC STAFF PROCEDURES AND POLICIES FOR CONDUCTING THE DETAILED SAFETY, ENVIRONMENTAL, AND ANTICIPATED REVIEWS THAT PROVIDE THE BASIS FOR THESE ASSURANCES. INCLUDED IS A DISCUSSION OF THE IMPROVEMENTS TO THE LICENSING PROCESS CURRENTLY BEING PROPOSED OR IMPLEMENTED TO ENHANCE ITS STABILITY AND PREDICTABILITY FOR THE BENEFIT OF ALL INVOLVED WITH THE REGULATION OF NUCLEAR POWER. THE VIEWS AND OPINIONS EXPRESSED IN THIS ARTICLE ARE THOSE OF THE AUTHOR ALONE AND DO NOT REPRESENT POSITIONS OF THE NRC.
- 18-3-1-291 TRANSPORT OF RADIOACTIVE MATERIALS IN THE UNITED STATES
NUCLEAR SAFETY STAFF
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENN.
IN 1975 THE NUCLEAR REGULATORY COMMISSION SPONSORED A SURVEY OF SHIPMENTS OF RADIOACTIVE MATERIALS IN THE UNITED STATES. THE SURVEY WAS CONDUCTED BY BATTELLE PACIFIC NORTHWEST LABORATORIES. OF OVER 15,000 LICENSERS, 7275 WERE SENT QUESTIONNAIRES, AND 59 PERCENT OF THE RECIPIENTS RESPONDED. ON THE BASIS OF THE RESPONSES, IT IS ESTIMATED THAT THE TOTAL NUMBER OF PACKAGES TRANSPORTED IN THE UNITED STATES IS ON THE ORDER OF 2.5 MILLION PACKAGES PER YEAR. ABOUT ONE-THIRD OF THE PACKAGES CONTAIN ONLY SMALL QUANTITIES OF RADIOACTIVE MATERIALS AND ARE EXEMPT FROM PACKAGING AND LABELING REQUIREMENTS OF DEPARTMENT OF TRANSPORTATION REGULATIONS. ON THE BASIS OF THE NUMBER OF PACKAGES SHIPPED ANNUALLY, THE MAJOR RADIONUCLIDES ARE IODINE-131, IODINE-125, TECHNETIUM-99M, MOLYBDENUM-99, AND URANIUM-238, WHEREAS THOSE SHIPPED IN THE GREATEST QUANTITIES (GRAMS OR CURIES) ARE COBALT-60, IRIIDIUM-192, AND URANIUM-238. THE MAJORITY OF PACKAGE TYPES SHIPPED ARE EXEMPT TYPES A AND LS (LOW SPECIFIC ACTIVITY), AND THE MOST COMMON MODES OF TRANSPORT WERE TRUCK, AIR, AND RAIL.
- 18-3-2-298 CRITICAL HEAT FLUX DURING A LOSS OF COOLANT ACCIDENT
GRIFFITH, P. + PEARSON, J. F. + LEPKOWSKI, R. J.
MASSACHUSETTS INSTITUTE OF TECHNOLOGY, CAMBRIDGE, MASS.
A METHOD OF CALCULATING THE MINIMUM TIME TO CRITICAL HEAT FLUX DURING A LOSS OF COOLANT ACCIDENT IS DEVELOPED. THE TIMES CALCULATED IN THIS WAY ARE SHOWN TO BE CONSERVATIVE BUT ARE CLOSE TO THE EXPERIMENTAL VALUES FOR WATER AND QUITE CONSERVATIVE FOR FREON 113. THE MODEL INVOLVES CALCULATING THE TIME REQUIRED TO DRY OUT A CHANNEL IN WHICH THE FLOW IS STAGNATED IN THE MIDDLE IN THE HOT REGION.
- 18-3-2-306 RESULTS OF THE FIRST THREE NONNUCLEAR TESTS IN THE LOFT FACILITY
MCPHERSON, G. D.
U. S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, D.C.
THE LOFT FACILITY IS A WELL INSTRUMENTED, SCALED MODEL OF A COMMERCIAL PRESSURIZED-WATER REACTOR. THE FACILITY IS DESIGNED TO STUDY THE BEHAVIOR OF SUCH ENGINEERED SAFETY SYSTEMS AS EMERGENCY CORE-COOLING SYSTEMS DURING REACTOR ACCIDENT CONDITIONS. THIS ARTICLE DESCRIBES THE LOFT FACILITY, THE CURRENT NONNUCLEAR EXPERIMENT SERIES, AND THE FORTHCOMING NUCLEAR EXPERIMENTS. SIGNIFICANT NONNUCLEAR EXPERIMENTAL RESULTS ALSO ARE REPORTED.
- 18-3-3-317 QUALIFICATION OF SAFETY RELATED SWITCHGEAR FOR NUCLEAR POWER APPLICATIONS
RHODES, E. W.
THE IMPERIAL CORPORATION, MONTGOMERYVILLE, PA.
THIS ARTICLE DISCUSSES SOME OF THE PROBLEMS ENCOUNTERED AND A MEANS FOR MEETING THE REQUIREMENTS OF IEEE STANDARD 323-1974 IN DEMONSTRATING QUALIFICATION OF SWITCHGEAR FOR SAFETY RELATED APPLICATIONS IN NUCLEAR POWER GENERATING STATIONS. THE SWITCHGEAR ASSEMBLIES ARE SUBJECTED TO A NUMBER OF TESTS (E.G., SERVICE CONDITIONS, SEISMIC CONDITIONS, LIFE, AND AGING), WHICH ARE REPORTED AND EVALUATED IN A QUALIFICATION SUMMARY REPORT. THE ARTICLE CONTAINS RECOMMENDATIONS FOR MAINTENANCE, INSPECTION, AND TESTING.

- 18-3-3-322 EMP AND NUCLEAR PLANT SAFETY
BARNES, D. R.
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENN.
THE ELECTROMAGNETIC PULSE (EMP) FROM A HIGH ALTITUDE NUCLEAR DETONATION CONSISTS OF A TRANSIENT PULSE OF HIGH INTENSITY ELECTROMAGNETIC FIELDS THAT INDUCE CURRENT AND VOLTAGE TRANSIENTS IN ELECTRICAL CONDUCTORS. ALTHOUGH MOST NUCLEAR POWER PLANT CABLES ARE NOT DIRECTLY EXPOSED TO THESE FIELDS, THE ATTENUATED EMP FIELDS THAT PROPAGATE INTO THE PLANT WILL COUPLE SOME EMP ENERGY TO THESE CABLES. THIS ARTICLE ATTEMPTS TO PREDICT THE PROBABLE EFFECTS OF THE EMP TRANSIENTS THAT COULD BE INDUCED IN CRITICAL CIRCUITS OF SAFETY RELATED SYSTEMS. IT IS CONCLUDED THAT THE MOST LIKELY CONSEQUENCE OF EMP FOR NUCLEAR PLANTS IS AN UNSCHEDULED SHUTDOWN. IN GENERAL, EMP COULD BE A NUISANCE TO NUCLEAR POWER PLANTS, BUT IT IS NOT CONSIDERED A SERIOUS THREAT TO PLANT SAFETY.
- 18-3-5-329 COLD SHOCK TO AQUATIC ORGANISMS - GUIDANCE FOR POWER PLANT SITING, DESIGN, AND OPERATION
COUTANT, C. C.
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENN.
PROBLEMS OF COLD SHOCK DAMAGES TO AQUATIC ORGANISMS HAVE ARISEN AT SOME CONDENSER COOLING WATER DISCHARGES OF THERMAL POWER STATIONS WHEN THE WARM WATER RELEASES HAVE SUDDENLY TERMINATED. THE BASIS FOR SUCH DAMAGE LIES IN THE EXPOSURE OF RESIDENT ORGANISMS TO A RAPID DECREASE IN TEMPERATURE AND A SUSTAINED EXPOSURE TO LOW TEMPERATURE THAT INDUCES ABNORMAL BEHAVIORAL OR PHYSIOLOGICAL PERFORMANCE AND OFTEN LEADS TO DEATH. ALTHOUGH SOME SPECTACULAR FISH KILLS FROM COLD SHOCK HAVE OCCURRED, THE PRESENT KNOWLEDGE OF THE HYDRAULIC AND BIOLOGICAL PROCESSES INVOLVED CAN PROVIDE GUIDANCE FOR THE SITING, DESIGN, AND OPERATION OF POWER PLANT COOLING SYSTEMS TO MINIMIZE THE LIKELIHOOD OF SIGNIFICANT COLD SHOCK EFFECTS. PREVENTING COLD-SHOCK DAMAGES IS ONE CONSIDERATION IN MINIMIZING OVERALL ENVIRONMENTAL IMPACTS OF POWER PLANT COOLING AND IN BALANCING PLANT COSTS WITH ENVIRONMENTAL BENEFITS.
- 18-3-5-343 COMPUTER CODES FOR THE ASSESSMENT OF RADIONUCLIDES RELEASED TO THE ENVIRONMENT
HOFFMAN, F. O. + MILLEP, C. W. + SHARFFER, D. L.
GARTEN, C. T., JR.
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENN.
THIS ARTICLE PRESENTS A COMPILATION OF COMPUTER CODES THAT MAY BE USED FOR THE ASSESSMENT OF ACCIDENTAL OR ROUTINE RELEASES OF RADIOACTIVITY TO THE ENVIRONMENT FROM NUCLEAR POWER FACILITIES. THE CAPABILITIES OF 93 COMPUTER CODES IN THE AREAS OF ENVIRONMENTAL TRANSPORT AND RADIATION DOSIMETRY ARE SUMMARIZED IN TABULAR FORM. THIS PRELIMINARY ANALYSIS CLEARLY INDICATES THAT THE INITIAL EFFORTS IN ASSESSMENT METHODOLOGY DEVELOPMENT HAVE CONCENTRATED ON ATMOSPHERIC DISPERSION, EXTERNAL DOSIMETRY, AND INTERNAL DOSIMETRY VIA INHALATION. THE INCORPORATION OF TERRESTRIAL AND AQUATIC FOOD-CHAIN PATHWAYS HAS BEEN A MORE RECENT DEVELOPMENT AND REFLECTS THE NEED FOR SATISFYING THE CURRENT REQUIREMENTS OF ENVIRONMENTAL LEGISLATION AND THE NEEDS OF REGULATORY AGENCIES. THE CHARACTERISTICS OF THE CONCEPTUAL MODELS EMPLOYED BY THESE CODES ARE REVIEWED.
- 18-3-6-355 STEAM GENERATOR TUBE FAILURES - WORLD EXPERIENCE IN WATER COOLED NUCLEAR REACTORS IN 1975
HARE, M. G.
ATOMIC ENERGY OF CANADA LIMITED, ONTARIO, CANADA
STEAM GENERATOR TUBE FAILURES WERE REPORTED IN 22 OUT OF 62 WATER COOLED NUCLEAR POWER PLANTS SURVEYED IN 1975. THIS WAS LESS THAN THE NUMBER OF PLANTS WITH REPORTED TUBE FAILURES IN 1974, AND THE NUMBER OF TUBES AFFECTED WAS NOTICEABLY LESS. THIS ARTICLE SUMMARIZES THESE FAILURES, MOST OF WHICH WERE DUE TO CORROSION. SECONDARY WATER CHEMISTRY CONTROL, PROCEDURES FOR INSPECTION AND REPAIR, TUBE MATERIALS, AND FAILURE RATES ARE DISCUSSED.
- 18-3-6-365 OCCUPATIONAL RADIATION EXPOSURES AT LIGHT WATER COOLED POWER REACTORS, 1969-1975
MURPHY, T. D. + DAYEM, N. J. + BLAND, J. S.
PASCIAK, W. J.
U. S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, D.C.
THIS ARTICLE IS A COMPILATION OF OCCUPATIONAL RADIATION EXPOSURES AT COMMERCIAL LIGHT WATER COOLED REACTORS (LWRS) FROM 1969 TO 1975 AND UPDATES PREVIOUS INFORMATION THAT COVERED EXPOSURES THROUGH 1974. THE INFORMATION WAS DERIVED FROM REPORTS SUBMITTED TO THE NUCLEAR REGULATORY COMMISSION IN ACCORDANCE WITH REQUIREMENTS OF INDIVIDUAL PLANT TECHNICAL SPECIFICATIONS AND THE CODE OF FEDERAL REGULATIONS. THE COLLECTIVE DOSE TO PERSONNEL (MAN-REMS PER REACTOR PER YEAR) AT LWRS WAS GREATER IN 1975 THAN IN 1974. ALTHOUGH THE AVERAGE EXPOSURE PER INDIVIDUAL REMAINED AT 0.8 REM/YEAR, THE AVERAGE NUMBER OF PERSONNEL RECEIVING MEASURABLE EXPOSURES PER REACTOR INCREASED IN 1975.
- 18-3-6-370 RADIOACTIVE EFFLUENTS FROM NUCLEAR POWER STATIONS IN EUROPE, 1970-1974
NUCLEAR SAFETY STAFF
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENN.
(EDITOR'S NOTE - THE PRODUCTION OF ELECTRICITY BY THE USE OF NUCLEAR POWER IS A WORLDWIDE PHENOMENON, AS IS THE CONCOMITANT CONCERN REGARDING RADIOACTIVE EFFLUENTS.) THIS ARTICLE WAS ADAPTED BY THE NUCLEAR SAFETY STAFF FROM A RECENT REPORT BY THE

COMMISSION OF EUROPEAN COMMUNITIES THAT SUMMARIZES THE DISCHARGE DATA FOR SOME 34 POWER REACTORS (LESS THAN 50 MW(E)) OPERATING WITHIN THE EUROPEAN COMMUNITY. ON THE BASIS OF THESE DISCHARGES, MAXIMUM EXPOSURE IN THE VICINITY OF POWER STATIONS IS ASSESSED AND COMPARED WITH THE DOSE LIMITS FIXED BY RADIOLOGICAL PROTECTION STANDARDS AND WITH THE NATURAL RADIATION LEVEL. ALSO, THE RADIOACTIVE WASTE DISCHARGE PER UNIT ELECTRICAL ENERGY PRODUCED IS GIVEN FOR EACH POWER STATION. IN GENERAL, THE EUROPEAN EXPERIENCE IS SIMILAR TO THAT OF THE UNITED STATES, WHERE, IN ACCORDANCE WITH NRC 'AS LOW AS REASONABLY ACHIEVABLE' REGULATIONS, INDUSTRIAL OFF-SITE EXPOSURES MUST BE KEPT BELOW 5 MREMS/YEAR.

18-4-1-427

THE HOME MADE NUCLEAR BOMB SYNDROME
MEYER, W. + LOYALKA, S. K. + NELSON, W. E.
WILLIAMS, R. W.

UNIVERSITY OF MISSOURI, COLUMBIA, MO.
WITH THE PUBLICATION OF NUCLEAR THEFT - RISKS AND SAFEGUARDS BY WILBRICH AND TAYLOR, SIGNIFICANT ATTENTION HAS BEEN FOCUSED BY THE MEDIA AND THE PUBLIC ON THE POSSIBILITY OF FISSILE MATERIALS BEING STOLEN BY A TERRORIST ORGANIZATION AND DIVERTED TO THE ACTUAL BUILDING, OR THE THREAT OF BUILDING, OF A NUCLEAR EXPLOSIVE DEVICE. THE IMPLICATION HAS BEEN CREATED THAT ONE OR SEVERAL RELATIVELY INEXPERIENCED INDIVIDUALS COULD OBTAIN THE MATERIALS NECESSARY AND FABRICATE A LOW-YIELD NUCLEAR EXPLOSIVE. THIS ARTICLE EXAMINES THESE CONTENTIONS IN SOME DETAIL. THE SAFEGUARDS AND USE-DENIAL METHODS PRESENTLY USED IN THE NUCLEAR FUEL CYCLE ARE CONSIDERED, AND THE DIFFICULTIES THEY PRESENT IN OBTAINING SIGNIFICANT AMOUNTS OF STRATEGIC NUCLEAR MATERIALS ARE EXAMINED. THE CHARACTERISTICS OF REACTOR GRADE PLUTONIUM ARE DISCUSSED, AND THE DIFFICULTIES ASSOCIATED WITH THE ASSEMBLY OF AN EFFICIENT NUCLEAR EXPLOSIVE DEVICE ARE OUTLINED.

18-4-1-438

THE RUSSIAN APPROACH TO NUCLEAR REACTOR SAFETY
LEWIN, J.

OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENN.
SOVIET REACTOR AND POWER STATION DESIGN INITIALLY PROCEEDED FROM A SAFETY PHILOSOPHY THAT DID NOT ACKNOWLEDGE A LOSS OF COOLANT ACCIDENT CAUSED BY A DOUBLE ENDED PIPE BREAK NOR A MASSIVE CORE MELTDOWN AS CREDIBLE EVENTUALITIES TO BE CONSIDERED IN THE DESIGN OF SYSTEMS AND DETAILS. GENERALLY, ENGINEERED SAFEGUARDS AND CONSERVATISM IN DESIGN HAVE BEEN REGARDED AS ADEQUATE INSURANCE AGAINST ACCIDENTS THAT COULD ESCALATE TO A POINT WHERE THERE IS SIGNIFICANT RADIATION DAMAGE TO EITHER PLANT PERSONNEL OR THE PUBLIC. RECENTLY, THERE HAS BEEN SOME CHANGE IN THE ATTITUDE OF SCIENTISTS TOWARD SECONDARY CONTAINMENT IN PRESSURIZED WATER REACTOR PLANTS. IN PRESSURE TUBE BOILING WATER REACTORS AND LIQUID METAL COOLED FAST BREEDER REACTORS, SOVIET EXPERIENCE ON SEVERAL DEMONSTRATION AND 'SEMICOMMERCIAL' UNITS HAS BEEN INTERPRETED TO MEAN THAT CORE DAMAGE PROPAGATION AND ACCIDENTS INVOLVING LARGE ENERGY RELEASES ARE NOT CREDIBLE. IT APPEARS, HOWEVER, THAT THERE IS NOT COMPLETE UNANIMITY ON ALL SAFETY QUESTIONS, AND GREATER DISPERSION OF AUTHORITY AND MORE FORMAL SAFETY REVIEWS SEEM TO BE IN THE MAKING.

18-4-2-451

1976 INTERNATIONAL MEETING ON FAST REACTOR SAFETY AND RELATED PHYSICS
PONTANA, M. H.

OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENN.
THIS ARTICLE REVIEWS SOME OF THE SIGNIFICANT SAFETY TOPICS THAT WERE DISCUSSED DURING THE INTERNATIONAL MEETING ON FAST REACTOR SAFETY AND RELATED PHYSICS HELD IN CHICAGO ON OCT. 5-8, 1976, UNDER THE AUSPICES OF THE AMERICAN NUCLEAR SOCIETY AND THE NEWLY FORMED EUROPEAN NUCLEAR SOCIETY. TWENTY-NINE SESSIONS WERE HELD, INCLUDING TWO PLENARY SESSIONS, MORE THAN 226 PAPERS WERE PRESENTED. BECAUSE OF THE IMPOSSIBILITY OF REPORTING ALL THE SESSIONS, THE REVIEWER HAS ATTEMPTED TO CONVEY A CONSENSUS OF THE STATE OF THE ART OF FAST REACTOR SAFETY AS REPORTED AT THIS MEETING.

18-4-3-469

IN-SERVICE INSPECTION TECHNIQUES FOR LIQUID METAL COOLED FAST BREEDER REACTORS
MCCLUNG, P. W. + SPANNER, J. C. + HAGEN, E. W.

OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENN. AND WESTINGHOUSE HANFORD COMPANY, RICHLAND, WASH.
ALTHOUGH FIRM REQUIREMENTS HAVE NOT YET BEEN ESTABLISHED IN THE UNITED STATES FOR IN-SERVICE INSPECTION OF LIQUID METAL COOLED FAST BREEDER REACTORS, SOME INITIAL DEVELOPMENT WORK ON POTENTIALLY APPLICABLE NONDESTRUCTIVE TESTING METHODS HAS BEEN CONDUCTED. THIS ARTICLE DESCRIBES PRELIMINARY INVESTIGATIONS OF SEVERAL ADVANCED NONDESTRUCTIVE TESTING CONCEPTS FOR LIQUID SODIUM SYSTEMS. THE METHODS HIGHLIGHTED FOR POTENTIAL APPLICATION ARE ULTRASONICS, EDDY CURRENTS, ELECTROTHERMAL TESTING, UNDER SODIUM VIEWING, AND RADIOGRAPHY.

18-4-4-481

NUCLEAR SAFETY EXPERIMENTS IN THE MARVIKEN POWER STATION
SLAUGHTERBECK, D. C. + ERICSON, L.

MARVIKEN, SWEDEN
THIS ARTICLE REVIEWS THREE MULTINATIONAL PROJECTS CONCERNING FULL SCALE NUCLEAR SAFETY EXPERIMENTS AT THE MARVIKEN POWER STATION IN SWEDEN. EXPERIMENTS IN THE FIRST PROJECT, CARRIED OUT IN 1972 AND 1973, WERE RELATED TO THE RESPONSE OF THE

PRESSURE SUPPRESSION CONTAINMENT TO SIMULATED RUPTURES IN PIPE SYSTEMS CONNECTED TO THE PRESSURE VESSEL. EXPERIMENTS IN THE SECOND PROJECT, CURRENTLY UNDER WAY, ARE RELATED TO PRESSURE OSCILLATIONS IN THE CONTAINMENT SYSTEM FOLLOWING SIMULATED RUPTURES IN THE PIPE SYSTEM. THE THIRD PROJECT CONCERNS A PROPOSED PROGRAM FOR THE EXPERIMENTAL INVESTIGATION OF CRITICAL MASS FLOW THROUGH SIMULATED RUPTURES IN A FULL SCALE PIPING SYSTEM.

- 18-4-5-492 CONTROLLING OCCUPATIONAL RADIATION EXPOSURE AT OPERATING NUCLEAR POWER STATIONS
DICKSON, H. W. + OAKES, T. W. + SHANK, K. E.
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENN.
THE HISTORICAL DEVELOPMENT OF THE PHILOSOPHY OF KEEPING THE RADIATION EXPOSURE OF WORKERS AT LIGHT WATER REACTORS AS LOW AS REASONABLY ACHIEVABLE (ALARA) IS PRESENTED. A REVIEW IS MADE OF SOME OF THE ALARA ACTIVITIES OF THE NUCLEAR REGULATORY COMMISSION, THE ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION, AND VARIOUS NUCLEAR INSTALLATIONS. DATA COMPILED BY THE NRC SHOW THAT ROUTINE AND SPECIAL MAINTENANCE AT LIGHT WATER REACTORS ACCOUNTS FOR 72 PERCENT OF ALL OCCUPATIONAL EXPOSURE AT THESE SITES. THE ROLE THAT OAK RIDGE NATIONAL LABORATORY HAS TAKEN IN ALARA RESEARCH IS PRESENTED, WITH EMPHASIS PLACED ON A STUDY OF VALVE MALFUNCTIONS AT LIGHT WATER REACTORS. THE VALVE STUDY INDICATES A TREND TOWARD DECREASING VALVE RELIABILITY OVER THE PAST FEW YEARS. FINALLY A COST BENEFIT ANALYSIS OF RADIATION DOSE REDUCTION IS DISCUSSED. THE RATIONALE FOR ASSIGNING A COST PER MAN REM BASED ON THE RADIATION EXPOSURE LEVEL THAT IS ENCOUNTERED IS PRESENTED.
- 18-4-5-502 INTERNATIONAL WASTE MANAGEMENT SYMPOSIUM
SHOUP, R. L.
UNION CARBIDE CORPORATION, NUCLEAR DIVISION, OAK RIDGE, TENN.
AN INTERNATIONAL SYMPOSIUM ON THE MANAGEMENT OF WASTES FROM THE LWR FUEL CYCLE WAS HELD IN DENVER, COLO., ON JULY 11-16, 1976. THE SYMPOSIUM COVERED A BROAD RANGE OF TOPICS FROM POLICY ISSUES TO TECHNOLOGY. PRESENTATIONS WERE MADE BY NATIONAL AND INTERNATIONAL SPEAKERS INVOLVED IN ALL ASPECTS OF WASTE MANAGEMENT - GOVERNMENT AND AGENCY OFFICIALS, LABORATORY MANAGERS, DIRECTORS, AND RESEARCHERS, AND INDUSTRIAL REPRESENTATIVES. MANY SPEAKERS ADVOCATED PRAGMATIC ACTION ON PROGRAMS FOR THE MANAGEMENT OF COMMERCIAL NUCLEAR WASTES TO COMPLETE THE LIGHT WATER REACTOR (LWR) FUEL CYCLE. THE INDUSTRIALIZED NATIONS' DEMAND FOR INCREASING SUPPLIES OF ENERGY AND THEIR INCREASING DEPENDENCE ON NUCLEAR ENERGY TO FULFILL THIS DEMAND WILL NECESSITATE THE DEVELOPMENT OF AN ACCEPTABLE SOLUTION TO THE DISPOSAL OF NUCLEAR WASTES WITHIN THE NEXT DECADE FOR SOME INDUSTRIAL NATIONS. WASTE DISPOSAL TECHNOLOGY SHOULD BE IMPLEMENTED ON A COMMERCIAL SCALE, BUT THE COMMERCIALIZATION MUST BE ACCOMPANIED BY THE DECISION TO USE THE TECHNOLOGY. AN IMPORTANT ISSUE IN THE USE OF NUCLEAR ENERGY IS THE QUESTION OF SHARING THE TECHNOLOGY WITH THE LESS INDUSTRIALIZED NATIONS AND WITH NATIONS THAT MAY NOT HAVE SUITABLE MEANS TO DISPOSE OF NUCLEAR WASTES. THE ESTABLISHMENT OF INTERNATIONAL AND MULTINATIONAL COOPERATION WILL BE AN IMPORTANT KEY IN REALIZING THIS OBJECTIVE. PRESSING ISSUES THAT INTERNATIONAL ORGANIZATIONS OR TASK GROUPS WILL HAVE TO ADDRESS ARE OCEAN DISPOSAL, PLUTONIUM RECYCLING AND SAFEGUARDS, AND DISPOSAL CRITERIA. THE IMPORTANCE OF ACHIEVING A VIABLE WASTE MANAGEMENT PROGRAM IS MADE EVIDENT BY THE INCREASED FUNDING AND ATTENTION THAT THE BACK END OF THE FUEL CYCLE IS NOW RECEIVING.
- 18-4-6-513 REACTOR VESSEL PRESSURE TRANSIENTS
NUCLEAR SAFETY STAFF
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENN.
(EDITOR'S NOTE - THE FOLLOWING ARTICLE WAS ADAPTED BY THE NUCLEAR SAFETY SECTION EDITOR FROM A NUCLEAR REGULATORY COMMISSION (NRC) DOCUMENT ENTITLED 'TECHNICAL REPORT ON REACTOR PRESSURE VESSEL TRANSIENTS,' WHICH WAS INCLUDED AS AN ATTACHMENT TO NUPEG-0138, 'STAFF DISCUSSION OF FIFTEEN TECHNICAL ISSUES LISTED IN ATTACHMENT TO NOVEMBER 3, 1976, MEMORANDUM FROM DIRECTOR OF NRR TO NRR STAFF.' SINCE SPACE LIMITATIONS DO NOT PERMIT US TO INCLUDE THE TECHNICAL REPORT IN ITS ENTIRETY, THE EDITORS HAVE PREPARED THE FOLLOWING CONDENSED VERSION LARGELY FROM EXCERPTS FROM THE ORIGINAL. THE ORIGINAL REPORT, DATED NOV. 1, 1976, WAS PREPARED BY A TASK GROUP WORKING UNDER THE AUSPICES OF THE NRC OFFICE OF NUCLEAR REACTOR REGULATION AND CHAIRED BY D. G. EISENHUT. THIS REPORT SUMMARIZES THE RELEVANT TECHNICAL CONSIDERATIONS, DISCUSSES THE SAFETY CONCERNS AND EXISTING MARGINS AT OPERATING REACTORS, AND DESCRIBES THE REGULATORY ACTIONS BEING TAKEN TO REDUCE THE LIKELIHOOD OF FUTURE PRESSURE TRANSIENT EVENTS AT OPERATING REACTORS.)
- 18-4-6-523 OCCUPATIONAL RADIATION EXPOSURES AT LICENSED FACILITIES, 1975
BROOKS, B. G.
U. S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, D. C.
PERSONNEL OCCUPATIONAL RADIATION EXPOSURES FOR CALENDAR YEAR 1975 WERE OBTAINED FROM ANNUAL AND TERMINATION REPORTS SUBMITTED BY VARIOUS TYPES OF NUCLEAR REGULATORY COMMISSION LICENSEES, INCLUDING NUCLEAR POWER PLANTS AND INDUSTRIAL

RADIOGRAPHERS, AS WELL AS FUEL AND BY-PRODUCT PROCESSORS, FABRICATORS, AND REPROCESSORS. ANNUAL REPORTS RECEIVED FROM 387 LICENSEES INDICATED THAT SOME 78,713 INDIVIDUALS, WHO INCURRED AN AVERAGE EXPOSURE OF 0.36 REM, WERE MONITORED FOR EXPOSURE TO RADIATION DURING 1975 AND THAT 21,601 INDIVIDUALS TERMINATED THEIR EMPLOYMENT OR WORK ASSIGNMENT IN 1975. THE NUMBER OF PERSONNEL OVEREXPOSURES REPORTED IN 1975 DECREASED FROM PREVIOUS YEARS.

- 18-5-1-581 TRENDS IN THE LICENSING OF NUCLEAR POWER PLANTS
KNUTH, D. P. + MCFEEN, J. E., JR.
KMC, INC., WASHINGTON, D.C.
THIS ARTICLE PRESENTS A BRIEF SUMMARY OF THE U.S. NUCLEAR LICENSING EXPERIENCE AND DISCUSSES THE EFFECT ON COSTS AND TIME TO PLACE A UNIT IN SERVICE. RECENT NUCLEAR REGULATORY COMMISSION POLICY INNOVATIONS, SUCH AS STANDARD REVIEW PLANS, STANDARD FORMAT, STANDARDIZATION, AND GENERIC HEARINGS, ARE DISCUSSED ALONG WITH OBSERVATIONS OF THE IMPACT ON THE LICENSING REVIEW. TECHNICAL AND POLICY UNCERTAINTIES THAT ARE CURRENTLY FACING LICENSEES ARE ALSO DISCUSSED, AS ARE THE POTENTIAL IMPACTS OF TECHNICAL AND LEGAL INTERFACES REQUIRED BY THE INCREASING NUMBER OF GENERIC HEARINGS, STATE HEARINGS, AND FEDERAL COURT REVIEWS.
- 18-5-1-589 NRC INTERNATIONAL AGREEMENTS ON REACTOR SAFETY RESEARCH
BENNETT, G. L. + SPANO, A. H. + SZAWLECZY, S. A.
U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, D.C.
THE NUCLEAR REGULATORY COMMISSION AND ITS PREDECESSOR, THE ATOMIC ENERGY COMMISSION, HAVE ENTERED INTO A NUMBER OF REACTOR SAFETY RESEARCH AGREEMENTS WITH OTHER COUNTRIES. THESE AGREEMENTS INVOLVE VARIOUS FORMS OF COOPERATION INCLUDING BILATERAL INFORMATION EXCHANGE AND JOINT RESEARCH PARTICIPATION IN SPECIFIC PROJECTS ON A BILATERAL OR MULTILATERAL LEVEL. UNDER THE TERMS OF THESE AGREEMENTS, REPORTS, COMPUTER CODES, AND DATA MAY BE EXCHANGED AND PERSONNEL VISITS AND ASSIGNMENTS PERMITTED. THESE AGREEMENTS HAVE PROVED TO BE BENEFICIAL IN PROVIDING FOR A COST EFFECTIVE EXTENSION OF THE BASE OF REACTOR SAFETY INFORMATION AVAILABLE TO THE PARTIES CONCERNED. SUCH AGREEMENTS HELP TO ENHANCE REACTOR SAFETY WORLDWIDE.
- 18-5-2-596 A REVIEW OF SHORT TERM FISSION PRODUCT DECAY POWER
BJERKE, M. A. + HOLM, J. S. + SHAY, M. R.
SPINRAD, R. I.
OREGON STATE UNIVERSITY, CORVALLIS, OREG.
EXPERIMENTS ON SHORT TERM FISSION PRODUCT DECAY POWER, WHICH MAY BE IMPORTANT FOR LOSS OF COOLANT ACCIDENT ANALYSIS, ARE REVIEWED. THE MOST RECENT EXPERIMENTS GIVE SUFFICIENT DATA TO FORM THE BASIS OF REASONABLE STANDARDS, PARTICULARLY WHEN THEY ARE SUPPLEMENTED WITH RESULTS FROM SUMMATION PREDICTIONS. THE PREPARATION OF IMPROVED STANDARDS FOR SCIENTIFIC AND REGULATORY PURPOSES IS IN AN ADVANCED STAGE. PRELIMINARY ESTIMATES INDICATE THAT THE EXISTING STANDARD PROPOSED BY THE AMERICAN NUCLEAR SOCIETY HAS AN EXTREMELY CONSERVATIVE UNCERTAINTY BAND ASSOCIATED WITH IT. NEW DATA PROVIDE FIRM JUSTIFICATION FOR REDUCING THE UNCERTAINTY ASSOCIATED WITH THE EXISTING STANDARD.
- 18-5-3-617 INSTRUMENTATION PROGRAMS FOR NUCLEAR POWER PLANT SITES
ALLEN, J. M. + KARNER, D. B.
ARIZONA NUCLEAR POWER PROJECT, PHOENIX, ARIZ.
TYPICAL INSTRUMENTATION PROGRAMS TO DETERMINE THE SUITABILITY OF A PROPOSED NUCLEAR POWER PLANT SITE ARE DESCRIBED. AN OVERVIEW OF REGULATORY REQUIREMENTS IS PRESENTED, ALONG WITH A BRIEF DISCUSSION OF TYPICAL METEOROLOGICAL, SEISMOLOGICAL, GEOLOGICAL, RADIOLOGICAL, AND SEWAGE EFFLUENT MONITORING SYSTEMS. THE DISCUSSION DEFINES THE VARIOUS PARAMETERS THAT MUST BE MEASURED AND DESCRIBES THE TYPICAL SENSORS, TRANSDUCERS, AND INSTRUMENTATION USED. PROBLEMS PRESENTED BY A REMOTE DESERT SITE, SUCH AS ONE LOCATED IN THE ARID SOUTHWESTERN UNITED STATES, ARE ALSO DISCUSSED.
- 18-5-3-624 COMMON-MODE FAILURES IN REACTOR SAFETY SYSTEMS
JOLLY, M. E. + WREATHALL, J.
U.K. CENTRAL ELECTRICITY GENERATING BOARD
THIS ARTICLE DESCRIBES THE PRINCIPLES ADOPTED BY THE U.K. CENTRAL ELECTRICITY GENERATING BOARD IN TACKLING THE HAZARDS OF COMMON-MODE FAILURES IN REACTOR SAFETY EQUIPMENT AND INDICATES THE WAYS IN WHICH THE PRINCIPLES ARE IMPLEMENTED IN PRACTICE. WHERE APPROPRIATE, REFERENCE IS ALSO MADE TO APPLICATIONS IN POSTTRIP COOLING AREAS. RECOGNITION IS GIVEN TO THE FACT THAT DIVERSITY IS NOT AN ABSOLUTE MEASURE, BUT ONE WHICH HAS VARYING DEGREES OF DEPTH. THE DISCUSSION IS EXTENDED TO SHOW THAT THE USE OF EXAMINATION IN DEPTH MUST INCLUDE NOT ONLY HARDWARE BUT ALSO CALCULATIONAL METHODS AND OPERATOR ASPECTS. IT IS CONCLUDED THAT THERE IS NO OBJECTIVE WAY OF ESTABLISHING THE PROBABILITY OF COMMON-MODE FAILURE FOR HIGH INTEGRITY EQUIPMENT AND THAT THERE IS NO SUBSTITUTE FOR THE USE OF ENGINEERING EXPERIENCE IN DEPTH.

- 18-5-4-633 CURRENT CHALLENGES IN AIR CLEANING AT NUCLEAR FACILITIES
MOELLER, D. W.
HARVARD UNIVERSITY, BOSTON, MASS.
THE SAFE OPERATION OF NUCLEAR FACILITIES IS HEAVILY DEPENDENT UPON THE ADEQUATE PERFORMANCE OF AIR CLEANING SYSTEMS. ALTHOUGH MANY PROBLEMS HAVE BEEN SOLVED, NEW QUESTIONS AND NEW CHALLENGES CONTINUE TO ARISE. THESE ARE WELL ILLUSTRATED BY WEAKNESSES IN ATE CLEANING AND VENTILATING SYSTEMS REVEALED IN THE BROWN'S FERRY FIFP AND BY THE NEED TO DEVELOP ADDITIONAL DATA ON THE RELIABILITY OF SUCH SYSTEMS, PARTICULARLY UNDER EMERGENCY CONDITIONS, AS ENUMERATED IN THE REACTOR SAFETY STUDY. ASSESSMENTS OF THE DEGREE TO WHICH ENGINEERED SAFETY FEATURES CAN COMPENSATE FOR DEFICIENCIES IN NUCLEAR POWER PLANT SITES CONTINUE TO CONCERN THOSE INVOLVED IN RISK / BENEFIT EVALUATIONS.
- 18-5-5-647 TRENDS IN PUBLIC HEALTH IN THE POPULATION NEAR NUCLEAR FACILITIES - A CRITICAL ASSESSMENT
PATRICK, C. H.
U.S. ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION, WASHINGTON, D.C.
TEN STUDIES THAT HAVE LOOKED SPECIFICALLY AT CHANGES IN PUBLIC HEALTH IN AREAS NEAR NUCLEAR FACILITIES ARE CRITICALLY REVIEWED. ALL BUT ONE OF THESE STUDIES HAVE BEEN UNABLE TO SHOW ADVERSE HEALTH EFFECTS IN THE LOCAL POPULATION THAT MIGHT BE RELATED TO RADIATION EXPOSURE. THE ONE STUDY THAT PURPORTS TO FIND AN ADVERSE EFFECT HAS SEVERE METHODOLOGICAL LIMITATIONS, WHICH PRECLUDE ANY MEANINGFUL INTERPRETATION OF THE DATA. ALSO PRESENTED IS AN ANALYSIS OF THE INDICATORS OF PUBLIC HEALTH IN THE AREA OF OAK RIDGE, TENN., WHICH SHOWS CANCER MORTALITY RATES THAT ARE NOT SIGNIFICANTLY HIGHER THAN WOULD BE EXPECTED IN THE GENERAL U.S. POPULATION. ALTHOUGH MUCH MORE RESEARCH IS NEEDED BEFORE ALL THE EFFECTS OF VERY LOW LEVELS OF RADIATION FROM NUCLEAR REACTORS WILL BE KNOWN, THE EXISTING STUDIES SUGGEST THAT NUCLEAR POWER PLANTS WILL NOT HAVE A SIGNIFICANT IMPACT ON PUBLIC HEALTH AS A RESULT OF NORMAL OPERATIONS.
- 18-5-6-664 NUCLEAR POWER PLANT PERFORMANCE ANALYSIS
KUPFER, K.
NORDOSTSCHWEIZERISCHE KRAFTWERK, BADEN, SWITZERLAND
EDITOR'S NOTE - IN NOVEMBER 1976 THE INTERNATIONAL CONFERENCE ON WORLD NUCLEAR POWER WAS HELD IN WASHINGTON, D.C., AND WAS JOINTLY SPONSORED BY THE AMERICAN NUCLEAR SOCIETY AND THE EUROPEAN NUCLEAR SOCIETY. K. KUPFER, WHO WAS COCHAIRMAN OF ONE OF THE SESSIONS, OPENED THAT SESSION WITH THE REMARKS THAT COMPRISE THE TEXT OF THIS ARTICLE. DR. KUPFER IS ASSOCIATED WITH NORDOSTSCHWEIZERISCHE KRAFTWERK OF BADEN, SWITZERLAND, AND HAS BEEN DEEPLY INVOLVED WITH THE OPERATION OF THE BEZNAU NUCLEAR POWER STATION. HIS REMARKS SUMMARIZE POWER PLANT PERFORMANCE IN EUROPE, IN THE UNITED STATES, AND ELSEWHERE AND SHOULD BE OF INTEREST TO ALL PERSONS CONCERNED WITH SUCH ACTIVITIES.
- 18-5-6-666 OPERATING EXPERIENCE WITH 13 LIGHT WATER REACTORS IN EUROPE
LUTZ, H. W. + KUPFER, K. + SCHENK, K.
KERNKRAFTWERK MUEHLEBERG DER BERNISCHE KRAFTWERK, MUEHLEBERG, SWITZERLAND / KERNKRAFTWERK BEZNAU DER NORDOSTSCHWEIZERISCHE KRAFTWERK, DOETTINGEN, SWITZERLAND / KERNKRAFTWERK OBRIGHEIM GMBH, OBRIGHEIM, NECKAR, FEDERAL REPUBLIC OF GERMANY
THE OPERATING EXPERIENCE OF 13 EUROPEAN LIGHT WATER REACTOR (LWR) POWER STATIONS THAT BEGAN OPERATION PRIOR TO JANUARY 1973 IS PRESENTED. GIVEN AS KEY PARAMETERS, SUCH AS AVERAGE LOAD FACTOR, LOAD DIAGRAMS, NONAVAILABILITY ANALYSES, STATISTICS ON LEAKING FUEL ELEMENTS, RADIOACTIVITY DISCHARGE VALUES, SIZE OF POWER STATION STAFFS, MAN REM EXPOSURES, ADDITIONAL INVESTMENTS, ETC. SOME SPECIAL EVENTS ARE DESCRIBED IN DETAIL. THEORIES FOR THE DISPARITIES IN CAPACITY FACTORS BETWEEN EUROPEAN AND AMERICAN LWR POWER STATIONS AND BETWEEN PRESSURIZED WATER REACTOR AND BOILING WATER REACTOR POWER STATIONS ARE ALSO PRESENTED.
- 18-6-1-727 GERMAN LIGHT WATER REACTOR SAFETY RESEARCH PROGRAM
SEIPEL, H. G. + LUMMEZHEIM, D. + RITTIG, D.
FEDERAL MINISTRY OF RESEARCH AND TECHNOLOGY, FEDERAL REPUBLIC OF GERMANY
THE LIGHT WATER REACTOR SAFETY RESEARCH PROGRAM, WHICH IS PART OF THE ENERGY PROGRAM OF THE FEDERAL REPUBLIC OF GERMANY, IS PRESENTED IN THIS ARTICLE. THE PROGRAM, FOR WHICH THE FEDERAL MINISTER OF RESEARCH AND TECHNOLOGY OF THE FEDERAL REPUBLIC OF GERMANY IS RESPONSIBLE, IS SUBDIVIDED INTO THE FOLLOWING FOUR MAIN PROBLEM AREAS, WHICH IN TURN ARE SUBDIVIDED INTO PROJECTS (1) IMPROVEMENT OF THE OPERATIONAL SAFETY AND RELIABILITY OF SYSTEMS AND COMPONENTS (PROJECTS - QUALITY ASSURANCE, COMPONENT SAFETY) (2) ANALYSIS OF THE CONSEQUENCES OF ACCIDENTS (PROJECTS - EMERGENCY CORE COOLING, CONTAINMENT, EXTERNAL IMPACTS, PRESSURE VESSEL FAILURE, CORE MELTDOWN) (3) ANALYSIS OF RADIATION EXPOSURE DURING OPERATION, ACCIDENT, AND DECOMMISSIONING (PROJECT - FISSION PRODUCT TRANSPORT AND RADIATION EXPOSURE) AND (4) ANALYSIS OF THE RISK CREATED BY THE OPERATION OF NUCLEAR POWER PLANTS (PROJECT - RISK AND RELIABILITY). VARIOUS PROBLEMS, WHICH ARE INCLUDED IN THE ABOVE MENTIONED PROJECTS, ARE CONCURRENTLY STUDIED WITHIN THE HEISS-DAMPF REAKTOR EXPERIMENTS. INVESTIGATIONS ON THE SAFETY

OF PRESSURIZED REACTOR COMPONENTS IN CONNECTION WITH RESEARCH AND DEVELOPMENT ACTIVITIES ON NONDESTRUCTIVE TESTING HAVE SHOWN THAT THE HIGH SAFETY STANDARDS THAT MUST BE SET FOR NUCLEAR INSTALLATIONS CAN BE MET BY A COMPREHENSIVE QUALITY ASSURANCE SYSTEM, WHEREBY THE MATERIAL AND PROCEDURAL TESTS, AS WELL AS THE NONDESTRUCTIVE TESTS BEFORE AND DURING THE OPERATION, ARE CAREFULLY COORDINATED WITH EACH OTHER. FURTHER INVESTIGATIONS ARE CONCENTRATED ON THE SAFETY MARGINS DURING LONGTIME OPERATION.

18-6-1-756

NUCLEAR SAFETY AT SALZBURG
NUCLEAR SAFETY STAFF

OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENN.

THIS ARTICLE IS A REVIEW OF SELECTED MATERIAL FROM THE IAEA INTERNATIONAL CONFERENCE ON NUCLEAR POWER AND ITS FUEL CYCLE HELD IN SALZBURG, AUSTRIA, MAY 2-13, 1977 (IAEA-CN-36). THE SESSIONS CONSIDERED DEAL WITH NUCLEAR REACTOR SAFETY AND PUBLIC OPINION, ALTHOUGH THE SUBSEQUENT DISCUSSION INCLUDES COMMENTS ON THE ENTIRE MEETING. IN GENERAL, THE SAFETY PAPERS ARE OF VALUE BECAUSE OF THEIR COMPREHENSIVE REVIEW OF THE SUBJECT MATTER RATHER THAN TO ANY SIGNIFICANT NEW DEVELOPMENTS. THE SESSIONS ON PUBLIC OPINION NOT ONLY INDICATED THE UNIVERSALITY OF THIS ELEMENT BUT ALSO REVEALED DIFFERING DEGREES OF CONCERN AND LEVELS OF RESPONSE. DESPITE THE MANY TECHNICAL PRESENTATIONS OF MERIT, THE CONFERENCE WAS DOMINATED BY THE PREVIOUSLY ANNOUNCED U.S. POLICY CONCERNING THE RECYCLING OF NUCLEAR FUEL AND THE DEPLOYMENT OF THE FAST BREEDER REACTOR. THE GENERAL AGREEMENT WITH REGARD TO THE NEED TO PREVENT THE SPREAD OF NUCLEAR WEAPONS DID NOT ENCOMPASS THE NEW U.S. POSITION.

18-6-2-761

AN ASSESSMENT OF HIGH ACCIDENT CONSEQUENCES

BARSELL, A. W. + JOKIMOVIC, V. + SILADY, F. A.
GENERAL ATOMIC COMPANY, SAN DIEGO, CALIF.

ASSESSMENTS WERE MADE OF THE CONSEQUENCES OF THE HIGHER RISK ACCIDENT CONDITIONS POSTULATED TO OCCUR IN A REFERENCE 1975 GENERAL ATOMIC 3000-MW(T) HIGH TEMPERATURE GAS COOLED REACTOR. THIS PROBABILISTIC RISK ASSESSMENT STUDY, KNOWN AS ACCIDENT INITIATION AND PROGRESSION ANALYSIS, IS FUNDED BY THE ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION. THE MOST REPRESENTATIVE ACCIDENT CONDITIONS ARE (1) CORE HEATUP CAUSED BY A LOSS OF OFF-SITE POWER OR BY A LARGE EARTHQUAKE, LEADING TO A LOSS OF FORCED CIRCULATION, (2) REHEATER TUBE FAILURE, (3) DEPRESSURIZATION OF THE PRIMARY COOLANT, AND (4) STEAM GENERATOR MAIN BUNDLE TUBE FAILURE. THE RADIOLOGICAL CONSEQUENCES, WHICH ARE BASED ON REPRESENTATIVE U.S. POPULATION DENSITIES, WERE ASSESSED IN REMS AS A FUNCTION OF DISTANCE FROM THE PLANT AND MAN-REM EXPOSURES TO THE SURROUNDING ENVIRONMENT. THE RESULTS INDICATE THAT THE HIGH TEMPERATURE GAS COOLED REACTOR HAS EXCELLENT SAFETY CHARACTERISTICS, WHICH ARE INHERENT IN THE CONCEPT AND ARE PRIMARILY ASSOCIATED WITH THE CHOICE OF COOLANT AND CORE DESIGN. OVER A WIDE RANGE OF ACCIDENT FREQUENCIES (FROM ONE ACCIDENT PER REACTOR YEAR TO ONE ACCIDENT IN 10 MILLION REACTOR YEARS), NO ACCIDENTS CONSIDERED IN THE STUDY ARE PREDICTED TO CAUSE EARLY OR DELAYED FATALITIES OR ILLNESSES.

18-6-3-774

HUMAN FACTORS IN THE NUCLEAR CONTROL ROOM

SEMINARA, J. L. + PACK, R. W. + GONZALEZ, W. R.
PARSONS, S. C.

ELECTRIC POWER RESEARCH INSTITUTE, PALO ALTO, CALIF. / LOCKHEED MISSILES AND SPACE COMPANY, INC., SUNNYVALE, CALIF.

HUMAN FACTORS ENGINEERING IS AN INTERDISCIPLINARY SPECIALTY CONCERNED WITH INFLUENCING THE DESIGN OF EQUIPMENT SYSTEMS, FACILITIES, AND OPERATIONAL ENVIRONMENTS TO PROMOTE SAFE, EFFICIENT, AND RELIABLE OPERATOR PERFORMANCE. THE HUMAN FACTORS ASPECTS OF FIVE REPRESENTATIVE NUCLEAR POWER PLANT CONTROL ROOMS WERE EVALUATED USING SUCH METHODS AS A CHECKLIST GUIDED OBSERVATION SYSTEM BASED ON MILITARY STANDARDS, STRUCTURED INTERVIEWS WITH OPERATORS AND TRAINERS, DIRECT OBSERVATIONS OF OPERATOR BEHAVIOR, TASK ANALYSES, PROCEDURE EVALUATIONS, AND HISTORICAL ERROR ANALYSES. THE REVIEW HAS SURFACED A WIDE SPECTRUM OF HUMAN FACTORS PROBLEM AREAS AND NEEDED IMPROVEMENTS. THE STUDY RECOMMENDS THAT A DETAILED SET OF APPLICABLE HUMAN FACTORS STANDARDS BE DEVELOPED TO STIMULATE A UNIFORM AND SYSTEMATIC CONCERN FOR HUMAN FACTORS. IT IS FURTHER RECOMMENDED THAT DESIGN GUIDES BE DEVELOPED TO FACILITATE THE IMPLEMENTATION OF SUCH STANDARDS BOTH FOR NEW DESIGNS AND FOR UPGRADING EXISTING CONTROL ROOMS. A NUMBER OF RESEARCH AREAS ARE DELINEATED IN ORDER TO DEVELOP A MORE COMPREHENSIVE DATA BASE ON WHICH TO PREDICATE HUMAN FACTORS STANDARDS.

18-6-4-791

FATIGUE CRACK PROPAGATION IN NEUTRON IRRADIATED FERRITIC PRESSURE VESSEL STEELS

JAMES, L. A.

WESTINGHOUSE HANFORD COMPANY, RICHLAND, WASH.

THE RESULTS OF A NUMBER OF EXPERIMENTS DEALING WITH FATIGUE CRACK PROPAGATION IN IRRADIATED REACTOR PRESSURE VESSEL STEELS ARE REVIEWED. THE STEELS INCLUDED ASTM ALLOYS A302B, A533B, A508-2, AND A543, AS WELL AS WELDMENTS IN A543 STEEL. FLUENCES AND IRRADIATION CONDITIONS WERE GENERALLY TYPICAL OF THOSE EXPERIENCED BY MOST POWER REACTORS. IN GENERAL, THE EFFECT OF

NEUTRON IRRADIATION ON THE FATIGUE CRACK PROPAGATION BEHAVIOR OF THESE STEELS WAS NEITHER SIGNIFICANTLY BENEFICIAL NOR SIGNIFICANTLY DETRIMENTAL.

- 18-6-5-802 POWER PLANT DISCHARGES - TOWARD MORE REASONABLE EFFLUENT LIMITS ON CHLORINE MATTICE, J. S.
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENN.
A METHOD IS PRESENTED FOR RESTRICTING CHLORINE IN POWER-PLANT EFFLUENTS TO ENVIRONMENTALLY SAFE LEVELS. DEVELOPMENT OF THIS METHOD WAS STIMULATED BY THE CONTROVERSY BETWEEN ELECTRIC UTILITIES AND REGULATORY AGENCIES OVER THE JUSTIFICATION OF THE PRESENT UNIVERSEALLY APPLIED LIMITS. THE SCIENTIFIC LITERATURE CONCLUSIVELY DEMONSTRATES THE EFFECTS OF PHYSICAL, CHEMICAL, AND BIOTIC FACTORS ON CHLORINE TOXICITY. THE METHOD PROPOSED INCLUDES THESE FACTORS, TO THE EXTENT CURRENTLY POSSIBLE, TO SET LIMITS BASED ON SITE SPECIFIC AQUATIC CONDITIONS AND PLANT DESIGN AND OPERATION SPECIFICATIONS. IN THESE EFFLUENT LIMITS, THE ORGANISMS CONSIDERED ARE THOSE WHICH ARE ENTRAINED INTO THE PLUME OR WHICH MAINTAIN THEMSELVES WITHIN THE PLUME DURING CHLORINATION. IN EACH INSTANCE THE TIME COURSE OF EXPOSURE CONCENTRATION IS DIVIDED INTO SMALL TIME INTERVALS. WEIGHTED MEAN CONCENTRATIONS FOR SUCCESSIVELY LARGER TIME INTERVALS FOLLOWING INITIAL EXPOSURE ARE THEN CALCULATED. EXPOSURES RESULTING FROM RELEASES AT VARIOUS LEVELS ARE COMPARED EITHER GRAPHICALLY OR MATHEMATICALLY WITH ACUTE AND CHRONIC MORTALITY THRESHOLDS TO FIND THE HIGHEST DISCHARGE CONCENTRATION THAT DOES NOT CAUSE MORTALITY. THE THRESHOLDS ARE DERIVED FROM EXISTING TOXICITY DATA AND ARE DIFFERENT FOR MARINE AND FRESHWATER ORGANISMS. THIS METHOD IS BASED ON THE LATEST LITERATURE AVAILABLE AND CAN INCORPORATE FURTHER DATA CONCERNING CHEMISTRY, TOXICITY, AND BEHAVIOR AS THEY BECOME AVAILABLE. THE METHOD ALSO IS AMENABLE TO COUPLING WITH MODELS OF CHEMICAL DISPERSION AND POPULATION DYNAMICS TO PERMIT MORE COMPLETE ANALYSIS. THIS APPROACH SERVES TO PERMIT USE OF CHLORINE FOR BIOFOULING CONTROL AT POWER PLANTS, WHILE ENSURING THAT THIS USE WILL NOT BE INIMICAL TO THE ENVIRONMENT.
- 19-1-1-1 THE STATE SIDE OF THE SITING EQUATION - SOME CASE STUDIES RYAN, B. G.
U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, D.C.
THIS ARTICLE IS A BRIEF SURVEY OF STATE ACTIVITIES IN THE SITING OF NUCLEAR PRODUCTION AND UTILIZATION FACILITIES. IT CONSISTS OF MATERIAL GATHERED BY THE OFFICE OF STATE PROGRAMS IN CONNECTION WITH A STUDY CARRIED OUT IN ACCORDANCE WITH EFFICIENCY IN FEDERAL/STATE SITING ACTIONS - DETAILED STUDY PLAN (NUREG-0128), WHICH WAS AUTHORIZED BY THE NUCLEAR REGULATORY COMMISSION (NRC) IN SEPTEMBER 1976. THE FINAL REPORT, IMPROVING REGULATORY EFFECTIVENESS IN FEDERAL/STATE SITING ACTIONS (NUREG-0195), WAS PRESENTED TO THE NRC IN MAY 1977.
- 19-1-2-10 THERMAL SHOCK STUDIES ASSOCIATED WITH INJECTION OF EMERGENCY CORE COOLANT FOLLOWING A LOSS OF COOLANT ACCIDENT IN PWRs CHEVERTON, R. D.
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENN.
THE THERMAL SHOCK RESULTING FROM INJECTION OF EMERGENCY CORE COOLANT FOLLOWING A LOSS OF COOLANT ACCIDENT MAY, UNDER CERTAIN CIRCUMSTANCES, RESULT IN PROPAGATION OF PREEXISTING CRACKS ON THE INNER SURFACE OF PRESSURIZED WATER REACTOR (PWR) PRESSURE VESSELS. AT OAK RIDGE NATIONAL LABORATORY, STUDIES BEING CONDUCTED IN CONNECTION WITH THIS PROBLEM INCLUDE THE THERMAL SHOCK TESTING OF 533-MM-OD BY 241-MM-ID STEEL TEST SPECIMENS. FOUR EXPERIMENTS HAVE BEEN CONDUCTED THIS FAR. THE RESULTS HAVE REVEALED NO SIGNIFICANT ANOMALIES AND TEND TO VALIDATE WITH REASONABLE ACCURACY THE METHODS OF ANALYSIS USED FOR PREDICTING THE BEHAVIOR OF PWR VESSELS UNDER THERMAL SHOCK CONDITIONS. OUR ANALYSIS OF THE PWR INDICATES THAT IN PRESENT GENERATION AND FUTURE PWR VESSELS CRACK PROPAGATION WILL NOT OCCUR AS A RESULT OF THERMAL SHOCK, BUT IN OLDER VESSELS IT MAY. HOWEVER, IT APPEARS THAT A PHENOMENON KNOWN AS WARM PRESTRESSING WILL PREVENT EXCESSIVE CRACK PENETRATION.
- 19-1-2-20 THE REFLOODING PHASE OF THE LOCA IN PWRs I. CORE HEAT TRANSFER AND FLUID FLOW YADIGAPOLU, G.
UNIVERSITY OF CALIFORNIA, BERKELEY, CALIF.
THIS IS THE FIRST OF TWO ARTICLES ON THE REFLOODING PHASE OF THE LOSS OF COOLANT ACCIDENT (LOCA) IN PRESSURIZED WATER REACTORS. (THE OTHER ARTICLE, PART II, IS SCHEDULED FOR VOL. 19, NO. 2.) THIS FIRST ARTICLE IS A GENERAL DESCRIPTION OF CORE BEHAVIOR DURING THE REFLOODING PHASE OF THE LOCA. A SUCCESSION OF HEAT TRANSFER AND TWO PHASE FLOW REGIMES MOVES ALONG THE ROD BUNDLE DURING REFLOODING OF THE CORE. PARAMETRIC RANGES AND OTHER FEATURES OF TRANSIENT REFLOODING EXPERIMENTS THAT HAVE BEEN CONDUCTED WITH ROD BUNDLES AND IN SIMPLE SINGLE CHANNEL GEOMETRIES ARE TABULATED. EXPERIMENTAL FINDINGS AND PARAMETRIC TRENDS ARE SUMMARIZED AND EXPLAINED. CORE HEAT TRANSFER AND HYDRODYNAMICS ANALYSIS METHODS INCORPORATED IN EMERGENCY CORE COOLING SYSTEM EVALUATION MODELS USED FOR LICENSING PURPOSES ARE REVIEWED, AND THE WORK ON MORE ADVANCED MODELS THAT ATTEMPT TO ESTIMATE CORE HEAT TRANSFER COEFFICIENTS ON THE BASIS OF CALCULATED LOCAL FLOW CONDITIONS IS NOTED.

- 19-1-3-38 INTERNATIONAL CONFERENCE ON NUCLEAR SYSTEMS RELIABILITY ENGINEERING AND RISK ASSESSMENT
HAGEN, E. W.
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENN.
AN INTERNATIONAL MEETING OF SPECIALISTS CONCERNED WITH THE METHODOLOGIES FOR RELIABILITY ANALYSIS AND RISK ASSESSMENT WAS HELD IN GATLINBURG, TENN., JUNE 20-24, 1977. THEORETICAL AND APPLICABLE PRESENTATIONS TREATED STATE OF THE ART TECHNIQUES IN ANALYSIS AND ASSESSMENT, FOR THE MOST PART UTILIZING REFINEMENTS BASED ON FAULT TREE STRUCTURE. SEVERAL GENERAL CATEGORIES WERE IDENTIFIED FROM THE 34 PAPERS WITH SEVERAL AUTHORS CLAIMING SOME ABILITY AT TREATMENT OF COMMON CAUSE FAILURES.
- 19-1-4-43 LOFT EMERGENCY CORE-COOLING SYSTEM EXPERIMENTS - RESULTS FROM THE L1-4 EXPERIMENT
LEACH, L. P. + YEARRONDO, L. J.
IDAHO NATIONAL ENGINEERING LABORATORY, IDAHO FALLS, IDAHO
RESULTS FROM EMERGENCY CORE COOLING SYSTEM EXPERIMENTS IN THE LOSS OF FLUID TEST FACILITY ARE DESCRIBED. THE EXPERIMENTAL RESULTS ARE PUT IN PERSPECTIVE BY COMPARING THEM WITH RESULTS FROM THE MUCH SMALLER SEMISCALE FACILITY AND PRETEST PREDICTIONS MADE WITH RELAP4/MOD5 COMPUTER CODE. EMPHASIS IS PLACED ON THE MOST RECENT LOSS OF FLUID TEST NONNUCLEAR EXPERIMENT, DESIGNATED L1-4, IN WHICH THE EMERGENCY CORE COOLING WATER WAS INJECTED INTO THE REACTOR INLET PIPE, AS IT IS IN MANY COMMERCIAL NUCLEAR REACTORS. GENERAL SYSTEM BEHAVIOR DURING THE DECOMPRESSION, EMERGENCY CORE COOLING WATER MIXING PHENOMENON, AND EMERGENCY CORE COOLING WATER BYPASS ARE EVALUATED.
- 19-1-5-50 2. SUMMARY OF SHALLOW LAND BURIAL OF RADIOACTIVE WASTES AT COMMERCIAL SITES BETWEEN 1962 AND 1976, WITH PROJECTIONS
HOLCOMB, W. F.
U.S. ENVIRONMENTAL PROTECTION AGENCY, WASHINGTON, D. C.
THE U.S. ENVIRONMENTAL PROTECTION AGENCY REQUESTED THE SIX STATES HAVING COMMERCIAL SHALLOW LAND BURIAL FACILITIES FOR OTHER THAN HIGH LEVEL RADIOACTIVE WASTES TO PROVIDE INVENTORIES OF THE TYPES AND QUANTITIES OF WASTES BURIED AT THESE SITES. COMPILATIONS AND INTERPRETATIONS OF THE INVENTORIES ARE PRESENTED IN TABLES AND FIGURES. PROJECTIONS TO THE YEAR 2000 ARE MADE AND COMPARED WITH OTHER PROJECTIONS OF THE QUANTITY OF FUEL CYCLE AND NONFUEL CYCLE WASTES TO BE DISPOSED OF BY SHALLOW LAND BURIAL. THESE PROJECTIONS ARE THEN COMPARED WITH THE ASSUMED AVAILABLE CAPACITY AND OPERATIONAL LIFE OF THE COMMERCIAL SITES. THE RESULTS OF THIS COMPARISON INDICATE THAT THE EXISTING SITES SHOULD HAVE ADEQUATE BURIAL CAPACITY UNTIL THE LATE 1990S.
- 19-1-5-60 FOURTH INTERNATIONAL CONGRESS OF THE INTERNATIONAL RADIATION PROTECTION ASSOCIATION
JACOBS, D. G.
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENN.
THE FOURTH INTERNATIONAL CONGRESS OF THE INTERNATIONAL RADIATION PROTECTION ASSOCIATION WAS HELD IN PARIS, FRANCE, APR. 24-30, 1977. THE CONGRESS WAS HOSTED BY THE SOCIETE FRANCAISE DE RADIOPROTECTION AND HAD AS ITS THEME 'RADIATION PROTECTION - AN EXAMPLE OF ACTION AGAINST MODERN HAZARDS.' THE MEETING WAS ATTENDED BY APPROXIMATELY 1200 SCIENTISTS REPRESENTING 25 COUNTRIES AND NUMEROUS INTERNATIONAL ORGANIZATIONS. ALL BUT 14 OF THE 222 PAPERS PRESENTED IN THE 30 ORAL SESSIONS AND ALL BUT 7 OF 119 PAPERS PRESENTED IN THE 7 POSTER SESSIONS WERE DISTRIBUTED IN THE PRINTED PROCEEDINGS AT THE MEETING. A BROAD SPECTRUM OF TOPICS WAS COVERED, RANGING FROM MOLECULAR AND CELLULAR BIOLOGY TO RADIOACTIVE WASTE MANAGEMENT AND EMERGENCY PLANS FOR NUCLEAR ACCIDENTS.
- 19-1-5-66 ENVIRONMENTAL SURVEILLANCE FOR NUCLEAR FACILITIES
MOELLER, D. W. + SELBY, J. M. + WAITE, D. A.
COPLEY, J. P.
HARVARD UNIVERSITY, BOSTON, MASS. / BATTELLE PACIFIC NORTHWEST LABORATORY, RICHLAND, WASH.
ONE OF THE PRIMARY GOALS OF ENVIRONMENTAL SURVEILLANCE PROGRAMS IN THE VICINITY OF NUCLEAR FACILITIES IS TO OBTAIN INFORMATION ESSENTIAL TO ASSESSING AND CONTROLLING DOSE RATES TO THE NEIGHBORING POPULATION. EXPERIENCE HAS SHOWN, HOWEVER, THAT ENVIRONMENTAL RADIONUCLIDE CONCENTRATIONS ARE FREQUENTLY SO LOW AND SO VARIABLE THAT DOSE ESTIMATES MUST BE BASED PRIMARILY ON IN-PLANT AND EFFLUENT MEASUREMENTS, COUPLED WITH SUITABLE CALCULATIONAL TECHNIQUES FOR EXTRAPOLATING SUCH DATA TO THE GENERAL ENVIRONMENT. ALTHOUGH THE NUMBER OF PATHWAYS BY WHICH EACH OF THE RELEASED RADIONUCLIDES MAY ULTIMATELY REACH THE POPULATION ARE NUMEROUS AND COMPLEX, IN MOST SITUATIONS THE PRIMARY CONTRIBUTORS TO THE POPULATION DOSE WILL CONSIST OF NO MORE THAN SIX RADIONUCLIDES MOVING THROUGH THREE OR FOUR PATHWAYS. CURRENT PROBLEMS ASSOCIATED WITH ENVIRONMENTAL SURVEILLANCE PROGRAMS INCLUDE (1) LACK OF A DEFINITION OF DE MINIMIS DOSE LEVELS FOR MEASUREMENT OR CALCULATION, (2) DEFICIENCIES IN QUALITY ASSURANCE, DATA TREATMENT, AND SOURCE IMPACT DEFINITION, (3) LACK OF PERIODIC IN-DEPTH REVIEW AND REEVALUATION OF PROGRAMMATIC NEEDS, AND (4) LACK OF SUFFICIENT RESOURCES ON THE PART OF STATE AND LOCAL AGENCIES FOR PROVIDING AN INDEPENDENT CHECK ON THE DATA REPORTED BY NUCLEAR FACILITY OPERATORS.

- 19-1-6-91 AN EXPLOSION AND FIRE DURING CONVERSION OF LIQUID URANYL NITRATE TO SOLID URANIUM OXIDE
GRAY, L. W.
SAVANNAH RIVER LABORATORY, AIKEN, S.C.
DURING THE CONVERSION OF MOLTEN URANYL NITRATE TO SOLID URANIUM OXIDE AT THE SAVANNAH RIVER PLANT, A RAPID CHEMICAL REACTION OCCURRED IN A DENITRATOR AND EJECTED THE CONTENTS, INCLUDING COMBUSTIBLE GASES, INTO THE PROCESS ROOM. THE GASES IGNITED AND CAUSED A GAS PHASE EXPLOSION AND FIRE. AN EXCESSIVE AMOUNT OF ORGANIC MATERIAL (ABOUT 120 LITERS OF TRIBUTYL PHOSPHATE IN THE FORM OF URANYL NITRATE ADDUCT) HAD BEEN UNINTENTIONALLY TRANSFERRED, ALONG WITH NORMAL PROCESS MATERIAL, THROUGH TWO EVAPORATORS TO THE DENITRATOR. DURING HEATING OF THE DENITRATOR CONTENTS, THE ORGANIC MATERIAL DECOMPOSED RAPIDLY BETWEEN 170C AND 210C, EMITTING COMBUSTIBLE AND NONCOMBUSTIBLE GASES THAT EJECTED THE DENITRATOR CONTENTS INTO THE DENITRATOR ROOM. THE GAS COLLECTED AT THE CEILING IN THE ROOM AND IGNITED WITH A LOW EXPLOSIVE FORCE. TWO EMPLOYEES SUSTAINED MINOR INJURIES, AND THERE WAS ABOUT \$230,000 DAMAGE TO THE BUILDING AND EQUIPMENT.
- 19-2-1-135 RISKS IN TRANSPORTING MATERIALS FOR VARIOUS ENERGY INDUSTRIES
RHODES, R. E. + JOHNSON, J. F.
BATTELLE PACIFIC NORTHWEST LABORATORIES, RICHLAND, WASH.
BATTELLE PACIFIC NORTHWEST LABORATORIES (PNL) IS CURRENTLY CONDUCTING A RESEARCH PROGRAM SPONSORED BY THE ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION TO ASSESS THE RISKS IN TRANSPORTING ENERGY MATERIALS. THE OBJECTIVE OF THIS PROGRAM IS TO USE A CONSISTENT METHODOLOGY TO ASSESS THE RISKS OF TRANSPORTING MATERIALS FOR ENERGY SYSTEMS WHICH ARE CURRENTLY IN USE AND FOR THOSE WHICH ARE BEING DEVELOPED OR PLANNED FOR THE FUTURE. THIS ARTICLE BRIEFLY REVIEWS THE BACKGROUND OF RISK ASSESSMENT, DESCRIBES THE RISK ASSESSMENT METHODOLOGY USED IN PNL'S TRANSPORTATION SAFETY STUDIES PROGRAM, SUMMARIZES THE WORK TO DATE, AND OUTLINES FUTURE PROGRAMS.
- 19-2-1-153 ANS TOPICAL MEETING ON THERMAL REACTOR SAFETY
BUCHANAN, J. B.
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENN.
A TOPICAL MEETING ON THERMAL REACTOR SAFETY SPONSORED BY THE AMERICAN NUCLEAR SOCIETY WAS HELD IN SUN VALLEY, IDAHO, JULY 31-AUG. 4, 1977. PRESENTED WERE 120 PAPERS ON THE FOLLOWING TOPICS - PROBABILISTIC METHODS, COMMUNICATING REACTOR SAFETY, REACTOR SAFETY RESEARCH AND LICENSING, PLANT DIAGNOSTICS, OPERATION, RESPONSE TO ACCIDENT CONDITIONS, PREVENTION, AND MITIGATION OF ACCIDENT CONDITIONS, UNDERSTANDING THE NUCLEAR STEAM SUPPLY SYSTEM (NSSS) RESPONSE TO DESIGN BASIS EVENTS, CONTAINMENT AND PLANT DESIGN AGAINST EXTERNAL HAZARDS, AND FUEL BEHAVIOR, FISSION PRODUCT BEHAVIOR, AND RESEARCH ON CORE MELTDOWN. ONE THIRD OF THE PAPERS WERE ON THE NSSS RESPONSE TO DESIGN BASIS EVENTS, WITH EMPHASIS ON THE LOSS OF COOLANT ACCIDENT. A BRIEF REVIEW OF THE MEETING HIGHLIGHTS IS PRESENTED.
- 19-2-2-160 THE REFLOODING PHASE OF THE LOCA IN PWRs II. REWETTING AND LIQUID ENTRAINMENT
ELIAS, E. + YADIGAROGU, G.
UNIVERSITY OF CALIFORNIA AT BERKELEY, BERKELEY, CALIF.
SURFACE REWETTING AND LIQUID DROPLET ENTRAINMENT PLAY AN IMPORTANT ROLE IN THE ANALYSIS OF THE REFLOODING PHASE OF THE LOSS OF COOLANT ACCIDENT IN PRESSURIZED WATER REACTORS. THE DEFINITIONS AND THE VARIOUS INTERPRETATIONS GIVEN TO THE REWETTING TEMPERATURE AND THE REWETTING MECHANISMS OF THE FUEL RODS ARE DISCUSSED. PUBLISHED MODELS OF THE AXIAL CONDUCTION CONTROLLED REWETTING PROCESS INCLUDE ONE DIMENSIONAL SOLUTIONS IN TWO AXIAL REGIONS, ONE DIMENSIONAL SOLUTIONS IN THREE AXIAL REGIONS WITH OR WITHOUT PRECURSORY COOLING, ONE AND TWO DIMENSIONAL NUMERICAL DIFFERENCE TECHNIQUES USING TEMPERATURE DEPENDENT HEAT TRANSFER COEFFICIENTS, AND ANALYTICAL TWO DIMENSIONAL SOLUTIONS. THE BASIC PHYSICAL ASSUMPTIONS AND THE NUMERICAL VALUES ASSIGNED TO THE VARIOUS PARAMETERS, AS WELL AS EMPIRICAL REWETTING CORRELATIONS, ARE DISCUSSED. THE PHYSICAL MECHANISMS FOR LIQUID DROPLET ENTRAINMENT AND ANALYTICAL FORMULATIONS OF THE CRITICAL GAS VELOCITY AND OF THE DROPLET DIAMETER AT THE ONSET OF ENTRAINMENT ARE REVIEWED.
- 19-2-2-176 LWR FUEL BEHAVIOR RESEARCH IN THE FEDERAL REPUBLIC OF GERMANY
FISCHER, M. + OSBORNE, M. F.
GESELLSCHAFT FÜR KERNFORSCHUNG, KARLSRUHE, FEDERAL REPUBLIC OF GERMANY
CONCURRENT WITH THE DEVELOPMENT IN THE FEDERAL REPUBLIC OF GERMANY OF LARGE LIGHT WATER REACTORS FOR ELECTRIC POWER PRODUCTION, A BROAD PROGRAM FOR INVESTIGATING THE SAFETY ASPECTS OF LARGE POWER REACTORS HAS BEEN ESTABLISHED. THIS REVIEW IS CONCERNED SPECIFICALLY WITH THE BEHAVIOR OF THE FUEL RODS AND BUNDLES UNDER VARIOUS ACCIDENT CONDITIONS, SUCH AS A LOSS OF COOLANT ACCIDENT, AN ANTICIPATED TRANSIENT WITHOUT SCRAM, AND A POWER COOLANT MISMATCH. THE PROPERTIES AND DEFORMATION CHARACTERISTICS OF THE ZIRCALOY CLADDING DURING TEMPERATURE TRANSIENTS IN STEAM ARE INVESTIGATED, ESPECIALLY WITH RESPECT TO THEIR INFLUENCE ON ROD FAILURE (RESULTING IN FISSION PRODUCT RELEASE) AND POSTSHUTDOWN COOLABILITY (WHICH IS IMPORTANT IN AVOIDING CORE MELTDOWN). EXPERIMENTAL AND THEORETICAL EFFORTS ARE CLOSELY COORDINATED, WITH THE OBJECTIVE BEING THE DEVELOPMENT OF THE VERIFIED ANALYTICAL MODELS NEEDED

TO RELIABLY PREDICT FUEL BEHAVIOR UNDER ANY SPECIFIC SET OF CONDITIONS OR SEQUENCE OF EVENTS.

- 19-2-4-190 EFFECT OF ENGINEERED SAFETY FEATURES ON THE RISK OF HYPOTHETICAL LMFBR ACCIDENTS
CYBULSKIS, P.
BATTELLE COLUMBUS LABORATORIES, COLUMBUS, OHIO
THE RISKS OF HYPOTHETICAL CORE DISRUPTIVE ACCIDENTS IN LIQUID METAL COOLED FAST BREEDER REACTORS WHICH INVOLVE MELT THROUGH OF THE REACTOR VESSEL ARE COMPARED FOR TWO PLANT DESIGNS - ONE DESIGN WITHOUT SPECIFIC PROVISIONS TO ACCOMMODATE SUCH AN ACCIDENT AND THE OTHER DESIGN WITH AN EX-VESSEL CORE CATCHER AND A CAVITY HOT LINER. THE APPROACH TO RISK ANALYSIS USED IS THAT DEVELOPED IN THE REACTOR SAFETY STUDY (WASH-1400). SINCE THE PROBABILITY OF OCCURRENCE OF SUCH AN EVENT HAS NOT BEEN EVALUATED, HOWEVER, INSIGHT INTO THE POTENTIAL RISK IS GAINED ONLY ON A RELATIVE BASIS. THE PRINCIPAL CONCLUSIONS OF THIS STUDY ARE - (1) ADDING A CORE CATCHER HOT LINER REDUCES THE PROBABILITY OF ACCIDENTS HAVING MAJOR CONSEQUENCES, (2) THE DEGREE TO WHICH HOT LINER CORE CATCHER SYSTEMS CAN REDUCE THE RISK OF MELT THROUGH ACCIDENTS IS LIMITED BY THE FAILURE PROBABILITY OF THESE SYSTEMS, (3) FRACTIONAL RADIOACTIVE RELEASES TO THE ENVIRONMENT IN THE LIQUID METAL COOLED FAST BREEDER REACTOR ACCIDENTS CONSIDERED ARE COMPARABLE TO THOSE FROM THE LIGHT WATER REACTORS EVALUATED IN WASH-1400, (4) SINCE SODIUM CONCRETE REACTIONS ARE A DOMINANT DRIVING FORCE DURING THE ACCIDENT, THE INTEGRITY OF THE CAVITY LINER IS AS IMPORTANT AS THE FUNCTION OF THE CORE CATCHER, (5) THERE MAY BE OTHER ACCIDENTS OR PATHS TO RADIOACTIVE RELEASES THAT ARE NOT AFFECTED BY THE ADDITION OF A HOT LINER CORE CATCHER.
- 19-2-5-205 PARAMETERIZATIONS FOR RESUSPENSION AND FOR WET AND DRY DEPOSITION OF PARTICLES AND GASES FOR USE IN RADIATION DOSE CALCULATIONS
SLINN, W. G. N.
OREGON STATE UNIVERSITY, CORVALLIS, OREG.
SOME COMMENTS ARE PRESENTED ABOUT METHODS AND ACCURACIES OF PARAMETERIZING PRECIPITATION SCAVENGING, DRY DEPOSITION, AND RESUSPENSION FOR USE IN BOTH ACCIDENTAL AND LONG TERM AVERAGE RADIATION DOSE CALCULATIONS. THE PRESENTATION EMPHASIZES WET, DRY, AND RESUSPENSION VELOCITIES. THE ACCURACIES OF THESE PARAMETERIZATIONS DECREASE WITH ATTEMPTS TO OBTAIN INCREASING TIME RESOLUTION. ANNUAL AVERAGE ESTIMATES FOR THE WET DEPOSITION VELOCITY ARE KNOWN TO WITHIN A FACTOR OF ABOUT 2 TO 5. SIMILARLY, ANNUAL AVERAGE ESTIMATES FOR THE DRY DEPOSITION VELOCITY ARE KNOWN TO WITHIN A FACTOR OF ABOUT 2 TO 5, EXCEPT WHEN THEY APPLY TO SUBMICRON PARTICLES AND SLIGHTLY REACTIVE GASES DEPOSITING ON VEGETATION. IN THESE CASES THERE IS AN ORDER OF MAGNITUDE UNCERTAINTY OR MORE. ASSOCIATED WITH THE RESUSPENSION VELOCITY PARAMETERIZATION OF RESUSPENSION, THERE ARE MANY ORDERS OF MAGNITUDE UNCERTAINTY. FURTHER RESEARCH AND AND ALTERNATIVE FORMULATIONS FOR DOSE CALCULATIONS ARE ENCOURAGED AND ONE ALTERNATIVE IS OUTLINED.
- 19-2-5-220 EFFECTS OF RAINSTORMS AND RUNOFF ON CONSEQUENCES OF ATMOSPHERIC RELEASES FROM NUCLEAR REACTOR ACCIDENTS
RITCHIE, L. T. + BROWN, W. D. + WAYLAND, J. R.
SANDIA LABORATORIES, ALBUQUERQUE, N. MEX.
A PRELIMINARY MODEL DESCRIBING THE EFFECTS OF WASHOUT AND RUNOFF ON THE CONSEQUENCES OF A NUCLEAR REACTOR ACCIDENT IS PRESENTED. THE MOST IMPORTANT NEW FEATURE OF THIS STRUCTURED MODEL RELATIVE TO THE MODEL DESCRIBED IN REPORT WASH-1400 IS THE SPATIAL STRUCTURE OF RAINSTORMS AND RUNOFF CONSISTING OF FOUR LEVELS OF RAIN INTENSITY THAT ARE NORMALIZED BY RAIN-GAUGE DATA. THE PREDICTED CONCENTRATIONS OF RADIOACTIVITY AND RESULTANT HEALTH CONSEQUENCES OF THE STRUCTURED MODEL ARE COMPARED TO THOSE OF THE MODEL IN WASH-1400 FOR SIMPLIFIED RAINSTORMS WITH FIXED METEOROLOGICAL CONDITIONS AND FOR AN ACTUAL RAINSTORM. RUNOFF AND THE SPATIAL STRUCTURE OF THE RAIN IN THE NEW MODEL CAN RESULT IN HEALTH CONSEQUENCES THAT ARE SIGNIFICANTLY DIFFERENT FROM THOSE OF THE WASH-1400 MODEL.
- 19-3-1-269 ENERGY INVESTMENT IN NUCLEAR POWER PLANTS
MAYS, G. T.
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENN.
THE ENERGY INVESTMENT IN TERMS OF ELECTRICAL AND THERMAL ENERGY REQUIREMENTS FOR NUCLEAR POWER PLANTS IS EXAMINED. THE TOTAL LIFETIME ENERGY INPUTS REQUIRED FOR A 1000-MW(B) PLANT BASED ON A 30-YEAR PLANT LIFETIME AND 0.75 PLANT FACTOR ARE PRESENTED FOR SEVERAL PRESSURIZED WATER REACTOR (PWR) AND BOILING WATER REACTOR (BWR) SYSTEMS, TWO HIGH TEMPERATURE GAS COOLED REACTOR (HTGR) SYSTEMS, AND ONE HEAVY WATER REACTOR (HWR) SYSTEM. THE ENERGY ANALYSES REVIEWED HERE HAVE DEMONSTRATED THAT THE ENERGY EXPENDITURES FOR THE VARIOUS REACTOR SYSTEMS ARE VERY MUCH LESS THAN THE ENERGY PRODUCED BY THE REACTORS AND THAT THE INITIAL ENERGY INVESTMENTS ARE RECOVERED IN A SHORT TIME AFTER STARTUP SEVERAL MONTHS TO 2 YEARS. THE ENERGY REQUIREMENTS ASSOCIATED WITH THE INDIVIDUAL PROCESSES, SUCH AS MINING, ENRICHMENT, CONSTRUCTION, AND WASTE DISPOSAL, ARE TABULATED FOR TWO DIFFERENT FUEL CYCLES FOR A PWR AND A BWR. THE ENRICHING PROCESS IS BY FAR THE LARGEST COMPONENT OF THE ELECTRICAL REQUIREMENTS, REPRESENTING 85 TO 90 PERCENT OF THE TOTAL ELECTRICAL ENERGY INVESTMENT. THE ENERGY USED IN CONSTRUCTING

AND OPERATING THE REACTOR CONSTITUTES THE LARGEST SINGLE INVESTMENT OF THERMAL ENERGY, REPRESENTING 50 PERCENT OF THE TOTAL THERMAL ENERGY REQUIREMENTS. RESULTS OF SEVERAL ANALYSES ARE EXAMINED AND COMPARISONS MADE BETWEEN NUCLEAR POWER PLANTS, A COAL PLANT, AND A SOLAR THERMAL CONVERSION PLANT.

- 19-3-1-281 FIFTH NRC WATER REACTOR SAFETY RESEARCH INFORMATION MEETING
COTTRELL, W. B.
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENN.
THIS ARTICLE SUMMARIZES THE FIFTH WATER REACTOR SAFETY RESEARCH INFORMATION MEETING, SPONSORED BY THE NUCLEAR REGULATORY COMMISSION'S DIVISION OF REACTOR SAFETY RESEARCH AND HELD AT THE NATIONAL BUREAU OF STANDARDS, GAITHERSBURG, MD., NOV. 7-11, 1977. PRESENTED AT THE MEETING WERE 126 PAPERS DIVIDED AMONG THE FOLLOWING FIVE RESEARCH PROGRAM AREAS - (1) LOSS OF COOLANT ACCIDENT STUDIES, (2) METALLURGY AND MATERIALS RESEARCH PROGRAM, (3) FUEL BEHAVIOR RESEARCH PROGRAM, (4) ANALYSES DEVELOPMENT PROGRAM, AND (5) REACTOR OPERATIONAL SAFETY PROGRAM. IN ADDITION, THE MEETING INCLUDED NUMEROUS WORKSHOPS ON SELECTED TOPICS. AMONG THE MANY PRESENTATIONS WERE SIX INVITED PAPERS ON SAFETY RESEARCH IN SEVERAL FOREIGN COUNTRIES AND NUMEROUS PAPERS ON RESEARCH SPONSORED BY THE ELECTRIC POWER RESEARCH INSTITUTE. FROM ALL THIS WORK, THE EVIDENCE CONTINUES TO MOUNT REGARDING THE EXTENT OF THE CONSERVATIVE APPROACH TO NUCLEAR SAFETY THAT IS TAKEN IN THIS COUNTRY.
- 19-3-1-292 WATER REACTOR SAFETY RESEARCH PROGRAM - APPLICATION OF RESEARCH RESULTS
TONG, L. S.
NUCLEAR REGULATORY COMMISSION, WASHINGTON, D.C.
(EDITOR'S NOTE - THE FOLLOWING ARTICLE WAS ADAPTED FROM A PAPER PRESENTED BY DR. L. S. TONG AT THE FIFTH WATER REACTOR SAFETY RESEARCH INFORMATION MEETING (SEE PRECEDING ARTICLE). IT DESCRIBES THE PHILOSOPHY BEHIND THE NRC WATER REACTOR SAFETY RESEARCH PROGRAM, WHILE HIGHLIGHTING THE ACCOMPLISHMENTS OVER THE PAST YEAR (NOMINALLY FY 1977). FOR PERSONS DESIRING MORE BACKGROUND INFORMATION, DR. TONG COAUTHORED (WITH G. L. BENNETT) A COMPREHENSIVE REVIEW OF THE NRC WATER REACTOR SAFETY RESEARCH PROGRAM, WHICH WAS PUBLISHED IN NUCLEAR SAFETY, 18(1) - 1-39 (1977).)
- 19-3-1-297 NUCLEAR STANDARDS IN THE FEDERAL REPUBLIC OF GERMANY - THE DIN NUCLEAR STANDARDS COMMITTEE
BECKER, K.
FEDERAL REPUBLIC OF GERMANY
WITHIN THE NUCLEAR TECHNOLOGY STANDARDS COMMITTEE (NKE) OF THE GERMAN STANDARDS INSTITUTE (DIN), ABOUT 40 WORKING GROUPS WITH SOME 400 EXPERTS, REPRESENTING LICENSING AND INSPECTION AUTHORITIES, MANUFACTURERS, UTILITIES, AND OTHER INTERESTED PARTIES, HAVE DEVELOPED ALMOST 100 NUCLEAR STANDARDS AND DRAFT STANDARDS. THE MAIN AREAS OF ACTIVITY ARE COMMUNICATIVE PRINCIPLES, RADIATION PROTECTION TECHNOLOGY, THE FUEL CYCLE, AND, MOST IMPORTANT, REACTOR SAFETY AND TECHNOLOGY. EFFORTS IN THIS AREA ARE CLOSELY CONNECTED WITH THOSE OF THE MORE RECENTLY ESTABLISHED SEMIGOVERNMENTAL NUCLEAR TECHNOLOGY BOARD (KTA), WHICH IS IN CHARGE OF COORDINATING AND APPROVING BASIC NATIONAL REACTOR SAFETY STANDARDS. INTERNATIONAL NKE ACTIVITIES FOCUS ON SERVING AS THE NATIONAL COUNTERPART FOR THE INTERNATIONAL ORGANIZATION FOR STANDARDIZATION'S (ISO'S) NUCLEAR TECHNOLOGY COMMITTEE (TC95), WHOSE SECRETARIAT HAS RECENTLY BEEN TRANSFERRED FROM THE AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI) TO DIN/NKE. THE SCOPE, PROGRESS, AND PROBLEMS OF NUCLEAR STANDARDS WORK DURING THE PAST FEW YEARS IN THE FEDERAL REPUBLIC OF GERMANY ARE BRIEFLY DESCRIBED.
- 19-3-2-305 PROBABILITY AND RISK ASSESSMENT - THE SUBJECTIVISTIC VIEWPOINT AND SOME SUGGESTIONS
APOSTOLAKIS, G.
UNIVERSITY OF CALIFORNIA, LOS ANGELES, CALIF.
THE PURPOSE OF THIS PAPER IS TO INVESTIGATE THE PHILOSOPHICAL BASIS FOR THE USE OF THE CONCEPT OF PROBABILITY IN RISK ASSESSMENT STUDIES. IT IS ARGUED THAT THE SUBJECTIVISTIC INTERPRETATION OF PROBABILITY (I.E., PROBABILITY AS A MEASURE OF DEGREE OF BELIEF) IS THE APPROPRIATE FRAMEWORK FOR SUCH STUDIES. THE RELATIONSHIP BETWEEN RELATIVE FREQUENCY AND SUBJECTIVE PROBABILITY IS EXAMINED, AND THE IMPORTANT CONCEPTS OF COHERENCE AND EXCHANGEABILITY ARE DISCUSSED. FINALLY, THE IMPLICATIONS OF ADOPTING THE SUBJECTIVISTIC INTERPRETATION ARE INVESTIGATED, AND SOME SUGGESTIONS STEMMING FROM THE REQUIREMENT OF COHERENCE ARE GIVEN, WHICH ARE USEFUL WHEN LOW PROBABILITIES OR FREQUENCIES ARE ASSESSED.
- 19-3-2-316 CLINCH RIVER BREEDER REACTOR PLANT SAFETY STUDY
PIPER, R. B. + CONRADI, L. L. + BUHL, A. R.
WOOD, P. J. + LEAVER, D. E. W.
PROJECT MANAGEMENT CORPORATION, OAK RIDGE, TENN. / WESTINGHOUSE ELECTRIC CORPORATION, MONROEVILLE, PA. / SCIENCE APPLICATIONS, INC., PALO ALTO, CALIF.
THIS ARTICLE PRESENTS A REVIEW AND DISCUSSION OF THE OBJECTIVES, METHODS, TECHNIQUES, AND RESULTS OF A SAFETY STUDY THAT WAS CONDUCTED FOR THE CLINCH RIVER BREEDER REACTOR (CRBR) PLANT. THE OBJECTIVES OF THE STUDY WERE (1) TO PROVIDE A REALISTIC ASSESSMENT OF ACCIDENT RISKS TO THE PUBLIC ASSOCIATED WITH OPERATION OF THE CRBR, (2) TO PLACE THOSE

IDENTIFIED RISKS IN PERSPECTIVE WITH OTHER LOCAL SOCIETAL RISKS, AND (3) TO AID IN DETERMINING WHETHER ACCIDENT RISKS FROM THE CRBR ARE COMPARABLE TO THOSE OF PREVIOUSLY LICENSED REACTORS.

ACHIEVEMENT OF THE OBJECTIVES OF THIS STUDY HAS REQUIRED IDENTIFICATION OF SIGNIFICANT CONTRIBUTORS TO RISK IN A LOGICAL AND ORDERLY MANNER. CONSIDERATION OF A COMPREHENSIVE SET OF ACCIDENT INITIATORS, INCLUSION OF EXPERIENCE DATA, RELIANCE ON PROVEN METHODS AND TECHNIQUES, EVALUATION OF A WIDE RANGE OF RADIONUCLIDE RELEASES AND ASSOCIATED HEALTH EFFECTS, AND UTILIZATION OF EXPERIENCED RISK ANALYSTS ARE THE SALIENT ELEMENTS EMPLOYED IN THE SYSTEMATIC APPROACH TO THIS STUDY. THIS, TOGETHER WITH HEAVY RELIANCE ON EXPERIENCE GAINED DURING YEARS OF LWR DESIGN, LICENSING, AND OPERATION, PROVIDES REASONABLE ASSURANCE THAT THE STUDY OBJECTIVES HAVE BEEN ACHIEVED.

THE RESULTS OF THE CRBR PLANT SAFETY STUDY INDICATE THAT THE RISK ARISING FROM THE OPERATION OF THE CRBR PLANT IS SMALL IN COMPARISON TO OTHER LOCAL SOCIETAL RISKS AND THAT THE RISK FROM THE CRBR PLANT IS COMPARABLE TO THE RISK FROM PREVIOUSLY LICENSED NUCLEAR POWER PLANTS, AS IDENTIFIED IN THE REACTOR SAFETY STUDY.

- 19-3-3-330 RELIABILITY OF D-C POWER SUPPLIES
HAGEN, P. W.
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENN.
THE RELIABILITY OF THE D-C POWER SYSTEM IN NUCLEAR PLANTS AND THE ADEQUACY OF THE NUCLEAR REGULATORY COMMISSION (NRC) REQUIREMENTS FOR THIS SYSTEM HAVE BEEN QUESTIONED BY SAFETY ANALYSTS. CONCERN WAS EXPRESSED THAT FAILURE OF THE D-C SYSTEM WOULD CONCURRENTLY ISOLATE THE PLANT FROM THE EXTERNAL A-C POWER GRID, THE ON SITE EMERGENCY A-C SYSTEM, THE CONTROL FUNCTIONS ASSOCIATED WITH TURBINE DRIVEN PUMPS, AND ALL PROCESS INDICATION AND RECORDING FUNCTIONS, WITH THE RESULT THAT REMOVAL OF DECAY HEAT WITHOUT FUEL AND/OR CONTAMINATED DAMAGE MIGHT NOT BE POSSIBLE. THIS ARTICLE OUTLINES THE POSTULATED SCENARIO, REVIEWS THE TECHNICAL BACKGROUND IN THE DESIGN AND CRITERIA FOR D-C POWER SYSTEMS AS WELL AS THE OPERATING EXPERIENCE WITH SUCH SYSTEMS, AND PRESENTS THE NRC STAFF'S VIEW AND POSITION. IT FURTHER DELINEATES THE SAFETY SIGNIFICANCE OF SUCH FAILURES, THE BASIS FOR THE STAFF'S VIEW ON THE LIKELIHOOD OF THE POSTULATED SCENARIO, AND A PROPOSAL FOR ADDITIONAL TECHNICAL STUDIES.
- 19-3-4-339 THE SODIUM LOOP SAFETY FACILITY
GAPSIDE, C. H. + BEZELLA, W. A. + THOMPSON, D. H.
LENNOX, D. H. + TESSIERE, J. H.
ARGONNE NATIONAL LABORATORY, ARGONNE, ILL.
AS THE ONLY FACILITY IN THE UNITED STATES CAPABLE OF CONDUCTING SAFETY TESTS ON RELATIVELY LARGE, FULL LENGTH LIQUID METAL FAST BREEDER REACTOR (LMFBR) FUEL ASSEMBLIES AT STEADY STATE POWER LEVELS, THE SODIUM LOOP SAFETY FACILITY (SLSF) IS AN IMPORTANT PART OF THE LMFBR SAFETY PROGRAM. THE IN PILE EXPERIMENTS THAT BEGAN IN SEPTEMBER 1975 IN THE ENGINEERING TEST REACTOR (ETR) ARE PROVIDING DATA NEEDED FOR ASSESSMENT OF CRITICAL SAFETY QUESTIONS. PRESENTED IN THIS ARTICLE ARE DESCRIPTIONS OF THE FACILITY, ITS EXPERIMENTAL CAPABILITIES, AND THE OVERALL RESEARCH PROGRAM.
- 19-3-5-356 HIGH LEVEL NUCLEAR WASTE MANAGEMENT IN THE UNITED STATES - A TIME FOR DECISIONS
MALARO, J. C.
NUCLEAR REGULATORY COMMISSION, WASHINGTON, D.C.
SINCE THE LATE 1950S, KNOWLEDGEABLE EXPERTS HAVE INSISTED THAT TECHNOLOGY EXISTS FOR THE SAFE DISPOSAL OF HIGH LEVEL RADIOACTIVE WASTES BUT THAT A MEANS FOR SAFE DISPOSAL HAS YET TO BE DEMONSTRATED. SAFE DISPOSAL OF THESE WASTES IS THE PRINCIPAL PUBLIC CONCERN ASSOCIATED WITH THE USE OF NUCLEAR POWER. THE ABILITY OF INDUSTRY OR GOVERNMENT TO SOLVE THIS PROBLEM HAS BEEN QUESTIONED BY MANY. SOME CRITICS ARE DEMANDING THAT LICENSING OF NUCLEAR POWER PLANTS BE SUSPENDED UNTIL SAFE AND EFFECTIVE DISPOSAL OF HIGH LEVEL RADIOACTIVE WASTE HAS BEEN DEMONSTRATED. AN INTENSE, COORDINATED, AND WELL FUNDED FEDERAL EFFORT TO SOLVE THIS PROBLEM IS UNDER WAY. NOW SOME DECISIONS ARE NEEDED.
- 19-3-6-369 THREE YEARS OF PHENIX OPERATION
MEGY, J. M. P. + CONTE, F. + GODDET, J. L.
COMMISSARIAT A L'ENERGIE ATOMIQUE, SCALAY, FRANCE
PHENIX IS A 250-MW (E) SODIUM COOLED PROTOTYPE FAST BREEDER REACTOR, WHICH WAS BUILT BY THE FRENCH ATOMIC ENERGY COMMISSION AND ELECTRICITE DE FRANCE AND HAS BEEN IN COMMERCIAL OPERATION SINCE THE SUMMER OF 1974. THIS ARTICLE REVIEWS THE OPERATIONAL HISTORY OF PHENIX, WHICH MAY BE DIVIDED INTO TWO PHASES. THE FIRST 2 YEARS, BEING RELATIVELY TROUBLE FREE, PERMITTED THE AMASSING OF IMPRESSIVE OPERATIONAL STATISTICS. DURING THE THIRD YEAR, WHEN COMPONENT FAILURES WERE EXPERIENCED AND WHEN THE REACTOR WAS OPERATED WITH ONE LOOP OUT OF SERVICE, VALUABLE INFORMATION ON PLANT MAINTENANCE WAS OBTAINED. OPERATING DATA ARE ALSO GIVEN FOR THE FIRST 3 YEARS OF OPERATION.

- 19-4-1-411 FRENCH SAFETY STUDIES OF PRESSURIZED WATER REACTORS
RINGOT, C.
ADJOINT AU CHES DU SERVICE D'ETUDES TECHNIQUES DE SURETE NUCLEARE
FRANCE
SINCE THE FRENCH NUCLEAR PROGRAM IS BASED MAINLY ON PRESSURIZED WATER REACTORS (PWRs), WITH 25,000 MW (E) UNDER CONSTRUCTION, MOST OF THE NUCLEAR RESEARCH AND DEVELOPMENT IN FRANCE IS DEVOTED TO THE SPECIFIC SAFETY PROBLEMS OF PWRs. THIS ARTICLE IS A BRIEF REVIEW OF THAT PROGRAM, WHICH IS CURRENTLY FUNDED AT ABOUT \$35 MILLION (IN U.S. DOLLARS) PER YEAR. THE PRINCIPAL AREAS OF RESEARCH, AS DISCUSSED HERE, INCLUDE FUEL ELEMENT BEHAVIOR, THE PRIMARY SYSTEM, PROBABILITY STUDIES, AND RADIOLOGICAL SAFETY STUDIES.
- 19-4-1-427 ANS EXECUTIVE CONFERENCE ON SAFEGUARDS
JENKINS, J. D.
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENN.
THE AMERICAN NUCLEAR SOCIETY EXECUTIVE CONFERENCE ON SAFEGUARDS IS REVIEWED. THE MEETING, WHICH WAS HELD ON OCT. 16-19, 1977, AT HYANNIS, CAPE COD, MASS., FEATURED PAPERS ON INTERNATIONAL SAFEGUARDS BY BOTH U.S. GOVERNMENT REPRESENTATIVES AND A NUMBER OF FOREIGN SPEAKERS. U.S. DOMESTIC SAFEGUARDS ISSUES, WHICH INCLUDED PROBLEMS INVOLVING PHYSICAL PROTECTION AND MATERIAL CONTROL AND ACCOUNTABILITY, WERE ALSO DISCUSSED BY REPRESENTATIVES FROM THE NUCLEAR REGULATORY COMMISSION AND INDUSTRY. IT WAS GENERALLY AGREED BY ALL SPEAKERS ADDRESSING THE INTERNATIONAL SAFEGUARDS ISSUE THAT MULTINATIONAL TREATIES AND CONTROLS (AS OPPOSED TO UNILATERAL AD HOC AGREEMENTS) WERE THE PREFERRED ROUTE TO PROLIFERATION RESISTANT NUCLEAR COMMERCE AND THAT THE INTERNATIONAL ATOMIC ENERGY AGENCY WAS THE LOGICAL BODY TO ADMINISTER AND OVERSEE THE REQUIRED INSPECTIONS. THERE WAS SOME DIVERGENCE OF OPINION BETWEEN THE FOREIGN AND U.S. PARTICIPANTS ON THE ISSUE OF PLUTONIUM RECYCLING, THE FORMER GROUP ASSUMING THAT THE INTERNATIONAL SAFEGUARDS SYSTEM WOULD HAVE TO CONFRONT THE PROBLEMS ASSOCIATED WITH PLUTONIUM RECYCLING DIRECTLY, AND THE U.S. SPEAKERS HELD OUT THE HOPE OF A LESS PROLIFERATION PRONE, AND HENCE MORE EASILY SAFEGUARDED, FUEL CYCLE. ON DOMESTIC SAFEGUARDS TOPICS, SPEAKERS FROM THE NUCLEAR REGULATORY COMMISSION AND THE DEPARTMENT OF ENERGY DESCRIBED SPECIFIC PROGRAMS UNDER WAY TO COUNTER AND CONTROL SUBNATIONAL TERRORIST THREATS AND TO ENSURE ACCURATE MATERIAL ACCOUNTING AND CONTROL. INDUSTRY SPEAKERS ADDRESSING DOMESTIC SAFEGUARDS ACQUIESCED TO THE REALITY OF THE PROBLEM BUT POINTED OUT THE NEED FOR WELL DEFINED PERFORMANCE CRITERIA AND STATIC REGULATORY GUIDELINES.
- 19-4-1-433 NRC SAFETY RESEARCH PROGRAM - A CRITIQUE AND AN EXTENSION
NUCLEAR SAFETY STAFF
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENN.
EDITOR'S NOTE - TWO RECENT REPORTS ARE UNIQUELY CONCERNED WITH THE NUCLEAR SAFETY RESEARCH PROGRAM OF THE NUCLEAR REGULATORY COMMISSION (NRC) IN THAT BOTH ARE IN RESPONSE TO CONGRESSIONAL MANDATES. ONE REPORT, IN DECEMBER 1977, IS BY THE ADVISORY COMMITTEE ON REACTOR SAFEGUARDS AND IS ENTITLED REVIEW AND EVALUATION OF THE NUCLEAR REGULATORY COMMISSION SAFETY RESEARCH PROGRAM, THE SECOND REPORT, DRAFTED EARLY THIS YEAR, IS BY THE NRC STAFF AND IS ENTITLED PLAN FOR RESEARCH TO IMPROVE THE SAFETY OF LIGHT WATER NUCLEAR POWER PLANTS. ALTHOUGH THE GENESSES OF THE TWO REPORTS ARE SOMEWHAT DIFFERENT, TO SOME EXTENT BOTH REPORTS ARE CRITIQUES OF THE PRESENT NRC SAFETY RESEARCH PROGRAM, AND THEY BOTH CONTAIN RECOMMENDATIONS FOR ADDITIONAL RESEARCH. HOWEVER, THE LATTER REPORT EMPHASIZES SYSTEM IMPROVEMENTS, ALTHOUGH IT IS RESTRICTED TO LIGHT WATER REACTORS. THIS ARTICLE PRESENTS A BRIEF RESUME OF BOTH DOCUMENTS.
- 19-4-2-440 RESPONSE OF UNIRRADIATED AND IRRADIATED PWR FUEL RODS TESTED UNDER POWER COOLING MISMATCH CONDITIONS
MACDONALD, P. E. + QUAPP, W. J. + MEHNER, A. S.
MARTINSON, Z. R. + MCCARDELL, R. K.
EG&G IDAHO, INC., IDAHO FALLS, IDAHO
THIS REPORT SUMMARIZES THE RESULTS FROM THE SINGLE ROD POWER COOLING MISMATCH (PCM) AND IRRADIATION EFFECTS (IE) TESTS CONDUCTED TO DATE IN THE POWER BURST FACILITY (PBF) AT THE U.S. DEPARTMENT OF ENERGY'S IDAHO NATIONAL ENGINEERING LABORATORY. THIS WORK WAS PERFORMED FOR THE U.S. NUCLEAR REGULATORY COMMISSION UNDER CONTRACT TO THE DEPARTMENT OF ENERGY. THESE TESTS ARE PART OF THE NUCLEAR REGULATORY COMMISSION'S FUEL BEHAVIOR PROGRAM, WHICH IS DESIGNED TO PROVIDE DATA FOR THE DEVELOPMENT AND VERIFICATION OF ANALYTICAL FUEL BEHAVIOR MODELS THAT ARE USED TO PREDICT FUEL RESPONSE TO ABNORMAL OR POSTULATED ACCIDENT CONDITIONS IN COMMERCIAL LIGHT WATER REACTORS (LWRs). THE MECHANICAL, CHEMICAL, AND THERMAL RESPONSE OF BOTH PREVIOUSLY UNIRRADIATED AND PREVIOUSLY IRRADIATED LWR TYPE FUEL RODS TESTED UNDER POWER COOLING MISMATCH CONDITIONS IS DISCUSSED. A BRIEF DESCRIPTION OF THE TEST DESIGNS IS PRESENTED. THE RESULTS OF THE PCM THERMAL HYDRAULIC STUDIES ARE SUMMARIZED. PRIMARY EMPHASIS IS PLACED ON THE BEHAVIOR OF THE FUEL AND CLADDING DURING AND AFTER STABLE FILM BOILING.

- 19-4-3-468 SECOND SPECIALISTS MEETING ON REACTOR NOISE
BOOTH, R. S.
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENN.
GATLINBURG, TENN., WAS THE SITE OF THE SECOND SPECIALISTS MEETING ON REACTOR NOISE (SMORN-II) WHICH TOOK PLACE ON SEPT. 19-23, 1977. IN CONTRAST TO SMORN-I WHICH SUCCESSFULLY COVERED THE STATUS OF NOISE ANALYSIS IN BOTH ZERO POWER AND POWER REACTORS, SMORN-II PLACED EMPHASIS ON PRACTICAL APPLICATIONS OF NOISE ANALYSIS FOR THE PURPOSE OF INCREASING THE SAFETY AND AVAILABILITY OF NUCLEAR POWER PLANTS. FIFTY SEVEN PAPERS WERE PRESENTED TO THE 117 DELEGATES AND APPROXIMATELY 30 VISITORS WHO REPRESENTED 25 COUNTRIES AND INTERNATIONAL ORGANIZATIONS. AN IMPORTANT CONCLUSION OF THE CONFERENCE WAS THAT NOISE ANALYSIS TECHNIQUES HAVE PROVED TO BE SUCCESSFUL AND COST EFFECTIVE IN SOLVING SURVEILLANCE, DIAGNOSTIC, AND SAFETY RELATED PROBLEMS OF NUCLEAR POWER STATIONS. EQUALLY IMPORTANT WERE THE NEW AND CHALLENGING APPLICATIONS THAT WERE IDENTIFIED.
- 19-4-4-473 RECENT ADVANCES IN ALTERNATE ECCS STUDIES FOR PRESSURIZED WATER REACTORS
CHON, W. Y.
STATE UNIVERSITY OF NEW YORK AT BUFFALO, NEW YORK
RESEARCH AND DEVELOPMENT WORK ON ALTERNATE METHODS IS CURRENTLY UNDER WAY TO IMPROVE THE PERFORMANCE OF EXISTING EMERGENCY CORE COOLING SYSTEMS (ECCSS) FOR PRESSURIZED WATER REACTORS (PWRs). RECENT ADVANCES IN THIS AREA IN THE UNITED STATES AND ABROAD ARE REVIEWED.
- 19-4-5-486 PLANNING AND VALIDATION OF ENVIRONMENTAL SURVEILLANCE PROGRAMS AT OPERATING NUCLEAR POWER PLANTS
EICHMOLZ, G. G.
GEORGIA INSTITUTE OF TECHNOLOGY, ATLANTA, GA.
THE CONDUCT OF THE OPERATIONAL PHASE OF THE ENVIRONMENTAL SURVEILLANCE PROGRAMS AT NUCLEAR POWER PLANTS ENTAILS A WIDE VARIETY OF ECOLOGICAL STUDIES AND ANALYSES OF LOW LEVEL RADIOACTIVE SAMPLES. UNLESS A CLOSE REIN IS KEPT TO ENSURE THAT SAMPLES ARE REPRESENTATIVE IN NATURE AND COUNTING TIMES AND ACTIVITIES ARE COMMENSURATE WITH THE ACCURACY SOUGHT, MUCH OF THAT WORK MAY BE MEANINGLESS AND MAY MERELY SERVE TO MEET REGULATORY REPORTING REQUIREMENTS.
IT IS RECOMMENDED THAT AN ACTION LEVEL PROGRAM BE ADOPTED WHEREBY ONLY THE MOST SIGNIFICANT SAMPLES ARE COLLECTED AND ANALYSED DURING ROUTINE OPERATIONS, WITH PROVISIONS TO STEP UP THE FREQUENCY OF SAMPLING AND EXTEND SAMPLE LOCATIONS WHENEVER EFFLUENT RELEASES EXCEED CERTAIN FRACTIONS OF SET LIMITS.
- 19-4-5-497 RADIOLOGICAL IMPACT OF AIRBORNE EFFLUENTS OF COAL FIRED AND NUCLEAR POWER PLANTS
MCBRIDE, J. P. + MOORE, R. E. + WITHERSPOON, J. P.
BLANCO, R. E.
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENN.
THE RADIOLOGICAL IMPACT OF NATURALLY OCCURRING RADIONUCLIDES IN AIRBORNE EFFLUENTS OF A MOWPL COAL FIRED STEAM PLANT (1000 MW(e)) IS EVALUATED, ASSUMING A RELEASE TO THE ATMOSPHERE OF 1 PERCENT OF THE ASH IN THE COAL BURNED, AND COMPARED WITH THE IMPACT OF RADIOACTIVE MATERIALS IN THE AIRBORNE EFFLUENTS OF MODEL LIGHT WATER REACTORS (1000 MW(t)). THE PRINCIPAL EXPOSURE PATHWAY FOR RADIOACTIVE MATERIALS RELEASED FROM BOTH TYPES OF PLANTS IS INGESTION OF CONTAMINATED FOODSTUFFS. FOR NUCLEAR PLANTS, IMMERSION IN THE AIRBORNE EFFLUENTS IS ALSO A SIGNIFICANT FACTOR IN THE DOSE COMMITMENT. ASSUMING THAT THE COAL BURNED CONTAINS 1 PPM URANIUM AND 2 PPM THORIUM TOGETHER WITH THEIR DECAY PRODUCTS AND USING THE SAME IMPACT ANALYSIS METHODS USED IN EVALUATING NUCLEAR FACILITIES, THE MAXIMUM INDIVIDUAL DOSE COMMITMENTS FROM THE COAL PLANT FOR THE WHOLE BODY AND MOST ORGANS (EXCEPT THE THYROID) ARE SHOWN TO BE GREATER THAN THOSE FROM A PRESSURIZED WATER REACTOR AND, WITH THE EXCEPTION OF THE BONE AND KIDNEY DOSES, LESS THAN THOSE FROM A BOILING WATER REACTOR. WITH THE EXCEPTION OF THE BONE DOSE, THE MAXIMUM INDIVIDUAL DOSE COMMITMENTS FROM THE COAL PLANT ARE LESS THAN THE NUMERICAL DESIGN GUIDELINE LIMITS LISTED IN 10 CFR 50, APPENDIX I, FOR LIGHT WATER REACTORS. POPULATION DOSE COMMITMENTS FROM THE COAL PLANT ARE HIGHER THAN THOSE FROM EITHER NUCLEAR PLANT, EXCEPT FOR THE THYROID DOSE FROM THE BOILING WATER REACTOR.
- 19-4-6-502 NRC REVIEW OF LICENSED OPERATOR REQUALIFICATION PROGRAMS FOR NUCLEAR POWER PLANTS
COOLPY, R. A.
U. S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, D. C.
PRESENTED HERE ARE THE RESULTS OF NUCLEAR REGULATORY COMMISSION (NRC) AUDITS OF THE LICENSED OPERATOR REQUALIFICATION PROGRAMS AT NUCLEAR POWER PLANTS. THE REQUALIFICATION PROGRAMS HAVE BEEN IN EFFECT FOR A LITTLE OVER 3 YEARS. THE RESULTS OF THE AUDITS CONDUCTED BY THE OPERATOR LICENSING BRANCH AND THE OFFICE OF INSPECTION AND ENFORCEMENT ARE DISCUSSED. THE PROGRAMS HAVE IMPROVED DURING THIS 3-YEAR PERIOD AND, IN THE OPINION OF MANY, ARE BENEFICIAL TO THE NUCLEAR INDUSTRY.
- 19-5-1-541 LIGHT WATER REACTOR SAFETY RESEARCH IN JAPAN
NUCLEAR SAFETY STAFF
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENN.
EDITOR'S NOTE - THE FOLLOWING ARTICLE WAS PREPARED BY THE EDITORS OF NUCLEAR SAFETY AND IS BASED ENTIRELY ON SEVERAL REPORTS OF THE JAPANESE WORK THAT HAVE BEEN RECEIVED IN THIS COUNTRY THROUGH THE AGREEMENT BETWEEN THE NUCLEAR REGULATORY

COMMISSION AND JAPAN FOR THE EXCHANGE OF INFORMATION ON WATER REACTOR SAFETY RESEARCH. ALTHOUGH WE EXPECT TO PUBLISH AN ARTICLE BY A JAPANESE AUTHOR IN 1979 ON THEIR EXPERIMENTAL RESULTS, THE PRESENT ARTICLE WILL PROVIDE MUCH USEFUL BACKGROUND INFORMATION ON THEIR PROGRAM. TO THE EXTENT POSSIBLE, WE HAVE USED THE PHRASEOLOGY OF THE JAPANESE REPORTS IN DESCRIBING THEIR WORK, OUR THOUGHTS ARE INTRODUCED ONLY AT THE END OF THE ARTICLE UNDER THE SUBHEADING COMMENTARY. THE DOCUMENTS DESCRIBING THE JAPANESE PROGRAM DO NOT GIVE FUNDING LEVELS OR IDENTIFY THE RESPONSIBLE RESEARCH ORGANIZATIONS, EXCEPT FOR THE FACT THAT ALMOST ALL THE WORK IS COORDINATED WITH, OR THROUGH, THE JAPAN ATOMIC ENERGY RESEARCH INSTITUTE. HOWEVER, THE PROGRAMMATIC RESPONSIBILITIES OF VARIOUS JAPANESE RESEARCH ORGANIZATIONS CAN BE INFERRED FROM THE TOPICAL REPORTS THAT WE HAVE RECEIVED AS A PART OF THE EXCHANGE AGREEMENT. THESE DOCUMENTS ARE LISTED IN THE BIBLIOGRAPHY AND ARE DISCUSSED IN GENERAL IN THE COMMENTARY.

- 19-5-1-556 THE ROLE OF RISK ASSESSMENT IN THE NUCLEAR REGULATORY PROCESS
LEVINE, SAGI
U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, D.C.
THE JUDICIOUS APPLICATION OF RISK ASSESSMENT TECHNIQUES CAN HELP TO REDUCE PRESENT REGULATORY UNCERTAINTIES, AND THE ACCEPTABILITY OF SUCH TECHNIQUES IS GAINING SUPPORT. ALTHOUGH THE APPLICATION OF THESE TECHNIQUES, IN THE MANNER OF REPORT WASH-1400 (THE REACTOR SAFETY STUDY), TO EACH PLANT WOULD BE FORMIDABLE, A PROBABILISTIC APPROACH CAN GUIDE THE DECISION MAKERS INVOLVED IN THE LICENSING PROCESS. SEVERAL EXAMPLES OF THE USE OF A PROBABILISTIC APPROACH ARE GIVEN. THE RISK ASSESSMENT TOOLS WILL BE IMPROVED UNDER A PLAN SUBMITTED TO CONGRESS TO IMPROVE REACTOR SAFETY. THE QUESTION OF ACCEPTABLE RISK CRITERIA WILL BE ADDRESSED IN THE ONGOING NUCLEAR REGULATORY COMMISSION (NRC) RESEARCH PROGRAM. IT IS EXPECTED THAT THE CONTINUED USE OF RISK ASSESSMENT TECHNIQUES WILL HELP TO IMPROVE THE EFFICIENCY AND THE STABILIZATION OF THE REGULATORY PROCESS BY FOCUSING THE ATTENTION OF THE NRC STAFF ON THE IMPORTANT CONTRIBUTORS TO RISK.
- 19-5-2-565 FRAP FUEL BEHAVIOR COMPUTER CODES
OEHLBERG, P. N. + JOHNSTON, W. V. + DEARIEN, J. A.
U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, D.C. / EG&G IDAHO, INC., IDAHO FALLS, IDAHO
THE FUEL ROD ANALYSIS PROGRAM (FRAP) COMPUTER CODES BEING DEVELOPED BY THE NUCLEAR REGULATORY COMMISSION (NRC) ARE REVIEWED. THE FRAP-S (THE STEADY STATE CODE) IS DESIGNED TO PROVIDE INITIAL CONDITIONS FOR FRAP-T (THE TRANSIENT CODE). THE MODELS CONTAINED IN EACH CODE, THE ABILITY OF THE RECENT VERSIONS OF THE CODES TO PREDICT EXPERIMENTS, AND JUDGMENTS AS TO THE CODES' STRENGTHS AND WEAKNESSES ARE PRESENTED. FUTURE DEVELOPMENT OF THE FRAP-T CODE IS DISCUSSED, AND A LISTING OF POTENTIALLY DESIRABLE MODELS FOR THE NRC TRANSIENT AND STEADY STATE CODES ARE DISPLAYED. THE CONTENT OF THE MATERIAL PROPERTIES PACKAGE (MATPRO) IS OUTLINED. THE MODULAR MATPRO IS ACTIVELY LINKED TO BOTH FRAP-T AND FRAP-S TO PROVIDE A WELL DOCUMENTED AND CONSISTENT SET OF MATERIAL PROPERTIES FOR THE FRAP CODES.
- 19-5-2-588 FRAP FUEL BEHAVIOR COMPUTER CODES - ADDENDUM ON FRAP-S3
MARINO, G. P.
U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, D.C.
AFTER THE PRECEDING ARTICLE WAS COMPLETED, THE LATEST VERSION OF THE STEADY STATE CODE (FRAP-S3) WAS DEVELOPED AND QUALIFIED. THIS ADDENDUM DESCRIBES THE IMPROVEMENTS IN FRAP-S3 AS WELL AS ITS QUALIFICATION IN A NUMBER OF PERFORMANCE CALCULATIONS. THE STANDARD ERRORS FOR THE CALCULATION OF A NUMBER OF OUTPUT PARAMETERS ARE PRESENTED.
- 19-5-3-590 ASSESSMENT OF SEISMIC TRIP SYSTEMS FOR COMMERCIAL POWER REACTORS
CUMMINGS, G. E. + WELLS, J. E. + LAMBERT, H. E.
LAWRENCE LIVERMORE LABORATORY, LIVERMORE, CALIF.
THIS ARTICLE ASSESSES THE VALUE OF SEISMIC TRIP (SCRAM) SYSTEMS ON COMMERCIAL NUCLEAR POWER REACTORS. EXPERIENCES WITH SEISMIC TRIP SYSTEMS ON RESEARCH AND TEST REACTORS ARE REVIEWED AS ARE CURRENT REGULATIONS CONCERNING SEISMIC INSTRUMENTATION ON POWER REACTORS. THE ADVANTAGES AND DISADVANTAGES OF SEISMIC TRIPS ARE DISCUSSED, AND A COMPARATIVE RISK ASSESSMENT IS MADE USING FAULT TREE TECHNIQUES. ALSO EXPLORED IS THE POSSIBILITY OF USING A PRECURSOR SIGNAL FROM AN EARTHQUAKE TO TRIP THE REACTOR BEFORE THE ARRIVAL OF STRONG MOTION.
- 19-5-5-602 SCENARIOS OF CARBON-14 RELEASES FROM THE WORLD NUCLEAR POWER INDUSTRY FROM 1975 TO 2020 AND THE ESTIMATED RADIOLOGICAL IMPACT
KILLOUGH, G. G. + TILL, J. F.
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENN.
THIS ARTICLE PRESENTS AN ASSESSMENT OF THE RADIATION DOSE TO THE WORLD POPULATION AND THE ASSOCIATED POTENTIAL HEALTH EFFECTS FROM THREE SCENARIOS OF CARBON-14 RELEASES BY THE NUCLEAR INDUSTRY BETWEEN 1975 AND 2020. MEASURES OF HEALTH IMPACT ARE DERIVED FROM SOURCE TERMS THROUGH THE USE OF A MULTICOMPARTMENT MODEL OF THE GLOBAL CARBON CYCLE, DOSE RATE FACTORS BASED ON CARBON-14 SPECIFIC ACTIVITY IN VARIOUS ORGANS OF MAN, AND HEALTH EFFECT INCIDENCE FACTORS RECENTLY

RECOMMENDED BY THE INTERNATIONAL COMMISSION ON RADIOLOGICAL PROTECTION (ICRP). THE THREE SCENARIOS FOR WORLDWIDE CARBON-14 RELEASES CONSIDERED ARE (1) A PESSIMISTIC SCENARIO IN WHICH ALL THE CARBON-14 PROJECTED TO BE PRODUCED IN FUEL CYCLES IS RELEASED, (2) AN OPTIMISTIC SCENARIO THAT ASSUMES A DECONTAMINATION FACTOR OF 100 FOR FUEL REPROCESSING, AND (3) AN INTERMEDIATE SCENARIO THAT SIMULATES A PHASED IMPROVEMENT IN THE EFFLUENT TREATMENT TECHNOLOGY AT REPROCESSING PLANTS. THE ESTIMATES OF CUMULATIVE POTENTIAL HEALTH EFFECTS BASED ON INTEGRATION OVER INFINITE TIME (EFFECTIVELY 46,000 YEARS OR ABOUT 8 HALF LIVES OF CARBON-14) ARE AS FOLLOWS - 110,000 CANCERS AND 75,000 GENETIC EFFECTS FROM THE PESSIMISTIC SCENARIO, 21,000 CANCERS AND 14,000 GENETIC EFFECTS FROM THE OPTIMISTIC SCENARIO, 22,000 CANCERS AND 15,000 GENETIC EFFECTS FROM THE INTERMEDIATE SCENARIO, 100,000 CANCERS AND 68,000 GENETIC EFFECTS FROM THE CARBON-14 FORMED IN NATURE BETWEEN 1975 AND 2020, AND 380,000 CANCERS AND 250,000 GENETIC EFFECTS FROM THE CARBON-14 FORMED BY THE DETONATION OF NUCLEAR EXPLOSIVES FROM 1945 TO 1974. COMPARABLE EFFECTS FROM THE NATURALLY FORMED CARBON-14 IN STEADY STATE IN THE ENVIRONMENT, ALSO INTEGRATED OVER 46,000 YEARS, ARE APPROXIMATELY 66 MILLION CANCERS AND 43 MILLION GENETIC EFFECTS. THESE ESTIMATES ARE BASED ON A WORLD POPULATION THAT IS ASSUMED TO REMAIN STATIONARY AT 12.2 BILLION AFTER 2075.

- 19-5-5-617 RADIOLOGICAL QUALITY OF THE ENVIRONMENT IN THE UNITED STATES, 1977
NUCLEAR SAFETY STAFF
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENN.
EDITOR'S NOTE - THE FOLLOWING ARTICLE WAS ADAPTED BY THE NUCLEAR SAFETY STAFF FROM CHAP. 1, INTRODUCTION, SUMMARY, AND CONCLUSIONS, OF A REPORT OF THE SAME TITLE, WHICH WAS PUBLISHED IN SEPTEMBER 1977 BY THE ENVIRONMENTAL PROTECTION AGENCY AS EPA 520/1-009. THE REPORT AND ITS SUMMARY HERE PROVIDE SIGNIFICANT DATA ON DOSE ASSESSMENT FOR EVALUATING THE RADIOLOGICAL QUALITY OF THE ENVIRONMENT.
- 19-5-6-623 NUCLEAR REACTOR OPERATOR LICENSING
BURSEY, R. J.
U. S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, D. C.
THE ATOMIC ENERGY ACT OF 1954, WHICH WAS AMENDED IN 1974 BY THE ENERGY REORGANIZATION ACT, ESTABLISHED THE REQUIREMENT THAT INDIVIDUALS WHO HAD THE RESPONSIBILITY OF OPERATING THE REACTORS IN NUCLEAR POWER PLANTS MUST BE LICENSED. SECTION 107 OF THE ACT STATES THE COMMISSION SHALL (1) PRESCRIBE UNIFORM CONDITIONS FOR LICENSING INDIVIDUALS..., (2) DETERMINE THE QUALIFICATIONS OF SUCH INDIVIDUALS, AND (3) ISSUE LICENSES TO SUCH INDIVIDUALS IN SUCH FORM AS THE COMMISSION MAY PRESCRIBE. THIS ARTICLE DISCUSSES THE TYPES OF LICENSES, THE SELECTION AND TRAINING OF INDIVIDUALS, AND THE ADMINISTRATION OF THE NUCLEAR REGULATORY COMMISSION LICENSING EXAMINATIONS.
- 19-5-6-628 RADIOACTIVE MATERIALS RELEASED FROM NUCLEAR POWER PLANTS IN 1976
DECKER, T. R.
U. S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, D. C.
RELEASES OF RADIOACTIVE MATERIALS IN AIRBORNE AND LIQUID EFFLUENTS FROM COMMERCIAL LIGHT WATER REACTORS DURING 1976 HAVE BEEN COMPILED AND ARE REPORTED HERE. DATA ON SOLID-WASTE SHIPMENTS, AS WELL AS SELECTED OPERATING INFORMATION, ARE INCLUDED. THE REPORT FROM WHICH THIS ARTICLE IS ADAPTED SUPPLEMENTS EARLIER ANNUAL REPORTS ISSUED BY THE FORMER ATOMIC ENERGY COMMISSION (NOW DOE) AND THE NUCLEAR REGULATORY COMMISSION. THE 1976 RELEASE DATA ARE COMPARED WITH THE RELEASES OF PREVIOUS YEARS IN TABULAR FORM. IN ALL CASES THE TOTAL RELEASES WERE BELOW THE LIMITS SET FORTH IN APPLICABLE REGULATIONS AND IN THE TECHNICAL SPECIFICATIONS FOR EACH PLANT.
- 19-6-1-671 THE NRC PROGRAM OF INSPECTION AND ENFORCEMENT
LEDoux, J. C. + RENFUSS, C.
U. S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, D. C.
THE NUCLEAR REGULATORY COMMISSION (NRC) REGULATES CIVILIAN USES OF NUCLEAR MATERIALS TO ENSURE THE PROTECTION OF THE PUBLIC HEALTH AND SAFETY AND THE ENVIRONMENT. THE OFFICE OF INSPECTION AND ENFORCEMENT (IE) DEVELOPS AND IMPLEMENTS THE INSPECTION, INVESTIGATION, AND ENFORCEMENT PROGRAMS FOR THE NRC. THE IE CONDUCTS INSPECTION PROGRAMS FOR REACTORS UNDER CONSTRUCTION AND IN OPERATION, NUCLEAR INDUSTRY VENDORS, FUEL FACILITIES AND USERS OF NUCLEAR MATERIALS, AND ALL ASPECTS OF THE SAFEGUARDING OF FACILITIES AND MATERIALS. RECENTLY THE IE BEGAN IMPLEMENTING A PROGRAM THAT WILL PLACE INSPECTORS ON SITE AT NUCLEAR POWER REACTORS AND WILL PROVIDE FOR NATIONAL APPRAISAL OF LICENSEE PERFORMANCE AND FOR AN EVALUATION OF THE EFFECTIVENESS OF THE INSPECTION PROGRAMS.
- 19-6-2-681 A REASSESSMENT OF TURBINE GENERATOR FAILURE PROBABILITY
BUSH, S. H.
BATTELLE PACIFIC NORTHWEST LABORATORIES, RICHLAND, WASH.
A PREVIOUS ARTICLE IN NUCLEAR SAFETY ASSESSED THE OVERALL PROBABILITY (P4) OF NUCLEAR PLANT DAMAGE DUE TO TURBINE FAILURES AS A FUNCTION OF THE COMBINED PROBABILITIES OF TURBINE FAILURE AND EJECTION OF AN ENERGETIC MISSILE (P1), A MISSILE STRIKING A CRITICAL COMPONENT (P2), AND SIGNIFICANT DAMAGE OCCURRING TO THE COMPONENT (P3). DUE TO QUESTIONS RAISED

CONCERNING THE METHODOLOGY USED, THE VALUE OF P1 HAS BEEN REASSESSSED, USING A SOMEWHAT BROADER DATA BASE AND OTHER METHODS OF DATA ANALYSIS. THE RANGE OF INSTANTANEOUS TURBINE FAILURE RATES CONSIDERED RELEVANT TO NUCLEAR SYSTEMS IS 3.3×10^{-5} TO 3.1×10^{-4} PER TURBINE YEAR IN THE CURRENT ARTICLE COMPARED TO A VALUE OF 7×10^{-5} PER TURBINE YEAR IN THE PREVIOUS ARTICLE.

- 19-6-2-699 FISSION GAS RELEASE FROM FUEL AT HIGH BURNUP
MEYER, R. O. + BEYER, C. E. + VOGLEWEDE, J. C.
U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, D.C.
THE RELEASE OF FISSION GAS FROM FUEL PELLETS AT HIGH BURNUP IS REVIEWED IN THE CONTEXT OF THE SAFETY ANALYSIS PERFORMED FOR REACTOR LICENSE APPLICATIONS. LICENSING ACTIONS THAT WERE TAKEN TO CORRECT DEFICIENT GAS RELEASE MODELS USED IN THESE SAFETY ANALYSES ARE DESCRIBED. A CORRECTION FUNCTION, WHICH WAS DEVELOPED BY THE NUCLEAR REGULATORY COMMISSION STAFF AND ITS CONSULTANTS, IS PRESENTED. RELATED INFORMATION, INCLUDING SOME PREVIOUSLY UNPUBLISHED DATA, IS ALSO SUMMARIZED. THE ARTICLE THUS PROVIDES GUIDANCE FOR THE ANALYSIS OF HIGH-BURNUP GAS RELEASE IN LICENSING SITUATIONS.
- 19-6-3-712 APPLICATION OF REACTOR SCRAM EXPERIENCE IN RELIABILITY ANALYSIS OF SHUTDOWN SYSTEMS
EDISON, G. E. + GERSTNER, M. T.
U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, D.C.
SCRAM EXPERIENCE AT A LIQUID METAL COOLED FAST BREEDER REACTOR (LMFBR) AND 14 COMMERCIAL LIGHT WATER REACTORS (LWRs) HAS BEEN REVIEWED AND ANALYZED FOR APPLICATION IN THE RELIABILITY ANALYSIS OF LMFBR SHUTDOWN SYSTEMS. THE DATE AND REACTOR POWER FOR EACH SCRAM WERE COMPILED FROM MONTHLY PLANT OPERATING REPORTS AND PERSONAL COMMUNICATIONS WITH PLANT OPERATING PERSONNEL. THE SCRAM FREQUENCY IN THE EXPERIMENTAL BREEDER REACTOR II (EBR-II) HAS BEEN HIGHER THAN THAT IN COMMERCIAL LWRs BECAUSE OF ITS CONSERVATIVE SHUTDOWN SYSTEM DESIGN WHICH LEADS TO MORE SCRAMS FROM MINOR CAUSES. THE SCRAM FREQUENCY OF THE EBR-II HAS DECLINED RAPIDLY WITH OPERATING EXPERIENCE AS SOME OF THE OVERLY CONSERVATIVE SCRAMS ARE ELIMINATED. THE EBR-II DATA TREND AND OTHER FACTS SUGGEST THAT THE SCRAM FREQUENCY FOR LARGE LMFBRs IS LIKELY TO BE IN THE SAME GENERAL RANGE AS THAT FOR COMMERCIAL LWRs. THE SCRAM FREQUENCY CURVE IN LWRs RESEMBLES A RELIABILITY BATHUB CURVE, WITH THE USEFUL LIFE PHASE OF OPERATION LEVELING OFF AT ABOUT 2.5 SCRAMS PER YEAR. A WEIBULL DISTRIBUTION APPEARS TO REPRESENT THE DATA WELL IN THE EARLY LIFE PORTION OF THE CURVE. NO SIGN OF A WEAR-OUT PHASE IS EVIDENT AFTER 16 YEARS OF OPERATION.
- 19-6-3-723 THE SEPARATION OF ELECTRICAL EQUIPMENT AND SYSTEMS IN NUCLEAR POWER PLANTS IN SWEDEN AND THE UNITED STATES
REISCH, F.
SWEDISH NUCLEAR POWER INSPECTORATE, STOCKHOLM, SWEDEN
DESIGN CRITERIA FOR THE SEPARATION OF CLASS 1E EQUIPMENT AND SYSTEMS AND THE SEPARATION REQUIREMENTS AS PRACTICED IN NUCLEAR POWER PLANTS IN SWEDEN AND IN THE UNITED STATES ARE COMPARED. SOME EXAMPLES ARE USED TO SHOW HOW THESE SAFETY REQUIREMENTS INFLUENCE CABLING INSTALLATION AND CONTROL ROOM DESIGN. ALSO, BRIEFLY DISCUSSED IS A DESIGN FEATURE USED TO SHUT DOWN THE REACTOR IN SOME POWER PLANTS IN OTHER COUNTRIES WHEN ACCESS TO THE CONTROL ROOM IS CONSIDERED TO BE TOO HAZARDOUS FOR THE OPERATOR.
- 19-6-5-732 PROTECTION OF THE THYROID GLAND IN THE EVENT OF RELEASES OF RADIOIODINE
NUCLEAR SAFETY STAFF
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENN.
EDITOR'S NOTE - THE FOLLOWING ARTICLE WAS ADAPTED BY THE NUCLEAR SAFETY STAFF FROM A REPORT OF THE SAME TITLE WHICH WAS ISSUED AUG. 1, 1977, BY THE NATIONAL COUNCIL ON RADIATION PROTECTION AND MEASUREMENTS AS NCRP REPORT NO. 55. THE REPORT AND ITS SUMMARY HERE PROVIDE USEFUL DATA ON MINIMIZING THE EFFECTS OF AN ACCIDENTAL RADIOIODINE RELEASE.
- 19-6-5-741 MEDICAL AND LEGAL IMPLICATIONS OF A LARGE RELEASE OF RADIOIODINE
HETTLER, F. A., JR. + KELSEY, C. A. + BAHAM, M. S.
THE UNIVERSITY OF NEW MEXICO, ALBUQUERQUE, N.M. / FRANKLIN PIERCE LAW CENTER, CONCORD, N.H.
DATA FROM NCRP REPORT NO. 55 BY THE NATIONAL COUNCIL ON RADIATION PROTECTION AND MEASUREMENTS ARE USED IN A HYPOTHETICAL RELEASE SITUATION TO DELINEATE THE POTENTIAL MEDICAL AND LEGAL PROBLEMS THAT MAY ARISE FROM SUCH A RELEASE. AN ANALYSIS OF THESE PROBLEMS INDICATES THAT THE EFFECTS OF RADIOIODINE RELEASE ARE THE MOST IMPORTANT AND THAT GUIDELINES FOR COUNTERMEASURES AND FOLLOW-UP ACTION MUST BE DEVELOPED AND PROMULGATED. MODEL GUIDELINES BASED ON THE HYPOTHETICAL RELEASE ARE PRESENTED AND DISCUSSED.
- 19-6-6-748 STEAM GENERATOR TUBE FAILURES - WORLD EXPERIENCE IN WATER COOLED NUCLEAR POWER REACTORS IN 1976
TATONE, O. S. + PATHANIA, R. S.
CHALK RIVER NUCLEAR LABORATORIES, ONTARIO, CANADA
A SURVEY WAS CONDUCTED OF EXPERIENCE WITH STEAM-GENERATOR TUBES AT NUCLEAR POWER STATIONS DURING 1976. FAILURES WERE REPORTED AT 25 OUT OF 68 WATER-COOLED REACTORS. THE CAUSES OF THESE FAILURES AND THE REPAIR AND INSPECTION PROCEDURES DESIGNED TO COPE WITH THEM ARE SUMMARIZED. EXAMINATION OF THE DATA

INDICATES THAT CORROSION WAS THE MAJOR CAUSE OF STEAM GENERATOR TUBE FAILURES. IMPROVEMENTS ARE NEEDED IN STEAM GENERATOR DESIGN, CONDENSER INTEGRITY, AND SECONDARY WATER CHEMISTRY CONTROL.

- 19-6-6-760 OCCUPATIONAL RADIATION EXPOSURE AT LIGHT WATER COOLED NUCLEAR POWER REACTORS, 1969-1976
JOHNSON, L. A.
U. S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, D. C.
THIS ARTICLE, WHICH IS ADAPTED FROM A REPORT BY THE NUCLEAR REGULATORY COMMISSION (REPORT NUREG-0323), PRESENTS AN UPDATED COMPILATION OF OCCUPATIONAL RADIATION EXPOSURES AT COMMERCIAL LIGHT WATER COOLED NUCLEAR POWER REACTORS FOR THE YEARS 1969 THROUGH 1976. THE INFORMATION IN THIS DOCUMENT WAS DERIVED FROM REPORTS SUBMITTED ANNUALLY TO THE NUCLEAR REGULATORY COMMISSION IN ACCORDANCE WITH REQUIREMENTS OF THE TECHNICAL SPECIFICATIONS FOR INDIVIDUAL PLANTS. AN ADDITIONAL 9 LIGHT WATER REACTORS COMPLETED A FULL CALENDAR YEAR OF COMMERCIAL OPERATION FOR THE FIRST TIME IN 1976, INCREASING THE TOTAL NUMBER OF OPERATING NUCLEAR POWER PLANTS TO 53. THE NUMBER OF PERSONNEL MONITORED AT LIGHT WATER REACTORS INCREASED ABOUT 34 PERCENT IN 1976, AND THE AVERAGE COLLECTIVE DOSE TO PERSONNEL (MAN-REMS PER REACTOR-YEAR) INCREASED 9 PERCENT OVER THE 1975 AVERAGE. THE AVERAGE NUMBER OF PERSONNEL RECEIVING MEASURABLE EXPOSURE PER REACTOR INCREASED 7 PERCENT, AND THE AVERAGE EXPOSURE PER INDIVIDUAL IN 1976 WAS 0.7 REM PER PERSON.
- 20-1-1-01 TWENTY YEARS OF NUCLEAR SAFETY
COTTRILL, W. B.
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENN.
THIS ARTICLE COMMEMORATES 20 YEARS OF NUCLEAR SAFETY BY REVIEWING THE HISTORICAL BACKGROUND SURROUNDING ITS GENESIS AND ITS EVOLUTION INTO THE REPUTABLE JOURNAL IT IS TODAY. THE JOURNAL, WHICH STARTED AS A SMALL QUARTERLY PUBLICATION, HAS GROWN TO A WIDELY RECOGNIZED PEER REVIEWED BIMONTHLY REVIEW PUBLICATION. THIS ARTICLE PRESENTS A BRIEF REVIEW OF THE PERSONNEL RESPONSIBLE FOR THE SUCCESS OF THE JOURNAL, THE MANY CHANGES THAT HAVE TAKEN PLACE, AND THE RECOGNITION THE JOURNAL HAS RECEIVED.
- 20-1-1-15 NUCLEAR POWER REACTOR DECOMMISSIONING
LAGUARDIA, T. S.
NUCLEAR ENERGY SERVICES, INC., DANBURY, CONN.
THIS ARTICLE SUMMARIZES THE MAJOR FINDINGS OF AN EVALUATION OF SEVERAL ALTERNATIVES FOR DECOMMISSIONING 1100-MW(E) NUCLEAR POWER REACTORS. THE EVALUATION INCLUDING THE TECHNICAL FEASIBILITY OF DECOMMISSIONING AND THE COSTS, SCHEDULE, ENVIRONMENTAL IMPACTS, AND OCCUPATIONAL EXPOSURES FOR THREE DECOMMISSIONING ALTERNATIVES - MOTHBALLING, ENTOMBMENT, AND PROMPT REMOVAL OF RADIOACTIVE COMPONENTS AND DISMANTLING. IN ADDITION, TWO COMBINATIONS OF THESE ALTERNATIVES WERE EVALUATED - MOTHBALLING DELAYED REMOVAL AND DISMANTLING AND ENTOMBMENT DELAYED REMOVAL AND DISMANTLING. THE EVALUATION DEMONSTRATED THAT NO NEW TECHNOLOGY IS REQUIRED TO SAFELY DECOMMISSION A LARGE POWER REACTOR. THE PROMPT REMOVAL OF RADIOACTIVE COMPONENTS AND DISMANTLING ALTERNATIVE IS THE HIGHEST IN COST, REQUIRING APPROXIMATELY \$50 MILLION AND APPROXIMATELY 6 YEARS TO REMOVE ALL STRUCTURES AT THE END OF USEFUL LIFE. THE RADIATION EXPOSURES AND ENVIRONMENTAL IMPACTS ARE LOW FOR ALL THE ALTERNATIVES SO THAT DECOMMISSIONING CAN BE ACCOMPLISHED WITHOUT UNDUE RISK TO PUBLIC HEALTH AND SAFETY.
- 20-1-1-24 REPORT OF THE NRC RISK ASSESSMENT REVIEW GROUP ON THE REACTOR SAFETY STUDY
NRC RISK ASSESSMENT REVIEW GR.
U. S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, D. C.
EDITOR'S NOTE - THE RISK ASSESSMENT REVIEW GROUP OF THE NUCLEAR REGULATORY COMMISSION (NRC) HAS COMPLETED ITS REVIEW AND REPORT ON THE REACTOR SAFETY STUDY (REPORT WASH-1400). THE SEVEN MEMBER INDEPENDENT ASSESSMENT GROUP, HEADED BY DR. HAROLD LEWIS OF THE UNIVERSITY OF CALIFORNIA AT SANTA BARBARA, WAS APPOINTED BY NRC IN 1977 TO CLARIFY THE ACHIEVEMENTS AND LIMITATIONS OF THE REACTOR SAFETY STUDY, SOMETIMES CALLED THE RASMUSSEN REPORT, AND TO ASSESS THE COMMENTS MADE ON IT. THE REACTOR SAFETY STUDY WAS SPONSORED FIRST BY THE FORMER U. S. ATOMIC ENERGY COMMISSION AND LATER BY NRC. THE GROUP OF SCIENTISTS ALSO WAS TO DEVELOP FOR NRC ADVICE AND RECOMMENDATIONS ON THE FUTURE DEVELOPMENT AND USE OF RISK ASSESSMENT METHODOLOGY IN THE REGULATORY AND LICENSING PROCESS. THE REPORT CONTAINS NUMEROUS FINDINGS AND RECOMMENDATIONS THAT NRC IS NOW CONSIDERING. SINGLE COPIES OF THE REPORT, DESIGNATED NUREG/CR-0400, CAN BE OBTAINED BY WRITING TO THE DIVISION OF TECHNICAL INFORMATION AND DOCUMENT CONTROL, U. S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, D. C. 20555.
- 20-1-2-27 SYNOPSIS OF THE BWR BLOWDOWN HEAT-TRANSFER PROGRAM
BURNETTE, G. W. + SOZZI, G. L.
GENERAL ELECTRIC COMPANY, SAN JOSE, CALIF.
SYSTEM PERFORMANCE AND THERMAL RESPONSE CHARACTERISTICS OF BOILING WATER REACTORS (BWRs) DURING THE INITIAL BLOWDOWN PHASE UNDER LOSS OF COOLANT ACCIDENT (LOCA) CONDITIONS WERE INVESTIGATED IN A SCALED TEST APPARATUS. A NUMBER OF INHERENT COOLING MECHANISMS WERE OBSERVED FOR WHICH NO CREDIT IS TAKEN IN THE CURRENT BWR LOCA EVALUATION METHOD. THE CURRENT METHOD,

WHEN APPLIED TO THE TEST APPARATUS, SHOWS A SUBSTANTIAL MARGIN IN THE PREDICTION OF PEAK CLADDING TEMPERATURE. SPECIFIC PHENOMENOLOGICAL MODEL IMPROVEMENTS ARE RECOMMENDED.

- 20-1-3-44 THE DOE INTRUSION DETECTION SYSTEMS HANDBOOK
MANGAN, D. L.
SANDIA LABORATORIES, ALBUQUERQUE, N.M.
THIS ARTICLE REVIEWS THE INTRUSION DETECTION SYSTEMS HANDBOOK THAT WAS PREPARED BY SANDIA LABORATORIES FOR THE U.S. DEPARTMENT OF ENERGY, OFFICE OF SAFEGUARDS AND SECURITY. THE PURPOSE OF THE HANDBOOK IS TO PROVIDE INFORMATION PERTINENT TO THE SELECTION, PROCUREMENT, INSTALLATION, TESTING, AND MAINTENANCE OF THE ELEMENTS OF AN INTRUSION DETECTION SYSTEM. THESE ELEMENTS INCLUDE INTERIOR AND EXTERIOR SENSORS, ALARM ASSESSMENT EQUIPMENT, AND ALARM REPORTING EQUIPMENT. THE HANDBOOK ALSO CONTAINS A DISCUSSION OF HOW THESE ELEMENTS CAN BE INTEGRATED INTO AN OPERATIONALLY EFFECTIVE SYSTEM.
- 20-1-4-54 HANDLING AND STORAGE OF SPENT FUEL FROM LIGHT WATER CTORS
NUCLEAR SAFETY STAFF
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENN.
THIS ARTICLE HAS BEEN ADAPTED FROM THE EXECUTIVE SUMMARY OF THE NUCLEAR REGULATORY COMMISSION (NRC) REPORT, GENERIC ENVIRONMENTAL IMPACT STATEMENT ON HANDLING AND STORAGE OF SPENT LIGHT WATER POWER REACTOR FUEL (NOREG-0004). THE REPORT WAS PREPARED BY THE NRC STAFF IN RESPONSE TO A DIRECTIVE FROM THE COMMISSIONERS. INASMUCH AS THERE HAVE BEEN - AND CONTINUE TO BE - SIGNIFICANT POLICY DEVELOPMENTS SINCE THE NRC'S DIRECTIVE WAS ISSUED, THIS IMPACT STATEMENT IS CONSIDERED TO BE AN INTERIM ACTION, NOT A FINAL SOLUTION. THE REPORT COVERS THE FOLLOWING CONCERNS - (1) EXPECTED MAGNITUDE OF THE SHORTAGE OF STORAGE CAPACITY, (2) THE OPTIONS FOR DEALING WITH THE PROBLEM, (3) A COST BENEFIT ANALYSIS OF THESE OPTIONS, (4) THE IMPACTS OF ADDITIONAL TRANSPORTATION OF SPENT FUELS, AND (5) THE NEED FOR MORE REGULATIONS AND GUIDANCE. THE STUDY CONCLUDES THAT THE STORAGE OF SPENT FUEL IS A WELL ESTABLISHED TECHNOLOGY, THAT THE AMOUNT OF SPENT FUEL REQUIRING AWAY-FROM-REACTOR STORAGE BY YEAR 2000 IS NOT GREAT, AND THAT THE ENVIRONMENTAL IMPACT OF EITHER AT-REACTOR OR AWAY-FROM-REACTOR SPENT-FUEL STORAGE IS INSIGNIFICANT.
- 20-1-4-63 THE FIFTEENTH DOE AIR CLEANING CONFERENCE
BELLAMY, R. R. + MOELLER, D. W. + UNDERHILL, D. W.
FIRST, M. W.
U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, D.C. / HARVARD UNIVERSITY, BOSTON, MASS.
THE FIFTEENTH DOE AIR CLEANING CONFERENCE WAS HELD AUG. 7-10, 1978, IN BOSTON, MASS. THE 331 NUCLEAR AIR CLEANING SPECIALISTS WHO ATTENDED CAME FROM GOVERNMENTAL AGENCIES, EDUCATIONAL INSTITUTIONS, NATIONAL LABORATORIES, AND ALL AREAS OF INDUSTRY AND INCLUDED REPRESENTATIVES FROM THE UNITED STATES AND 10 FOREIGN COUNTRIES. MAJOR TOPICS DISCUSSED DURING THE CONFERENCE WERE WASTE TREATMENT, INCLUDING VOLUME REDUCTION AND PREPARATION FOR STORAGE, THE REMOVAL OF TRITIUM, CARBON-14, AND OZONE, CONTAINMENT OF ACCIDENTAL RELEASES, ADSORBENTS AND ABSORBENTS, THE TREATMENT OF OFF GASES FROM CHEMICAL PROCESSING, AEROSOL BEHAVIOR, LABORATORY AND IN PLACE FILTER TESTING METHODS, AND PARTICULATE FILTRATION. THE CONFERENCE FOCUSED ON NEW RESEARCH DEVELOPMENTS, NEEDS, AND REFINEMENTS IN AIR CLEANING SYSTEMS AND COMPONENTS. RESEARCH TRENDS, ESPECIALLY IN FOREIGN COUNTRIES, APPEAR TO BE MOVING AWAY FROM RADIODIODE AND TOWARD NOBLE-GAS RELEASES FROM POWER REACTORS AND THE TREATMENT OF VARIOUS CHEMICALS (BOTH RADIOACTIVE AND NONRADIOACTIVE) RELEASED DURING THE CHEMICAL PROCESSING OF FUEL ELEMENTS. NEW CHALLENGES ARE EMERGING TO IMPROVE THE SAFETY AND LOWER THE COST OF DISPOSAL OF CONTAMINATED AIR CLEANING COMPONENTS AND TO REDUCE SPACE REQUIREMENTS FOR AIR CLEANING SYSTEMS AT REACTOR STATIONS. RELIABLE AND ACCURATE MONITORING OF RELEASES CONTINUES AS AN ELUSIVE GOAL, BUT IT HAS BEEN POINTED OUT THAT CAREFUL ANALYSIS OF FAILURE DATA ON OPERATING COMPONENTS IS LIKELY TO LEAD TO IMPROVEMENTS IN FUTURE DESIGNS. IMPROVED TESTING TECHNIQUES FOR VERIFYING THE SUITABILITY OF SYSTEMS AND COMPONENTS FOR NUCLEAR SERVICE CONTINUE TO BE EMPHASIZED BY THOSE IN THE AIR CLEANING INDUSTRY. AN OVERVIEW OF WESTERN EUROPEAN AIR AND GAS CLEANING CONCERNS AND PRACTICES INDICATES MANY AREAS OF COMMON INTEREST WITH U.S. AND CANADIAN SCIENTISTS AND ENGINEERS.
- 20-1-6-78 BROWNS FERRY CHARCOAL ADSORBER INCIDENT
MAYS, G. T.
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENN.
THIS ARTICLE REVIEWS THE TEMPERATURE EXCURSION IN THE CHARCOAL ADSORBER BEDS OF THE BROWNS FERRY UNIT 3 OFF GAS SYSTEM THAT OCCURRED ON JULY 17, 1977. SIGNIFICANT TEMPERATURE INCREASES WERE EXPERIENCED IN THE CHARCOAL ADSORBER BEDS WHEN CHARCOAL FINES WERE IGNITED BY THE IGNITION OF A COMBUSTIBLE MIXTURE OF HYDROGEN AND OXYGEN IN THE OFF GAS SYSTEM. THE BROWNS FERRY OFF GAS SYSTEM IS DESCRIBED, AND EVENTS LEADING UP TO AND SURROUNDING THE INCIDENT ARE DISCUSSED. THE FOLLOW-UP INVESTIGATION BY TENNESSEE VALLEY AUTHORITY AND GENERAL ELECTRIC COMPANY PERSONNEL AND THEIR RECOMMENDATIONS FOR SYSTEM AND OPERATIONAL MODIFICATIONS ARE SUMMARIZED.

- 20-1-6-83 A REVIEW OF SAFETY RELATED EVENTS AT NUCLEAR POWER PLANTS AS REPORTED IN 1977
SCOTT, R. L. + GALLAHER, R. B.
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENN.
THIS ARTICLE REVIEWS THE REPORTS OF SAFETY RELATED EVENTS AT LIGHT WATER REACTOR NUCLEAR POWER PLANTS SUBMITTED IN 1977 TO THE U.S. NUCLEAR REGULATORY COMMISSION. THE REVIEW COVERS 1222 REPORTS FROM BOILING WATER REACTOR FACILITIES AND 1780 REPORTS FROM PRESSURIZED WATER REACTOR FACILITIES. INFORMATION IS PRESENTED IN TABLES LISTING INSTRUMENT FAILURES, EQUIPMENT FAILURES, SYSTEMS INVOLVED, CAUSES, DEFICIENCIES, AND TIMES OF OCCURRENCES (I.E., REFUELING, TESTING, OPERATION, OR CONSTRUCTION). THE TABLES GIVE THE NUMBER OF REPORTS CONCERNED WITH EACH LISTED ITEM AND THEREFORE INDICATE THE FREQUENCIES OF EVENTS AND THOSE EVENTS WHICH SHOULD RECEIVE MORE ATTENTION IN THE FORM OF MAINTENANCE AND TESTING TO IMPROVE PLANT RELIABILITY AND SAFETY.
- 20-2-1-123 NUCLEAR POWER PLANT SAFETY IN DEVELOPING COUNTRIES
ROSEN, M.
INTERNATIONAL ATOMIC ENERGY AGENCY, VIENNA, AUSTRIA
BY 1990 THERE WILL BE COMMERCIAL NUCLEAR POWER PLANTS IN 17 COUNTRIES THAT ARE PRESENTLY CONSIDERED INDUSTRIALLY LESS DEVELOPPD. ONLY RECENTLY HAS SOME ATTENTION BEEN FOCUSED ON THE ADDITIONAL AND SPECIAL NUCLEAR SAFETY ASPECTS OF THESE EXPORTED POWER FACILITIES. THIS ARTICLE DISCUSSES THESE ASPECTS, IN PARTICULAR THE NONSTANDAPD NATURE OF THE EXPORTED NUCLEAR FACILITY AND THE NONUNIFORM SAFETY STANDARDS AND REQUIREMENTS THAT ARE USED. SUGGESTIONS ARE MADE FOR RAISING THE LEVEL OF THE IMPORTANT REGULATORY EFFORT IN THE LESS DEVELOPED COUNTRIES BY UPGRADING THE TRADITIONALLY SUPPLIED SAFETY DOCUMENTATION, PRINCIPALLY BY THE USE OF A SUPPLEMENTARY INFORMATION REPORT WRITTEN SPECIFICALLY FOR A SMALLER AND LESS TECHNICALLY QUALIFIED STAFF, AND BY ADDRESSING THE NEEDS OF SMALLER COUNTRIES IN THE OPERATING REGULATIONS (TECHNICAL SPECIFICATIONS FOR OPERATION). FINALLY THE SAFETY ASSISTANCE AVAILABLE FROM THE INTERNATIONAL ATOMIC ENERGY AGENCY (IAEA) AS WELL AS FROM NATIONAL ORGANIZATIONS IS OUTLINED.
- 20-2-1-136 THE AERIAL MEASURING SYSTEMS PROGRAM
JOBST, J. E.
EG AND G, INC., NORTH LAS VEGAS, NEVADA
EG AND G, INC., HAS DEVELOPED FOR THE DEPARTMENT OF ENERGY (DOE) AN AERIAL MEASURING SYSTEMS (AMS) PROGRAM DEDICATED TO ENVIRONMENTAL RESEARCH AT FACILITIES OF INTEREST TO DOE, THE NUCLEAR REGULATORY COMMISSION (NRC), AND OTHER FEDERAL AGENCIES. THE AMS WAS ORIGINALLY CREATED TO MEASURE NUCLEAR RADIATION, THE PROGRAM SCOPE HAS BEEN BROADENED DRAMATICALLY TO INCLUDE A WIDE VARIETY OF REMOTE SENSORS - MULTISPECTRAL AND MAPPING CAMERAS, OPTICAL AND INFRARED MULTISPECTRAL SCANNERS, AIR SAMPLING SYSTEMS, AND METEOROLOGICAL SENSORS. THE AMS MAINTAINS SEVEN AIRCRAFT AS SURVEY PLATFORMS, BOTH FIXED WING AIRCRAFT AND HELICOPTERS. PHOTOGRAPHY, SCANNER IMAGERY, AND RADIATION DATA ARE PROCESSED IN DEDICATED, MODERN LABORATORIES AND USED FOR A BROAD RANGE OF ENVIRONMENTAL IMPACT STUDIES. A GRAPHIC OVERVIEW SYSTEM HAS BEEN DEVELOPED FOR EFFECTIVE PRESENTATION OF ALL TYPES OF REMOTELY SENSED DATA OBTAINED AT A FACILITY OF INTEREST.
- 20-2-2-148 RISK BENEFIT EVALUATION FOR LARGE TECHNOLOGICAL SYSTEMS
OKRENT, D.
UNIVERSITY OF CALIFORNIA, LOS ANGELES, CALIF.
THE RELATED TOPICS OF RISK BENEFIT ANALYSIS, RISK ANALYSIS, AND RISK ACCEPTANCE CRITERIA (HOW SAFE IS SAFE ENOUGH) ARE OF GROWING IMPORTANCE. AN INTERDISCIPLINARY STUDY ON VARIOUS ASPECTS OF THESE TOPICS, INCLUDING APPLICATIONS TO NUCLEAR POWER, WAS RECENTLY COMPLETED AT THE UNIVERSITY OF CALIFORNIA, LOS ANGELES (UCLA), WITH THE SUPPORT OF THE NATIONAL SCIENCE FOUNDATION. IN ADDITION TO MORE THAN 30 TOPICAL REPORTS AND VARIOUS OPEN LITERATURE PUBLICATIONS, A FINAL REPORT (UCLA-ENG-7777) TO THE STUDY, TITLED A GENERALIZED EVALUATION APPROACH TO RISK BENEFIT FOR LARGE TECHNOLOGICAL SYSTEMS AND ITS APPLICATION TO NUCLEAR POWER, WAS ISSUED IN EARLY 1978. THIS ARTICLE BRIEFLY SUMMARIZES PORTIONS OF THE FINAL REPORT DEALING WITH GENERAL ASPECTS OF RISK BENEFIT METHODOLOGY, SOCIETAL KNOWLEDGE AND PERCEPTION OF RISK, AND RISK ACCEPTANCE CRITERIA.
- 20-2-3-166 IAEA MEETING ON POWER SUPPLY ARRANGEMENTS IN NUCLEAR POWER PLANTS
HAGEN, E. W.
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENN.
AN INTERNATIONAL MEETING OF SPECIALISTS CONCERNED WITH ELECTRIC POWER SUPPLY ARRANGEMENTS IN NUCLEAR POWER STATIONS WAS HELD IN STOCKHOLM, SWEDEN, SEPT.5-8, 1978, UNDER THE AUSPICES OF THE INTERNATIONAL ATOMIC ENERGY AGENCY AND THE NUCLEAR POWER INSPECTORATE OF SWEDEN. ACTUAL REQUIREMENTS AND DESIGNS AS WELL AS OPERATIONAL EXPERIENCES AT NUCLEAR POWER STATIONS WERE PRESENTED IN THE FORMAL SESSIONS AND THEN DISCUSSED IN QUESTION AND ANSWER PERIODS AND LATER IN OPEN FORUMS AND PRIVATE CONVERSATIONS.

- 20-2-4-176 FAILURES IN AIR MONITORING, AIR CLEANING, AND VENTILATION SYSTEMS IN COMMERCIAL NUCLEAR POWER PLANTS (JAN. 1, 1975-JUNE-30, 1978)
MOELLER, D. W.
HARVARD UNIVERSITY, BOSTON, MASS.
DURING THE PERIOD JAN. 1, 1975, TO JUNE-30, 1978, OVER 9000 LICENSEE EVENT REPORTS (LERS) PERTAINING TO THE OPERATION OF COMMERCIAL LIGHT WATER REACTOR NUCLEAR POWER PLANTS IN THE UNITED STATES WERE SUBMITTED TO THE NUCLEAR REGULATORY COMMISSION (NRC). OF THESE REPORTS, OVER 1200 (APPROXIMATELY 13 PERCENT) PERTAINED TO FAILURES IN AIR MONITORING, AIR CLEANING, AND VENTILATION SYSTEMS. FOR BOILING WATER REACTOR (BWR) INSTALLATIONS, OVER HALF (51 PERCENT) OF THE REPORTED EVENTS RELATED TO FAILURES IN EQUIPMENT FOR MONITORING THE PERFORMANCE OF AIR CLEANING SYSTEMS RATHER THAN TO FAILURES IN THE SYSTEMS THEMSELVES. IN PRESSURIZED WATER REACTOR (PWR) INSTALLATIONS, FAILURES IN MONITORING EQUIPMENT AMOUNTED TO ABOUT 32 PERCENT OF THE TOTAL. REPORTED PROBLEM AREAS IN BWR INSTALLATIONS INCLUDED THE PRIMARY CONTAINMENT AND STANDBY GAS TREATMENT AND OFF GAS SYSTEMS, AS WELL AS THE HIGH PRESSURE COOLANT INJECTION AND REACTOR CORE ISOLATION SYSTEMS. FOR PWR INSTALLATIONS, REPORTED PROBLEM AREAS INCLUDED THE PRIMARY CONTAINMENT AND ASSOCIATED SPRAY SYSTEMS AND THE WASTE PROCESSING EQUIPMENT. ALTHOUGH THIS STUDY WAS LIMITED IN SCOPE AND THE RESULTING DATA CAN BE INTERPRETED IN A VARIETY OF WAYS, SEVERAL MESSAGES ARE CLEAR. FIRST, THERE IS A NEED FOR RESEARCH ON THE DEVELOPMENT OF MORE RELIABLE EQUIPMENT FOR MONITORING OF AIR CLEANING AND VENTILATION SYSTEMS. SECOND, ALTHOUGH THERE HAS BEEN A SIGNIFICANT REDUCTION IN RECENT YEARS IN THE CONTRIBUTIONS OF HUMAN ERROR TO FAILURES IN AIR CLEANING SYSTEMS, ABOUT HALF OF ALL FAILURES CONTINUE TO RESULT DIRECTLY FROM THIS SOURCE. THIRD, THIS STUDY HAS SHOWN THAT ANALYSES OF LER INFORMATION CAN PROVIDE USEFUL DATA TO CONFIRM ESTIMATES OF THE RELIABILITY OF VARIOUS REACTOR SAFETY SYSTEMS. A PROGRAM TO DEVELOP SUCH DATA IS UNDER WAY WITHIN THE PROBABILISTIC ANALYSIS SECTION OF THE OFFICE OF NUCLEAR REGULATORY RESEARCH OF THE NRC.
- 20-2-5-190 ABUNDANCE AND DISTRIBUTION OF RADIONUCLIDES DISCHARGED FROM A BWR NUCLEAR POWER STATION INTO A MARINE BAY
BLANCHARD, P. L. + KARN, B.
U.S. ENVIRONMENTAL PROTECTION AGENCY, MONTGOMERY, ALA.
THIS ARTICLE SUMMARIZES A PORTION OF ONE OF A SERIES OF RADIOLOGICAL SURVEILLANCE STUDIES CONDUCTED BY THE U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA) AT NUCLEAR POWER STATIONS. RADIONUCLIDE CONCENTRATIONS WERE MEASURED IN BARNEGAT BAY AT THE NEW JERSEY SHORE DURING EPA'S 2-YEAR RADIOLOGICAL SURVEILLANCE STUDY AT THE OYSTER CREEK NUCLEAR GENERATING STATION. THE STATION DISCHARGES BATCHES OF RADIOACTIVE LIQUID WASTE INTO EFFLUENT CONDENSER COOLING WATER, WHICH FLOWS THROUGH OYSTER CREEK INTO BARNEGAT BAY 3 KM FROM THE POINT OF DISCHARGE. THE BAY IS LONG, NARROW, AND SHALLOW, WITH FEW PASSAGES TO THE ATLANTIC OCEAN. RADIONUCLIDE CONCENTRATIONS WERE MEASURED REPEATEDLY IN WATER, SEDIMENT, MARINE VEGETATION, FISH, CLAMS, AND CRABS AT VARIOUS SAMPLING POINTS. MEASURED VALUES WERE COMPARED TO CALCULATED VALUES BASED ON BIOACCUMULATION FACTORS, AND BOTH SETS WERE USED TO COMPUTE DOSE EQUIVALENT RATES TO THE MOST EXPOSED PERSONS IN THE ENVIRONMENT. THE TWO OBSERVED CRITICAL RADIATION EXPOSURE PATHWAYS - FISH CONSUMPTION AND STANDING ON BEACHES - RESULTED IN DOSE EQUIVALENTS OF LESS THAN 1 mrem/year. THE CRITICAL RADIONUCLIDES WERE STRONTIUM-90 AND COBALT-60, RESPECTIVELY. INDICATOR RADIONUCLIDES WERE IDENTIFIED, AND ENVIRONMENTAL RADIOLOGICAL MONITORING ACTIVITIES WERE RECOMMENDED.
- 20-2-6-206 ANOTHER PERSPECTIVE OF THE 1958 SOVIET NUCLEAR ACCIDENT
TRABALKA, J. R. + EYMAN, L. D. + PARKER, F. L.
STRUKNES, E. G. + AUERSBACH, S. I.
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENN. / VANDERBILT UNIVERSITY, NASHVILLE, TENN.
THE OCCURRENCE OF A MAJOR SOVIET NUCLEAR ACCIDENT INVOLVING STORED, REPROCESSED, LONG LIVED FISSION WASTES HAS BEEN REPORTED BY FORMER SOVIET CITIZENS. Z. A. MEDVEDEV, WRITING IN THE POPULAR SCIENCE MAGAZINE NEW SCIENTIST, BELIEVED THAT THE ACCIDENT RESULTED IN SIGNIFICANT LOSS OF LIFE AND REQUIRED THE PERMANENT EVACUATION OF THE CIVILIAN POPULATION FROM A LARGE AREA (SEVERAL THOUSAND SQUARE MILES). ALTHOUGH MEDVEDEV APPEARS TO HAVE REACHED UNTENABLE CONCLUSIONS ABOUT THE EXACT ORIGIN AND EXTENT OF THE CONTAMINATED AREA, IT DOES APPEAR THAT A CREDIBLE CASE CAN BE MADE FOR AN ACCIDENTAL AIRBORNE RELEASE OF FISSION WASTES IN THE GENERAL GEOGRAPHIC LOCATION HE SUGGESTED. IN VIEW OF THE GROWING IMPORTANCE OF NUCLEAR POWER AS A WORLD ENERGY SOURCE, AN EXHAUSTIVE CRITICAL REVIEW OF THE SOVIET LITERATURE IS WARRANTED TO RESOLVE DOUBTS ABOUT THE EXACT NATURE AND CONSEQUENCES, INDEED EVEN THE OCCURRENCE, OF THE POSTULATED ACCIDENT.
- 20-2-6-210 OUTAGES AT LIGHT WATER REACTOR POWER PLANTS - A REVIEW OF 1973-1977 EXPERIENCE
SCOTT, R. L.
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENN.
THE RESULTS OF A REVIEW OF OUTAGE EXPERIENCE AT NUCLEAR POWER PLANTS FOR THE PERIOD 1973-1977 ARE GIVEN. SPECIFICALLY, THE OUTAGES EXPERIENCED WERE EXAMINED TO DETERMINE CAUSES, FREQUENCIES, TIME, ETC., TO SEE IF TRENDS WERE EVIDENT OR OTHER

INSIGHTS COULD BE OBTAINED. THE DATA REVIEWED REPRESENT 230 REACTOR YEARS OF EXPERIENCE - 58 PERCENT OF THE TOTAL ACCUMULATION IN THE UNITED STATES AT THE END OF 1977. THIRTEEN TABLES AND TWO FIGURES PRESENT THE DATA, AND A SUMMARY GIVES THE IMPORTANT DEDUCTIONS.

- 20-3-1-249 SIXTH NRC WATER REACTOR SAFETY RESEARCH INFORMATION MEETING
COTTRELL, W. B.
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENN.
THIS ARTICLE SUMMARIZES THE SIXTH WATER REACTOR SAFETY RESEARCH INFORMATION MEETING, SPONSORED BY THE NUCLEAR REGULATORY COMMISSION'S (NRC'S) DIVISION OF REACTOR SAFETY RESEARCH AND HELD AT THE NATIONAL BUREAU OF STANDARDS, GAITHERSBURG, MD., NOV. 6-9, 1978. PRESENTED AT THIS MEETING WERE 116 PAPERS IN THE FOLLOWING FIVE RESEARCH PROGRAM AREAS - (1) ANALYSIS DEVELOPMENT PROGRAM, (2) FUEL BEHAVIOR RESEARCH, (3) REACTOR OPERATIONAL SAFETY PROGRAM, (4) LOSS OF COOLANT ACCIDENT STUDIES, AND (5) METALLURGY AND MATERIALS RESEARCH. IN ADDITION, THE MEETING INCLUDED SEVERAL WORKSHOPS ON SELECTED TOPICS. AMONG THE MANY PRESENTATIONS WERE 12 INVITED PAPERS ON SAFETY RESEARCH IN SEVERAL FOREIGN COUNTRIES, THE RESULTS OF WHICH BOTH COMPLEMENT AND REINFORCE THOSE FROM THE NRC PROGRAM. ALTHOUGH SOME COMPONENTS OF THE NRC PROGRAM HAVE BEEN COMPLETELY, THE LOSS OF COOLANT ACCIDENT (LOCA) STUDIES, WHICH CONSTITUTE THE LARGEST PORTION OF THE NRC PROGRAM, WILL CONTINUE UNTIL THE LARGE SCALE EXPERIMENTS, SUCH AS THE FLECHT-SET AND LOCA TESTS IN THE LOSS OF FLUID TEST (LOFT) FACILITY, ARE COMPLETED AND THEIR RESULTS ARE ABSORBED INTO THE ANALYTICAL PROGRAMS AND DATA BANKS FOR REACTOR LICENSING CONSIDERATIONS. FULL SCALE TESTING IN LOFT WAS TO COMMENCE WITHIN 6 WEEKS OF THE END OF THE MEETING. HOWEVER, INCREASING EMPHASIS ON OPERATIONAL SAFETY PROBLEMS IS ALREADY IN EVIDENCE. THERE WERE NO FINDINGS REPORTED THAT WOULD THREATEN OUR PRESENT UNDERSTANDING OF REACTOR SAFETY, AND THERE WAS MUCH WHICH EITHER SUPPORTED THAT UNDERSTANDING OR DEMONSTRATED CONSERVATISM.
- 20-3-1-258 REVIEW OF AUGUST 1978 CHANGES TO THE NRC'S PROGRAM FOR STANDARDIZATION OF NUCLEAR POWER PLANTS
KANE, W. F.
U. S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, D.C.
THE NUCLEAR REGULATORY COMMISSION'S (NRC'S) STANDARDIZATION PROGRAM FOR THE LICENSING OF NUCLEAR POWER PLANTS WAS INITIATED IN APRIL 1972 AND HAS BEEN USED EXTENSIVELY BY INDUSTRY SINCE THAT TIME. IN JUNE 1977 THE NRC DIRECTED THE STAFF TO UNDERTAKE A DETAILED STUDY OF THE PROGRAM. AS PART OF THAT STUDY, THE STAFF WAS TO DETERMINE STEPS THAT THE NRC MIGHT TAKE TO FURTHER ENCOURAGE STANDARDIZATION. THIS ARTICLE DISCUSSES THE CHANGES MADE TO THE STANDARDIZATION PROGRAM THAT RESULTED FROM THAT STUDY.
- 20-3-2-267 AN OVERVIEW OF NRC'S EMERGENCY CORE COOLANT BYPASS RESEARCH
BECKNER, W. D.
U. S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, D.C.
AN OVERVIEW OF RESEARCH SPONSORED BY THE NUCLEAR REGULATORY COMMISSION ON COUNTERCURRENT FLOW FLOODING IN RELATIONSHIP TO THE EMERGENCY CORE COOLANT (ECC) BYPASS PHENOMENON IS PRESENTED. PROGRESS HAS BEEN MADE IN UNDERSTANDING THE TRANSIENT ECC PENETRATION PROBLEM IN SMALL SCALE MODELS OF REACTOR PRESSURE VESSELS. EXPERIMENTS HAVE BEEN MADE TO STUDY ECC PENETRATION IN THE PRESENCE OF TRANSIENT COUNTERCURRENT STEAM FLOW AND SUPERHEATED VESSEL WALLS OVER A VARIETY OF TEST CONDITIONS. THE RESULTS OF THIS WORK HAVE BEEN USED TO DEVELOP MODELS AND CORRELATIONS TO ANALYZE THE ECC INJECTION PHASE OF THE HYPOTHETICAL LOSS OF COOLANT ACCIDENT (LOCA). THE APPLICABILITY AND LIMITATIONS OF THIS WORK IN RELATION TO BEST ESTIMATE EVALUATIONS OF THE LOCA AND IN THE LICENSING PROCESS ARE EXAMINED.
- 20-3-3-280 INSTRUMENTATION FOR MONITORING PLUTONIUM IN THE ENVIRONMENT
NERO, A. V., JR.
LAWRENCE BERKELEY LABORATORY, BERKELEY, CALIF.
SUBSTANTIAL AMOUNTS OF PLUTONIUM ARE PRODUCED IN BOTH CIVILIAN AND MILITARY NUCLEAR PROGRAMS, AND PERMISSIBLE ENVIRONMENTAL PLUTONIUM CONCENTRATIONS ARE VERY LOW. THIS ARTICLE DESCRIBES INSTRUMENTATION FOR MONITORING PLUTONIUM IN THE ENVIRONMENT, WITH EMPHASIS ON ALPHA MONITORING TECHNIQUES USED FOR DIRECT AIR MONITORING OR FOLLOWING RADIOCHEMICAL ANALYSIS AND GAMMA / X-RAY MONITORING TECHNIQUES FOR SURVEYING POSSIBLE CONTAMINATION OF AREAS OR HUMANS.
- 20-3-4-294 REVIEW OF FIRE PROTECTION IN THE NUCLEAR FACILITIES OF THE ATOMIC ENERGY COMMISSION, 1947-1975
MAYBEE, W. W.
U. S. DEPARTMENT OF ENERGY, WASHINGTON, D.C.
IN THE 28 YEARS IN WHICH IT GREW FROM A TEMPORARY WARTIME BOMB DEVELOPMENT PROGRAM TO A FEDERAL AGENCY WITH OVER \$30 BILLION WORTH OF FACILITIES HOUSING MUCH OF THE NATION'S ADVANCED RESEARCH EFFORTS, THE ATOMIC ENERGY COMMISSION SET MANY RECORDS FOR SAFETY. AMONG THE BEST WAS A CUMULATIVE FIRE LOSS RATIO OF 1.2 CENTS PER \$100 OF VALUE. A 1969 FIRE - ONE OF FOUR IN ITS HISTORY THAT EXCEEDED \$1 MILLION IN LOSS - INCURRED DAMAGES TOTALING \$26 MILLION AND PROMPTED MAJOR ADDITIONS TO ITS FIRE PROTECTION PROGRAMS. THE ADDED PROGRAMS ENCOMPASSING ADDITIONAL

FIRE PROTECTION ENGINEERS, NEW PROTECTION SYSTEMS, INDEPENDENT INSPECTION PROGRAMS, AND NEW PERFORMANCE BASED GOALS, RESULTED IN AN ORDER OF MAGNITUDE IMPROVEMENT. THE CUMULATIVE FIRE LOSS RATIO AFTER 1969 WAS 0.06 CENTS PER \$100 OF VALUE, A RECORD FEW INDUSTRIES HAVE EVER ACHIEVED.

- 20-3-4-308 NUCLEAR PLANT FIRE INCIDENT DATA FILE
SIDERIS, A. G. + HOCKENBURY, R. W.
YEATER, M. L. + VESELY, W. E.
AMERICAN NUCLEAR INSURERS, FARMINGTON, CONN. / RENSSELAER
POLYTECHNIC INSTITUTE, TROY, N.Y. / U.S. NUCLEAR REGULATORY
COMMISSION, WASHINGTON, D.C.
A COMPUTERIZED NUCLEAR PLANT FIRE INCIDENT DATA FILE WAS
DEVELOPED BY AMERICAN NUCLEAR INSURERS AND WAS FURTHER ANALYZED
BY RENSSELAER POLYTECHNIC INSTITUTE WITH TECHNICAL AND MONETARY
SUPPORT PROVIDED BY THE NUCLEAR REGULATORY COMMISSION. DATA ON
214 FIRES THAT OCCURRED AT NUCLEAR FACILITIES HAVE BEEN ENTERED
IN THE FILE. A COMPUTER PROGRAM HAS BEEN DEVELOPED TO SORT THE
FIRE INCIDENTS ACCORDING TO VARIOUS PARAMETERS. THE PARAMETRIC
SORTS THAT ARE PRESENTED IN THIS ARTICLE ARE SIGNIFICANT SINCE
THEY ARE THE MOST COMPREHENSIVE STATISTICS PRESENTLY AVAILABLE
ON FIRES THAT HAVE OCCURRED AT NUCLEAR FACILITIES.
- 20-3-5-319 RADIOLOGICAL IMPACT OF THORIUM MINING AND MILLING
MEYER, H. R. + TILL, J. E. + BOMAR, E. S.
BOND, W. D. + MORSE, L. E. + TENNERY, V. J.
YALCINTAS, M. G.
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENN.
IMPLEMENTATION OF AN ALTERNATE FUEL USAGE SCHEME INVOLVING
URANIUM-233 WOULD REQUIRE VERY LARGE INCREASES IN THORIUM-232
PRODUCTION RATES, PROBABLY NECESSITATING THE MINING OF THORITE
(THSTO4) FROM WESTERN U.S. DEPOSITS. THIS ARTICLE REVIEWS
CURRENT ESTIMATES OF THE EXTENT OF THAT RESOURCE AND ESTIMATES
THE RADIOLOGICAL IMPACT OF OPERATING A THORIUM MINE AND MILL IN
THE REGION. RADIOLOGICAL DOSES TO A HYPOTHETICAL MAXIMALLY
EXPOSED INDIVIDUAL LOCATED 1.6 KM FROM THE SITE ARE ESTIMATED
TO BE 2.4 MREMS (TO TOTAL BODY), 9.5 MREMS (TO BONE), AND 35.3
MREMS (TO LUNGS). THESE DOSES ARE DUE PRIMARILY TO INGESTION
AND INHALATION OF RADON-220 DAUGHTERS, RADIUM-228 AND
THORIUM-232. DOSES TO THE GENERAL POPULATION IN THE AREA
SURROUNDING THE SITE AND POSTOPERATIONAL DOSES DUE TO TAILINGS
PILE RELEASES ARE ALSO CALCULATED.
- 20-3-5-330 RECOMMENDATIONS OF THE INTERNATIONAL COMMISSION ON RADIOLOGICAL PROTECTION
NUCLEAR SAFETY STAFF
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENN.
EDITOR'S NOTE - THE FOLLOWING ADAPTION BY THE NUCLEAR SAFETY
EDITORIAL STAFF WAS MADE FROM A MUCH LONGER REPORT OF THE
SAME NAME (ICRP PUBLICATION 26). THE REPORT IS AN AUTHORITATIVE
SOURCE OF INFORMATION ON RISK ESTIMATES OF ILL HEALTH
ASSOCIATED WITH IONIZING RADIATION AND PROVIDES AN ESTABLISHED
BASIS FOR RADIATION PROTECTION ACTIONS AND POLICIES BOTH IN
THIS COUNTRY AND ELSEWHERE. A SUMMARY IS PRESENTED HERE TO
PROVIDE A PENETRATING INSIGHT INTO THIS IMPORTANT AREA.
- 20-3-6-345 OCCUPATIONAL RADIATION EXPOSURE FROM THE U.S. NAVAL REACTOR PROGRAM, 1977
MILES, M. E.
DEPARTMENT OF THE NAVY, WASHINGTON, D.C. 20362
EDITOR'S NOTE - THIS ARTICLE IS ADAPTED FROM THE REPORT,
OCCUPATIONAL RADIATION EXPOSURE FROM U.S. NAVAL NUCLEAR
PROPULSION PLANTS AND THEIR SUPPORT FACILITIES, NT-78-2, NAVAL
SEA SYSTEMS COMMAND, DEPARTMENT OF THE NAVY, MARCH 1978. THE
ADAPTION HERE INCLUDES EXCERPTS IN WHICH THE WORKING IS
SUBSTANTIALLY THE SAME AS THAT IN THE NAVY REPORT, WHICH WAS
CONSIDERABLY LONGER. THE ARTICLE IS INCLUDED HERE, SINCE THE
SUBJECT OF OCCUPATIONAL EXPOSURES IS BECOMING OF INCREASING
INTEREST WITH RESPECT TO COMMERCIAL NUCLEAR POWER EXPERIENCE.
THE AVERAGE OCCUPATIONAL EXPOSURE IN THE NAVY PROGRAM IN 1977
WAS ABOUT 1/4 REM PER PERSON, WHICH IS LESS THAN THE AVERAGE
ANNUAL OCCUPATIONAL EXPOSURE FOR PERSONNEL AT NUCLEAR
REGULATORY COMMISSION (NRC) LICENSEE STATIONS (0.36 REM PER
PERSON IN 1976 AND IS DECREASING).
- 20-4-1-387 ADVISORY COMMITTEE ON REACTOR SAFEGUARDS - ITS ROLE IN NUCLEAR SAFETY
LAWROSKI, S. + MOELLER, D. W.
ARGONNE NATIONAL LABORATORY, ARGONNE, ILL. / HARVARD UNIVERSITY,
BOSTON, MASS.
FOR OVER 25 YEARS THE ADVISORY COMMITTEE ON REACTOR SAFEGUARDS
(ACES) HAS HAD A CONTINUING RESPONSIBILITY FOR CONDUCTING
INDEPENDENT REVIEWS AND EVALUATIONS OF THE HEALTH AND SAFETY
ASPECTS OF NUCLEAR POWER REACTORS, SPENT-FUEL REPROCESSING
PLANTS, AND ASSOCIATED ACTIVITIES, WHICH INCLUDE EVALUATION OF
ABNORMAL OCCURRENCES AND PROPOSED CHANGES AT OPERATING
FACILITIES, THE ADEQUACY OF RELATED SAFETY STANDARDS AND
CRITERIA, THE ADEQUACY OF THE RELATED SAFETY RESEARCH PROGRAMS,
AND SPECIFIC GENERIC QUESTIONS, SUCH AS THE RELIABILITY OF
REACTOR PRESSURE VESSELS. THE ACES NORMALLY ISSUES 40 TO 50
REPORTS ON SPECIFIC NUCLEAR FACILITIES AND SAFETY-RELATED
QUESTIONS EACH YEAR. TOPICS DISCUSSED IN THIS ARTICLE INCLUDE
THE VIEWS AND THOUGHTS OF THE ACES WITH RESPECT TO EMERGENCY
CORE-COOLING SYSTEMS, ANTICIPATED TRANSIENTS WITHOUT SCRAM,
REACTOR PRESSURE VESSEL FAILURE, TURBINE MISSILES, STEAMLINE

BREAKS, SEISMICITY, ENVIRONMENTAL MONITORING, EMERGENCY
PLANNING, WASTE MANAGEMENT, SITING, AND REACTOR SAFETY
RESEARCH.

- 20-4-1-399 1978 ACRS CRITIQUE OF NRC SAFETY RESEARCH PROGRAM
ADVISORY COMMITTEE ON REACTOR SAFEGUARDS / U.S. NUCLEAR REGULATORY
COMMISSION, WASHINGTON, D.C.
EDITOR'S NOTE: AS REQUIRED BY STATUTE (SECTION 5 OF PUBLIC LAW
95-209), THE ADVISORY COMMITTEE ON REACTOR SAFEGUARDS (ACRS)
ANNUALLY REVIEWS AND EVALUATES THE NRC SAFETY RESEARCH PROGRAM.
THE FIRST SUCH REVIEW WAS CONDUCTED IN 1977, AND A REPORT WAS
SUBMITTED TO CONGRESS IN DECEMBER 1977. EXCERPTS FROM THAT
REPORT WERE PUBLISHED IN NUCLEAR SAFETY. THE EXECUTIVE SUMMARY
OF THE 1978 REVIEW, WHICH WAS INCLUDED IN THE REPORT SENT TO
CONGRESS IN DECEMBER 1978, IS GIVEN HERE. AS IN ITS FIRST
REPORT, THE ACRS HAS INTERPRETED THE WORDS "REACTOR SAFETY
RESEARCH" AS USED IN THE ENABLING LEGISLATION TO INCLUDE
SAFETY-RELATED RESEARCH IN ALL PHASES OF THE NUCLEAR CYCLE.
- 20-4-2-402 THE MECHANISTIC ANALYSIS OF LMFBR ACCIDENT ENERGETICS
BOUDREAU, J. E.
LOS ALAMOS SCIENTIFIC LABORATORY, LOS ALAMOS, N.M.
THE STATE OF THE ART IS REVIEWED FOR LIQUID-METAL-COOLED FAST
BREEDER REACTOR (LMFBR) POSTDISASSEMBLY ENERGETICS ANALYSIS.
PREVIOUS ATTEMPTS HAVE PROVIDED BOUNDING AND CONSERVATIVE
EFFICIENCY ESTIMATES FOR CONVERTING FISSION ENERGY INTO
PRIMARY-SYSTEM DAMAGE. HOWEVER, CALCULATIONAL RESULTS USING THE
SIMMER-TI CODE INDICATE THAT CURRENT U.S. PRIMARY-SYSTEM
DESIGNS MAY WITHSTAND SUBSTANTIALLY LARGER REACTIVITY INSERTION
RATIOS THAN PREVIOUSLY THOUGHT. DETAILED RESULTS ARE PRESENTED
FOR THE ENERGETICS RESULTING FROM A VOIDED-CORE EXPANSION,
ALONG WITH A DISCUSSION OF CODE-VERIFICATION ACTIVITIES.
FURTHER RESULTS ARE PRESENTED FOR EXPANSIONS INVOLVING OTHER
INITIAL AND BOUNDARY CONDITIONS, AND THE IMPORTANCE OF THE
SODIUM INITIALLY PRESENT IN THE CORE IS DEFINED. FINALLY, THE
RANGE OF REACTIVITY INSERTION RATES THAT THE PRIMARY SYSTEM CAN
ACCOMMODATE IS ESTIMATED FOR THE VOIDED-CORE CASE, AND THE
REMAINING TECHNICAL ISSUES ARE DEFINED.
- 20-4-3-422 ANTICIPATED TRANSIENTS WITHOUT SCRAM FOR LIGHT WATER REACTORS
THADANI, A. C. + HAGEN, E. W.
U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, D.C. / OAK RIDGE
NATIONAL LABORATORY, OAK RIDGE, TENN.
THIS ARTICLE SUMMARIZES AN NRC STAFF REPORT (NUREG-0460) WHICH
REVIEWS AND EVALUATES THE INFORMATION NOW AVAILABLE ON THE
SUBJECT OF ANTICIPATED TRANSIENTS WITHOUT SCRAM (ATWS), IN
PARTICULAR, THE MATERIAL DEVELOPED SUBSEQUENT TO THE
PUBLICATION OF THE PREVIOUS STATUS REPORTS BY THE STAFF, WHICH
WERE CRITICIZED BY THE NUCLEAR INDUSTRY. REPORT NUREG-0460 IS,
IN PART, A RESPONSE TO THAT INDUSTRY CRITICISM; IT IS A
STATEMENT OF THE CURRENT POSITION OF THE DSS STAFF REGARDING
THE TREATMENT OF ATWS EVENTS IN THE SAFETY EVALUATION OF
NUCLEAR POWER PLANTS AND AN EXPOSITION OF THE BASES FOR THAT
POSITION. THE STAFF RECOMMENDS THE PROVISION OF SYSTEMS TO
MITIGATE THE CONSEQUENCES OF ATWS EVENTS, SHOULD THEY OCCUR, AS
THE MOST PROMISING ALTERNATIVE FOR MEETING THE SAFETY
OBJECTIVE. THE REPORT CONSISTS OF THE MAIN BODY OF TEXT,
APPENDICES IN WHICH THE DETAILS OF THE BASES FOR THE STAFF'S
PROPOSED RECOMMENDATIONS ARE DISCUSSED, AND A SUPPLEMENT WHICH
PROPOSES A COURSE OF ACTION FOR RESOLVING PROBLEMS RELATING TO
ATWS.
- 20-4-4-434 RADIOACTIVE WASTE MANAGEMENT AT THE HANFORD RESERVATION
NATIONAL ACADEMY OF SCIENCES
WASHINGTON, D.C.
DURING SOME 30 YEARS OF PLUTONIUM PRODUCTION, THE HANFORD
RESERVATION HAS ACCUMULATED LARGE QUANTITIES OF LOW- AND
HIGH-LEVEL RADIOACTIVE WASTES. THE HIGH-LEVEL WASTES HAVE BEEN
STORED IN UNDERGROUND TANKS, AND THE LOW-LEVEL WASTES HAVE BEEN
PERCOLATED INTO THE SOIL. IN RECENT YEARS SOME PROGRAMS FOR
SOLIDIFICATION AND SEPARATION OF THE HIGH-LEVEL WASTES HAVE
BEEN INITIATED. THE HANFORD WASTE-MANAGEMENT SYSTEM WAS STUDIED
BY A PANEL OF THE COMMITTEE ON RADIOACTIVE WASTE MANAGEMENT OF
THE NATIONAL ACADEMY OF SCIENCES. THE PANEL CONCLUDED THAT
HANFORD WASTE-MANAGEMENT PRACTICES WERE ADEQUATE AT PRESENT AND
FOR THE IMMEDIATE FUTURE BUT RECOMMENDED INCREASED RESEARCH AND
DEVELOPMENT PROGRAMS RELATED TO LONG-TERM ISOLATION OF THE
WASTES. THE PANEL ALSO CONSIDERED SOME ALTERNATIVES FOR ON-SITE
DISPOSAL OF THE WASTES. THE HANFORD RESERVATION WAS ORIGINALLY
ESTABLISHED FOR THE PRODUCTION OF PLUTONIUM FOR MILITARY
PURPOSES. DURING MORE THAN 30 YEARS OF OPERATION, LARGE VOLUMES
OF HIGH- AND LOW-LEVEL RADIOACTIVE WASTES HAVE BEEN ACCUMULATED
AND CONTAINED AT THE SITE. THE MANAGEMENT OF THESE WASTES HAS
BEEN THE SUBJECT OF CONTROVERSY AND CRITICISM. TO OBTAIN A TRUE
TECHNICAL EVALUATION OF THE HANFORD WASTE SITUATION, THE ENERGY
RESEARCH AND DEVELOPMENT ADMINISTRATION (NOW PART OF THE
DEPARTMENT OF ENERGY) ISSUED A CONTRACT TO THE NATIONAL ACADEMY
OF SCIENCES AND THE NATIONAL RESEARCH COUNCIL TO "CONDUCT AN
INDEPENDENT REVIEW AND EVALUATION OF THE HANFORD
WASTE-MANAGEMENT PRACTICES AND PLANS." A PANEL OF THE COMMITTEE
ON RADIOACTIVE WASTE MANAGEMENT (CRWM) OF THE NATIONAL ACADEMY
OF SCIENCES CONDUCTED THIS STUDY BETWEEN THE SUMMER OF 1976 AND

THE SUMMER OF 1977. THIS ARTICLE IS A SUMMARY OF THE FINAL REPORT OF THAT PANEL.

- 20-4-5-446 ENVIRONMENTAL MONITORING AND DISPOSAL OF RADIOACTIVE WASTE FROM NAVAL NUCLEAR VESSELS AND SUPPORT FACILITIES IN 1978
MILES, M. E. + SJOBLON, G. L. + EAGLES, J. D.
DEPARTMENT OF THE NAVY, WASHINGTON, D.C.
THE ENVIRONMENTAL EFFECT OF DISPOSAL OF RADIOACTIVE WASTES ORIGINATING FROM THE U.S. NAVY'S NUCLEAR PROPULSION PLANTS AND THEIR SUPPORT FACILITIES IS ASSESSED. THE TOTAL GAMMA RADIOACTIVITY IN LIQUIDS, LESS TRITIUM, DISCHARGED TO ALL PORTS AND HARBORS FROM THE MORE THAN 100 NAVAL NUCLEAR-POWERED SHIPS AND SUPPORTING TENDERS AND FROM NAVAL BASES AND SHIPYARDS WAS LESS THAN 0.002 CI IN 1978. THE TOTAL AMOUNT OF TRITIUM RELEASED TO ALL PORTS AND HARBORS WAS LESS THAN 1 CI IN 1978. THIS ARTICLE CONFIRMS THAT THE PROCEDURES USED BY THE U.S. NAVY TO CONTROL RELEASES OF RADIOACTIVITY FROM ITS NUCLEAR-POWERED SHIPS AND THEIR SUPPORT FACILITIES ARE EFFECTIVE IN PROTECTING THE ENVIRONMENT AND THE HEALTH AND SAFETY OF THE GENERAL PUBLIC.
- 20-4-5-458 AN ANALYSIS OF NRC METHODS FOR ESTIMATING THE EFFECTS OF DRY DEPOSITION IN ENVIRONMENTAL RADIOLOGICAL ASSESSMENTS
MILLER, C. W. + HOFFMAN, F. O.
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENN.
THE METHODS CONTAINED IN METEOROLOGY AND ATOMIC ENERGY - 1968, WHICH ARE COMMONLY USED FOR ESTIMATING THE EFFECTS OF DRY DEPOSITION IN RADIOLOGICAL ASSESSMENTS, HAVE BEEN COMPARED TO THE METHODS CONTAINED IN NUCLEAR REGULATORY COMMISSION (NRC) REGULATORY GUIDE 1.111. ALTHOUGH DESIGNED FOR USE WHEN DETERMINING COMPLIANCE WITH TITLE 10, CODE OF FEDERAL REGULATIONS, PART 50, APPENDIX 1 FOR LIGHT-WATER-COOLED REACTORS, THE NRC GUIDE HAS THE POTENTIAL OF BEING USED FOR OTHER TYPES OF NUCLEAR REACTORS AND FOR NUCLEAR FACILITIES AS WELL. THIS COMPARISON HAS RAISED A NUMBER OF CONCERNS ABOUT THE NRC APPROACH: 1. DEPOSITION RATE ESTIMATES ARE INDEPENDENT OF THE USER'S CALCULATED AIR CONCENTRATION. 2. DEPOSITION ESTIMATES FOR ELEVATED RELEASES SEEM TOO HIGH CLOSE TO THE SOURCE. 3. THE PLUME DEPLETION CURVES IN THE GUIDE DO NOT BEHAVE AS EXPECTED RELATIVE TO THE COMMONLY USED PLUME DEPLETION METHOD. IN VIEW OF THESE CONCERNS, IT IS RECOMMENDED THAT OTHER, SIMPLER APPROACHES TO THESE PROCESSES BE CONSIDERED FOR RADIOLOGICAL ASSESSMENT PURPOSES.
- 20-4-6-468 RADIOACTIVE EFFLUENTS FROM NUCLEAR POWER STATIONS AND FUEL REPROCESSING PLANTS IN EUROPE, 1972-1976
DAVIS, JR., W.
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENN.
DATA ON THE RADIOACTIVE GASBORNE AND LIQUID EFFLUENTS FROM 58 NUCLEAR POWER STATIONS AND 7 FUEL REPROCESSING PLANTS IN THE EUROPEAN COMMUNITY FOR THE YEARS 1972-1976 ARE PRESENTED. THERE ARE WIDE VARIATIONS IN RELEASES FROM BOTH REACTOR STATIONS AND FUEL REPROCESSING PLANTS BECAUSE OF DIFFERENCES IN REACTOR TYPE, PLANT SIZE, POWER LEVELS, AND EFFLUENT TREATMENT LEVELS. DATA COVERING SPECIFIC ISOTOPES OF PARTICULAR INTEREST ARE SUMMARIZED. IN NEARLY ALL CASES, RELEASES OF RADIOACTIVITY WERE BELOW MAXIMUM APPLICABLE VALUES OR THE TREATMENTS USED WERE CONSIDERED TO SATISFY THE REQUIREMENT THAT THE BEST PRACTICABLE MEANS BE USED TO MINIMIZE THE AMOUNT OF RADIOACTIVITY DISCHARGED. THIS ARTICLE IS ADAPTED FROM AN APRIL 1978 REPORT PREPARED BY THE COMMISSION OF THE EUROPEAN COMMUNITIES.
- 20-4-6-476 RADIOACTIVE MATERIALS RELEASED FROM NUCLEAR POWER PLANTS IN 1977
DECKER, T. R.
U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, D.C.
RELEASES OF RADIOACTIVE MATERIALS IN AIRBORNE AND LIQUID EFFLUENTS FROM COMMERCIAL LIGHT-WATER REACTORS DURING 1977, AS WELL AS DATA ON SOLID-WASTE SHIPMENTS, HAVE BEEN COMPILED AND REPORTED. THIS REPORT SUPPLEMENTS EARLIER ONES ISSUED BY THE FORMER ATOMIC ENERGY COMMISSION AND THE NUCLEAR REGULATORY COMMISSION. THE 1977 RELEASE DATA ARE COMPARED WITH THE RELEASES OF PREVIOUS YEARS IN TABULAR FORM. DATA COVERING SPECIFIC RADIONUCLIDES ARE SUMMARIZED.
- 20-4-6-483 PRELIMINARY REPORT ON THE THREE MILE ISLAND INCIDENT
CASTO, W. R. + COTTRELL, W. B.
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENN.
ABOUT 4:00 A.M. ON MAR.28,1979, UNIT 2 AT THE THREE MILE ISLAND NUCLEAR POWER STATION EXPERIENCED A TURBINE TRIP. THE SUBSEQUENT SEQUENCE OF EVENTS INVOLVING HUMAN ERRORS, DESIGN DEFICIENCIES, AND EQUIPMENT FAILURES RESULTED IN AN ACCIDENT UNIQUE IN REACTOR OPERATING EXPERIENCE TO DATE. ALTHOUGH NO ONE WAS INJURED BY THIS INCIDENT, IT HAS RESULTED IN INCREASED CONCERN FOR THE NUCLEAR OPTION AND HAS PROMPTED NUMEROUS INVESTIGATIONS. THIS PRELIMINARY REPORT SUMMARIZES THE STATUS OF THE PLANT AND RELATED ACTIVITIES THROUGH APRIL 30, PRIMARILY ON THE BASIS OF INFORMATION FROM NUCLEAR REGULATORY COMMISSION (NRC) PRESS RELEASES, PRELIMINARY NOTIFICATION OF OCCURRENCE MEMORANDUMS, AND INSPECTION AND ENFORCEMENT BULLETINS. NO CONCLUSIONS ARE DRAWN AT THIS TIME, BUT THE INCIDENT WILL BE FULLY COVERED IN A SUBSEQUENT ARTICLE WHEN THE FINDINGS FROM SOME OF THE MORE SUBSTANTIVE INVESTIGATING COMMITTEES BECOME AVAILABLE.

- 20-5-1-525 A COST-BENEFIT COMPARISON OF NUCLEAR AND NONNUCLEAR HEALTH AND SAFETY PROTECTIVE MEASURES AND REGULATIONS
O'DONNELL, E. P. + MAURO, J. J.
ERASCO SERVICES, INC., NEW YORK, N.Y.
THIS ARTICLE COMPARES THE COSTS AND BENEFITS OF HEALTH AND SAFETY MEASURES AND REGULATIONS IN THE NUCLEAR AND NONNUCLEAR FIELDS. A COST-BENEFIT METHODOLOGY FOR NUCLEAR SAFETY CONCERNS IS PRESENTED AND APPLIED TO EXISTING NUCLEAR PLANT ENGINEERED SAFETY FEATURES. COMPARISONS IN TERMS OF INVESTMENT COSTS TO ACHIEVE REDUCTIONS IN MORTALITY RATES ARE THEN MADE BETWEEN NUCLEAR PLANT SAFETY FEATURES AND THE PROTECTIVE MEASURES AND REGULATIONS ASSOCIATED WITH NONNUCLEAR RISKS, PARTICULARLY WITH COAL-FIRED POWER PLANTS. THESE COMPARISONS REVEAL A MARKED INCONSISTENCY IN THE COST EFFECTIVENESS OF HEALTH AND SAFETY POLICY, IN WHICH NUCLEAR REGULATORY POLICY REQUIRES MUCH GREATER INVESTMENTS TO REDUCE THE RISK OF PUBLIC MORTALITY THAN IS REQUIRED IN NONNUCLEAR AREAS WHERE REDUCTIONS IN MORTALITY RATES COULD BE ACHIEVED AT MUCH LOWER COST. A SPECIFIC EXAMPLE OF REGULATORY DISPARITY REGARDING GASEOUS EFFLUENT LIMITS FOR NUCLEAR AND FOSSIL-FUEL POWER PLANTS IS PRESENTED. IT IS CONCLUDED THAT A CONSISTENT HEALTH AND SAFETY REGULATORY POLICY BASED ON UNIFORM RISK AND COST-BENEFIT CRITERIA SHOULD BE ADOPTED AND THAT FUTURE PROPOSED NUCLEAR REGULATORY COMMISSION REGULATORY REQUIREMENTS SHOULD BE CRITICALLY EVALUATED FROM A COST-BENEFIT VIEWPOINT.
- 20-5-2-541 SYSTEM RELIABILITY ENGINEERING METHODOLOGY - A DISCUSSION OF THE STATE OF THE ART
FUSSELL, J. B. + ARENDT, J. S.
UNIVERSITY OF TENNESSEE, KNOXVILLE, TENN. / JBF ASSOCIATES, INC., KNOXVILLE, TENN.
THE SYSTEM RELIABILITY ENGINEERING METHODOLOGY THAT IS IN GENERAL USE FOR NUCLEAR SYSTEMS APPLICATIONS IS DISCUSSED. NO EFFORT IS MADE TO ADDRESS THE PRESENT STATE OF THEORETICAL DEVELOPMENT; THE APPROACHES COVERED ARE THOSE WHICH HAVE BEEN TESTED BY EXTENSIVE APPLICATION. SINCE NUCLEAR SYSTEMS RELIABILITY ENGINEERING FREQUENTLY INVOLVES TOO MUCH INFORMATION FOR MANUAL PROCESSING TECHNIQUES, THIS ARTICLE LISTS SOME OF THE AVAILABLE COMPUTER PROGRAMS THAT CAN BE USED TO PROVIDE INPUT TO THE ENGINEERING EFFORT. ALSO, SEVERAL THEORETICAL PROBLEMS ARE PRESENTED THAT CAN RESULT IN ERRONEOUS CONCLUSIONS AND RECOMMENDATIONS WHEN CERTAIN ANALYSIS PROCEDURES ARE USED.
- 20-5-2-551 COUPLED FLUID STRUCTURE ANALYSIS FOR LWRS IN THE FEDERAL REPUBLIC OF GERMANY
SCHLECHTENDAHN, E. G.
INSTITUT FÜR REAKTORENTWICKLUNG, FEDERAL REPUBLIC OF GERMANY
THE DEVELOPMENT OF LARGE COMMERCIAL LIGHT-WATER REACTORS FOR ELECTRIC-POWER GENERATION IN THE FEDERAL REPUBLIC OF GERMANY IS ACCOMPANIED BY A BROAD PROGRAM FOR INVESTIGATION OF THE SAFETY ASPECTS OF NUCLEAR PLANTS. CONSIDERABLE EFFORT IS DEVOTED TO THE ANALYSIS OF TRANSIENT LOADS ON CRITICAL REACTOR COMPONENTS DURING ABNORMAL CONDITIONS AND THE RESPONSE OF THE COMPONENTS TO SUCH LOADS. THIS REVIEW CONCENTRATES ON THOSE SITUATIONS AND COMPONENTS WHERE THE INTERACTION OF FLUID AND STRUCTURES MUST BE TAKEN INTO ACCOUNT IN A BEST-ESTIMATE ANALYSIS. IN THESE CASES AN UNCOUPLED ANALYSIS WOULD PRODUCE UNREALISTIC - THOUGH GENERALLY CONSERVATIVE - RESULTS. THE WORK OF SEVERAL ORGANIZATIONS IS CLOSELY COORDINATED, BOTH WITH RESPECT TO CODE DEVELOPMENT AND WITH RESPECT TO CODE ASSESSMENT USING RESULTS FROM LARGE-SCALE EXPERIMENTS.
- 20-5-3-560 A NEW APPROACH TO THE PROBLEMS OF ELECTRICAL INTERFERENCE IN INSTRUMENTATION AND CONTROL SYSTEMS
WILSON, I.
ATOMIC ENERGY ESTABLISHMENT, WINFRITH, DORCHESTER, DORSET, ENGLAND
IN THE CONTEXT OF NUCLEAR REACTOR CONTROL AND SAFETY, ELECTRICAL INTERFERENCE CAN BE POTENTIALLY DETRIMENTAL, SOMETIMES IN SUBTLE WAYS. THE MOST PROLIFIC DISTURBANCES ARE GENERATED BY SWITCHING MAINS-POWERED EQUIPMENT, THE LOCAL GROUND STRUCTURE CONSTITUTING A MAJOR COUPLING PATH VIA WHICH HIGH-FREQUENCY TRANSIENTS CAN AFFECT ELECTRONIC SYSTEMS. WHEN DESIGN CONSIDERATIONS ARE OUTLINED, THE ADVANTAGES OF USING IMPROVED SCREENED COMPONENTS, SUCH AS SUPERSCREENED CABLES, VIRTUALLY TO ELIMINATE INTERFERENCE PROBLEMS BECOME CLEAR. PROCEDURES FOR MEASURING THE INTERFERENCE IMMUNITY OF EQUIPMENT AND OF INSTALLED SYSTEMS IN SITU HAVE BEEN DEVELOPED. THEY PROVIDE POWERFUL DIAGNOSTIC, QUALITY CONTROL, AND COMMISSIONING AIDS. SEVERAL CASE HISTORIES ARE PRESENTED TO ILLUSTRATE HOW THE ESSENTIAL PRINCIPLES HAVE BEEN APPLIED SUCCESSFULLY IN PRACTICE AND TO DEMONSTRATE THAT ELECTRICAL INTERFERENCE NEED NO LONGER BE A PROBLEM.
- 20-5-5-582 UNIQUE ECOLOGICAL IMPACTS ASSOCIATED WITH OFFSHORE FLOATING NUCLEAR POWER PLANTS
ADAMS, S. H. + MCLEAN, R. B.
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENN.
THE ECOLOGICAL IMPACTS THAT COULD OCCUR AS A RESULT OF SITE CONSTRUCTION AND OPERATION OF AN OFFSHORE FLOATING NUCLEAR POWER PLANT ARE IDENTIFIED BY COMPARING THE PRINCIPAL ECOLOGICAL FEATURES ASSOCIATED WITH OFFSHORE SITING WITH THOSE ASSOCIATED WITH THE SITING OF ONSHORE ESTUARINE PLANTS. IN GENERAL, THE ECOLOGICAL IMPACTS OF OFFSHORE NUCLEAR PLANTS SHOULD BE RELATIVELY SMALLER THAN THOSE OF ESTUARINE PLANTS. POSSIBLE FACTORS THAT COULD INCREASE THE RELATIVE IMPACTS OF

OFFSHORE PLANTS ARE HIGH FREQUENCY OF CONTACT WITH SCHOOLS OF FISH, SITING NEAR INLETS TO ESTUARIES OR OTHER ECOLOGICALLY IMPORTANT AREAS, AND THE PERSISTENCE OF HALOGEN RESIDUALS. IDENTIFYING THE POTENTIAL ECOLOGICAL IMPACTS ASSOCIATED WITH THE SITING OF OFFSHORE PLANTS PERMITS THE DEVELOPMENT OF VARIOUS MONITORING PROGRAMS AND MEASURES TO MINIMIZE THESE IMPACTS.

- 20-5-5-591 PRELIMINARY DOSE AND HEALTH IMPACT OF THE ACCIDENT AT THE THREE MILE ISLAND NUCLEAR STATION
AD HOC POPULATION DOSE ASSESSMENT GROUP COMPOSED OF THE NUCLEAR REGULATORY COMMISSION, THE DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE, AND THE ENVIRONMENTAL PROTECTION AGENCY / WASHINGTON, D. C.
EDITOR'S NOTE: THE AD HOC POPULATION DOSE ASSESSMENT GROUP IS COMPOSED OF MEMBERS OF THE NUCLEAR REGULATORY COMMISSION, THE DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE, AND THE ENVIRONMENTAL PROTECTION AGENCY. THIS GROUP HAS EXAMINED THE AVAILABLE DATA FOR THE PERIOD FOLLOWING THE ACCIDENT AND HAS CONCLUDED THAT THE OFF-SITE COLLECTIVE DOSE ASSOCIATED WITH THE RADIOACTIVE MATERIAL REPRESENTS MINIMAL RISKS OF ADDITIONAL HEALTH EFFECTS TO THE OFF-SITE POPULATION, E.G., AN INCREASE OF 1 CANCER DEATH OVER THE 325,000 WHICH WOULD OTHERWISE BE EXPECTED. FURTHERMORE, THE COLLECTIVE DOSE WILL NOT BE SIGNIFICANTLY INCREASED BY EXTENDING THE PERIOD PAST APRIL 7. THE 100-PAGE REPORT OF THE AD HOC GROUP, DATED MAY 10, 1979, IS ON SALE BY THE SUPERINTENDENT OF DOCUMENTS, U.S. GOVERNMENT PRINTING OFFICE, WASHINGTON, D. C. 20402, STOCK NUMBER 017-001-00409-1. PRESENTED HERE IS THE SUMMARY AND DISCUSSION OF FINDINGS FROM THAT REPORT.
- 20-5-6-595 STEAM GENERATOR TUBE PERFORMANCE - WORLD EXPERIENCE WITH WATER COOLED NUCLEAR POWER REACTORS DURING 1977
PATHANIA, R. S. + TATONE, O. S.
CHALK RIVER NUCLEAR LABORATORIES, ONTARIO, CANADA
THE PERFORMANCE OF STEAM-GENERATOR TUBES IN WATER-COOLED NUCLEAR POWER REACTORS IN VARIOUS COUNTRIES IS REVIEWED FOR 1977. TUBE FAILURES WERE REPORTED AT 34 OF THE 79 REACTORS SURVEYED. THE CAUSES OF THESE FAILURES AND THE INSPECTION AND REPAIR PROCEDURES DESIGNED TO DEAL WITH THEM ARE PRESENTED. ALTHOUGH DENTING CAUSED BY CORROSION REMAINED THE LEADING CAUSE OF TUBE FAILURES, SPECIFIC MECHANISMS HAVE BEEN IDENTIFIED, AND METHODS OF DEALING WITH THEM HAVE BEEN DEVELOPED. THESE METHODS ARE BEING APPLIED AND SHOULD LEAD TO A REDUCTION OF CORROSION FAILURES IN THE FUTURE.
- 20-5-6-613 DEVELOPMENTS PERTAINING TO THE THREE MILE ISLAND ACCIDENT
COTTRILL, W. B.
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENN.
A PRELIMINARY REPORT ON THE THREE MILE ISLAND ACCIDENT OF MARCH 28, 1979, WAS INCLUDED IN THE PREVIOUS ISSUE OF NUCLEAR SAFETY. AS WAS STATED IN THAT ARTICLE, A FINAL REPORT ON THE ACCIDENT WILL BE PRESENTED IN NUCLEAR SAFETY WHEN THE VARIOUS INVESTIGATING COMMITTEES REPORT ON THEIR FINDINGS. MOST OF THESE REPORTS SHOULD BE AVAILABLE BY THE END OF THE YEAR. HOWEVER, SOME OF THE DEVELOPMENTS OF THE PAST 2 MONTHS PERTAINING TO THE ACCIDENT ARE OF GENERAL INTEREST AND WILL BE SUMMARIZED HERE. NO ATTEMPT IS MADE HERE TO PRESENT A COMPREHENSIVE REVIEW OF THE ACCIDENT NOR EVEN TO EVALUATE THE MATERIAL THAT HAS BECOME AVAILABLE; RATHER, GIVEN THE INTEREST IN THE SUBJECT, THIS ARTICLE WILL MERELY CALL ATTENTION TO THE AVAILABLE INFORMATION. (IN ADDITION, THE REPORT BY THE AD HOC DOSE ASSESSMENT GROUP IS SUMMARIZED IN THE PREVIOUS SECTION OF THIS ISSUE OF NUCLEAR SAFETY.) THE DEVELOPMENTS REPORTED HERE FALL INTO THE FOLLOWING TOPICS: LESSONS LEARNED TASK FORCE, ADVISORY COMMITTEE ON REACTOR SAFEGUARDS (ACRS) REPORTS ON THREE MILE ISLAND, CONGRESSIONAL INVESTIGATIONS, METROPOLITAN EDISON COMPANY INTERIM REPORT, NUCLEAR REGULATORY COMMISSION (NRC) REPORT ON BARCOCK AND WILCOX (B+W) TERD WATER TRANSIENTS, TENNESSEE VALLEY AUTHORITY (TVA) NUCLEAR PROGRAM REVIEW, RADIOACTIVITY SAMPLING, LIABILITY INSURANCE PAYMENTS, AND A CATCHALL HEADING ENTITLED MISCELLANEOUS ACTIONS OF NOTE.
- 20-6-1-655 EDUCATION AND PUBLIC ACCEPTANCE OF NUCLEAR POWER PLANTS
DELCOIGNE, G.
INTERNATIONAL ATOMIC ENERGY AGENCY, VIENNA, AUSTRIA
EDITOR'S NOTE - THE FOLLOWING ARTICLE WAS ADAPTED FROM A TALK BY MR. DELCOIGNE WHICH WAS PRESENTED AT THE EUROPEAN NUCLEAR SOCIETY/AMERICAN NUCLEAR SOCIETY (ENS/ANS) INTERNATIONAL TOPICAL MEETING ON NUCLEAR POWER REACTOR SAFETY HELD IN BRUSSELS, BELGIUM, OCT. 16-19, 1978. THOSE FAMILIAR WITH THE TOPIC WILL FIND NOTHING NEW IN THIS ARTICLE, BUT THE DISCUSSION OF THIS TOPIC FROM THE EUROPEAN PERSPECTIVE PROVIDES AMPLE EVIDENCE OF THE COMMONALITY OF THE PROBLEM ON BOTH SIDES OF THE ATLANTIC. FURTHERMORE, THE ARTICLE IS WELL DOCUMENTED NOT ONLY WITH TEXTUAL CITATIONS BUT ALSO BY THE INCLUSION OF A BIBLIOGRAPHY. THE EVOLUTION OF THE SO-CALLED NUCLEAR DEBATE FROM THE LATE 1960S TO THE PRESENT TIME IS REVIEWED, AND THE CURRENT MANIFESTATIONS OF THE ANTINUCLEAR MOVEMENT IN MANY COUNTRIES ARE DESCRIBED. DESPITE THE EMERGENCE OF PRONUCLEAR GROUPS AND DISCUSSIONS IN MANY COUNTRIES, THE AUTHOR CONCLUDES THAT PUBLIC EDUCATION IS THE CRUX OF THE PROBLEM, AND HE DISCUSSES THE ROLE OF THE INTERNATIONAL ATOMIC ENERGY AGENCY (IAEA) IN THE NUCLEAR DEBATE.

- 20-6-1-664 RISKS ASSOCIATED WITH NUCLEAR POWER
NATIONAL ACADEMY OF SCIENCES
WASHINGTON, D.C.
EDITOR'S NOTE: THE REPORT FROM WHICH THIS ARTICLE IS ADAPTED HAD ITS ORIGIN IN 1975 IN A REQUEST BY PHILIP HANDLER, PRESIDENT OF THE NATIONAL ACADEMY OF SCIENCES, TO ITS COMMITTEE ON SCIENCE AND PUBLIC POLICY (COSPOP), TO REVIEW THE DRAFT OF THE REACTOR SAFETY STUDY (WASH-1400, ALSO KNOWN AS THE FASNUSSEN REPORT). THE COSPOP WELCOMED THIS CHARGE AND DECIDED TO UNDERTAKE A SURVEY OF ALL THE TYPES OF RISKS ASSOCIATED WITH THE NUCLEAR POWER PROGRAM THROUGH A CRITICAL REVIEW OF THE LITERATURE. AT THE SAME TIME THE NATIONAL RESEARCH COUNCIL WAS ORGANIZING A COMMITTEE ON NUCLEAR AND ALTERNATIVE ENERGY SYSTEMS (CONAES) FOR A BROAD STUDY REQUESTED BY THE ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION (ERDA), NOW THE DEPARTMENT OF ENERGY (DOE). IT WAS AGREED THAT THE LITERATURE REVIEW PROPOSED BY COSPOP WOULD PROVIDE INFORMATION THAT COULD CONTRIBUTE SIGNIFICANTLY TO THE CONAES STUDY. ACCORDINGLY, THE COSPOP STUDY WAS SUPPORTED LARGELY BY FUNDS MADE AVAILABLE BY ERDA AND DOE FOR THE CONAES EFFORT; ADDITIONAL SUPPORT WAS PROVIDED BY THE NATIONAL ACADEMY OF SCIENCES. THIS ARTICLE CONSISTS PRIMARILY OF THE "INTRODUCTION" (SECTION I) AND "OVERALL ASSESSMENT" (SECTION VIII) OF THE "SUMMARY AND SYNTHESIS CHAPTER" OF THE COSPOP LITERATURE REVIEW. THE "SUMMARY AND SYNTHESIS CHAPTER" WAS RELEASED IN APRIL 1979 - BEFORE COMPLETION OF THE FULL REPORT - BECAUSE OF THE INTENSITY OF CURRENT INTEREST IN THE SUBJECT.
- 20-6-2-671 BURNOUT IN BOILING HEAT TRANSFER III. HIGH QUALITY FORCED CONVECTION SYSTEMS
BERGLES, A. E.
IOWA STATE UNIVERSITY, AMES, IOWA
THIS IS THE THIRD AND FINAL PART OF A REVIEW OF BURNOUT DURING BOILING HEAT TRANSFER. THE STATUS OF BURNOUT IN HIGH-QUALITY FORCED-CONVECTION SYSTEMS IS REVIEWED, AND RECENT DEVELOPMENTS ARE SUMMARIZED IN DETAIL. A GENERAL GUIDE TO THE CONSIDERABLE LITERATURE IS GIVEN. PARAMETRIC EFFECTS AND CORRELATIONS FOR WATER IN CIRCULAR AND NONCIRCULAR DUCTS ARE PRESENTED. OTHER TOPICS DISCUSSED INCLUDE TRANSIENTS, STEAM-GENERATOR APPLICATIONS, CORRELATIONS FOR OTHER FLUIDS, FOULING, AND AUGMENTATION.
- 20-6-3-690 ASSESSMENT OF THE FREQUENCY OF FAILURE TO SCRAM IN LIGHT WATER REACTORS
APOSTOLAKIS, G. + KAPLAN, S. + GARRICK, B. J.
DICKTER, W.
UNIVERSITY OF CALIFORNIA, LOS ANGELES, CALIF. / PICKARD, LOWE AND GARRICK, INC., IRVINE, CALIF.
BAYESIAN METHODS ARE USED TO CONSTRUCT A DISTRIBUTION FOR THE PROBABILITY OF FAILURE OF THE REACTOR PROTECTION SYSTEM (RPS) PER DEMAND IN LIGHT-WATER REACTORS. THIS DISTRIBUTION EXPRESSES QUANTITATIVELY OUR CURRENT STATE OF KNOWLEDGE AS FORMED BY OUR OWN ANALYSIS OF THE RPS, BY THE AVAILABLE STATISTICAL EVIDENCE, AND BY THE WORK OF THE ELECTRIC POWER RESEARCH INSTITUTE AND THE NUCLEAR REGULATORY COMMISSION STAFF ON ANTICIPATED TRANSIENTS WITHOUT SCRAM. THE DISTRIBUTION CAN BE SUMMARIZED BY THE FOLLOWING VALUES: 5TH PERCENTILE: 6×10^{-6} PER DEMAND; MEDIAN: 2.8×10^{-5} PER DEMAND; MEAN: 5.4×10^{-5} PER DEMAND; 95TH PERCENTILE: 1.2×10^{-4} PER DEMAND.
- 20-6-4-706 SUMMARY OF THE REPORT TO THE PRESIDENT BY THE INTERAGENCY REVIEW GROUP ON NUCLEAR WASTE MANAGEMENT
INTERAGENCY REVIEW GROUP
WASHINGTON, D.C.
ON MAR. 13, 1978, IN RESPONSE TO THE FINDINGS OF AN INTERNAL DEPARTMENT OF ENERGY (DOE) TASK FORCE WHICH HAD REVIEWED THE UNITED STATES NUCLEAR WASTE MANAGEMENT PROGRAM, PRESIDENT CARTER ESTABLISHED THE INTERAGENCY REVIEW GROUP (IRG) TO FORMULATE RECOMMENDATIONS FOR THE ESTABLISHMENT OF AN ADMINISTRATIVE POLICY WITH RESPECT TO LONG-TERM MANAGEMENT OF NUCLEAR WASTES AND SUPPORTING PROGRAMS. CHAIRED BY THE SECRETARY OF ENERGY, THE IRG IS COMPOSED OF REPRESENTATIVES OF 14 GOVERNMENT ENTITIES. THE NUCLEAR REGULATORY COMMISSION (NRC) PARTICIPATED IN THE ACTIVITIES OF THE IRG AS A NONVOTING MEMBER. THE IRG ATTEMPTED TO OBTAIN A BROAD RANGE OF INPUTS AND VIEWS FROM MANY SOURCES, INCLUDING CONGRESS, STATE AND LOCAL GOVERNMENTS, INDIAN NATIONS, INDUSTRY, THE SCIENTIFIC AND TECHNICAL COMMUNITY, PUBLIC INTEREST AND ENVIRONMENTAL ORGANIZATIONS, AND THE PUBLIC. IN OCTOBER 1978 THE IRG ISSUED A DRAFT REPORT FOR PUBLIC REVIEW AND COMMENT. SOME 3300 COMMENTS WERE RECEIVED AND REVIEWED, AND THEIR FINAL REPORT, WHICH WAS PUBLISHED IN MARCH 1979, REFLECTS THEIR CONSIDERATION OF THESE COMMENTS. THIS ARTICLE SUMMARIZES THE FINAL REPORT, USING TO THE EXTENT PRACTICAL THE SAME FORMAT, WORDING, AND EMPHASIS.
- 20-6-5-722 NATURAL AND TECHNOLOGICALLY ENHANCED SOURCES OF RADON-222
TRAVIS, C. C. + WATSON, A. P.
MCDOWELL-BOYER, L. M. + COTTER, S. J.
RANDOLPH, M. L. + FIELDS, D. E.
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENN.
AN ASSESSMENT OF RADON-222 RELEASES (CURIES/YEAR) FROM MAJOR NATURAL AND TECHNOLOGICALLY ENHANCED SOURCES IN THE UNITED STATES IS PRESENTED. THE RESULTING INHALATION POPULATION DOSE COMMITMENTS TO THE BRONCHIAL EPITHELIUM OF THE LUNG (LUNG-REM) ARE ALSO ESTIMATED. THE COURSES OF RADON CONSIDERED ARE NATURAL

SOIL, EVAPOTRANSPIRATION, POTABLE WATER SUPPLIES, BUILDING MATERIALS, NATURAL GAS, URANIUM MINING AND MILLING, COAL AND PHOSPHATE MINING, PHOSPHATE FERTILIZER, LIQUEFIED PETROLEUM GAS, GEOTHERMAL POWER FACILITIES, COAL-FIRED POWER PLANTS, AND GAS AND OIL WELLS. THE MOST IMPORTANT NATURAL SOURCE OF RADON-222 IS DECAY OF RADIUM-226 IN THE SOIL AND ROCKS OF THE EARTH'S CRUST. THIS SOURCE RESULTS IN APPROXIMATELY 40 PERCENT OF THE TOTAL POPULATION DOSE FROM ALL SOURCES OF RADON. THE LARGEST TECHNOLOGICALLY ENHANCED CONTRIBUTOR TO POPULATION DOSE IS AIRBORNE RADON-222 IN BUILDING INTERIORS, WHICH IS ESTIMATED TO CONTRIBUTE 55 PERCENT TO THE TOTAL POPULATION EXPOSURE TO RADON-222. EACH OF THE OTHER SOURCES IS ESTIMATED TO CONTRIBUTE LESS THAN 3 PERCENT TO THE TOTAL.

- 20-6-6-729 STRESS CORROSION CRACKING IN PIPING OF LIGHT WATER REACTOR PLANTS
PIPE CRACK STUDY GROUP
U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, D.C.
EDITOR'S NOTE: THE PIPE CRACK STUDY GROUP, ESTABLISHED BY THE NUCLEAR REGULATORY COMMISSION (NRC), REVIEWED INTERGRANULAR STRESS-CORROSION CRACKING (IGSCC) OF PIPING IN BOILING-WATER REACTORS (BWRs) AND IN 1975 ISSUED A REPORT, NUREG-75/067. DURING 1978 SUCH CRACKING WAS REPORTED FOR THE FIRST TIME IN LARGE-DIAMETER PIPING (GREATER THAN 20 IN.) IN A BWR IN THE FEDERAL REPUBLIC OF GERMANY. THIS DISCOVERY, TOGETHER WITH THE REPORTED QUESTIONS CONCERNING THE INTERPRETATION OF ULTRASONIC INSPECTIONS, LED TO THE ESTABLISHMENT OF A NEW PIPE CRACK STUDY GROUP BY THE NRC. THE CHARTER OF THE NEW GROUP WAS EXPANDED TO INCLUDE (1) A REVIEW OF THE POTENTIAL FOR STRESS-CORROSION CRACKING IN PRESSURIZED-WATER REACTORS (PWRs) AS WELL AS IN BWRs, (2) AN EXAMINATION OF THE OPERATING EXPERIENCE IN FOREIGN REACTORS RELEVANT TO IGSCC, AND (3) A RESPONSE TO FIVE SPECIFIC QUESTIONS CONCERNING IGSCC. THIS ARTICLE SUMMARIZES THE FINDINGS OF THE NEW PIPE CRACK STUDY GROUP; COMPLETE DETAILS ARE PRESENTED IN THEIR REPORT, NUREG-0531.
- 20-6-6-735 SUMMARY OF TMI-2 LESSONS LEARNED TASK FORCE REPORT
NUCLEAR SAFETY STAFF
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENN.
AFTER ITS REVIEW OF THE THREE MILE ISLAND 2 ACCIDENT, THE TMI-2 LESSONS LEARNED TASK FORCE RECOMMENDED THAT A NUMBER OF ACTIONS IN THE AREAS OF DESIGN AND ANALYSIS AND PLANT OPERATIONS BE REQUIRED IN THE SHORT TERM TO PROVIDE SUBSTANTIAL ADDITIONAL PROTECTION FOR THE PUBLIC HEALTH AND SAFETY. ALL NUCLEAR POWER PLANTS IN OPERATION OR IN VARIOUS STAGES OF CONSTRUCTION OR LICENSING ACTION ARE AFFECTED TO VARYING DEGREES BY THE SPECIFIC RECOMMENDATIONS. COMMENTS BY THE ADVISORY COMMITTEE ON REACTOR SAFEGUARDS CONCERNING THE SHORT-TERM RECOMMENDATIONS ARE PRESENTED.
- 21-1-1-1 THERMAL REACTOR SAFETY RESEARCH IN SWEDEN
GRANLUND, C. + HELLSTRAND, E.
STUDSVIK ENERGITEKNIK AB, SWEDEN
SWEDEN BENEFITS IN MANY WAYS FROM THE REACTOR SAFETY RESEARCH PERFORMED IN OTHER COUNTRIES. ITS OWN ACTIVITY COMPLEMENTS THIS EFFORT, BUT A CERTAIN FRACTION IS ORIENTED TOWARD SAFETY ISSUES THAT ARE INTIMATELY RELATED TO THE SPECIAL DESIGN OF THE ASEA-ATOM BOILING-WATER REACTOR. THROUGH THE AVAILABILITY OF THE DECOMMISSIONED MARVIKEN REACTOR PLANT, SWEDEN HAS BEEN ABLE TO PLAY A LEADING ROLE IN INTEGRAL CONTAINMENT EXPERIMENTS WITH INTERNATIONAL PARTICIPATION. JOINT EFFORTS WITH OTHER COUNTRIES ARE NOW DEVOTED TO DEFINING NEW LARGE-SCALE EXPERIMENTS TO BE PERFORMED IN THE UNIQUE MARVIKEN FACILITY. THE LARGEST PORTION OF THE SAFETY RESEARCH PROGRAM IN SWEDEN IS PERFORMED BY STUDSVIK ENERGITEKNIK AB, BUT VARIOUS UNIVERSITIES, CONSULTANT FIRMS, AND RESEARCH INSTITUTES ARE ALSO INVOLVED. IN ADDITION, A SUBSTANTIAL AMOUNT OF WORK IS DONE BY THE REACTOR VENDOR ASEA-ATOM BUT IS NOT INCLUDED IN THIS ARTICLE. THE OVERALL ANNUAL BUDGET IS AT PRESENT BETWEEN \$7 AND \$8 MILLION, WITH THREE GOVERNMENTAL AUTHORITIES AS THE MAIN FINANCING BODIES.
- 21-1-1-16 STRUCTURAL MECHANICS IN REACTOR TECHNOLOGY
COTTFELL, W. B.
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENN.
IN A BRIEF ARTICLE ON A BIG CONFERENCE - THE FIFTH INTERNATIONAL CONFERENCE ON STRUCTURAL MECHANICS IN REACTOR TECHNOLOGY (SMIRT-5) - THE SCOPE AND CONTENTS OF THAT CONFERENCE ARE IDENTIFIED, AND SELECTED HIGHLIGHTS ARE PRESENTED. OVER 1400 PERSONS ATTENDED THE WEEK-LONG MEETING, WHICH WAS HELD IN BERLIN, AUG. 13-17, 1979. OVER 700 PAPERS WERE PRESENTED IN OVER 100 TECHNICAL SESSIONS NOT COUNTING 10 SATELLITE 2-DAY SESSIONS THAT WERE HELD BOTH BEFORE AND AFTER THE CONFERENCE ITSELF. FEW TECHNICAL DETAILS ARE PRESENTED IN THIS BRIEF REVIEW, BUT THE PLENARY TALKS ARE SUMMARIZED AND THE CONTRIBUTIONS OF DR. THOMAS A. JAEGER, GENERAL CHAIRMAN OF THIS AND ALL PREVIOUS SMIRT CONFERENCES, ARE LAUDED.
- 21-1-2-26 IN-PILE TESTS AT KARLSRUHE OF LWR FUEL ROD BEHAVIOR DURING THE HEATUP PHASE OF A LOCA
KAPP, E. H.
FEDERAL REPUBLIC OF GERMANY
IN ORDER TO INVESTIGATE THE INFLUENCE OF A NUCLEAR ENVIRONMENT ON THE MECHANISMS OF FUEL-ROD FAILURE, IN-PILE TESTS SIMULATING THE HEATUP PHASE OF A LOSS-OF-COOLANT ACCIDENT IN A

PRESSURIZED-WATER REACTOR ARE BEING CONDUCTED WITH IRRADIATED AND UNIRRADIATED SHORT-LENGTH SINGLE RODS IN THE PR2 REACTOR AT KERNFORSCHUNGSZENTRUM KARLSRUHE (KARLSRUHE NUCLEAR RESEARCH CENTER), FEDERAL REPUBLIC OF GERMANY, WITHIN THE PROJECT NUCLEAR SAFETY. WITH NEARLY 70 PERCENT OF THE SCHEDULED TESTS COMPLETED, NO SUCH INFLUENCES HAVE BEEN FOUND. THE IN-PILE BURST AND DEFORMATION DATA ARE IN GOOD AGREEMENT WITH RESULTS FROM NONNUCLEAR TESTS WITH ELECTRICALLY HEATED FUEL-ROD SIMULATORS. THE PHENOMENON OF PELLETT DISINTEGRATION, WHICH HAS BEEN OBSERVED IN ALL TESTS WITH PREVIOUSLY IRRADIATED RODS, NEEDS FURTHER INVESTIGATION.

- 21-1-3-38 TECHNICAL ASSESSMENT OF DISTURBANCE ANALYSIS SYSTEMS
LONG, A. B.
ELECTRIC POWER RESEARCH INSTITUTE, PALO ALTO, CALIF.
IN DECEMBER 1978, THE ELECTRIC POWER RESEARCH INSTITUTE SPONSORED AN INTERNATIONAL SPECIALISTS WORKSHOP ON DISTURBANCE ANALYSIS SYSTEMS. SINCE THE THREE MILE ISLAND INCIDENT, THE ELECTRIC-POWER INDUSTRY HAS BEEN EVALUATING THE USE OF THIS TYPE OF SYSTEM AS A MEANS TO IMPROVE THE OPERATOR-PROCESS INTERFACE DURING NORMAL AND ABNORMAL MODES OF NUCLEAR PLANT OPERATION. THE FUNCTIONAL REQUIREMENTS, JUSTIFICATION, TECHNICAL DESCRIPTIONS, AND OPERATION EXPERIENCE WITH SUCH SYSTEMS ARE SUMMARIZED ON THE BASIS OF THE WORKSHOP PRESENTATIONS. UNRESOLVED PROBLEMS ARE IDENTIFIED AND ONGOING RESEARCH AND DEVELOPMENT ACTIVITIES IN THE UNITED STATES AND EUROPE ARE BRIEFLY REVIEWED.
- 21-1-3-51 AGING TECHNIQUES AND QUALIFIED LIFE FOR SAFETY SYSTEM COMPONENTS
WEAVER, W. W.
POWER GENERATION GROUP, LYNCHBURG, VA.
PRESENTLY, THE QUALIFIED LIFE OBJECTIVE FOR CLASS 1E SAFETY SYSTEM COMPONENTS IN NUCLEAR POWER PLANTS IS SOMEWHAT OF A SUBJECTIVE ENGINEERING JUDGMENT. WHEN THE DESIRED QUALIFIED LIFE IS ASCERTAINED, THERE ARE OTHER CHOICES THAT MUST BE MADE (WHICH MAY BE INFLUENCED BY THE DESIRED QUALIFIED LIFE) SUCH AS SELECTING THE AGING PROCEDURE TO USE IN THE QUALIFICATION PROCESS. ADDING COMPLEXITY TO THE SITUATION IS THE FACT THAT THERE ARE SOME LIMITATIONS IN AGING TECHNIQUES AT THE PRESENT TIME. THIS ARTICLE PRESENTS (1) A DISCUSSION OF THE LIMITATIONS IN AGING PROCEDURES, (2) THE GENERAL PHILOSOPHY OF QUALIFICATION, AND (3) A PROPOSED METHOD FOR SPECIFYING A DESIRED QUALIFIED LIFE, WHICH USES A PROBABILISTIC APPROACH. THE PROBABILISTIC APPROACH PROPOSED IN ITEM 3 CAN BE APPLIED TO NATURAL AGING PROGRAMS AND EVENTUALLY TO ACCELERATED AGING ONCE THE PRESENT TECHNICAL DIFFICULTIES ARE OVERCOME.
- 21-1-4-59 FIRE HAZARDS AND CONSEQUENCES OF FIRES IN NUCLEAR POWER PLANTS
TALBERT, J. H.
NATIONAL LOSS CONTROL SERVICE CORPORATION, LONG GROVE, ILL.
THIS ARTICLE BRIEFLY DESCRIBES THE FIRE HAZARDS IN NUCLEAR POWER PLANTS, THE POTENTIAL NUCLEAR-SAFETY-RELATED AND ECONOMIC CONSEQUENCES THAT CAN BE CAUSED BY FIRES IN NUCLEAR POWER PLANTS, AND THE USE OF A FIRE PROTECTION PROGRAM TO PREVENT UNACCEPTABLE CONSEQUENCES FROM OCCURRING.
- 21-1-5-68 EFFECTS OF LOW LEVEL RADIATION - A CRITICAL REVIEW
ARCHER, V. E.
PUBLIC HEALTH SERVICE, SALT LAKE CITY, UTAH
BOTH NEGATIVE AND POSITIVE REPORTS ON THE EFFECTS ON MAN OF LOW-DOSE AND PROTRACTED RADIATION EXPOSURES ARE REVIEWED. SUCH EFFECTS ARE OBSERVABLE ONLY IN LARGE POPULATIONS BY EPIDEMIOLOGICAL TECHNIQUES. ALTHOUGH NOT CONCLUSIVE, THERE IS CONSIDERABLE EVIDENCE TO SUPPORT THE HYPOTHESIS THAT BACKGROUND RADIATION AND ARTIFICIAL RADIATION IN COMPARABLE DOSES PROBABLY HAVE DETECTABLE EFFECTS ON MAN. CERTAINLY THIS IS THE PRUDENT CONCLUSION TO REACH. THIS MEANS THAT NUCLEAR POWER SHOULD BE ASSESSED ON THE BASIS OF RISK VS. BENEFIT. THE SAME TYPE OF ASSESSMENT SHOULD BE APPLIED TO NONNUCLEAR POWER SOURCES.
- 21-1-5-83 SOME OBSERVATIONAL BASES FOR ESTIMATING THE ONCOGENIC EFFECTS OF IONIZING RADIATION
TOTTER, J. R.
OAK RIDGE ASSOCIATED UNIVERSITIES, OAK RIDGE, TENN.
DATA EXTRACTED FROM SEVERAL STUDIES ON HUMAN SUBJECTS WHO RECEIVED PARTIAL- OR WHOLE-BODY EXPOSURES TO IONIZING RADIATION ARE PRESENTED. THE USE OF THESE DATA TO ESTIMATE THE EXPECTED MORTALITY FROM WHOLE-BODY IRRADIATION IS DISCUSSED. THE INTERPRETATIONS OF THE RESULTS FROM RETROSPECTIVE CASE-CONTROL STUDIES, AS EXEMPLIFIED BY THE OXFORD SURVEY OF CHILDHOOD CANCERS, ARE CRITICALLY REVIEWED. IT IS FOUND THAT THE OXFORD DATA OF 1972 DO NOT SUPPORT CONVENTIONAL DOSE-RESPONSE RELATIONS ANY BETTER THAN DO RANDOM NUMBERS WITH SIMILAR RANGES AND MEANS. ALSO DISCUSSED IS A METHOD FOR ANALYZING THE RESULTS OF WHOLE-BODY RADIATION STUDIES, WHICH RELATES THE NUMBER OF DEATHS FROM CANCER TO THOSE FROM ALL OTHER CAUSES EXCLUDING ACCIDENTS.

- 21-2-1-147 FIFTH INTERNATIONAL SYMPOSIUM ON THE PACKAGING AND TRANSPORTATION OF RADIOACTIVE MATERIALS
ALLEN, G. C., JR + KENT, D. C. + POPE, R. B.
SANDIA LABORATORIES, ALBUQUERQUE, NEW MEXICO
THIS ARTICLE IS A BRIEF REVIEW OF THE FIFTH INTERNATIONAL SYMPOSIUM ON THE PACKAGING AND TRANSPORTATION OF RADIOACTIVE MATERIALS HELD AT LAS VEGAS, NEV., MAY 7-12, 1979. THIS SYMPOSIUM WAS SPONSORED BY SANDIA LABORATORIES UNDER THE AUSPICES OF THE DEPARTMENT OF ENERGY. HIGHLIGHTING THE MEETING WERE PAPERS ON REGULATIONS, LEGAL ISSUES, LOGISTICS AND PLANNING, RISK ASSESSMENT, AND VARIOUS TECHNOLOGY- AND SYSTEMS-RELATED TOPICS. IT IS APPARENT THAT, ALTHOUGH TRANSPORTATION OF RADIOACTIVE MATERIALS HAS RECEIVED MUCH ATTENTION IN THE PAST, EVEN MORE ATTENTION WILL BE REQUIRED IN THE FUTURE OF TRANSPORTATION MAY BECOME A LIMITING FACTOR IN THE NUCLEAR POWER OPTION. AREAS REQUIRING SPECIAL ATTENTION INCLUDE (1) THE CONTINUED EVALUATION AND UPDATING OF REGULATIONS AND THE COORDINATION OF THIS EFFORT ON AN INTERNATIONAL LEVEL; (2) THE USE OF RISK ANALYSIS NOT ONLY TO ESTABLISH, MODIFY, OR VERIFY REGULATIONS BUT ALSO TO LEND CREDENCE TO THE REGULATIONS IN THE PUBLIC VIEW; (3) THE DEVELOPMENT OF TECHNOLOGY TO PROVIDE COST-EFFECTIVE AND MORE EASILY USED PACKAGING AND TRANSPORTATION SYSTEMS; (4) THE EXPANSION OF EFFORT TO PROVIDE ACCURATE INFORMATION TO LEGISLATIVE AND OTHER RULE-MAKING BODIES AND TO THE PUBLIC TO AID IN MAKING RATIONAL DECISIONS RELATIVE TO TRANSPORTATION; (5) THE EVALUATION OF LARGE-SCALE INTERNATIONAL TRANSFER OF SPENT FUEL; AND (6) THE COMMITMENT TO, AND FABRICATION OF, THE LARGE FLEETS OF SHIPPING SYSTEMS THAT WILL SOON BE REQUIRED TO TRANSPORT THE GROWING QUANTITIES OF SPENT FUEL, NUCLEAR WASTE, AND OTHER RADIOACTIVE MATERIALS.
- 21-2-1-158 INTERNATIONAL COOPERATION IN NUCLEAR SAFETY AND LICENSING IN THE FRAMEWORK OF THE OECD NUCLEAR ENERGY AGENCY
HAYASHI, M. + OLIVER, D. + OLIVIER, J. P.
STADIE, K. B. + STEPHENS, M.
ORGANISATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT, PARIS, FRANCE
THIS ARTICLE DESCRIBES THE INTERNATIONAL COOPERATIVE PROGRAM IN NUCLEAR SAFETY AND LICENSING THAT IS CARRIED OUT IN THE FRAMEWORK OF THE NUCLEAR ENERGY AGENCY (NEA) OF THE ORGANIZATION FOR ECONOMIC COOPERATION AND DEVELOPMENT (OECD) AND IS DIRECTED BY THE NEA COMMITTEE ON THE SAFETY OF NUCLEAR INSTALLATIONS (CSNI). ITS PRINCIPAL OBJECTIVES ARE (1) TO INCREASE THE FUND OF KNOWLEDGE IN KEY AREAS OF SAFETY RESEARCH THROUGH INTERNATIONAL COOPERATION AND HENCE BROADEN THE TECHNICAL DATA BASE AVAILABLE TO REGULATORY AUTHORITIES AND (2) TO BRING ABOUT AN INTERNATIONAL CONSENSUS ON IMPORTANT SAFETY ISSUES. THE CSNI ALSO PROVIDES A FORUM FOR THE EXCHANGE OF INFORMATION AND EXPERIENCE BETWEEN LICENSING AUTHORITIES IN THE OECD COUNTRIES. THE PROGRAM IS MADE UP OF GENERAL EXCHANGES OF INFORMATION AND OPERATIONAL COOPERATION. THE ARTICLE GIVES EXAMPLES OF BOTH ASPECTS OF THE PROGRAM, DESCRIBING THE OBJECTIVES AND THE DIFFERENT WORKING METHODS USED. IT GOES ON TO POINT OUT THE NEED FOR ENHANCED INTERNATIONAL COOPERATION IN SAFETY RESEARCH AND OUTLINES THE DIRECTIONS THIS SHOULD TAKE.
- 21-2-2-171 DEVELOPMENT AND ASSESSMENT OF THE TRANSIENT REACTOR ANALYSIS CODE (TRAC)
VIGIL, J. C. + PRYOR, R. J.
LOS ALAMOS SCIENTIFIC LABORATORY, LOS ALAMOS, NEW MEXICO
THE TRANSIENT REACTOR ANALYSIS CODE (TRAC) IS AN ADVANCED BEST-ESTIMATE COMPUTER PROGRAM FOR THE SAFETY ANALYSIS OF LIGHT-WATER REACTORS. THE TRAC-PIA PROVIDES THIS ANALYSIS CAPABILITY FOR PRESSURIZED-WATER REACTORS. THE ADVANCED FEATURES OF TRAC-PIA INCLUDE NONHOMOGENEOUS, NONEQUILIBRIUM, AND MULTIDIMENSIONAL HYDRODYNAMICS WITH FLOW-REGIME-DEPENDENT CONSTITUTIVE RELATIONS; QUENCH-FRONT TRACKING CAPABILITY FOR BOTH BOTTOM FLOOD AND FALLING FILMS; CONSISTENT TREATMENT OF ENTIRE ACCIDENT SEQUENCES INCLUDING THE GENERATION OF INITIAL STEADY-STATE CONDITIONS; AND MODULAR DESIGN THAT ALLOWS REPRESENTATION OF A WIDE VARIETY OF EXPERIMENTAL CONFIGURATIONS, RANGING FROM SINGLE COMPONENTS TO MULTILoop SYSTEMS. THE TRAC-PIA HAS BEEN TESTED AGAINST AN INITIAL SET OF SEPARATE- AND INTEGRAL-EFFECTS EXPERIMENTS. FURTHER ASSESSMENT OF THE CODE THROUGH PRETEST AND POSTTEST PREDICTIONS OF OTHER EXPERIMENTS IS IN PROGRESS. THE OVERALL RESULTS OF THESE TESTING AND ASSESSMENT ACTIVITIES ARE ENCOURAGING.
- 21-2-3-184 COMMON MODE/Common Cause FAILURE - A REVIEW
HAGEN, E. W.
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENN.
COMMON-MODE/Common-Cause (CM/CC) FAILURE AND ITS PREVENTION HAS BEEN A SERIOUS CONCERN IN THE NUCLEAR SAFETY COMMUNITY DURING THE PAST FEW YEARS. SINCE REDUNDANCY WAS FIRST USED IN AN ATTEMPT TO ACHIEVE HIGH RELIABILITY IN SYSTEMS, THE CM/CC FAILURE PHENOMENON HAS BEEN INHERENT IN SYSTEM DESIGNS. THE CONCERN IS THAT HIGH-RELIABILITY SYSTEMS ARE SUBJECT TO COMPROMISE BY HUMAN ERROR AND ENVIRONMENTAL FACTORS. POTENTIAL CM/CC FAILURES ARE THE RESULT OF ADDING COMPLEXITY TO SYSTEM DESIGNS. THEY ARE THE PRODUCT OF A SUPERSAFE PHILOSOPHY. THIS ARTICLE REVIEWS THE CM/CC FAILURE PHENOMENON. CLASSES OF CM/CC FAILURES ARE COMPILED, AND THE DEFENSES AGAINST SUCH FAILURES AND THEIR WEAKNESSES ARE SURVEYED. SOME REGULATORY

CONSIDERATIONS, OPERATING EXPERIENCES, AND RELIABILITY ANALYSIS
METHODOLOGY ARE TOUCHED UPON.

- 21-2-4-193 A REVIEW OF SOLID RADIOACTIVE WASTE PRACTICES IN LIGHT WATER COOLED NUCLEAR REACTOR POWER PLANTS
FIBBEY, A. H. + GODBEE, H. W. + COMPERE, E. L.
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENN.
THIS ARTICLE EXAMINES RECENT TRENDS IN ROUTINE SOLID RADWASTE GENERATION AT LIGHT-WATER-COOLED NUCLEAR REACTOR POWER PLANTS. THE SOURCES OF THESE RADWASTES, ESPECIALLY THOSE ARISING FROM PROCESS STREAM CLEANUP, AND THE METHODS USED TO TREAT THEM BEFORE SHIPMENT OFF SITE FOR BURIAL ARE DESCRIBED. THROUGH 1977 RESPECTIVE CUMULATIVE PRESSORIZED-WATER REACTOR (PWR) AND BOILING-WATER REACTOR (BWR) THERMAL OUTPUTS WERE 1.8×10^{19} AND 1.2×10^{19} MWH(T). CORRESPONDING CUMULATIVE SOLID RADWASTE VOLUMES SHIPPED WERE ABOUT 5.6×10^{4} AND 7.7×10^{4} M(3) OR $3.1 \times 10^{(-5)}$ AND $6.4 \times 10^{(-5)}$ M(3)/MWH(T). THE CONTAINED RADIOACTIVITY AVERAGED 1.0 AND 1.6 CI/M(3) OR $3.2 \times 10^{(-5)}$ AND $1.0 \times 10^{(-4)}$ CI/MWH(T) FOR PWRs AND BWRs, RESPECTIVELY. THE PWRs MADE LARGER, BUT ABOUT FOUR TIMES FEWER, SHIPMENTS THAN DID THE BWRs.
- 21-2-4-205 EARTHQUAKE VIBRATORY GROUND MOTION INTENSITY ATTENUATION
YOUNG, G. A.
AGBARIAN ASSOCIATES, EL SEGUNDO, CALIF.
THIS ARTICLE REVIEWS EARTHQUAKE VIBRATORY GROUND-MOTION INTENSITY-DISTANCE-ATTENUATION RELATIONSHIPS AND DEPICTS THE EVOLUTION AND LIMITATIONS OF CURRENTLY USED PROCEDURES FOR PREDICTING THE RATE OF ATTENUATION OF INTENSITY OF VIBRATORY GROUND MOTION WITH RESPECT TO DISTANCE FROM THE EARTHQUAKE SOURCE. TWO GENERAL PROCEDURES ARE CONSIDERED: ONE PROCEDURE RELATES PEAK HORIZONTAL GROUND ACCELERATION, EARTHQUAKE MAGNITUDE, AND DISTANCE; THE OTHER RELATES EPICENTRAL MODIFIED MERCALLI INTENSITY (MMI), DISTANCE, AND ATTENUATED MMI. A CORRELATION RELATIONSHIP BETWEEN MMI AND PEAK HORIZONTAL GROUND ACCELERATIONS IS USED WITH THE LATTER. USING THE PROCEDURES, CONCLUSIONS ARE DRAWN REGARDING THE RELATIVE VALIDITY OF VARIOUS GROUND-MOTION ATTENUATION RELATIONSHIPS IN VARIOUS SOILS.
- 21-2-5-217 QUALITY ASSURANCE APPLIED TO ENVIRONMENTAL RADIOLOGICAL SURVEILLANCE
OAKES, T. W. + SHANK, K. E. + ELDRIDGE, J. S.
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENN.
THE FOLLOWING ELEMENTS OF A QUALITY-ASSURANCE (QA) PROGRAM AS APPLIED TO ENVIRONMENTAL RADIOLOGICAL SURVEILLANCE ACTIVITIES ARE PRESENTED: (1) A PHILOSOPHICAL AND CONCEPTUAL FRAMEWORK FOR QA, WITH A DETAILED ASSESSMENT OF THE SOURCES OF UNCERTAINTY IN A MONITORING PROGRAM; (2) THE REQUIREMENTS FOR THE FORMULATION OF GENERAL AND TECHNICAL PROCEDURES OF QUALITY CONTROL; (3) THE ENVIRONMENTAL QA ACTIVITIES IMPLEMENTED AT OAK RIDGE NATIONAL LABORATORY (ORNL); (4) DETAILS ON RECORD KEEPING, DATA REDUCTION AND COMPILATION, AUDITING, ANALYTICAL PROCEDURES, AND DATA INTERPRETATION ALONG WITH PRACTICAL OBSERVATIONS FROM THE ORNL PROGRAM; AND (5) THE ROLE MANAGEMENT MUST PLAY TO ENSURE A SUCCESSFUL PROGRAM. THE QA PRINCIPLES DEVELOPED HERE MAY ALSO BE APPLIED TO NONRADIOLOGICAL SURVEILLANCE PROGRAMS.
- 21-2-6-227 THIRD SYMPOSIUM ON TRAINING OF NUCLEAR FACILITY PERSONNEL
MANGIN, A. M.
INPO, ATLANTA, GEORGIA
THIS ARTICLE REVIEWS THE THIRD SYMPOSIUM ON TRAINING OF NUCLEAR FACILITY PERSONNEL HELD APR. 29-MAY 2, 1979, IN GATLINBURG, TENN. THE SYMPOSIUM, SPONSORED BY OAK RIDGE NATIONAL LABORATORY AND THE AMERICAN NUCLEAR SOCIETY, ATTRACTED 250 PEOPLE REPRESENTING NUCLEAR UTILITIES, REACTOR AND EQUIPMENT VENDORS, UNIVERSITIES, NUCLEAR FUEL CYCLE FACILITIES, ARCHITECT-ENGINEERS AND CONSTRUCTORS, TRAINING CONSULTANTS, AND GOVERNMENT LABORATORIES AND REGULATORS. PAPERS WERE PRESENTED ON A WIDE VARIETY OF PERSONNEL TRAINING TOPICS INCLUDING CURRENT ISSUES IN TRAINING PHILOSOPHIES AND APPROACHES, THE STATUS OF TRAINING PROGRAMS, AND RECENT DEVELOPMENTS IN EDUCATIONAL TECHNOLOGY AND TRAINING HARDWARE. THE PAPERS PRESENTED REFLECTED THE GROWING INTEREST IN THE TRAINING OF SUPPORT PERSONNEL, THE USE OF TRAINING MEDIA IN ADDITION TO CLASSROOM LECTURES, AND THE USE OF SIMULATORS.
- 21-2-6-234 REPORT OF THE PRESIDENT'S COMMISSION ON THE ACCIDENT AT THREE MILE ISLAND
NUCLEAR SAFETY STAFF
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENN.
EDITOR'S NOTE: THE REPORT OF THE PRESIDENT'S COMMISSION ON THE ACCIDENT AT THREE MILE ISLAND, WHICH WAS RELEASED IN THE LATTER PART OF OCTOBER 1979, IS SUBTITLED THE NEED FOR CHANGE: THE LEGACY OF TMI. THE TABLE OF CONTENTS OF THE REPORT IS AS FOLLOWS: PREFACE, OVERVIEW, COMMISSION FINDINGS, COMMISSION RECOMMENDATIONS, ACCOUNT OF THE ACCIDENT, APPENDICES: EXECUTIVE ORDER, COMMISSION OPERATIONS AND METHODOLOGY, COMMISSIONERS' BIOGRAPHIES, STAFF LIST, AND GLOSSARY. THE PREFACE AND THE COMMISSION RECOMMENDATIONS ARE REPRINTED HERE IN THEIR ENTIRETY.

- 21-3-1-289 SEVENTH NRC WATER REACTOR SAFETY RESEARCH INFORMATION MEETING
COTTRELL, W. B.
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TN.
THIS ARTICLE SUMMARIZES THE SEVENTH WATER-REACTOR SAFETY RESEARCH INFORMATION MEETING, SPONSORED BY THE NUCLEAR REGULATORY COMMISSION DIVISION OF REACTOR SAFETY RESEARCH AND HELD AT THE NATIONAL BUREAU OF STANDARDS, GAITHERSBURG, MD., NOV. 5-9, 1979. PRESENTED AT THIS MEETING WERE 163 PAPERS IN THE FOLLOWING EIGHT RESEARCH PROGRAM AREAS: (1) LOSS-OF-FLUID TEST, (2) SEPARATE-EFFECTS TESTS AND ANALYSIS, (3) ANALYSIS DEVELOPMENT, (4) METALLURGY AND MATERIALS, (5) FUEL BEHAVIOR RESEARCH, (6) REACTOR OPERATIONAL SAFETY, (7) SAFEGUARDS, FUEL CYCLE, AND ENVIRONMENTAL RESEARCH, AND (8) ELECTRIC POWER RESEARCH INSTITUTE (EPRI) REACTOR SAFETY RESEARCH, THE LATTER TWO RESEARCH PROGRAMS BEING OUTSIDE THE DIVISION OF REACTOR SAFETY RESEARCH. IN ADDITION, THE MEETING BEGAN WITH A PLENARY SESSION ENCOMPASSING THE LATEST THREE MILE ISLAND 2 FINDINGS AND INCLUDED NINE WORKSHOPS ON SELECTED TOPICS AND 22 INVITED FOREIGN PAPERS ON RELATED WORK.
- 21-3-2-319 RECENT DEVELOPMENTS IN THE UNDERSTANDING OF ENERGETIC MOLTEN FUEL-COOLANT INTERACTIONS
CRONENBERG, A. W.
ENGINEERING SCIENCE AND ANALYSIS, IDAHO FALLS, IDAHO
SOME OF THE MORE RECENT THEORIES RELATING TO ENERGETIC MOLTEN FUEL-COOLANT INTERACTIONS FOR NUCLEAR REACTOR SAFETY ASSESSMENT ARE CRITICALLY REVIEWED AND ASSESSED IN THIS ARTICLE. SPECIFICALLY, THE SPONTANEOUS NUCLEATION-PRESSURE SUPPRESSION AND THERMAL DETONATION CONCEPTS ARE REVIEWED. IN ADDITION, A DISCUSSION OF THE IMPORTANCE OF RAPID, FINE-SCALE FRAGMENTATION OF HOT MOLTEN FUEL UPON CONTACT WITH LIQUID COOLANT AND ENERGY CONSIDERATIONS FOR INTERMIXING OF SUCH FRAGMENTED FUEL AND COOLANT ARE PRESENTED.
- 21-3-2-337 SEMISCALE PROGRAM SUMMARY - A REVIEW OF MOD-1 RESULTS
HANSON, D. J. + LANSON, T. K.
EG AND G IDAHO, INC., IDAHO FALLS, IDAHO
THE OBJECTIVES OF THE SEMISCALE PROGRAM ARE BRIEFLY DEFINED, AND ACCOMPLISHMENTS DURING THE MOD-1 PORTION OF THE PROGRAM ARE SUMMARIZED. SIGNIFICANT RESULTS FROM SEVERAL SERIES OF EXPERIMENTS ARE PRESENTED INCLUDING: (1) RESULTS FROM TESTS DESIGNED TO AID IN PLANNING AND EVALUATING FUTURE TESTS (LOFT), (2) INVESTIGATIONS OF BLOWDOWN AND OF REFLOOD THERMAL-HYDRAULICS, (3) INVESTIGATION OF INTEGRAL BLOWDOWN-REFLOOD BEHAVIOR, (4) DETERMINATION OF THE POTENTIAL BENEFITS OF ALTERNATE EMERGENCY COOLING CONCEPTS, AND (5) EVALUATION OF THE INFLUENCE OF STEAM-GENERATOR TUBE RUPTURES ON INTEGRAL BLOWDOWN-REFLOOD RESPONSE.
- 21-3-3-351 HUMAN FACTORS ENGINEERING ENHANCEMENT OF NUCLEAR POWER PLANT CONTROL ROOMS
SEMINARA, J. L. + PACK, R. W. + SEIDENSTEIN, S.
ECKERT, S. K.
LOCKHEED MISSILES AND SPACE COMPANY, INC., SUNNYVALE, CALIF. /
ELECTRIC POWER RESEARCH INSTITUTE, PALO ALTO, CALIF.
HUMAN FACTORS ENGINEERING IS AN INTERDISCIPLINARY SPECIALTY CONCERNED WITH INFLUENCING THE DESIGN OF EQUIPMENT, SYSTEMS, FACILITIES, AND OPERATIONAL ENVIRONMENTS TO PROMOTE SAFE, EFFICIENT, AND RELIABLE OPERATOR PERFORMANCE. A HUMAN FACTORS REVIEW OF FIVE REPRESENTATIVE NUCLEAR POWER-PLANT CONTROL ROOMS REPORTED IN THE NOVEMBER-DECEMBER 1977 ISSUE OF NUCLEAR SAFETY REVEALED THAT OPERATIONAL CONTROL ROOMS DEVIATE IN MANY SIGNIFICANT WAYS FROM HUMAN FACTORS PRINCIPLES OF DESIGN. THE PRESENT ARTICLE DEALS WITH METHODS FOR UPGRADING OPERATIONAL CONTROL ROOMS TO IMPROVE THE MAN-MACHINE INTERFACE. TWO LEVELS OF ENHANCEMENT ARE CONSIDERED: (1) A VARIETY OF SURFACE CHANGES THAT COULD BE EFFECTED WITHOUT INTERRUPTING POWER GENERATION AND (2) MODIFICATIONS THAT ARE POSSIBLE DURING SCHEDULED EXTENDED OUTAGES. BOTH LEVELS OF ENHANCEMENT WOULD RESULT IN SUBSTANTIAL IMPROVEMENTS, BUT IT IS IMPORTANT TO STATE THAT NEITHER APPROACH WILL FULLY OPTIMIZE THE CONTROL BOARDS FROM THE HUMAN FACTORS STANDPOINT. IDEALLY, HUMAN FACTORS METHODS SHOULD BE APPLIED THROUGHOUT THE DESIGN PROCESS - FROM CONCEPT DEVELOPMENT TO SYSTEM IMPLEMENTATION - RATHER THAN ON A BACKFIT BASIS.
- 21-3-4-364 DECOMMISSIONING OF NUCLEAR FACILITIES
MOORE, E. B., JR.
PACIFIC NORTHWEST LABORATORY, RICHLAND, WA
EDITOR'S NOTE: THE FOLLOWING ARTICLE IS EXCERPTED FROM E. B. MOORE, JR., FACILITATION OF DECOMMISSIONING LIGHT WATER REACTORS, NRC REPORT NUREG/CR-0569, PACIFIC NORTHWEST LABORATORIES, DECEMBER 1979. AN EARLIER ARTICLE IN VOL. 20, NO. 1, OF NUCLEAR SAFETY SUMMARIZED THE RESULTS OF AN ATOMIC INDUSTRIAL FORUM STUDY ON THIS SUBJECT.
- 21-3-5-367 THERMAL ECOLOGY RESEARCH AT THE SAVANNAH RIVER PLANT - A REVIEW
GIBBONS, J. W. + SHARITZ, R. E.
BRISBIN, I. L., JR.
SAVANNAH RIVER ECOLOGY LABORATORY, AIKEN, S.C.
THE U. S. DEPARTMENT OF ENERGY'S SAVANNAH RIVER PLANT (SRP) NEAR AIKEN, S.C., PROVIDES A UNIQUE SITUATION FOR STUDYING THE ENVIRONMENTAL EFFECTS AND PHENOMENA ASSOCIATED WITH HIGH-TEMPERATURE EFFLUENTS FROM NUCLEAR PRODUCTION REACTORS. A

PLETHORA OF THERMAL SITUATIONS CAN BE FOUND AT THE SITE, INCLUDING RESERVOIRS AND STREAMS WITH SURFACE TEMPERATURES ABOVE 60C, MODERATELY WARMED SWAMPS AND LAKES, AQUATIC AREAS THAT HAVE RECEIVED HOT WATER CONTINUALLY FOR 25 YR, AND MAJOR POST-THERMAL-RECOVERY AREAS OF DIFFERING AGES. THIS ARTICLE DISCUSSES NUMEROUS THERMAL STUDIES CONDUCTED AT THE SRP IN THE PAST DECADE BY ECOLOGISTS, ESPECIALLY THOSE ASSOCIATED WITH THE UNIVERSITY OF GEORGIA'S SAVANNAH RIVER ECOLOGY LABORATORY (SREL). THE RESEARCH ON THE FLOPA AND FAUNA OF THE REGION HAS REVEALED BOTH EXPECTED AND UNEXPECTED PROPERTIES OF THE BIOLOGICAL CHARACTERISTICS OF INDIVIDUALS, POPULATIONS, AND COMMUNITIES. THE STUDIES HAVE DEALT WITH A NUMBER OF SUBJECTS, INCLUDING METABOLISM, THERMAL TOLERANCE, GENETICS, DISPERSAL, SPECIES DIVERSITY, PRODUCTIVITY, GROWTH AND DEVELOPMENT, AND THE SYNERGISTIC EFFECTS OF TEMPERATURE AND OTHER FORMS OF ENVIRONMENTAL STRESS.

- 21-3-5-380 INVENTORY (1962-1978) AND PROJECTIONS (TO 2000) OF SHALLOW LAND BURIAL OF RADIOACTIVE WASTES AT COMMERCIAL SITES - AN UPDATE
HOLCOMB, W. F.
U. S. ENVIRONMENTAL PROTECTION AGENCY, WASHINGTON, D.C.
THE U. S. ENVIRONMENTAL PROTECTION AGENCY (EPA) HAS WORKED WITH THE SIX STATES HAVING COMMERCIAL SHALLOW LAND BURIAL FACILITIES FOR OTHER-THAN-HIGH-LEVEL RADIOACTIVE WASTES TO PROVIDE INVENTORIES OF THE TYPES AND QUANTITIES OF WASTES BURIED AT THESE SITES. COMPILATIONS AND INTERPRETATIONS OF THE INVENTORIES ARE PRESENTED IN TABLES AND FIGURES. THE EPA HAS PROPOSED AN EQUATION TO ESTIMATE THE VOLUME OF WASTE GENERATED FROM THE TOTAL FUEL CYCLE AS A FUNCTION OF INSTALLED GENERATING CAPACITY. NON-FUEL-CYCLE WASTES ARE ALSO ESTIMATED. THREE OF THE SIX COMMERCIAL BURIAL SITES HAVE CLOSED. BECAUSE OF THE RECENT PROJECTIONS OF POWER-GENERATING CAPACITY AND WASTE-GENERATION RATE AND THE PROPOSED BURIAL LIMITATIONS, THE PROJECTED CUMULATIVE VOLUME OF WASTE GENERATED INDICATES THAT THE BURIAL CAPACITY MAY BE INADEQUATE BY THE MID-1980S.
- 21-3-6-389 THE BOGOVIN REPORT ON THREE MILE ISLAND 2
EDITOR'S NOTE: THE LAST OF SEVERAL MAJOR INQUIRIES INTO THE MAR. 28, 1979, ACCIDENT AT UNIT 2 OF THE THREE MILE ISLAND NUCLEAR PLANT WAS THE SPECIAL INQUIRY SPONSORED BY THE NUCLEAR REGULATORY COMMISSION (NRC) BUT CONDUCTED BY THE LAW FIRM OF BOGOVIN, STERN AND HUGG, FROM WHICH THE REPORT DERIVES ITS NAME. THE REPORT, RELEASED IN LATE JANUARY 1980, IS ENTITLED VOLUME 1, THREE MILE ISLAND: A REPORT TO THE COMMISSIONERS AND TO THE PUBLIC. THERE IS NO REPORT NUMBER, BUT THE VOLUME IS AVAILABLE FROM NRC AND NTIS.
- 21-3-6-393 ACRS REVIEW OF NRC REGULATORY ACTIVITIES
EDITOR'S NOTE: A RECENT REPORT PREPARED BY THE ADVISORY COMMITTEE ON REACTOR SAFEGUARDS (ACRS) REVIEWS THE LICENSING PROCESS FROM THE ACRS PERSPECTIVE OF MANY YEARS OF OBSERVATION AND EXAMINATION. THE ACRS BELIEVES THAT CHANGES ARE URGENTLY NEEDED IN SOME AREAS AND THAT THE REPORT WILL BE HELPFUL TO THOSE EXAMINING THE REGULATORY PROCESS BY DISCUSSING HOW IT WORKS, WHERE IT IS WEAK, AND THE OPPORTUNITIES FOR IMPROVEMENT. THE REPORT, ENTITLED A REVIEW OF NRC REGULATORY PROCESSES AND FUNCTIONS (NUREG-0642, JANUARY 1980), IS AVAILABLE FROM NRC AND NTIS.
- 21-4-1-435 EPRI NUCLEAR SAFETY AND ANALYSIS RESEARCH PROGRAM
LORWENSTEIN, W. B. + ADAMANTIADES, A. G.
ELECTRIC POWER RESEARCH INSTITUTE, PALO ALTO, CALIF.
THE MOTIVATIONS, OBJECTIVES, STRUCTURE, AND CURRENT STATUS OF THE ELECTRIC POWER RESEARCH INSTITUTE (EPRI) NUCLEAR SAFETY AND ANALYSIS RESEARCH PROGRAM ARE PRESENTED. BY USING ESTABLISHED EXPERIMENTAL AND ANALYTICAL TECHNIQUES AND DEVELOPING NEW ONES, THE PROGRAM AIMS AT PROVIDING A BETTER UNDERSTANDING OF PHENOMENA AND BEHAVIOR IN NUCLEAR POWER PLANTS. THIS ENHANCED CAPABILITY FOR UNDERSTANDING AND PREDICTION LEADS NOT ONLY TO A QUANTIFICATION OF THE MARGIN OF SAFETY BUT ALSO TO WAYS OF IMPROVING THE AVAILABILITY, PRODUCTIVITY, AND HENCE THE ECONOMICS OF NUCLEAR PLANTS. THE ACTIVITIES OF THE PROGRAM, WHICH SPAN MANY SCIENTIFIC DISCIPLINES, ARE INTEGRATED INTO PROGRAM AND SUBPROGRAM AREAS: LOSS-OF-COOLANT ACCIDENTS AND EMERGENCY CORE-COOLING SYSTEMS; LIGHT-WATER-REACTOR (LWR) SYSTEM BEHAVIOR; STRUCTURAL INTEGRITY; PROBABILISTIC ANALYSIS AND APPLICATION; REACTOR PERFORMANCE; STEAM GENERATOR TECHNOLOGY; LIQUID-METAL FAST BREEDER REACTOR; AND ADVANCED SYSTEMS. MAJOR RECENT ACCOMPLISHMENTS AND CURRENT EMPHASIS ARE PRESENTED.
- 21-4-1-451 CONTROL OF SPENDING ON NUCLEAR SAFETY
SIDDALL, E.
ATOMIC ENERGY OF CANADA LIMITED, ONTARIO, CANADA
NUCLEAR SAFETY IS REVIEWED IN RELATION TO SAFETY IN THE COMMUNITY AS A WHOLE. A METHOD IS PROPOSED WHICH POINTS TO AN OPTIMUM EXPENDITURE ON NUCLEAR SAFETY MEASURES AS OPPOSED TO THE PRESENT OPEN-ENDED SITUATION. AT THIS OPTIMUM POINT THE COST OF SAVING EXTRA LIVES IN THE NUCLEAR FIELD IS EQUAL TO THE COST OF SAVING EXTRA LIVES IN OTHER ACTIVITIES IN THE COMMUNITY. THE METHOD REQUIRES THAT THE PRESENT LEVEL OF SAFETY BE ESTIMATED, AND THIS IS DONE BY RELATING THE WORK OF

RASMUSSEN, FARMER AND BEATTIE, AND THE RECENT GERMAN STUDY TO THE ACTUAL RECORD OF ACCIDENTS. THE ANALYSIS INDICATES THAT PRESENT EXPENDITURES ON REACTOR SAFETY ARE FAR IN EXCESS OF THE OPTIMUM. AN EVEN MORE STRIKING CONCLUSION IS REACHED WHEN THE POSSIBLE EFFECT OF THE WEALTH GENERATED BY THE NUCLEAR INDUSTRY ON THE GENERAL SAFETY OF THE COMMUNITY IS CONSIDERED. THE APPLICATION OF THE THEME TO THE PICKERING NUCLEAR GENERATING STATION IS DEVELOPED.

- 21-4-2-461 RESULTS OF THE FIRST NUCLEAR POWERED LOSS OF COOLANT EXPERIMENTS IN THE LOFT FACILITY
LEACH, L. P. + MCPHERSON, G. D.
EG AND G IDAHO, INC., IDAHO FALLS, IDAHO / U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, D.C.
RESULTS FROM THREE LOSS-OF-COOLANT EXPERIMENTS IN THE LOSS-OF-FLUID TEST FACILITY WITH THE NUCLEAR CORE AT SELECTED POWER LEVELS ARE DESCRIBED. EMPHASIS IS PLACED ON THE THERMAL-HYDRAULIC BEHAVIOR WHICH LED TO AN UNEXPECTED REWETTING, OR EARLY COOLING, OF THE FUEL RODS PRIOR TO THE ACTION OF THE EMERGENCY CORE-COOLING SYSTEM. PHENOMENA IMPORTANT TO THE OBSERVED BEHAVIOR ARE DESCRIBED.
- 21-4-3-469 ANTICIPATED TRANSIENTS WITHOUT SCRAM
LELLOUCHE, G. S.
ELECTRIC POWER RESEARCH INSTITUTE, PALO ALTO, CALIF.
THIS ARTICLE DISCUSSES IN VARIOUS DEGREES OF DEPTH THE PUBLICATIONS WASH-1270 (REF. 1), WASH-1400 (REF. 2), AND NUREG-0460 (REF. 3), AND HAS AS ITS PURPOSE A DESCRIPTION OF THE TECHNICAL WORK DONE BY ELECTRIC POWER RESEARCH INSTITUTE (EPRI) PERSONNEL AND ITS CONTRACTORS ON THE SUBJECT OF ANTICIPATED TRANSIENTS WITHOUT SCRAM (ATWS). IT DEMONSTRATES THE CLOSE RELATION BETWEEN THE PROBABILITY OF SCRAM FAILURE DERIVED FROM HISTORICAL SCRAM DATA AND THAT DERIVED FROM THE USE OF COMPONENT DATA IN A MODEL OF A SYSTEM (THE SO-CALLED SYNTHESIS METHOD), SUCH AS WAS DONE IN WASH-1400. THE INHERENT CONSERVATISM OF THESE MODELS IS DEMONSTRATED BY SHOWING THAT THEY PREDICT SIGNIFICANTLY MORE EVENTS THAN HAVE IN FACT OCCURRED AND THAT SUCH MODELS STILL PREDICT SCRAM FAILURE PROBABILITIES LOW ENOUGH TO MAKE ATWS AN INSIGNIFICANT CONTRIBUTOR TO ACCIDENT RISK.
- 21-4-3-480 THE HUMAN - KEY FACTOR IN NUCLEAR SAFETY
HAGEN, E. W.
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENN.
ON DEC. 2-7, 1979, THE INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS, INC. (IEEE), THE NUCLEAR REGULATORY COMMISSION, AND THE BROOKHAVEN NATIONAL LABORATORY SPONSORED AN INTERDISCIPLINARY, INTERNATIONAL WORKSHOP TITLED "1979 IEEE STANDARDS WORKSHOP ON HUMAN FACTORS AND NUCLEAR SAFETY" AT MYRTLE BEACH, S.C. THE OBJECTIVE OF THE WORKSHOP WAS TO ESTABLISH THE BASIS FOR DEVELOPING SOUND TECHNICAL STANDARDS IN THIS AREA. AS SUCH, THE WORKSHOP TREATED VARIOUS APPROACHES TO HUMAN ACTIONS EVALUATION, PERFORMED A CONSTRUCTIVE CRITIQUE OF THE STATE OF THE ART OF HUMAN ERROR ANALYSIS, AND CONSIDERED TECHNIQUES FOR ESTIMATING HUMAN FAILURE RATES. THE IMMEDIATE BENEFIT FROM THIS FIRST-OF-A-KIND WORKSHOP WILL BE THE PUBLISHED PROCEEDINGS, A MESSAGE TO THE INDUSTRY.
- 21-4-5-486 A REVIEW OF PARAMETERS DESCRIBING TERRESTRIAL FOOD CHAIN TRANSPORT OF LEAD-210 AND RADIUM-226
MCDOWELL-BOYER, L. M. + WATSON, A. P.
TRAVIS, C. C.
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENN.
BECAUSE OF THE TECHNOLOGICAL ENHANCEMENT AND ENVIRONMENTAL PERSISTENCE OF NATURALLY OCCURRING (210)PB AND (226)RA, FOOD-CHAIN TRANSPORT OF THESE NUCLIDES IS IMPORTANT TO THE EVALUATION OF MAN'S POTENTIAL INTERNAL RADIATION EXPOSURE. PARAMETERS DESCRIBING THIS TRANSPORT ARE DETERMINED IN THIS ARTICLE FOR USE IN CURRENTLY AVAILABLE EQUILIBRIUM MODELS THROUGH WHICH POTENTIAL DIETARY EXPOSURES MAY BE EVALUATED. ELEMENT-SPECIFIC LITERATURE DESCRIBING SOIL-PLANT AND PLANT-ANIMAL RELATIONSHIPS IS REVIEWED AND INTERPRETED IN TERMS OF DERIVING CONCENTRATION FACTORS AND TRANSFER COEFFICIENTS FOR (210)PB AND (226)RA. ALSO PROVIDED ARE UNWEIGHTED MEANS AND ASSOCIATED RANGES FOR THESE PARAMETERS, WHICH REPRESENT AVERAGES OF DATA COLLECTED OVER A VARIETY OF ENVIRONMENTAL CONDITIONS, SOIL TYPES, AND CHEMICAL FORMS OF LEAD AND RADIUM. A COMPARISON OF MEAN VALUES DETERMINED IN THIS REVIEW WITH VALUES FOR THE SAME PARAMETERS THAT ARE RECOMMENDED IN THE NUCLEAR REGULATORY COMMISSION'S MARCH 1976 DRAFT OF REGULATORY GUIDE 1.109 INDICATES THAT THE LATTER ESTIMATES FOR (210)PB AND (226)RA MAY NOT BE APPROPRIATE FOR GENERIC EXPOSURE ASSESSMENTS.
THE PREDICTIVE CAPABILITIES OF THE AVERAGE VALUES ARE TESTED AGAINST MEASURED DIETARY CONCENTRATIONS OF (210)PB AND (226)RA. PREDICTED VALUES DIFFERED BY NO MORE THAN AN ORDER OF MAGNITUDE FROM OBSERVED VALUES. REASONS FOR DISCREPANCIES BETWEEN PREDICTED AND MEASURED VALUES ARE DISCUSSED. ALTHOUGH SITE-SPECIFIC DATA ARE DESIRABLE IN ASSESSING FOOD-CHAIN TRANSPORT, THESE AVERAGE VALUES MAY BE USEFUL IN PRELIMINARY ASSESSMENTS WHEN SITE-SPECIFIC INFORMATION IS NOT AVAILABLE.

- 21-4-5-495 CHROMATED COOLING TOWER DRIFT AND THE TERRESTRIAL ENVIRONMENT - A REVIEW
TAYLOR, P. G.
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENN.
NUMEROUS INVESTIGATIONS HAVE BEEN CONDUCTED AT DEPARTMENT OF ENERGY (DOE) FACILITIES IN PADUCAH, KY., AND OAK RIDGE, TENN., TO DETERMINE THE ENVIRONMENTAL EFFECTS OF COOLING TOWER DRIFT AND THE EFFECTS OF A SPECIFIC DRIFT TOXICANT (HEXAVALENT CHROMIUM) ON BIOLOGICAL SYSTEMS. THE RESULTS OF THESE INVESTIGATIONS PROVIDED THE FIRST QUANTITATIVE EVIDENCE OF THE TRANSPORT OF CHROMIUM IN COOLING TOWER DRIFT TO VEGETATION IN THE SURROUNDING AREA, ILLUSTRATED THAT MOST OF THE DRIFT (GREATER THAN 75 PERCENT) FELL WITHIN DOE PROPERTIES (1 KM DOWNWIND), AND PROVIDED EVIDENCE FOR POTENTIAL ADVERSE BIOLOGICAL EFFECTS IN PLANTS. ADDITIONAL STUDIES INVESTIGATED THE TRANSFER OF DRIFT CONSTITUENTS ALONG FOOD CHAINS AND THE HORIZONTAL AND VERTICAL MOVEMENT OF DRIFT CHEMICALS IN COILS BY MOISTURE FLOW. EXPERIMENTS SIMULATING DRIFT PROVIDED ESTIMATES OF FRACTIONAL INTERCEPTION AND RETENTION TIMES OF DRIFT ON PLANTS WITH DIVERSE FOLIAGE (GRASSES, PINE, BROADLEAF PLANTS). THIS REVIEW PROVIDES CONDENSED SUMMARIES OF SEVERAL ECOLOGICAL STUDIES; ALTHOUGH THE STUDIES ARE SITE SPECIFIC, THE RESULTS HAVE GENERIC APPLICATION IN MONITORING DESIGN SAMPLE COLLECTION, AND ASSESSMENT OF DRIFT EFFECTS AT OTHER SITES.
- 21-5-1-553 NUCLEAR SAFETY ACTIVITIES OF THE CEC
VINCK, W. + GABOLDE, J.
COMMISSION OF THE EUROPEAN COMMUNITIES, BELGIUM
THE COMMISSION OF THE EUROPEAN COMMUNITIES (CEC) HAS ENGAGED IN VARIOUS ACTIVITIES IN THE AREAS OF NUCLEAR SAFETY AND HEALTH PROTECTION IN ORDER TO PROMOTE AND COORDINATE RESEARCH AND TO ENHANCE HARMONIZATION OF REGULATIONS AND TECHNOLOGICAL SAFETY PRACTICES, RULES, AND STANDARDS IN THE MEMBER STATES. A BROAD SURVEY OF THESE ACTIVITIES, MAINLY UNDERTAKEN WITHIN THE FRAMEWORK OF THE CEC JOINT RESEARCH CENTER AND OF SPECIALIZED WORKING GROUPS, IS GIVEN IN THIS ARTICLE.
- 21-5-1-562 RADIATION ACCIDENTS - A CONFERENCE REVIEW
SAGAN, L. A. + FRY, S. A.
ELECTRIC POWER RESEARCH INSTITUTE, PALO ALTO, CALIF. / OAK RIDGE ASSOCIATED UNIVERSITIES, OAK RIDGE, TENN.
SINCE 1940, 98 SEPARATE ACCIDENTS IN WHICH PERSONS HAVE BEEN INJURED BY ACCIDENTAL EXPOSURE TO IONIZING RADIATION HAVE BEEN RECORDED WORLDWIDE. AMONG THESE WERE 14 CRITICALITY ACCIDENTS WITH 5 FATALITIES, NONE OF WHICH OCCURRED AFTER 1965. SINCE 1965, THE MAJORITY OF ACCIDENTS HAVE BEEN CAUSED BY EXPOSURE TO SUCH RADIATION DEVICES AS MACHINES OR SOURCES, SOMETIMES PRODUCING LOCALIZED BURNS WITH NO FATALITIES (48 ACCIDENTS), BUT SOMETIMES PRODUCING TOTAL-BODY IRRADIATION RESULTING IN 9 FATALITIES (20 ACCIDENTS). THIS EXPERIENCE, INCLUDING DETAILS OF MEDICAL MANAGEMENT, WAS REVIEWED AT A CONFERENCE CONVENED BY THE RADIATION EMERGENCY ASSISTANCE CENTER/TRAINING SITE, A UNIT OF THE MEDICAL AND HEALTH SCIENCES DIVISION OPERATED FOR THE U. S. DEPARTMENT OF ENERGY BY OAK RIDGE ASSOCIATED UNIVERSITIES, TO ADDRESS THE TOPIC, "THE MEDICAL BASIS FOR RADIATION ACCIDENT PREPAREDNESS." THE CONFERENCE, WHICH WAS HELD ON OCT. 18-20, 1979, IN OAK RIDGE, TENN. IS REVIEWED IN THIS ARTICLE.
- 21-5-2-572 SOME ISSUES IN THE SEISMIC DESIGN OF NUCLEAR POWER PLANT FACILITIES
HADJIAN, A. H. + IWAN, W. D.
BECHTEL POWER CORPORATION, NORWALK, CALIF. / CALIFORNIA INSTITUTE OF TECHNOLOGY, PASADENA, CALIF.
THIS PAPER SUMMARIZES THE MAJOR ISSUES DISCUSSED BY AN INTERNATIONAL PANEL OF EXPERTS DURING THE POST-SMIRT (STRUCTURAL MECHANICS IN REACTOR TECHNOLOGY) SEMINAR ON EXTREME LOAD DESIGN OF NUCLEAR POWER-PLANT FACILITIES, WHICH WAS HELD IN BERLIN, AUG. 20-21, 1979. THE EMPHASIS OF THE DELIBERATIONS WAS ON THE STATE OF THE ART OF SEISMIC-RESPONSE CALCULATIONS TO PREDICT THE EXPECTED PERFORMANCE OF STRUCTURES AND EQUIPMENT DURING EARTHQUAKES. FOUR SEPARATE PANELS DISCUSSED ISSUES ON (1) SOIL-STRUCTURE INTERACTION AND STRUCTURAL RESPONSE, (2) MODELING, MATERIALS, AND BOUNDARY CONDITIONS, (3) DAMPING IN STRUCTURES AND EQUIPMENT, AND (4) FRAGILITY LEVELS OF EQUIPMENT. THE INTERNATIONAL CHARACTER OF THE SEMINAR WAS PARTICULARLY HELPFUL IN THE CROSS-POLLINATION OF IDEAS REGARDING THE ISSUES AND THE STEPS REQUIRED TO ENHANCE THE CAUSE OF SAFETY OF NUCLEAR PLANTS.
- 21-5-2-582 ASSESSMENT OF LIGHT WATER REACTOR FUEL DAMAGE DURING A REACTIVITY INITIATED ACCIDENT
MACDONALD, P. R. + SEIFFERT, S. L.
MARTINSON, Z. R. + MCCARDELL, R. K. + OWEN, D. E.
FUKUDA, S. K.
EG AND G IDAHO, INC., IDAHO FALLS, IDAHO
THIS ARTICLE PRESENTS AN ASSESSMENT OF DAMAGE TO LIGHT-WATER-REACTOR FUEL DURING A REACTIVITY-INITIATED ACCIDENT AND COMMENTS ON THE ADEQUACY OF THE PRESENT NUCLEAR REGULATORY COMMISSION DESIGN REQUIREMENTS. RESULTS FROM EARLY EXPERIMENTS IN THE SPECIAL POWER EXCURSION REACTOR TEST (SPERT) ARE REVIEWED AND COMPARED WITH RESULTS FROM RECENT COMPUTER SIMULATIONS AND POWER BURST FACILITY TESTS. A PROGRESSION OF FUEL-ROD AND CLADDING DAMAGE EVENTS IS PRESENTED.

HIGH-STRAIN-RATE DEFORMATION OF RELATIVELY COOL IRRADIATED CLADDING EARLY IN THE TRANSIENT CAN RESULT IN FRACTURE AT A RADIAL AVERAGE PEAK FUEL ENTHALPY OF ABOUT 140 CAL/G UO₂. VOLUME EXPANSION OF PREVIOUSLY IRRADIATED FUEL ON MELTING CAN CAUSE DEFORMATION AND RUPTURE OF THE CLADDING AND COOLANT CHANNEL BLOCKAGE AT HIGHER PEAK ENTHALPIES. WHEN CLADDING TEMPERATURES REACHED VALUES NEAR THE MELTING POINT, VARIATIONS IN COOLANT CONDITIONS AROUND AND ALONG THE ROD CAUSE THICKENING AND THINNING OF THE CLADDING. THE REGIONS OF CLADDING WALL THINNING ARE SUBSEQUENTLY OXIDIZED TO BRITTLE OXYGEN-STABILIZED ALPHA ZIRCALOY AND ZIRCONIUM DIOXIDE AND FRACTURE DURING QUENCHING WHEN THE RADIAL AVERAGE PEAK FUEL ENTHALPY IS 250 CAL/G UO₂ OR ABOVE. THE MODE OF ROD FAILURE IS STRONGLY AFFECTED BY PREVIOUS IRRADIATION AND PEAK FUEL ENTHALPY.

- 21-5-3-603 SURVEY OF CONTROL ROOM DESIGN PRACTICES WITH RESPECT TO HUMAN FACTORS ENGINEERING
SEMINARA, J. L. + PARSONS, S. O.
LOCKHEED MISSILES AND SPACE COMPANY, INC., SUNNYVALE, CALIF.
HUMAN FACTORS ENGINEERING IS AN INTERDISCIPLINARY SPECIALTY CONCERNED WITH INFLUENCING THE DESIGN OF EQUIPMENT SYSTEMS, FACILITIES, AND OPERATIONAL ENVIRONMENTS TO PROMOTE SAFE, EFFICIENT, AND RELIABLE OPERATOR PERFORMANCE. THIS EMPHASIS HAS BEEN APPLIED TO MOST MILITARY AND SPACE SYSTEMS IN THE PAST 30 YR. A REVIEW OF FIVE NUCLEAR POWER-PLANT CONTROL ROOMS, REPORTED IN THE NOVEMBER-DECEMBER 1977 ISSUE OF NUCLEAR SAFETY, REVEALED THAT HUMAN FACTORS PRINCIPLES OF DESIGN HAVE GENERALLY NOT BEEN INCORPORATED IN PRESENT-GENERATION CONTROL ROOMS. THIS ARTICLE SUMMARIZES THE FINDINGS OF A SURVEY OF 20 CONTROL-BOARD DESIGNERS FROM A MIX OF NUCLEAR STEAM-SUPPLY SYSTEM AND ARCHITECT-ENGINEERING FIRMS. THE INTERVIEWS WITH THESE DESIGNERS PROBED DESIGN METHODS CURRENTLY USED IN DEVELOPING CONTROL ROOMS. FROM THESE DATA IT WAS CONCLUDED THAT THERE IS CURRENTLY NO CONSISTENT, FORMAL, UNIFORM CONCERN FOR THE HUMAN FACTORS ASPECTS OF CONTROL-ROOM DESIGN ON THE PART OF THE DESIGN ORGANIZATIONS, THE UTILITIES, OR THE NUCLEAR REGULATORY COMMISSION. ALTHOUGH ALL THE PARTIES INVOLVED ARE CONCERNED WITH HUMAN FACTORS ISSUES, THIS RESPONSIBILITY IS NOT FOCUSED, AND HUMAN FACTORS "YARDSTICKS," OR DESIGN STANDARDS, SPECIFIC TO POWER PLANTS HAVE NOT BEEN EVOLVED AND APPLIED IN THE DEVELOPMENT AND VERIFICATION OF CONTROL-ROOM DESIGNS FROM THE STANDPOINT OF THE MAN-MACHINE INTERFACE.
- 21-5-4-618 PRIMARY CONTAINMENT LEAKAGE INTEGRITY - AVAILABILITY AND REVIEW OF FAILURE EXPERIENCE
WEINSTEIN, H. B.
AMERICAN NUCLEAR INSURERS, FARMINGTON, CONN.
LEAKAGE-RATE TESTING AND FAILURE EXPERIENCE ON PRIMARY REACTOR CONTAINMENT SYSTEMS HAVE BEEN REVIEWED TO DETERMINE (1) OVERALL AVAILABILITY OF LEAKAGE INTEGRITY; (2) VARIATION IN AVAILABILITY OF LEAKAGE INTEGRITY WITH YEAR, AGE OF PLANT, AND TYPE OF PLANT; (3) TRENDS IN FAILURE MAGNITUDES; AND (4) CAUSES OF FAILURES. LEAKAGE-RATE TESTING IS IMPORTANT, SINCE LEAKAGE RATES IN EXCESS OF THE MAXIMUM ALLOWED BY TECHNICAL SPECIFICATION REQUIREMENTS COULD RESULTS IN OFF-SITE EXPOSURES ABOVE THOSE SPECIFIED BY REGULATIONS FOR CORE-DAMAGE ACCIDENTS. THE AVAILABILITY OF LEAKAGE INTEGRITY IS LOW (POSSIBLY ABOUT 85 PERCENT) BUT IS SHOWING SOME IMPROVEMENT SINCE THE AMOUNT OF LEAKAGE BY WHICH TESTS FAIL HAS BEEN DECREASING. LEAKAGE-RATE TESTING PRACTICES, STANDARDS, AND REGULATORY REQUIREMENTS ARE ALSO REVIEWED AS ARE LEAKAGE MONITORING AND MITIGATING SYSTEMS. RECOMMENDATIONS FOR INCREASING AVAILABILITY AND TESTING PROGRAM EFFICACY ARE OFFERED.
- 21-5-5-634 ECONOMIC METHODOLOGY FOR ASSESSING THE RADIOLOGICAL IMPACT OF HYPOTHETICAL REACTOR ACCIDENTS
LASSEY, K. R.
THE INSTITUTE OF NUCLEAR SCIENCES, NEW ZEALAND
IN ASSESSING THE CONSEQUENCES OF A RELEASE OF RADIOACTIVITY TO THE ATMOSPHERE, WE SHOW THAT THE COMPUTATION OF BOTH THE DOSES DELIVERED TO EXPOSED PERSONS AND THE CONSEQUENCES OF THOSE DOSES CAN BE SEPARATED FROM THE COMPUTATION OF THE RADIOACTIVITY DISPERSAL. SUCH A SEPARATION OFFERS USEFUL ECONOMIES IN PRACTICAL CALCULATIONS IN ADDITION TO ITS CONCEPTUAL ADVANTAGES. FOR A POSTULATED RADIOACTIVITY RELEASE REPRESENTATIVE OF A SERIOUS REACTOR ACCIDENT, WE PRESENT DETAILED ILLUSTRATIVE PREDICTIONS OF MODELS DESCRIBING THE DOSES BORNE BY BODY TISSUES, AND THE LATENT CONSEQUENCES OF THOSE DOSES, WITHOUT RESORTING TO A SPECIFIC DESCRIPTION OF ATMOSPHERIC DISPERSAL.
- 21-5-6-648 ICPP CRITICALITY EVENT OF OCTOBER 17, 1978
NUCLEAR SAFETY STAFF
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENN.
EDITOR'S NOTE: THIS ARTICLE IS ADAPTED FROM INVESTIGATION OF THE 10-17-1978 CRITICALITY INCIDENT IN THE URANIUM EXTRACTION PROCESS AT THE IDAHO CHEMICAL PROCESSING PLANT, A REPORT ISSUED BY THE IDAHO NATIONAL ENGINEERING LABORATORY IN NOVEMBER 1978. THE PROBABLE CAUSE OF THE CRITICALITY INCIDENT DESCRIBED IN THIS REPORT WAS THE FAILURE OF MANAGEMENT TO RECTIFY DEFICIENCIES IN BOTH ADMINISTRATIVE CONTROL AND INSTRUMENTATION, BOTH OF WHICH HAD BEEN PREVIOUSLY IDENTIFIED AS BEING REQUIRED. HOWEVER, THE INCIDENT PRODUCED NO PERSONNEL INJURY, NEITHER ON-SITE NOR OFF-SITE CONTAMINATION, AND NO DAMAGE TO EQUIPMENT OR PROPERTY.

- 21-6-1-691 NUCLEAR PROLIFERATION AND NUCLEAR POWER - A REVIEW OF THE NASAP AND INFCE STUDIES
SPIEWAK, I. + BARKENBUS, J. N.
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENN. / OAK RIDGE
ASSOCIATED UNIVERSITIES, OAK RIDGE, TENN.
THIS ARTICLE SUMMARIZES THE WORK OF THE RECENTLY COMPLETED
NONPROLIFERATION ALTERNATIVE SYSTEMS ASSESSMENT PROGRAM (NASAP)
AND THE INTERNATIONAL NUCLEAR FUEL-CYCLE EVALUATION (INFCE).
THE METHODOLOGY USED IN PROLIFERATION ASSESSMENT IS OUTLINED,
AND THE RESULTS OF THE EVALUATION OF ALTERNATIVE CYCLES ARE
PRESENTED. URANIUM RESOURCE CONSTRAINTS ARE ANALYZED BOTH IN A
U. S. AND A WORLD CONTEXT, SINCE RESOURCE CONSTRAINTS ARE THE
MAIN DRIVING FORCE PROPELLING NATIONS TOWARD ADOPTION OF LESS
PROLIFERATION-RESISTANT FUEL CYCLES. OTHER INSTITUTIONAL
FACTORS ARE BRIEFLY SUMMARIZED, AS ARE IMPLICATIONS FOR NUCLEAR
RESEARCH AND DEVELOPMENT. THE MAJOR DIFFERENCES IN OUTLOOK
BETWEEN NASAP AND INFCE ARE PRESENTED.
- 21-6-1-703 CONCEPTS, PROBLEMS, AND ISSUES IN DEVELOPING SAFETY GOALS AND OBJECTIVES FOR COMMERCIAL NUCLEAR POWER
MATTSON, R. + ERNST, M. + MINNERS, W.
SPANGLER, M.
ENVIRONMENTAL PROTECTION AGENCY, WASHINGTON, D. C. / NUCLEAR
REGULATORY COMMISSION, WASHINGTON, D. C.
THE ENERGY REORGANIZATION ACT OF 1974 CALLED FOR A STATEMENT OF
THE SHORT- AND LONG-RANGE GOALS, PRIORITIES, AND PLANS OF THE
NUCLEAR REGULATORY COMMISSION AS THEY RELATE TO THE BENEFITS,
COSTS, AND RISKS OF COMMERCIAL NUCLEAR POWER. SINCE THE
ACCIDENT AT THREE MILE ISLAND, THERE HAS BEEN AN UPSURGE OF
INTEREST IN NUCLEAR SAFETY GOALS. THIS ARTICLE DISCUSSES A
NUMBER OF CANDIDATE GOAL FORMS, ISSUES, AND DECISION CRITERIA
WHICH COULD SERVE AS A FRAMEWORK FOR CONSIDERING AND
INTEGRATING A WIDE RANGE OF VIEWS. DIALOGUE AMONG GOVERNMENT,
INDUSTRY, AND PUBLIC GROUPS WILL BE AN IMPORTANT PART IN
DETERMINING THE ANSWER TO THE QUESTION, "HOW SAFE IS SAFE
ENOUGH?" THIS ARTICLE POSES SOME OF THE QUESTIONS TO BE ASKED
ALONG THE WAY.
- 21-6-2-724 RADIATION EMBRITTLEMENT - SIGNIFICANCE OF ITS EFFECTS ON INTEGRITY AND OPERATION OF LWR PRESSURE VESSELS
MARSTON, T. D. + STAHLKOPF, K. E.
ELECTRIC POWER RESEARCH INSTITUTE, PALO ALTO, CALIF.
THE SIGNIFICANCE OF RADIATION EMBRITTLEMENT OF REACTOR PRESSURE
VESSEL MATERIALS IS DISCUSSED RELATIVE TO THE INTEGRITY AND
OPERATION OF THE EARLY-GENERATION LIGHT-WATER-REACTOR SYSTEMS.
THE ECONOMIC IMPACT OF EXCEEDING THE CURRENT EMBRITTLEMENT
LIMITS IMPOSED BY FEDERAL REGULATIONS IS ESTIMATED. THE
EMBRITTLEMENT LIMITS ARE EVALUATED IN TERMS OF ACTUAL REACTOR
INTEGRITY CONSIDERATIONS. THE SATURATION OF RADIATION
EMBRITTLEMENT PHENOMENON IS DESCRIBED, WITH SUPPORTING
EXPERIMENTAL AND ANALYTICAL EVIDENCE. FINALLY, THE IMPACT OF
THE EMBRITTLEMENT SATURATION ON THE OPERATION OF THE
EARLY-GENERATION NUCLEAR PLANT IS ASSESSED.
- 21-6-4-735 ISSUES OF SOIL-STRUCTURE INTERACTION AND SEISMIC INPUT DEFINITION FOR NUCLEAR POWER PLANTS
ALLEN, N. P. + SHAW, D. E.
D'APPOLONIA CONSULTING ENGINEERS, INC., PITTSBURGH, PA.
CERTAIN SEISMIC CRITERIA FOR THE DESIGN OF NUCLEAR POWER PLANTS
IN THE UNITED STATES SUGGESTED BY THE NUCLEAR REGULATORY
COMMISSION (NRC) ARE REVIEWED TO EVALUATE THEIR
APPROPRIATENESS. IN ADDITION, SOME ASSUMPTIONS USED IN
COMPUTER CODES WHICH HAVE BEEN ACCEPTED IN SOME LICENSING
ACTIONS BY THE NRC ARE ALSO EVALUATED. EVALUATION METHODS
INCLUDED LITERATURE RESEARCH AND COMPUTATIONAL ANALYSIS. THE
CRITERIA REVIEWED RELATE TO THE DEFINITION OF SEISMIC INPUT TO
A NUCLEAR POWER PLANT FROM ITS GEOLOGIC AND TOPOGRAPHIC
ENVIRONMENT AND TO SOIL-STRUCTURE INTERACTION AS AFFECTED BY
BY SITE STRATIGRAPHY, STRAIN INPUT, AND FOUNDATION EMBEDMENT.
- 21-6-5-749 METEOROLOGICAL MEASUREMENT METHODS AND DIFFUSION MODELS FOR USE AT COASTAL NUCLEAR REACTOR SITES
RAYNOR, G. S. + MICHAEL, P. + SETHURAMAN, S.
BROOKHAVEN NATIONAL LABORATORY, UPTON, N. Y.
A STUDY, BASED ON A LITERATURE REVIEW, WAS MADE TO EXAMINE
CURRENTLY RECOMMENDED METEOROLOGICAL MEASUREMENT PROGRAMS AND
DIFFUSION PREDICTION METHODS FOR NUCLEAR POWER PLANTS TO
DETERMINE THEIR ADEQUACY FOR PLANTS LOCATED IN COASTAL ZONES.
ALTHOUGH PROCEDURES FOR HANDLING THE "NEAR-WORST" CASE
(STABLE, LIGHT-WIND SITUATION) WERE JUDGED ADEQUATELY
CONSERVATIVE, DEFICIENCIES IN GUIDELINES AND PROCEDURES, WERE
FOUND WITH RESPECT TO THE FOLLOWING: FAILURE TO CONSIDER THE
ROLE OF COASTAL INTERNAL BOUNDARY LAYERS, SPECIFICATIONS FOR
TOWER LOCATIONS AND INSTRUMENT HEIGHTS, METHODS OF CLASSIFYING
ATMOSPHERIC STABILITY, METHODS OF ALLOWING CREDIT FOR PLUME
MEANDER, AND MODELS SPECIFIED FOR DIFFUSION CALCULATIONS.
RECOMMENDATIONS WERE MADE FOR CHANGES IN THE GUIDELINES
APPLICABLE TO THESE TOPICS. AREAS IN WHICH ADDITIONAL RESEARCH
IS NEEDED WERE IDENTIFIED.
- 21-6-5-766 STEAM GENERATOR TUBE PERFORMANCE - WORLD EXPERIENCE WITH WATER COOLED NUCLEAR POWER REACTORS DURING 1978
TATONE, O. S. + PATHANIA, R. S.
ATOMIC ENERGY OF CANADA LIMITED, CHALK RIVER, ONTARIO, CANADA
THE PERFORMANCE OF STEAM-GENERATOR TUBES IN WATER-COOLED
NUCLEAR POWER REACTORS DURING 1978 IS REVIEWED. TUBE FAILURES
OCCURRED AT 31 OF THE 86 REACTORS SURVEYED. THE CAUSES OF
THESE FAILURES AND THE PROCEDURES DESIGNED TO DEAL WITH THEM

ARE DESCRIBED. THE NUMBER OF TUBES PLUGGED HAS DECREASED DRAMATICALLY IN 1978 COMPARED TO THE PREVIOUS YEAR. THIS IS ATTRIBUTED TO THE DILIGENT APPLICATION OF TECHNIQUES DEVELOPED THROUGH IN-PLANT EXPERIENCE AND RESEARCH AND DEVELOPMENT PROGRAMS OVER THE PAST SEVERAL YEARS.

22-1-1-1

THE NUCLEAR SAFETY ANALYSIS CENTER
ZEBROSKI, E. L. + LEVERETT, M. C.
ELECTRIC POWER RESEARCH INSTITUTE, PALO ALTO, CALIF.
IMMEDIATELY AFTER THE THREE MILE ISLAND (TMI) ACCIDENT, THE U.S. UTILITY INDUSTRY ASKED THE ELECTRIC POWER RESEARCH INSTITUTE (EPRI) TO SET UP A NUCLEAR SAFETY ANALYSIS CENTER (NSAC) CHARGED WITH ANALYZING THE ACCIDENT, DERIVING LESSONS TO BE LEARNED FROM IT, AND PERFORMING OTHER SAFETY-RELATED FUNCTIONS. FINANCED BY INDUSTRY SUBSCRIPTIONS AND STAFFED WITH A NUCLEUS OF EPRI EMPLOYEES, WITH LOANED EMPLOYEES FROM UTILITY COMPANIES, REACTOR MANUFACTURERS, NATIONAL LABORATORIES, AND OTHER INDUSTRIES, NSAC NOW HAS 35 TO 40 PROFESSIONALS. THE NSAC'S PRESENT PROGRAM IS A NATURAL OUTGROWTH OF ITS TMI INVESTIGATION AND INVOLVES: EVALUATION OF SIGNIFICANT PLANT OPERATING EVENTS; NUCLEAR POWER PLANT EXPERIENCE CASE STUDIES; RESPONSE TO REGULATORY ISSUES; GENERIC SAFETY STUDIES; TECHNICAL AND OPERATING INFORMATION CLEARINGHOUSE; STRATEGIC ANALYSIS. THE NSAC IS FULFILLING A NEED THAT PROBABLY EXISTED IN THE INDUSTRY FOR MANY YEARS BEFORE THE TMI ACCIDENT AND IS EXPECTED TO EXIST INDEFINITELY.

22-1-1-10

NEW TRENDS IN THE EVALUATION AND IMPLEMENTATION OF THE SAFETY - RELATED OPERATING EXPERIENCE ASSOCIATED WITH NRC - LICENSED REACTORS
MICHELSON, C. + HELTENNES, C. J.
U. S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, D.C.
THIS ARTICLE IS AN OVERVIEW OF THE NUCLEAR REGULATORY COMMISSION PROGRAM FOR THE EVALUATION AND DISSEMINATION OF THE SAFETY-RELATED OPERATING EXPERIENCE ASSOCIATED WITH ALL NRC-LICENSED REACTORS. IT DISCUSSES THE HISTORICAL BACKGROUND AND PAST PROBLEMS THAT LED TO THE RECENT FORMATION OF NRC'S OFFICE FOR ANALYSIS AND EVALUATION OF OPERATIONAL DATA (AEOO) AND DETAILS ITS ACTIVITIES, ORGANIZATION, STAFFING, AND PROPOSED ANALYSIS AND EVALUATION METHODOLOGY. THE PROGRAMS OF INDUSTRY ORGANIZATIONS AND NUCLEAR PLANT LICENSEES AND THE INTEGRATION OF FOREIGN OPERATING EXPERIENCE ARE INCLUDED IN THE OVERVIEW. THE PROBLEMS AND LIMITATIONS OF THE LICENSEE EVENT REPORT (LER) PROGRAM AND THE NUCLEAR PLANT RELIABILITY DATA SYSTEM PROGRAM ARE DISCUSSED. THE AEOO ANALYSIS AND EVALUATION METHODOLOGY PROGRAM INCLUDES SOME NEW IMPROVEMENTS IN THE ASSESSMENT OF SAFETY-RELATED OPERATING EXPERIENCE. OF PARTICULAR NOTE IS THE SEQUENCE CODING AND SEARCH PROCEDURE BEING DEVELOPED BY AEOO UNDER A CONTRACT WITH THE NUCLEAR SAFETY INFORMATION CENTER AT THE OAK RIDGE NATIONAL LABORATORY. THIS COMPUTER-BASED RETRIEVAL SYSTEM WILL HAVE MARKEDLY IMPROVED SEARCH STRATEGY CAPABILITY FOR SUCH ITEMS AS COMMON-CAUSE FAILURES OR COMPLEX SYSTEM INTERACTIONS INVOLVING VARIOUS FAILURE SEQUENCES AND OTHER RELATIONSHIPS ASSOCIATED WITH AN EVENT. THE SYSTEM RETRIEVES FAILURE DATA AND INFORMATION ON THE PRINCIPAL LER OCCURRENCE AND ON RELATED COMPONENT AND SYSTEM RESPONSES. THE COMPUTER-GENERATED POWER REACTOR WATCH LIST ENABLES AEOO TO MONITOR ALL CRITICAL OR UNUSUAL SITUATIONS WARRANTING CLOSE ATTENTION BECAUSE OF POTENTIAL PUBLIC HEALTH AND SAFETY. THIS LISTING IS SUPPORTED BY A PREESTABLISHED COMPUTER SEARCH STRATEGY OF THE HISTORICAL DATA BASE PERMITTING IDENTIFICATION OF ALL PAST EVENTS AND STATISTICAL INFORMATION THAT ARE APPLICABLE TO THE SITUATION BEING WATCHED.

22-1-2-28

CHARACTERIZATION AND EVALUATION OF UNCERTAINTY IN PROBABILISTIC RISK ANALYSIS
PARRY, G. W. + WINTER, P. W.
UNITED KINGDOM ATOMIC ENERGY AGENCY, WARRINGTON, UNITED KINGDOM
THE SOURCES OF UNCERTAINTY IN PROBABILISTIC RISK ANALYSIS ARE DISCUSSED, USING THE EVENT AND FAULT-TREE METHODOLOGY AS AN EXAMPLE. THE ROLE OF STATISTICS IN QUANTIFYING THESE UNCERTAINTIES IS INVESTIGATED. A CLASS OF UNCERTAINTIES IS IDENTIFIED WHICH ARE, AT PRESENT, UNQUANTIFIABLE USING EITHER CLASSICAL OR BAYESIAN STATISTICS. IT IS ARGUED THAT BAYESIAN STATISTICS IS THE MORE APPROPRIATE VEHICLE FOR THE PROBABILISTIC ANALYSIS OF RARE EVENTS, AND A SHORT REVIEW IS GIVEN WITH SOME DISCUSSION ON THE REPRESENTATION OF IGNORANCE.

22-1-3-43

LIGHT - WATER - REACTOR DIAGNOSTIC EXPERIENCE USING NOISE ANALYSIS
BALL, R. M. + HUZDOVICH, J. M.
BABCOCK AND WILCOX COMPANY, LYNCHBURG, VA.
RANDOM NOISE IN SYSTEMS, PROCESSES, AND ANALOG SIGNALS HAS BEEN STUDIED FOR MORE THAN A DECADE, WITH A FEW SUCCESSFUL APPLICATIONS DEMONSTRATING THE VALUE OF NOISE AND VIBRATION TECHNOLOGY IN SOLVING OR DEFINING ENGINEERING PROBLEMS. MORE RECENTLY, APPLICATION ENGINEERING HAS BECOME A SUBSTANTIAL PART OF THE TECHNOLOGY AND, COUPLED WITH CONTINUING DETAILED INVESTIGATION, HAS RESULTED IN VALID TECHNIQUES AND SYSTEMS, WHICH ARE BECOMING A PART OF AN ELECTRIC GENERATING STATION'S OPERATIONS. ADDITIONALLY, THE TECHNOLOGY IS FINDING APPLICATION TO SOMEWHAT UNIQUE PROBLEMS WITH POTENTIAL FOR EXPANSION INTO A PLANTWIDE DIAGNOSTIC SYSTEM. THE EVOLUTION TO DATE HAS RESULTED IN TECHNIQUE, HARDWARE, AND EXPERIENCED PERSONNEL THROUGHOUT

THE UTILITY INDUSTRY TO SUCH AN EXTENT THAT A MAJOR CHANGE IN THE LEVEL OF APPLICATION IS BECOMING EVIDENT.

- 22-1-4-56 DOE RADIOACTIVE WASTE INCINERATION TECHNOLOGY
BOEDDIN, L. C. + TABOAS, A. L.
LOS ALAMOS SCIENTIFIC LABORATORY, LOS ALAMOS, N. MEX.
THE CURRENT INVENTORY OF LOW-LEVEL RADIOACTIVE WASTE (RADWASTE) FROM DEFENSE AND COMMERCIAL INDUSTRIES IS ABOUT 2×10^{16} M(3) AND INCREASES ABOUT 10^{15} M(3)/YR DUE TO CURRENT OPERATIONS. MOST OF THIS WASTE CAN BE CLASSIFIED AS COMBUSTIBLES, LIQUIDS AND SLUDGES, OR AS NONCOMBUSTIBLE SOLIDS. THE SUBSTANTIAL COMBUSTIBLE FRACTION, WHICH HAS THE GREATEST POTENTIAL FOR EFFECTIVE WASTE TREATMENT, CONSTITUTES AN AVERAGE OF 40 PERCENT OF THE NEWLY GENERATED WASTE. PROPER INCINERATION REDUCES WASTE MASS AND VOLUME, RESULTS IN A MORE HOMOGENEOUS AND CHEMICALLY INERT WASTE FORM, AND ALSO ENHANCES THE SAFETY AND CERTAINTY OF WASTE HANDLING, PACKAGING, AND STORAGE AND/OR DISPOSAL OPERATIONS. THIS ARTICLE PRESENTS AN INTRODUCTION TO INCINERATION CONCERNS AND AN OVERVIEW OF THE PROMINENT RADWASTE INCINERATION PROCESSES BEING DEVELOPED WITHIN THE DEPARTMENT OF ENERGY. BRIEF PROCESS DESCRIPTIONS, THE STATUS AND GOALS OF INDIVIDUAL INCINERATION SYSTEMS, AND PLANNED OR POTENTIAL APPLICATIONS ARE ALSO INCLUDED.
- 22-1-5-70 RADIOLOGICAL IMPACTS OF URANIUM RECOVERY IN THE PHOSPHATE INDUSTRY
RYAN, M. T.
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENN.
THIS ARTICLE CHARACTERIZES THE OCCUPATIONAL AND PUBLIC RADIOLOGICAL HEALTH IMPACTS ASSOCIATED WITH PHOSPHATE MINING AND MILLING. THESE IMPACTS ARE RELATED TO THE PHOSPHATE INDUSTRY'S URANIUM PRODUCTION POTENTIAL AND ARE COMPARED WITH THOSE ASSOCIATED WITH CONVENTIONAL URANIUM MINING AND MILLING. THE RADIOLOGICAL IMPACTS RESULTING FROM OCCUPATIONAL AND NON-OCCUPATIONAL EXPOSURES ARE ASSESSED. OCCUPATIONAL EXPOSURES IN PHOSPHATE FACILITIES ARE COMPARED TO BACKGROUND EXPOSURES AND RADIOLOGICAL POPULATION DOSE ASSESSMENTS, WHICH CHARACTERIZE IMPORTANT RADIONUCLIDES AND EXPOSURE PATHWAYS. THE FOLLOWING CONCLUSIONS WERE REACHED: (1) PUBLIC CONSEQUENCES OF PHOSPHATE MINING WILL OCCUR WHETHER OR NOT URANIUM IS RECOVERED AS A BY-PRODUCT, (2) RADIOLOGICAL CONSEQUENCES OF PHOSPHATE MINING MAY BE COMPARABLE TO THOSE ASSOCIATED WITH URANIUM MINING AND MILLING PER UNIT URANIUM PRODUCTION, (3) RADIOLOGICAL IMPACTS VIA SURFACE WATERWAYS AND CROPS FERTILIZED WITH URANIUM-BEARING PHOSPHATES ARE OF MINOR CONSEQUENCE, AND (4) MAJOR RADIOLOGICAL PUBLIC HEALTH PROBLEMS ASSOCIATED WITH PHOSPHATE MINING ARE RELATED TO RADON AND RADON PROGENY EXPOSURES IN STRUCTURES BUILT ON RECLAIMED LANDS OR WITH PHOSPHATE MINING RESIDUES, ALTHOUGH THE MAGNITUDES OF THESE IMPACTS ARE DIFFICULT TO EVALUATE WITH CURRENT DATA.
- 22-1-6-78 A METHODOLOGICAL APPROACH TO NUCLEAR LICENSEE PERFORMANCE EVALUATION
CHAKOFF, H. E. + SPEAKER, D. M. + THOMPSON, S. R.
COHEN, S. C.
TEKNEKRON RESEARCH, INC., MCLEAN, VA.
THE IMPORTANCE OF THE MAN-MACHINE INTERFACE IN NUCLEAR POWER-PLANT OPERATION HAS RECEIVED INCREASING ATTENTION SINCE THE THREE MILE ISLAND ACCIDENT. THIS ARTICLE SUMMARIZES A METHODOLOGY FOR ANALYZING LICENSEE PERFORMANCE THAT FOCUSES ON THE ROLE OF THE HUMAN ELEMENT IN INFLUENCING ITS QUALITY.
- 22-1-6-87 ACCIDENT AT THE EXPERIMENTAL NUCLEAR POWER STATION IN LUCENS
FRITZSCHE, A. F.
FEDERAL COMMISSION FOR THE SAFETY OF NUCLEAR INSTALLATIONS,
WINTERTHUR, SWITZERLAND
RESULTS OF INVESTIGATIONS OF THE 1969 ACCIDENT WHICH OCCURRED AT THE EXPERIMENTAL NUCLEAR POWER STATION IN LUCENS, SWITZERLAND, ARE REPORTED. THE CHAIN OF EVENTS WAS EXTREMELY COMPLEX, AND THE DETERMINATION OF THE PRIMARY CAUSE WAS RENDERED DIFFICULT BECAUSE NO ADVANCE INDICATIONS WERE OBSERVED AT THE TIME. THIS DISQUIETING FACT WAS EXPLORED AND IS EXPLAINED IN DETAIL. DESPITE THE FACT THAT ONE FUEL ELEMENT WAS DESTROYED AND THE CORE OF THE REACTOR WAS SERIOUSLY DAMAGED, THE RADIOACTIVITY RELEASED CONSTITUTED A NEGLIGIBLE EXPOSURE FOR THE PUBLIC. THE LESSONS LEARNED FROM THIS ACCIDENT WHICH ARE RELEVANT TO TODAY'S REACTOR ARE DISCUSSED.
- 22-2-1-147 PUBLIC ATTITUDES AND INFORMATION ON THE NUCLEAR OPTION
FIREBAUGH, M. W.
OAK RIDGE ASSOCIATED UNIVERSITIES, OAK RIDGE, TENN.
THE PRINCIPAL FINDINGS OF PUBLIC-OPINION SURVEYS ON NUCLEAR ENERGY ARE SUMMARIZED IN THIS ARTICLE. ATTITUDES POLLED INCLUDE THOSE ON BUILDING MORE NUCLEAR POWER PLANTS, A NUCLEAR MORATORIUM, OPTIONS FOR REDUCING RISKS, QUESTIONS OF SAFETY AND COST ADVANTAGE, AND THE MOST TRUSTED SOURCES OF INFORMATION ABOUT NUCLEAR ENERGY. NEXT, SOME LESS EMPIRICAL OBSERVATIONS FOR INTERPRETING THESE RESULTS ARE PRESENTED. THESE ADDRESS THE INERTIA OF BELIEFS, THE NATURE OF RISK PERCEPTION, SYMBOLIC ASPECTS OF NUCLEAR ENERGY, AND THE FEASIBILITY OF NUCLEAR EDUCATION PROGRAMS.
FINALLY, SEVERAL SUGGESTIONS FOR PUBLIC INFORMATION PROGRAMS BASED ON THE PREVIOUSLY NOTED FINDINGS AND OBSERVATIONS ARE MADE. THESE INCLUDE A SAFETY PROGRAM ANALOGOUS TO FIRE DRILLS,

- ITEMIZED ELECTRIC BILLS, NUCLEAR INFORMATION WORKSHOPS FOR NEWS MEDIA PERSONNEL, AND SUGGESTIONS FOR IMPROVED COMMUNICATION ON NUCLEAR ISSUES. THESE RELATIVELY LOW COST, FOCUSED EFFORTS MAY BE MORE EFFECTIVE THAN MASS MEDIA INFORMATION PROGRAMS.
- 22-2-1-156 AN EXISTING-SITE POLICY FOR THE U.S. NUCLEAR ENERGY SYSTEM
BURNELL, C. C.
OAK RIDGE ASSOCIATED UNIVERSITIES, OAK RIDGE, TENN.
THIS ARTICLE PRESENTS A BRIEF SUMMARY OF STUDIES ON NUCLEAR POWER-REACTOR SITING RECENTLY COMPLETED AT THE INSTITUTE FOR ENERGY ANALYSIS, OAK RIDGE ASSOCIATED UNIVERSITIES, OAK RIDGE, TENN. THE UNDERLYING ASSUMPTION IS THAT THE U.S. NUCLEAR ENERGY SYSTEM WILL BE MORE ACCEPTABLE IF THE POWER REACTORS THAT COMPRISE THE SYSTEM ARE CONFINED TO FEWER SITES RATHER THAN BEING DISPERSED TO A GREATER NUMBER OF SITES. A POSSIBLE ROUTE TO CONCENTRATED NUCLEAR SITING IS THROUGH THE EXPANSION OF THE EXISTING SITES. THE MAIN CONCLUSIONS OF THE STUDIES ARE THAT MOST U.S. NUCLEAR POWER-REACTOR SITES ARE WELL-SUITED TO EXPANSION, THAT THE ENVIRONMENTAL IMPACTS OF EXPANDING EXISTING SITES ARE LESS THAN THE IMPACTS OF ESTABLISHING ADDITIONAL NEW SITES, AND THAT SITE EXPANSION WOULD STABILIZE AND CONSOLIDATE AND THEREFORE STRENGTHEN THE ORGANIZATIONS RESPONSIBLE FOR NUCLEAR OPERATIONS.
- 22-2-2-165 REDUCTION IN REACTOR RISK BY THE MITIGATION OF ACCIDENT CONSEQUENCES
DENNING, P. S. + CYBULSKI, P.
BATTELLE COLUMBUS LABORATORIES, COLUMBUS, OHIO
APPROACHES ARE EXAMINED TO REDUCING THE PUBLIC RISK FROM NUCLEAR POWER REACTORS BY USING SAFETY SYSTEMS TO CONTROL THE CONSEQUENCES OF CORE MELTDOWN ACCIDENTS. MECHANISMS THAT COULD LEAD TO FAILURE OF THE CONTAINMENT ARE IDENTIFIED. ENGINEERED SAFETY FEATURES ARE THEN DESCRIBED WHICH WOULD REDUCE THE LIKELIHOOD OF CONTAINMENT FAILURE OR REDUCE THE SUBSEQUENT RELEASE OF RADIOACTIVITY TO THE ENVIRONMENT. THE POTENTIAL FOR REDUCING RISK IS ASSESSED AND IS FOUND TO BE SIGNIFICANT FOR SOME SAFETY FEATURES. HOWEVER, TO ADEQUATELY ASSESS THE POTENTIAL REDUCTION IN RISK, A SYSTEMATIC ANALYSIS OF SYSTEM INTERACTIONS MUST BE PERFORMED.
- 22-2-3-179 NUCLEAR POWER PLANT SAFETY FUNCTIONS
CORCORAN, W. R. + FINNICUM, D. J.
HUBBARD III, F. R. + MUSICK, C. R. + WALZER, P. F.
COMBUSTION ENGINEERING, INC., WINDSOR, CONN.
THE CONCEPT OF SAFETY FUNCTIONS IS DISCUSSED. TEN CRITICAL SAFETY FUNCTIONS AND THE MULTIPLE SUCCESS PATHS AVAILABLE FOR ACCOMPLISHING THEM ARE DESCRIBED. USE OF THE SAFETY FUNCTION CONCEPT IN THE DEVELOPMENT OF EMERGENCY PROCEDURES, OPERATOR TRAINING, AND CONTROL-ROOM DISPLAYS PROVIDES A SYSTEMATIC APPROACH AND A HIERARCHY OF PROTECTION THAT AN OPERATOR CAN USE TO MITIGATE THE CONSEQUENCES OF AN EVENT. THE SAFETY FUNCTION CONCEPT CAN ALSO BE APPLIED TO THE DESIGN AND ANALYSIS OF NUCLEAR PLANT SYSTEMS AND TO THE EVALUATION OF PAST EXPERIENCE.
- 22-2-3-191 ANTICIPATED TRANSIENTS WITHOUT SCRAM FOR LIGHT WATER REACTORS: UNRESOLVED SAFETY ISSUE TAP A-9
HAGEN, E. W.
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENN.
THIS IS A SYNOPSIS OF THE FOURTH VOLUME OF THE NRC STAFF'S REVIEW ON THE SUBJECT OF ANTICIPATED TRANSIENTS WITHOUT SCRAM, WHICH CONTAINS THE PROPOSED RESOLUTION OF THIS UNRESOLVED SAFETY ISSUE IN THE FORM OF REQUIREMENTS RECOMMENDED TO BE IMPOSED ON LICENSEES AND APPLICANTS. A PHASED APPROACH IS PROPOSED, WITH NEAR-TERM IMPROVEMENTS IN SAFETY, BOTH HARDWARE AND PROCEDURAL, BEING REQUIRED OVER THE NEXT 1 TO 2 YR TO PROVIDE AN EXPEDITIOUS SAFETY INCREMENT.
- 22-2-5-205 METHODOLOGIES FOR CALCULATING THE RADIATION DOSE TO MAN FROM ENVIRONMENTAL RELEASES OF TRITIUM
TILL, J. E. + ETNIER, E. L. + MEYER, H. R.
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENN.
NUMEROUS METHODS HAVE BEEN RECOMMENDED FOR CALCULATING THE RADIATION DOSE TO MAN FROM RELEASES OF TRITIUM TO THE ENVIRONMENT BY NUCLEAR FACILITIES. THIS STUDY ANALYZES FOUR DIFFERENT METHODOLOGIES THAT VARY CONSIDERABLY IN MODELING DETAIL. THE FIRST APPROACH CONSIDERED IS A DIRECT SPECIFIC ACTIVITY CALCULATION, WHICH ASSUMES THAT THE CONCENTRATION OF HYDROGEN IN TISSUE IS IDENTICAL TO THAT IN ATMOSPHERIC WATER VAPOR. OTHER METHODS CONSIDERED ARE THOSE RECOMMENDED BY THE NATIONAL COUNCIL ON RADIATION PROTECTION AND MEASUREMENTS (NCRP), THE COMPUTER PROGRAM AIRDOSE-EPA SPONSORED BY THE ENVIRONMENTAL PROTECTION AGENCY, AND THE NUCLEAR REGULATORY COMMISSION. WITH EACH MODEL, DOSES ARE CALCULATED USING IDENTICAL INPUT DATA SO THAT THE RESULTING DOSE ESTIMATES CAN BE COMPARED. OUR ANALYSIS LEADS TO THE CONCLUSION THAT THE INCORPORATION OF CERTAIN SITE-SPECIFIC DATA IS IMPORTANT IN TRITIUM DOSE MODELS. INCREASED COMPLEXITY OF MODELS ALONE, HOWEVER, DOES NOT NECESSARILY RESULT IN A MORE ACCURATE ESTIMATE OF DOSE. A COMPROMISE BETWEEN MODEL REALISM AND SIMPLICITY IS PROPOSED WITH A MODIFIED NCRP METHODOLOGY OUTLINED IN THIS ARTICLE. THIS STUDY MIGHT SERVE AS A GUIDE FOR EVALUATING OTHER MODELS FOR ASSESSING RADIONUCLIDE RELEASES TO THE ENVIRONMENT. IT IS POSSIBLE THAT SIMPLER APPROACHES WHICH

STILL RESPOND TO THE INFORMATION NEEDS, SUCH AS THE "SPECIFIC ACTIVITY" CALCULATION REVIEWED HERE, WOULD BE ADEQUATE FOR ESTIMATING DOSE FROM RADIOACTIVE DISCHARGES.

- 22-2-5-214 TRANSPORT OF PLUTONIUM, AMERICIUM, AND CURIUM FROM SOILS INTO PLANTS BY ROOT UPTAKE
PINEL, M. + SCHUTTEKOPF, H.
NUCLEAR RESEARCH CENTER, KARLSRUHE, FEDERAL REPUBLIC OF GERMANY
CALCULATION OF THE DOSE BURDEN RESULTING FROM THE INGESTION OF FOOD DERIVED FROM PLANTS REQUIRES A KNOWLEDGE OF THE SOIL-TO-PLANT TRANSFER FACTORS FOR THE RADIONUCLIDES OF INTEREST. A LITERATURE SEARCH WAS PERFORMED SO THAT THE MAGNITUDE OF THE TRANSFER FACTORS (CONCENTRATION RATIO) FOR PLUTONIUM, AMERICIUM, AND CURIUM COULD BE EVALUATED. THE SEARCH YIELDED TRANSFER FACTORS OF 10^{-9} TO 10^{-3} FOR PLUTONIUM AND 10^{-6} TO 1 FOR AMERICIUM. HARDLY ANY DATA ON CURIUM WERE FOUND IN THE LITERATURE. THE TRANSFER FACTORS ARE DEPENDENT ON THE CATIONIC EXCHANGE CAPACITY OF THE SOIL, THE AMOUNT OF ORGANIC MATERIAL IN THE SOIL, THE PH, AND THE TYPE OF CONTAMINATION. COMPLEXING AGENTS INCREASE THE TRANSFER FACTORS BY UP TO A FACTOR OF 1300. FERTILIZERS EXERT AN INFLUENCE ON TRANSFER AS DO THE SPECIES AND THE AGE OF PLANTS. HOWEVER, IN MOST CASES, THESE RELATIONSHIPS HAVE NOT BEEN STUDIED SUFFICIENTLY; CONSEQUENTLY, FOR THE TIME BEING, THERE IS NO SATISFACTORY EXPLANATION FOR THE GREAT VARIATION FOUND IN TRANSFER FACTORS.
- 22-2-6-226 PARTIAL FAILURE TO SCRAM AT BROWNS FERRY 3
NUCLEAR SAFETY STAFF
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENN.
(EDITOR'S NOTE: THE FOLLOWING ARTICLE WAS COMPILED BY NUCLEAR SAFETY STAFF MEMBERS FROM THE EXECUTIVE SUMMARIES OF TWO REPORTS BY THE NRC OFFICE FOR ANALYSIS AND EVALUATION OF OPERATIONAL DATA ON THE SUBJECT. THE FIRST, REPORT ON THE BROWNS FERRY 3 PARTIAL FAILURES TO SCRAM ON JUNE 28, 1980, WAS ISSUED JULY 30, 1980; THE SECOND, REPORT ON THE INTERIM EQUIPMENT AND PROCEDURES AT BROWNS FERRY TO DETECT WATER IN THE SCRAM DISCHARGE VOLUME, WAS ISSUED IN SEPTEMBER 1980. THIS INCIDENT IS OF PARTICULAR INTEREST TO THE NUCLEAR COMMUNITY BECAUSE IT IDENTIFIED A MECHANISM THAT CAN CAUSE FAILURE TO SCRAM, WHICH HITHERTO HAS BEEN PRESUMED A NEAR IMPOSSIBILITY.)
- 22-2-6-229 VALVE FAILURE PROBLEMS IN LWR POWER PLANTS
BEYER, R. J. + RIDDINGTON, J. W.
BORNS AND ROE, INC., WOODBURY, NEW YORK
A STUDY OF THE CAUSES OF AND SOLUTIONS FOR RECURRENT VALVE FAILURES CAUSING REACTOR SHUTDOWNS HAS BEEN PERFORMED. FREQUENCY AND ROOT CAUSES OF THE VALVE FAILURES WERE IDENTIFIED FROM LICENSEE EVENT REPORTS AND MEETINGS WITH UTILITY, NUCLEAR STEAM-SYSTEM SUPPLIER, AND VALVE MANUFACTURER PERSONNEL. VALVES ARE RESPONSIBLE FOR ABOUT 19 PERCENT OF LIGHT-WATER-REACTOR (LWR) POWER-PLANT SHUTDOWNS, MORE THAN ANY OTHER TYPE OF COMPONENT.
VALVE-STEM LEAKAGE AND FAILURES OF PILOT-OPERATED MAIN STEAM SAFETY-RELIEF VALVES WERE THE MOST FREQUENT CAUSES OF VALVE-INITIATED SHUTDOWNS. OTHER VALVES THAT FREQUENTLY CAUSED SHUTDOWNS INCLUDED MAIN STEAM ISOLATION VALVES, FEEDWATER REGULATOR VALVES, SAFETY-SYSTEM MOTOR-OPERATED VALVES, PRESSURIZER SPRAY VALVES, AND CONTAINMENT ISOLATION VALVES. FROM THE HISTORY OF VALVE FAILURES IN LWRS, IT CAN BE CONCLUDED THAT NOT ENOUGH ATTENTION HAS BEEN GIVEN TO THE SPECIFICATIONS, SELECTION OF THE MANUFACTURER, AND TESTING OF KEY VALVES TO ENSURE THAT VALVES ARE SUITABLE FOR THE INTENDED SERVICE. PRESENT-DAY CODES ADDRESS ONLY THE PRESSURE BOUNDARY REQUIREMENTS OF VALVES; THEY DO NOT CONSIDER THEIR FUNCTIONAL REQUIREMENTS.
- 22-3-1-277 EIGHTH NRC WATER REACTOR SAFETY RESEARCH INFORMATION MEETING
COTTRELL, W. B.
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENN.
THIS ARTICLE SUMMARIZES THE EIGHTH WATER-REACTOR SAFETY RESEARCH INFORMATION MEETING SPONSORED BY THE NUCLEAR REGULATORY COMMISSION (NRC) DIVISION OF REACTOR SAFETY RESEARCH (RES) AND HELD AT THE NATIONAL BUREAU OF STANDARDS, GAITHERSBURG, MD., ON OCT. 27-31, 1980. PRESENTED AT THIS MEETING WERE OVER 150 PAPERS (INCLUDING 10 ON FOREIGN RESEARCH) IN EIGHT RES RESEARCH PROGRAM AREAS, IN ADDITION TO AN INVITED SESSION ON RELATED RESEARCH SPONSORED BY THE ELECTRIC POWER RESEARCH INSTITUTE (EPRI) AND A SESSION ON RISK STUDIES SPONSORED BY THE NRC DIVISION OF SYSTEMS AND RELIABILITY RESEARCH. THE TEN SESSIONS WERE (1) LOFT PROGRAM, (2) SEPARATE-EFFECTS PROGRAM, (3) ANALYSIS DEVELOPMENT PROGRAM, (4) FUEL AND CORE BEHAVIOR RESEARCH PROGRAM, (5) RISK AND SEVERE ACCIDENT SEQUENCE ANALYSIS, (6) EPRI REACTOR SAFETY RESEARCH PROGRAM, (7) REACTOR OPERATIONAL SAFETY PROGRAM, (8) SITE SAFETY RESEARCH PROGRAMS, (9) METALLURGY AND MATERIALS RESEARCH PROGRAMS, AND (10) STRUCTURAL AND MECHANICAL ENGINEERING RESEARCH PROGRAMS. THE MEETING OPENED WITH A PLENARY SESSION FEATURING INTRODUCTORY REMARKS BY NRC CHAIRMAN J. H. AMEARNE AND SUMMARY PAPERS BY T. E. MURLEY AND L. S. TONG. THE MEETING ALSO INCLUDED AT LEAST FIVE WORKSHOPS ON SELECTED TOPICS; THUS THE MORE THAN 800 PARTICIPANTS, INCLUDING 177 ATTENDEES FROM 21 FOREIGN COUNTRIES, HAD A FULL WEEK.

- 22-3-1-300 EPRI NUCLEAR FUEL CYCLE ACCIDENT RISK ASSESSMENT
NUCLEAR SAFETY STAFF
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENN.
THE PRESENT RESULTS OF THE NUCLEAR FUEL-CYCLE ACCIDENT RISK ASSESSMENT CONDUCTED BY THE ELECTRIC POWER RESEARCH INSTITUTE SHOW THAT THE TOTAL RISK CONTRIBUTION OF THE NUCLEAR FUEL CYCLE IS ONLY ABOUT 1 PERCENT OF THE ACCIDENT RISK OF THE POWER PLANT; HENCE, WITH LITTLE ERROR, THE ACCIDENT RISK OF NUCLEAR ELECTRIC POWER IS ESSENTIALLY THAT OF THE POWER PLANT ITSELF. THE POWER-PLANT RISK, ASSUMING A VERY LARGE USAGE OF NUCLEAR POWER BY THE YEAR 2005, IS ONLY ABOUT 0.5 PERCENT OF THE RADIOLOGICAL RISK OF NATURAL BACKGROUND. THE SMALLNESS OF THE FUEL-CYCLE RISK RELATIVE TO THE POWER-PLANT RISK MAY BE ATTRIBUTED TO THE LACK OF INTERNAL ENERGY TO DRIVE AN ACCIDENT AND THE SMALL AMOUNT OF DISPERSIBLE MATERIAL. THIS WORK AIMS AT A REALISTIC ASSESSMENT OF THE PROCESS HAZARDS, THE EFFECTIVENESS OF CONFINEMENT AND MITIGATION SYSTEMS AND PROCEDURES, AND THE ASSOCIATED LIKELIHOOD OF ERRORS AND THE ESTIMATED SIZE OF ERRORS. THE PRIMARY PROBABILISTIC ESTIMATION TOOL IS FAULT-TREE ANALYSIS, WITH THE RELEASE SOURCE TERMS CALCULATED USING PHYSICOCHEMICAL PROCESSES. DOSES AND HEALTH EFFECTS ARE CALCULATED WITH CRAC (CONSEQUENCES OF REACTOR ACCIDENT CODE). NO EVACUATION OR MITIGATION IS CONSIDERED; SOURCE TERMS MAY BE CONSERVATIVE THROUGH THE ASSUMPTION OF HIGH FUEL BURNUP (40 000 MWD/T) AND SHORT COOLING PERIOD (90 TO 150D); HIGH-EFFICIENCY PARTICULATE AIR FILTER EFFICIENCIES ARE DERIVED FROM EXPERIMENTS. FUTURE WORK WILL INCLUDE REFINEMENTS OF THE WORK PRESENTED HERE AS WELL AS ALTERNATIVE FUEL CYCLES, ROUTINE AND OCCUPATIONAL RISKS, AND TREATMENT OF FUEL-CYCLE STEPS BELIEVED TO PRESENT NEGLIGIBLE RISK COMPARED WITH THOSE PRESENTED HERE.
- 22-3-2-312 SEMISCALE PROGRAM SUMMARY: A REVIEW OF MOD-3 RESULTS
LARSON, T. K. + HARVEGO, E. A.
EG AND G IDAHO, INC., IDAHO FALLS, IDAHO
THE OBJECTIVES OF THE SEMISCALE PROGRAM ARE BRIEFLY DEFINED, AND ACCOMPLISHMENTS DURING THE MOD-3 PORTION OF THE PROGRAM ARE SUMMARIZED. SIGNIFICANT RESULTS FROM SEVERAL SERIES OF EXPERIMENTS ARE PRESENTED: (1) RESULTS FROM A SERIES OF BASELINE EXPERIMENTS THAT INCLUDED LARGE-BREAK BLOWDOWN, REFLOOD, AND INTEGRAL BLOWDOWN-REFLOOD TESTS; (2) RESULTS FROM SIMULATIONS OF THE TRANSIENT AT THE THREE MILE ISLAND 2 NUCLEAR POWER STATION; (3) EXPERIMENTAL FINDINGS FROM A SMALL-BREAK BLOWDOWN TEST SERIES; AND (4) MISCELLANEOUS EXPERIMENTAL RESULTS INCLUDING PLANT BLACKOUT SIMULATIONS (COMPLETE LOSS OF ELECTRICAL POWER), UPPER-HEAD INJECTION DRAIN TESTS, AND NATURAL CIRCULATION INVESTIGATIONS.
- 22-3-3-238 PITFALLS IN CURRENT DESIGN REQUIREMENTS
WEAVER, W. R.
BARCOCK AND WILCOX, LYNCHBURG, VA.
IT IS ILLOGICAL TO CONTINUE USING SOME CURRENT DESIGN REQUIREMENTS IN THEIR PRESENT FORM. SPECIFYING DESIGN CRITERIA TO GUARD AGAINST VARIOUS OCCURRENCES WHILE NEGLECTING AN EXAMINATION OF THEIR LIKELIHOOD IS UNJUSTIFIABLE. PROBABILISTIC ANALYSES, FOLLOWED IF NECESSARY BY COST-BENEFIT ANALYSES, CAN FOCUS ON AND BRING INTO PERSPECTIVE VARIOUS ADVERSE IMPLICATIONS RESULTING FROM SOME DETERMINISTIC CRITERIA AND REQUIREMENTS. PROPER USE AND PROBABILISTIC ANALYSIS TECHNIQUES WILL GIVE SYSTEM DESIGNERS LATITUDE IN DESIGN DECISIONS, THEREBY ELIMINATING THE BUILT-IN BIASES OF DESIGN PHILOSOPHY BASED ON DETERMINISTIC CRITERIA. THIS RESULTANT PHILOSOPHICAL DIVERSITY APPLIED TO ATTAINING DESIGN GOALS SHOULD BE BENEFICIAL IN REDUCING RISKS FROM NUCLEAR STATIONS.
- 22-3-3-337 HUMAN FACTORS ENGINEERING IN THE U.S. NUCLEAR ARENA
HAGEN, E. W. + MAYS, G. T.
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENN.
THE CHRONOLOGY OF HUMAN FACTORS ENGINEERING IN THE U.S. NUCLEAR POWER INDUSTRY IS HIGHLIGHTED. HUMAN FACTORS ENGINEERING IS DEFINED HEREIN AS AN INTERDISCIPLINARY SPECIALTY CONCERNED WITH INFLUENCING (1) THE DESIGN OF EQUIPMENT AND SYSTEMS AND (2) THE MANAGEMENT OF FACILITIES AND OPERATIONAL ENVIRONMENTS TO PROMOTE SAFE, EFFICIENT, AND RELIABLE MAN-MACHINE PERFORMANCE. PROBLEMS AND CONCERNS ARE COALESCED TO GIVE A PERSPECTIVE FOR THE NEXT EVOLUTIONARY PHASE OF HUMAN FACTORS ENGINEERING APPLICATION, I. E., THE SOLVING OF PRESENT PROBLEMS IN A REASONABLE AND PRACTICAL WAY, THUS OVERCOMING PREVIOUS NEGLECT OF AN IMPORTANT ASPECT OF NUCLEAR SAFETY.
- 22-3-4-347 SIXTEENTH DOE NUCLEAR AIR CLEANING CONFERENCE
BELLAMY, R. R. + NOELLER, D. W. + UNDERHILL, D. W.
FIRST, N. W.
NUCLEAR REGULATORY COMMISSION, WASHINGTON, D. C. / HARVARD UNIVERSITY, BOSTON, MASS. / UNIVERSITY OF PITTSBURGH, PITTSBURGH, PA.
THE SIXTEENTH DOE NUCLEAR AIR-CLEANING CONFERENCE WAS HELD ON OCT. 20-23, 1980, IN SAN DIEGO, CALIF. THE 350 AIR-CLEANING SPECIALISTS WHO ATTENDED WERE AFFILIATED WITH GOVERNMENTAL AGENCIES, EDUCATIONAL INSTITUTIONS, NATIONAL LABORATORIES, AND MANY SECTORS OF THE NUCLEAR INDUSTRY, REPRESENTING THE UNITED STATES AND 11 FOREIGN COUNTRIES. MAJOR TOPICS DISCUSSED DURING

THE CONFERENCE WERE WASTE TREATMENT INCLUDING VOLUME REDUCTION AND STORAGE, SYSTEM AND COMPONENT RESPONSE TO STRESS AND ACCIDENT CONDITIONS, THE THREE MILE ISLAND ACCIDENT, IODINE ADSORPTION, THE TREATMENT AND STORAGE OF NOBLE GAS, THE TREATMENT OF OFF-GASES FROM CHEMICAL PROCESSING, AEROSOL BEHAVIOR, CONTAINMENT VENTING, LABORATORY AND IN-PLACE FILTER-TESTING METHODS, AND PARTICULATE FILTRATION. THE CONFERENCE FOCUSED ON THE EXCHANGE OF INFORMATION AMONG THE PARTICIPANTS. AIR-CLEANING RESEARCH IS CONTINUING TO MOVE FORWARD IN BOTH THE UNITED STATES AND FOREIGN COUNTRIES, YET THERE ARE DISTINCT DIFFERENCES IN THE NATURE OF THESE EFFORTS. IN THE EUROPEAN COUNTRIES, RESEARCH EFFORTS ARE DIRECTED TOWARD AIR-CLEANING PROBLEMS ASSOCIATED WITH THE REPROCESSING OF SPENT FUELS. FOREIGN RESEARCHERS ARE ALSO EXPENDING CONSIDERABLE TIME AND EFFORT ON REMOTE CHANGING AND PACKAGING OF SPENT FILTER ELEMENTS. WITHIN THE UNITED STATES, RESEARCH IS MOVING FORWARD ON THE DEVELOPMENT OF FILTERED VENTED CONTAINMENT SYSTEMS FOR COMMERCIAL NUCLEAR POWER PLANTS, AND THE USE OF SAND FILTERS IN THE VENTING SYSTEM IS ONCE AGAIN RECEIVING ATTENTION. THE THREE MILE ISLAND ACCIDENT OF MARCH 1979 AND THE ASSOCIATED AIR-CLEANING ASPECTS WERE ALSO DISCUSSED AT LENGTH AND IN DETAIL DURING THE CONFERENCE.

- 22-3-5-362 THE CALCULATION OF WET DEPOSITION FROM RADIOACTIVE PLUMES
BRENN, H. D. + VOGT, K. J.
SYSTEMPLANUNG UMFELTSCHUTZ, AACHEN, FEDERAL REPUBLIC OF GERMANY
A REEVALUATION OF THE CURRENT WET DEPOSITION MODELS FOR RADIOACTIVE PLUMES OF THE GAUSSIAN TYPE IS PRESENTED. THE APPLICATION OF THE METHODOLOGY TO ROUTINE AND ACCIDENTAL ACTIVITY RELEASES FROM NUCLEAR FACILITIES IS DISCUSSED. A SET OF WASHOUT PARAMETERS FOR A SIMPLIFIED MODEL HAS BEEN INCLUDED.
- 27-3-1-372 1979 OUTAGE EXPERIENCE OF NUCLEAR ELECTRIC POWER GENERATING PLANTS
SCOTT, R. L.
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENN.
THIS ARTICLE SUMMARIZES THE 1979 OUTAGE EXPERIENCE OF 67 LICENSED NUCLEAR POWER PLANTS. OPERATING STATISTICS AND DATA ARE PRESENTED FOR EACH PLANT THAT WAS IN COMMERCIAL OPERATION AT THE END OF THE YEAR AND HAD SUFFICIENT ELECTRICAL GENERATION FOR MEANINGFUL ANALYSES. THE ONE EXCEPTION IS THREE MILE ISLAND 2. AUTHORITY TO OPERATE THIS FACILITY WAS SUSPENDED BY THE NUCLEAR REGULATORY COMMISSION ON JULY 20, 1979; THEREFORE OPERATIONAL DATA FOR THIS UNIT COVERS ONLY THE PERIOD JAN. 1 THROUGH JULY 19, 1979. INCLUDED IN THIS ARTICLE ARE THE DATA FOR 25 BOILING-WATER REACTOR (BWR) PLANTS; 41 PRESSURIZED-WATER REACTOR (PWR) PLANTS; AND FORT ST. VRAIN, THE ONLY HIGH-TEMPERATURE GAS-COOLED REACTOR (HTGR) PLANT COMMERCIALY OPERABLE IN THE UNITED STATES. DURING 1979 THE 25 OPERATING BWR EXPERIENCED AN AVERAGE OF 2419 H OF OUTAGE TIME COMPARED TO AN AVERAGE OF 3169 H FOR THE 41 OPERATING PWR. THE PERCENTAGE OF FORCED OUTAGE TIME AT BWR WAS 37 PERCENT COMPARED TO 46 PERCENT AT PWR. THE PRIMARY CAUSE OF FORCED OUTAGES AT BWR WAS EQUIPMENT FAILURE. AT PWR THE PRIMARY CAUSE OF FORCED OUTAGES WAS REGULATORY REQUIREMENTS. REFUELING WAS THE PRIMARY CAUSE OF SCHEDULED OUTAGES AT BOTH BWR AND PWR. IMPLEMENTATION OF NEW REGULATORY REQUIREMENTS AND MAINTENANCE OR TESTING ACCOUNTED FOR LARGE PERCENTAGES OF THE SCHEDULED OUTAGE TIME AT BOTH TYPES OF PLANTS. THE DOMINANCE OF REGULATORY REQUIREMENTS AS THE CAUSE FOR LARGE PERCENTAGES OF FORCED AND SCHEDULED OUTAGES WAS THE RESULT OF ACTION TAKEN WITH REGARD TO ASPECTS OF THE THREE MILE ISLAND 2 INCIDENT AND WITH REGARD TO CONCERN FOR SEISMIC DESIGN DEFICIENCIES IN SAFETY-RELATED PIPING. FORT ST. VRAIN, AN HTGR, DECLARED COMMERCIAL OPERATION JULY 1, 1979. FOR THE REMAINDER OF THE YEAR, THE UNIT ACQUIRED AN AVAILABILITY FACTOR OF 22.2 PERCENT HAVING EXPERIENCED EIGHT FORCED OUTAGES AND THREE SCHEDULED OUTAGES FOR A TOTAL OUTAGE TIME OF 3434 H.
- 22-4-1-423 OVERVIEW OF THE U.S. FLIGHT SAFETY PROCESS FOR SPACE NUCLEAR POWER
BENNETT, G. L.
DEPARTMENT OF ENERGY, GERMANTOWN, MD.
THE TWO CURRENT TYPES OF NUCLEAR POWER SOURCES USED IN U.S. SPACECRAFT ARE DESCRIBED ALONG WITH THE FLIGHT SAFETY PHILOSOPHIES GOVERNING THEIR USE. IN THE CASE OF RADIOISOTOPE THERMOELECTRIC GENERATORS, THE DESIGN PHILOSOPHY CONSISTS OF CONTAINMENT, IMMOBILIZATION, AND RECOVERY OF THE NUCLEAR MATERIALS. FOR REACTORS, THE EMPHASIS IS ON MAINTAINING A SUBCRITICAL CONFIGURATION IN ALL CREDIBLE ACCIDENT ENVIRONMENTS. TO DOCUMENT THE SAFETY ACTIVITIES, A SAFETY ANALYSIS REPORT IS PREPARED FOR EACH MISSION. THESE REPORTS, WHICH ARE BASED ON THE PROBABILISTIC RISK ASSESSMENT METHODOLOGY PIONEERED BY THE SPACE NUCLEAR SAFETY COMMUNITY, ARE SUBJECTED TO AN INTERAGENCY SAFETY REVIEW BEFORE A RECOMMENDATION IS MADE TO APPROVE THE LAUNCH OF A NUCLEAR-POWERED SPACECRAFT.
- 22-4-1-435 SOURCES OF NUCLEAR REGULATORY REQUIREMENTS
KOMANOFF, C.
KOMANOFF ENERGY ASSOCIATES, NEW YORK, N.Y.
THIS ARTICLE REVIEWS THE EVOLUTION OF REGULATORY REQUIREMENTS PERTAINING TO THE DESIGN AND CONSTRUCTION OF COMMERCIAL NUCLEAR POWER PLANTS IN THE UNITED STATES. IT IDENTIFIES THREE MAIN

FACTORS THAT HAVE CAUSED REGULATORY REQUIREMENTS TO BECOME MORE STRINGENT: (1) THE INCREASING REACTOR POPULATION HAS NECESSITATED REDUCING THE PER-REACTOR ACCIDENT RISK TO MAINTAIN A HIGH PROBABILITY THAT A SERIOUS ACCIDENT WILL NOT OCCUR; (2) LICENSING REVIEWS AND OPERATING EXPERIENCE HAVE DEMONSTRATED THAT THE DESIRED LEVELS OF SAFETY FOR THE NUCLEAR SECTOR AS A WHOLE WERE NOT BEING ACHIEVED; AND (3) THE INCREASED REGULATORY EFFORT REQUIRED TO LICENSE AND OVERSEE AN EXPANDING NUCLEAR SECTOR HAS CAUSED REGULATORY STANDARDS TO BE MADE MORE UNIFORM THROUGHOUT THE SECTOR, GENERALLY AT A HIGHER COMMON DENOMINATOR. THE CLOSE LINK BETWEEN REGULATORY STRINGENCY AND THE SIZE OF THE NUCLEAR SECTOR SUGGESTS THAT FUTURE EXPANSION OF THE NUCLEAR SECTOR WILL LEAD TO THE IMPOSITION OF NEW REGULATORY REQUIREMENTS.

- 22-4-2-449 NRC LIGHT WATER REACTOR PRESSURE VESSEL SURVEILLANCE DOSIMETRY IMPROVEMENT PROGRAM
SERPAN, C. Z.
U. S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, D.C.
THE NUCLEAR REGULATORY COMMISSION HAS ESTABLISHED THE LIGHT-WATER-REACTOR PRESSURE VESSEL (LWR-PV) SURVEILLANCE DOSIMETRY IMPROVEMENT PROGRAM IN ORDER TO IMPROVE AND STANDARDIZE THE PROCEDURES FOR DOSIMETRY, DAMAGE CORRELATION, AND ASSOCIATED REACTOR ANALYSIS USED FOR PREDICTING THE INTEGRATED EFFECT OF NEUTRON EXPOSURE ON LWR-PVS. THIS MULTILABORATORY INTERNATIONAL PROGRAM IS DEVELOPING AND VALIDATING A SERIES OF 17 STANDARD PROCEDURES FOR NEUTRON SURVEILLANCE DOSIMETRY AND EMBRITTLEMENT EVALUATION AND IS ESTABLISHING A SERIES OF EXPERIMENTAL BENCHMARK EXPERIMENTS FOR NEUTRON PHYSICS CALCULATIONS, DOSIMETRY MEASUREMENTS, AND EMBRITTLEMENT PREDICTIONS. RECOMMENDATIONS ALREADY DEVELOPED INCLUDE (1) THE NECESSITY FOR BENCHMARK REFERENCING OF REACTOR PHYSICS CALCULATIONS USING THE POOL CRITICAL ASSEMBLY TEST DATA FROM OAK RIDGE NATIONAL LABORATORY, (2) THE USE OF DPA (DISPLACEMENTS PER ATOM) AS AN IMPROVED EXPOSURE CRITERION REPLACING "FLUENCE GREATER THAN 1 MEV," AND (3) THE NECESSITY FOR DOSIMETRY MEASUREMENT CERTIFICATION.
- 22-4-3-466 DEFECT FLOW ANALYSIS OF CONTROL-ROD-DRIVE OPERATIONAL EVENTS
THAGGERT, H. L. + JACOBS, I. M. + CRELLIN, G. L.
SMITH, A. M.
GENERAL ELECTRIC COMPANY, SHERBURY, CALIF. ENGINEERING DECISION ANALYSIS COMPANY, INC. PALO ALTO, CALIF.
A DEFECT FLOW ANALYSIS OF LICENSEE EVENT REPORT DATA INVOLVING CONTROL-ROD (CR) AND CONTROL-ROD-DRIVE MECHANISM (CRDM) OPERATIONAL EVENTS WAS CONDUCTED TO EXTRACT THE LESSONS TO BE LEARNED FROM THE PAST EXPERIENCE OF LIGHT-WATER NUCLEAR REACTORS OPERATING IN THE UNITED STATES. THE RESULTS OF THE ANALYSIS ARE USED TO FORMULATE CHARACTERISTICS OF CR/CRDM DEFECTS. AMONG THOSE FORMULATED ARE (1) THE LEADING DIRECT CAUSES OF DEFECTS ARE INADEQUATE DESIGN AND INADEQUATE OPERATOR TRAINING, (2) A RELATIVELY LARGE NUMBER OF DEFECTS ARE SYSTEMATIC, AND (3) DEFECTS THAT RESULT IN SYSTEM FAILURE ARE RARE. THE ANALYSIS RESULTS INDICATE THAT MOST DEFECTS COULD EASILY HAVE BEEN PREVENTED.
- 22-4-4-477 POTENTIAL SAFETY RELATED INCIDENTS IN NUCLEAR FUEL REPROCESSING PLANTS
PERKINS, W. C. + DURANT, W. S.
SAVANNAH RIVER LABORATORY, AIKEN, S. C.
THIS ARTICLE PRESENTS A COMPILATION OF POTENTIAL INITIATING EVENTS IN NUCLEAR FUEL REPROCESSING PLANTS FOR WHICH SAFETY FEATURES SHOULD BE PROVIDED TO REDUCE THE RISK TO OPERATING PERSONNEL OR TO THE GENERAL PUBLIC. BOTH GENERAL INCIDENTS AND INCIDENTS SPECIFIC TO THE KEY OPERATIONS IN REPROCESSING ARE INCLUDED TO AID PLANT DESIGN AND PRELIMINARY HAZARDS ANALYSIS.
- 22-4-5-484 OPTIMIZATION OF RADIATION PROTECTION
LOCHARD, J.
CENTRE D'ETUDE SUR L'EVALUATION DE LA PROTECTION DANS LE DOMAINE NUCLEAIRE, PARIS, FRANCE
THE PRACTICAL AND THEORETICAL PROBLEMS RAISED BY THE OPTIMIZATION OF RADIOLOGICAL PROTECTION MERIT A REVIEW OF DECISION-MAKING METHODS, THEIR RELEVANCE, AND THE WAY IN WHICH THEY ARE USED IN ORDER TO BETTER DETERMINE WHAT ROLE THEY SHOULD PLAY IN THE DECISION-MAKING PROCESS. FOLLOWING A BRIEF SUMMARY OF THE THEORETICAL BACKGROUND OF THE COST-BENEFIT ANALYSIS, WE EXAMINE THE METHODOLOGICAL CHOICES IMPLICIT IN THE MODEL PRESENTED IN THE INTERNATIONAL COMMISSION ON RADIOLOGICAL PROTECTION PUBLICATION NO. 26 AND, PARTICULARLY, THE CONSEQUENCES OF THE THEORY THAT THE LEVEL OF RADIATION PROTECTION, THE BENEFITS, AND THE PRODUCTION COSTS OF AN ACTIVITY CAN BE TREATED SEPARATELY.
- 22-4-6-498 PERSONNEL OVEREXPOSURES AT COMMERCIAL NUCLEAR POWER PLANTS (JANUARY 1, 1976 - JUNE 30, 1980)
MOELLER, D. W. + SUN, L. C.
HARVARD UNIVERSITY SCHOOL OF PUBLIC HEALTH, BOSTON, MASS / U.S.
NUCLEAR REGULATORY COMMISSION, WASHINGTON, D.C.
A REVIEW OF OPERATING EXPERIENCE AT COMMERCIAL NUCLEAR POWER PLANTS IN THE UNITED STATES REVEALED THAT 46 OVEREXPOSURE EVENTS INVOLVING 89 PEOPLE OCCURRED DURING THE PERIOD FROM JAN. 1, 1976, TO JUNE 30, 1980. ABOUT 90 PERCENT OF THESE EVENTS INVOLVED WHOLE-BODY EXPOSURES, AND 96 PERCENT OCCURRED WHILE THE PLANTS WERE SHUT DOWN OR BEING SHUT DOWN. ONLY 4 PERCENT OF

THE EVENTS OCCURRED DURING POWER OPERATIONS. APPROXIMATELY 28 PERCENT OF THE EVENTS WERE ATTRIBUTED TO ERRORS OR DELAYS IN RECORD-KEEPING SYSTEMS; 22 PERCENT WERE CAUSED BY DIRECT VIOLATIONS OF ESTABLISHED PROCEDURES. SEVENTY PERCENT OF THE EVENTS INVOLVED MECHANICAL AND ELECTRICAL WORKERS, 13 PERCENT INVOLVED PLANT OPERATORS, AND 10 PERCENT INVOLVED HEALTH PHYSICISTS. MORE THAN 50 PERCENT OF THE OVEREXPOSURES INVOLVED CONTRACTOR PERSONNEL. OVERALL, THERE HAS BEEN A DECLINE IN RECENT YEARS IN THE FREQUENCY OF OVEREXPOSURE EVENTS COMPARED TO THE NUMBER OF WORKERS.

- 22-4-6-505 REVIEW OF SAFETY RELATED EVENTS AT NUCLEAR POWER PLANTS AS REPORTED IN 1979
SCOTT, R. L. + GALLAHER, R. B.
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENN.
THIS ARTICLE REVIEWS THE REPORTS OF SAFETY-RELATED EVENTS AT LIGHT-WATER-REACTOR NUCLEAR POWER PLANTS SUBMITTED IN 1979 TO THE NUCLEAR REGULATORY COMMISSION. THE REVIEW COVERS 1345 REPORTS FROM BOILING-WATER-REACTOR FACILITIES AND 2064 REPORTS FROM PRESSURIZED-WATER-REACTOR FACILITIES. INFORMATION IS PRESENTED IN TABLES LISTING INSTRUMENT FAILURES, EQUIPMENT FAILURES, SYSTEMS INVOLVED, CAUSES, DEFICIENCIES, AND TIMES OF OCCURRENCE (I.E., REFUELING, TESTING, OPERATION, OR CONSTRUCTION). THE TABLES GIVE THE NUMBER OF REPORTS CONCERNED WITH EACH LISTED ITEM AND THEREFORE INDICATE THE FREQUENCIES OF EVENTS AND THOSE EVENTS WHICH SHOULD RECEIVE MORE ATTENTION IN THE FORM OF MAINTENANCE AND TESTING TO IMPROVE PLANT RELIABILITY AND SAFETY.
- 22-5-1-561 DEFENSE IN DEPTH APPROACH TO SAFETY IN LIGHT OF THE THREE MILE ISLAND ACCIDENT
BREEN, R. J.
ELECTRIC POWER RESEARCH INSTITUTE, PALO ALTO, CALIF.
DEFENSE IN DEPTH HAS BEEN A USEFUL CONCEPT FOR ADDRESSING SAFETY IN CURRENT LIGHT-WATER REACTORS. IT IS DISCUSSED HERE IN THE CONTEXT OF THE ACCIDENT AT THREE MILE ISLAND 2 AND SOME OF THE FOLLOW-UP ACTIONS BY THE INDUSTRY AND THE NUCLEAR REGULATORY COMMISSION (NRC). ALSO DISCUSSED IS THE IMPACT OF VARIOUS CURRENT ACTIVITIES OF BOTH THE INDUSTRY AND THE NRC ON DEFENSE IN DEPTH. PARTICULAR ATTENTION IS GIVEN TO THE ROLE THAT SIGNIFICANT-EVENT EVALUATION, SAFETY-PARAMETER DISPLAY SYSTEMS, AND SYSTEMATIC DECISION-MAKING PROCESSES IN EMERGENCY PLANNING MAY PLAY IN STRENGTHENING THE THREE LEVELS OF DEFENSE IN DEPTH (PREVENT, DETECT AND MITIGATE, AND CONTAIN AND PROTECT). THE INCREASING UTILIZATION OF QUANTITATIVE TECHNIQUES FOR ASSESSING REACTOR SAFETY IS ALSO DISCUSSED.
- 22-5-1-570 EQUITY ASPECTS OF RISK MANAGEMENT: TRADE OFFS BETWEEN PUBLIC AND OCCUPATIONAL HAZARDS IN THE NUCLEAR INDUSTRY
LOMBARD, J. + FAGNANI, F.
CENTRE D'ETUDE SUR L'EVALUATION DE LA PROTECTION DANS LE DOMAINE NUCLEAIRE, FRANCE
EQUITY PROBLEMS ARISE IN RISK MANAGEMENT WHENEVER A SITUATION JUSTIFIES DIVIDING THE EXPOSED POPULATION INTO SPECIFIC SUBGROUPS. THE USUAL PRACTICE IN RADIATION PROTECTION IN THE NUCLEAR FUEL CYCLE, WHICH CONSISTS ROUGHLY IN DIVIDING THE POPULATION INTO TWO GROUPS (PLANT EMPLOYEES AND THE GENERAL PUBLIC), ASSUMES THAT MANAGEMENT OF THE PROTECTION SYSTEM FOR EACH GROUP IS RELATIVELY INDEPENDENT. BUT IN THE CASE OF PUBLIC PROTECTION AGAINST RISKS ASSOCIATED WITH PRESSURIZED-WATER REACTORS, FOR EXAMPLE, WE SHOW THAT THIS HYPOTHESIS OF INDEPENDENCE IS NOT VALID AND THAT THERE ARE SIGNIFICANT RISK TRADE-OFFS BETWEEN THE PUBLIC AND THE EMPLOYEES. THIS LEADS US TO QUESTION THE VALUATION OF THE IMPLICIT VALUE OF A MAN-SIEVERT, DEPENDING ON WHETHER ONE IS DEALING WITH EMPLOYEES OR THE PUBLIC, FOR THE ANSWER TO THIS QUESTION STRONGLY AFFECTS THE RESULT OF ANY OPTIMIZATION OF CHOICES IN RADIATION PROTECTION.
- 22-5-2-583 THERMAL HYDRAULIC AND CORE DAMAGE ANALYSES OF THE TMI-2 ACCIDENT
IRELAND, J. R. + WENNER, T. R. + KIRCHNER, W. L.
LOS ALAMOS NATIONAL LABORATORY, LOS ALAMOS, N. MEX.
THIS ARTICLE SUMMARIZES THERMAL-HYDRAULIC AND CORE-DAMAGE ANALYSES, COMPLETED BY AUG. 31, 1979, OF THE INITIAL PART OF THE ACCIDENT AT THE THREE MILE ISLAND 2 NUCLEAR POWER PLANT ON MAR. 28, 1979. SIMULATIONS PERFORMED WITH THE TRANSIENT REACTOR ANALYSIS CODE (TRAC) PROVIDED A BETTER UNDERSTANDING OF THE PRIMARY-SYSTEM THERMAL-HYDRAULIC RESPONSE DURING THE FIRST 10 800 S (3 H) OF THE ACCIDENT AND PROVIDED A BASIS FOR REACTOR CORE-DAMAGE ESTIMATES. THE CALCULATED PRIMARY-COOLANT-SYSTEM PRESSURES AND TEMPERATURES AND PRESSURIZER LEVEL AGREED WELL WITH THE MEASURED DATA. ON THE BASIS OF TRAC-CALCULATED RESULTS, ESTIMATES WERE MADE OF THE EXTENT OF CORE DAMAGE AND THE AMOUNT OF HYDROGEN PRODUCED DURING THE FIRST 10 800 S (3 H). ALSO, MAXIMUM CORE-DAMAGE ESTIMATES WERE MADE FROM EXTRAPOLATIONS BEYOND 10 800 S (3 H) AND FROM PLANT DATA. THESE ESTIMATES INDICATED THAT THE REACTOR FUEL DID NOT REACH ITS MELTING TEMPERATURE, THAT A SUBSTANTIAL AMOUNT OF FUEL-ROD CLADDING WAS SEVERELY OXIDIZED, AND THAT SOME CLADDING MELTING AND RELOCATION OCCURRED.

- 22-5-4-599 REVIEW AND EVALUATION OF FACTORS AFFECTING NOBLE-GAS ADSORPTION ON ACTIVATED CARBON
MOELLEB, D. W. + UNDERHILL, D. W.
HARVARD UNIVERSITY, BOSTON, MASS. / UNIVERSITY OF PITTSBURGH,
PITTSBURGH, PA.
THIS ARTICLE IS A CRITICAL REVIEW OF THE LITERATURE DESCRIBING
THE INFLUENCE OF VARIOUS FACTORS ON THE ADSORPTION COEFFICIENTS
FOR RADIOACTIVE KRYPTON AND XENON ON ACTIVATED CARBON.
NUMERICAL ANALYSES SHOW THAT THE THREE-PARAMETER ANTOINE
EQUATION IS USEFUL FOR CORRELATING THE EFFECTS OF TEMPERATURE
ON THE ADSORPTION COEFFICIENTS. OTHER IMPORTANT OBSERVATIONS
ARE (1) UNDER SIMILAR CONDITIONS, CHARCOALS DIFFER
SIGNIFICANTLY IN THEIR ABILITY TO ADSORB KRYPTON AND XENON;
(2) EXCEPT AT UNUSUALLY HIGH CONCENTRATIONS, ADSORPTION
COEFFICIENTS APPEAR TO BE INDEPENDENT OF THE CONCENTRATION OF
THE NOBLE GAS; AND (3) THE COMPOSITION OF THE CARRIER GAS
SIGNIFICANTLY AFFECTS THE ADSORPTION COEFFICIENT, ESPECIALLY AT
LOW TEMPERATURES.
- 22-5-5-612 SOURCES OF TRITIUM
PHILLIPS, J. E. + EASTERLY, C. E.
OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENN.
A REVIEW OF BOTH NATURAL AND MAN-MADE TRITIUM SOURCES IS
PRESENTED. TRITIUM PRODUCTION AND RELEASE RATES ARE DISCUSSED
FOR LIGHT-WATER REACTORS (LWR), HEAVY-WATER REACTORS (HWR),
HIGH-TEMPERATURE GAS-COOLED REACTORS (HTGR), LIQUID-METAL FAST
BREEDER REACTORS (LMFBR), AND MOLTEN-SALT BREEDER REACTORS
(MSBR). IN ADDITION, RELEASE RATES ARE DISCUSSED FOR THE
TRITIUM PRODUCTION FACILITY NEAR AIKEN, S. C.,
FUEL-REPROCESSING PLANTS, EXPLOSIVES, AND FUSION REACTORS. A
DISCUSSION OF THE CHEMICAL FORMS OF RELEASES IS INCLUDED.
ENERGY-PRODUCING FACILITIES ARE RANKED IN ORDER OF INCREASING
TRITIUM PRODUCTION AND RELEASE AS FOLLOWS: HTGR, LWR, LMFBR,
MSBR, AND HWR. THE MAJORITY OF TRITIUM RELEASES HAVE BEEN IN
THE FORM OF TRITIATED WATER (HTO).
- 22-5-5-626 THE BEIR III REPORT: A REVIEW
PAFIS, O. H.
NUCLEAR REGULATORY COMMISSION, WASHINGTON, D.C.
THE FINAL EDITION OF THE BEIR III REPORT WAS PUBLISHED IN LATE
NOVEMBER 1980. AN ORIGINAL DRAFT VERSION HAD BEEN RELEASED IN
MAY 1979, BUT THAT VERSION CONTAINED A "DISSENTING REPORT,"
WHICH SAID THAT THE RISK OF RADIATION-INDUCED CANCER HAD BEEN
EXAGGERATED. AFTER MANY MEMBERS OF THE BEIR III COMMITTEE
INDICATED THEIR AGREEMENT WITH THE DISSENT, THE CHAPTER ON
CANCER WAS SUBSTANTIALLY REVISED. NEVERTHELESS, THAT CHAPTER
STILL CONTAINS DISSENTING OPINIONS IN THE FINAL EDITION.
CANCER RISK FROM LOW-LEVEL, LOW LINEAR ENERGY TRANSFER (LET)
RADIATION WAS ESTIMATED IN BEIR III USING A LINEAR-QUADRATIC
FUNCTION TO EXTRAPOLATE TO LOW DOSES FROM MORE RELIABLE DATA AT
HIGH DOSE LEVELS. UPPER- AND LOWER-BOUND ESTIMATES WERE DERIVED
USING THE LINEAR MODEL AND THE PURE QUADRATIC MODEL,
RESPECTIVELY. THE LINEAR-QUADRATIC ESTIMATES, CONSIDERED BY THE
COMMITTEE TO BE SCIENTIFICALLY MORE PLAUSIBLE, WERE
CONSISTENTLY LESS THAN COMPARABLE RISK ESTIMATES OBTAINED FROM
THE 1972 BEIR I REPORT, WHICH USED THE LINEAR HYPOTHESIS.
GENETIC RISK WAS ESTIMATED IN BEIR III USING SOME METHODS AND
ASSUMPTIONS SIMILAR TO THOSE USED IN BEIR I, INCLUDING USE OF
THE LINEAR HYPOTHESIS. NEW INFORMATION AVAILABLE SINCE 1972
CONTRIBUTED TO REFINEMENTS IN MAKING RISK ESTIMATES. THE BEIR
III COMMITTEE NOTED, HOWEVER, THAT RADIATION-INDUCED
TRANSMITTED GENETIC EFFECTS STILL HAVE NOT BEEN DEMONSTRATED IN
MAN; SO GENETIC RISK ESTIMATES MUST BE BASED ON EXPERIMENTS
WITH LABORATORY ANIMALS. THE BEIR III ESTIMATES OF GENETIC RISK
ARE NOT NOTABLY DIFFERENT FROM THOSE IN BEIR I.
- 22-5-6-636 STEAM GENERATOR TUBE PERFORMANCE: WORLD EXPERIENCE WITH WATER COOLED NUCLEAR POWER REACTORS DURING 1979
TATONE, O. S. + PATHANIA, R. S.
THE PERFORMANCE OF STEAM GENERATOR TUBES IN WATER-COOLED
NUCLEAR POWER REACTORS IS REVIEWED FOR 1979. TUBE FAILURES
OCCURRED AT 38 OF THE 93 REACTORS SURVEYED. THE CAUSES OF THESE
FAILURES AND THE PROCEDURES DESIGNED TO DEAL WITH THEM ARE
DESCRIBED. THE DEFECT RATE, ALTHOUGH HIGHER THAN THAT IN 1978,
WAS STILL LOWER THAN THE RATES OF THE TWO PREVIOUS YEARS.
METHODS BEING EMPLOYED TO DETECT DEFECTS INCLUDE THE INCREASED
USE OF MULTIFREQUENCY EDDY-CURRENT TESTING AND A TREND TO
FULL-LENGTH INSPECTION OF ALL TUBES. TO REDUCE THE INCIDENCE OF
TUBE FAILURE BY CORROSION, PLANT OPERATORS ARE TURNING TO
FULL-FLOW CONDENSATE DEMINERALIZATION AND MORE LEAK-RESISTANT
CONDENSER TUBES.
- 22-6-1-695 BASIC ASPECTS AND RESULTS OF THE GERMAN RISK STUDY
BAYER, A. + HEUSER, F. W.
KERNFORSCHUNGSZENTRUM KARLSRUHE, FEDERAL REPUBLIC OF GERMANY /
GESELLSCHAFT FÜR REAKTORSICHERHEIT, FEDERAL REPUBLIC OF GERMANY
THIS ARTICLE PRESENTS AN OVERVIEW OF THE INVESTIGATIONS AND
RESULTS OF THE GERMAN RISK STUDY (PHASE A). SIMILAR TO ITS
AMERICAN COUNTERPART REACTOR SAFETY STUDY (WASH-1400), THE
GERMAN RISK STUDY ASSESSES THE SOCIETAL RISKS ASSOCIATED WITH
POTENTIAL ACCIDENTS IN NUCLEAR POWER PLANTS SITED IN THE
FEDERAL REPUBLIC OF GERMANY. THE TECHNICAL PART OF THE ANALYSIS
WAS PERFORMED FOR A REPRESENTATIVE PRESSURIZED-WATER-REACTOR
NUCLEAR POWER PLANT OF THE 1300-MW(e) CLASS. FOR THE RISK

ASSESSMENT, 19 SITES WERE CONSIDERED, WITH A TOTAL OF 25 REACTOR UNITS PRESENTLY IN OPERATION, UNDER CONSTRUCTION, OR UNDERGOING THE LICENSING PROCEDURE. IN THE SPRING OF 1981 A TRANSLATION OF THE MAIN REPORT GERMAN RISK STUDY--MAIN REPORT (EPRI-NP-1809-SR), INCLUDING THE INVESTIGATIONS AND RESULTS OF PHASE A, WAS PUBLISHED BY THE ELECTRIC POWER RESEARCH INSTITUTE.

- 22-6-2-712 THE MARVIKEN CRITICAL FLOW TEST PROGRAM
SCHULTZ, R. R. + ERICSON, L.
EG AND G IDAHO, INC., IDAHO FALLS, IDAHO / STUDSVIK ENERGITEKNIK, SWEDEN
IN THE MARVIKEN FULL-SCALE CRITICAL FLOW TEST PROGRAM, A MULTINATIONAL PROJECT, 27 TESTS WERE CONDUCTED TO OBTAIN CRITICAL MASS FLOW DATA FOR SHORT NOZZLE GEOMETRIES (200 TO 509 MM IN DIAMETER WITH LENGTH-TO-DIAMETER RATIOS FROM 0.3 TO 3.7) COMPARABLE TO PIPE SIZES PRESENT IN WORLD NUCLEAR REACTOR STATIONS. THE NOZZLE INLET PRESSURES RANGED FROM 5.2 TO 2.6 MPA WITH THE FLUID SUBCOOLED AS MUCH AS 50C TO LOW-QUALITY SATURATION. A MAXIMUM NOZZLE MASS FLOW RATE OF 14 MG/S WAS MEASURED. TYPICAL DATA ARE PRESENTED AND DISCUSSED IN THIS ARTICLE. THESE DATA PROVIDE AN IMPORTANT LINK BETWEEN THE PREVIOUSLY AVAILABLE SMALL-SCALE CRITICAL MASS FLOW RATE DATA AND EXISTING OPERATIONAL HARDWARE.
- 22-6-3-728 SOME POSSIBLE WAYS TO IMPROVE NUCLEAR POWER PLANT INSTRUMENTATION
HSU, Y. Y. + HON, A. L. M.
NUCLEAR REGULATORY COMMISSION, WASHINGTON, D.C.
THIS ARTICLE EXAMINES THE ADEQUACY OF NUCLEAR POWER-PLANT INSTRUMENTATION ON THE BASIS OF THE LESSONS LEARNED FROM THE ACCIDENT AT THREE MILE ISLAND 2 AND FROM SOME OF THE AVAILABLE ADVANCED TECHNOLOGY. THE EXAMINATION IDENTIFIES TWO AREAS THAT COULD BE IMPROVED--UNAMBIGUOUS INDICATION AND RELIABLE DATA COLLECTION. IT SUGGESTS THAT THESE TWO AREAS CAN BE IMPROVED BY (1) DIRECT MEASUREMENT OF KEY PARAMETERS, (2) GROUPING OF INFORMATION, (3) DISTURBANCE ANALYSIS, (4) SELF-VERIFICATION OF SENSORS, AND (5) ABILITY OF THE SENSORS TO SURVIVE IN A HOSTILE ENVIRONMENT AND TO MEASURE AN EXTENDED RANGE. ALSO REPORTED ARE SOME OF THE ONGOING RESEARCH PROGRAMS, INCLUDING PROJECTS ON IN-VESSEL LIQUID-LEVEL MEASUREMENT AND ON-LINE REACTOR SURVEILLANCE SYSTEMS, AT THE NUCLEAR REGULATORY COMMISSION.
- 22-6-3-738 SURVEILLANCE OF INSTRUMENTS BY NOISE ANALYSIS
THIE, J. A.
CONSULTANT, BARRINGTON, ILL.
RANDOM FLUCTUATIONS OF NEUTRON FLUX, TEMPERATURE, AND PRESSURE IN A REACTOR PROVIDE MULTIFREQUENCY EXCITATION OF THE CORRESPONDING INSTRUMENTATION CHAINS. MATHEMATICAL DESCRIPTORS SUITABLE FOR CHARACTERIZING THE OUTPUT, OR NOISE, OF THE INSTRUMENTATION ARE REVIEWED WITH A VIEW TOWARD USING SUCH NOISE IN DETECTING INSTRUMENT FAULTS. DEMONSTRATIONS OF THE FEASIBILITY OF THIS APPROACH IN A NUMBER OF REACTORS PROVIDE ILLUSTRATIVE EXAMPLES. COMPARISONS WITH TRADITIONAL SURVEILLANCE TESTING ARE MADE, AND A NUMBER OF ADVANTAGES AND SOME DISADVANTAGES OF USING NOISE ANALYSIS AS A SUPPLEMENTARY TECHNIQUE ARE POINTED OUT.
- 22-6-4-751 CRITICAL REVIEW OF NOBLE GAS RECOVERY AND TREATMENT SYSTEMS
PENCE, D. T.
SCIENCE APPLICATIONS, INC., SAN DIEGO, CALIF.
NOBLE GAS TREATMENT SYSTEMS FOR VARIOUS APPLICATIONS IN THE NUCLEAR INDUSTRY ARE REVIEWED AND DISCUSSED. THE APPLICATIONS CONSIDERED INCLUDE NUCLEAR FUEL REPROCESSING, REACTOR WASTE GAS TREATMENT SYSTEMS, AND REACTOR EMERGENCY NOBLE GAS RECOVERY SYSTEMS. THE STATUS OF TECHNOLOGY AND DEVELOPMENT WORK IN PROGRESS IS DISCUSSED.
- 22-6-5-766 A DYNAMIC MODELING SYSTEM FOR THE TRANSFER OF RADIOACTIVITY IN TERRESTRIAL FOOD CHAINS
SIMMONDS, J. J. + LINSLEY, G. S.
NATIONAL RADIATION PROTECTION BOARD, OXFORDSHIRE, ENGLAND
A DYNAMIC MODELING SYSTEM IS DESCRIBED FOR THE TRANSFER OF RADIONUCLIDES IN TERRESTRIAL FOOD CHAINS. THE MAIN FEATURES OF THE SYSTEM ARE ITS ABILITY TO PREDICT THE TIME DEPENDENCE OF THE MAJOR TRANSFER PROCESSES AND ITS FLEXIBILITY AND APPLICABILITY TO A RANGE OF CONTAMINATION SCENARIOS. THE MODELING SYSTEM IS REGARDED AS A BASIC FRAMEWORK ON WHICH MORE REALISTIC MODELS CAN BE BASED, GIVEN THE AVAILABILITY OF RELIABLE ENVIRONMENTAL TRANSFER DATA. AN EXAMPLE OF SUCH A DEVELOPMENT IS INCLUDED FOR STRONTIUM-90 IN THE PASTURE-COW-MILK PATHWAY. THE MODEL PREDICTS ANNUAL AVERAGE CONCENTRATIONS OF STRONTIUM-90 IN MILK CAUSED BY FALLOUT IN THE UNITED KINGDOM TO WITHIN 15 PERCENT OF MEASURED VALUES FOR OVER MOST OF THE 20-YR PERIOD FOR WHICH DATA EXIST. IT MAKES POSSIBLE THE EVALUATION OF THE TIME DEPENDENCE OF THE CONTRIBUTIONS OF VARIOUS TRANSFER PROCESSES.
FOLLOWING ACUTE RELEASES TO THE ATMOSPHERE OR RELEASES IN ANY OTHER CONTAMINATION SCENARIO WHERE DIRECT DEPOSITION IS ABSENT, CERTAIN PATHWAYS OFTEN NOT CONSIDERED IN FOOD-CHAIN MODELS, SUCH AS THE EXTERNAL CONTAMINATION OF PLANTS CAUSED BY RESUSPENSION PROCESSES OR THE INGESTION OF CONTAMINANTS TOGETHER WITH SOIL BY GRAZING ANIMALS, ARE SHOWN TO BE POTENTIALLY IMPORTANT IN THE TRANSFER OF ACTIVITY TO MAN.

THE MAIN APPLICATION OF DYNAMIC FOOD-CHAIN MODELS IS THE PREDICTION OF THE CONSEQUENCES OF ACCIDENTAL RELEASES TO THE TERRESTRIAL ENVIRONMENT. THE PREDICTIONS CAN BE USED IN PLANNING COUNTERMEASURES AND IN ASSESSING THE HEALTH, ECONOMIC, AND SOCIAL IMPACTS OF ACCIDENTAL RELEASES.

22-6-6-778

BWR FEEDWATER NOZZLE AND CONTROL ROD DRIVE RETURN LINE NOZZLE CRACKING
LEWIN, J.

OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENN.

IN ITS 1978 ANNUAL REPORT TO CONGRESS, THE NUCLEAR REGULATORY COMMISSION IDENTIFIED AS AN "UNRESOLVED SAFETY ISSUE" THE APPEARANCE OF CRACKS IN FEEDWATER NOZZLES AT BOILING-WATER REACTORS (BWR). LATER SIMILAR CRACKING, DETECTED IN RETURN WATER LINES FOR CONTROL-ROD-DRIVE SYSTEMS AT BWR, WAS DESIGNATED PART II OF THE ISSUE. THIS ARTICLE OUTLINES THE RESOLUTION OF THESE CRACKING PROBLEMS.

22-6-6-782

RADIOACTIVE MATERIAL RELEASED FROM NUCLEAR POWER PLANTS IN 1978
NUCLEAR SAFETY STAFF

OAK RIDGE NATIONAL LABORATORY, OAK RIDGE, TENN.

RELEASES OF RADIOACTIVE MATERIALS IN AIRBORNE AND LIQUID EFFLUENTS FROM COMMERCIAL LIGHT-WATER REACTORS DURING 1978 HAVE BEEN COMPILED AND REPORTED. DATA ON SOLID-WASTE SHIPMENTS AS WELL AS SELECTED OPERATING INFORMATION ARE INCLUDED. THIS REPORT SUPPLEMENTS EARLIER ANNUAL REPORTS ISSUED BY THE FORMER ATOMIC ENERGY COMMISSION AND THE NUCLEAR REGULATORY COMMISSION. THE 1978 RELEASE DATA ARE COMPARED WITH RELEASES FROM PREVIOUS YEARS IN TABULAR FORM. DATA COVERING SPECIFIC RADIONUCLIDES ARE SUMMARIZED.

Section 2

PERMUTED-TITLE (KWIC) INDEX

A KWIC (KeyWord in Context) index is one in which article titles are permuted around the various significant words contained therein. For example, the title, "Design Basis for Nuclear Power Plant Protection Systems," is indexed under the words Design, Nuclear, Power, Plant, and Protection. The index words are arranged alphabetically in a column in the center of the page, with the titles permuted around them. In some cases, additional significant words in parentheses have been added to the title by the editors to allow more precise indexing. A slash (/) indicates the end of a title. The location of the articles listed in the main index (orange) is indicated by the seven-digit numbers in the column to the right of the page, as described in the Introduction.

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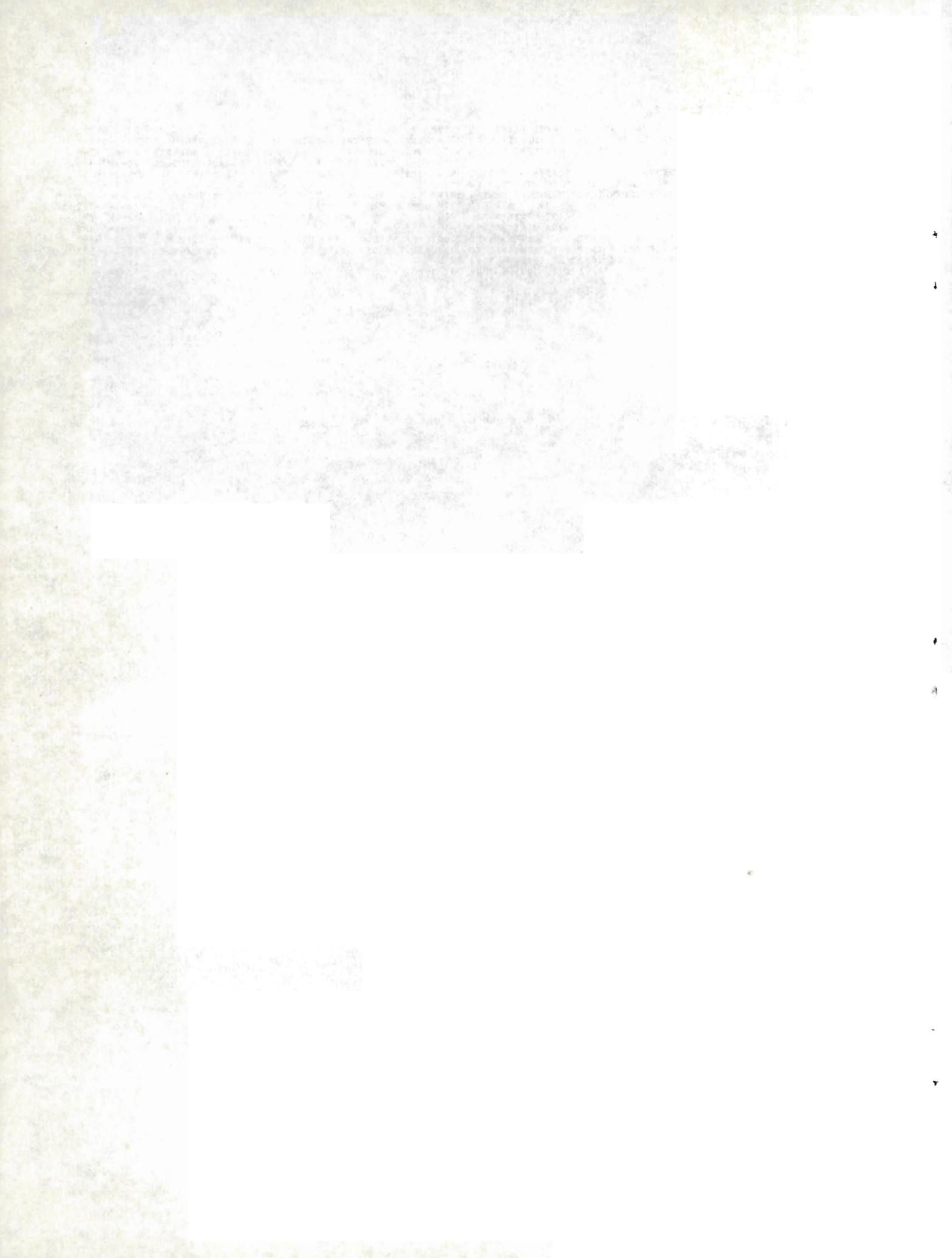
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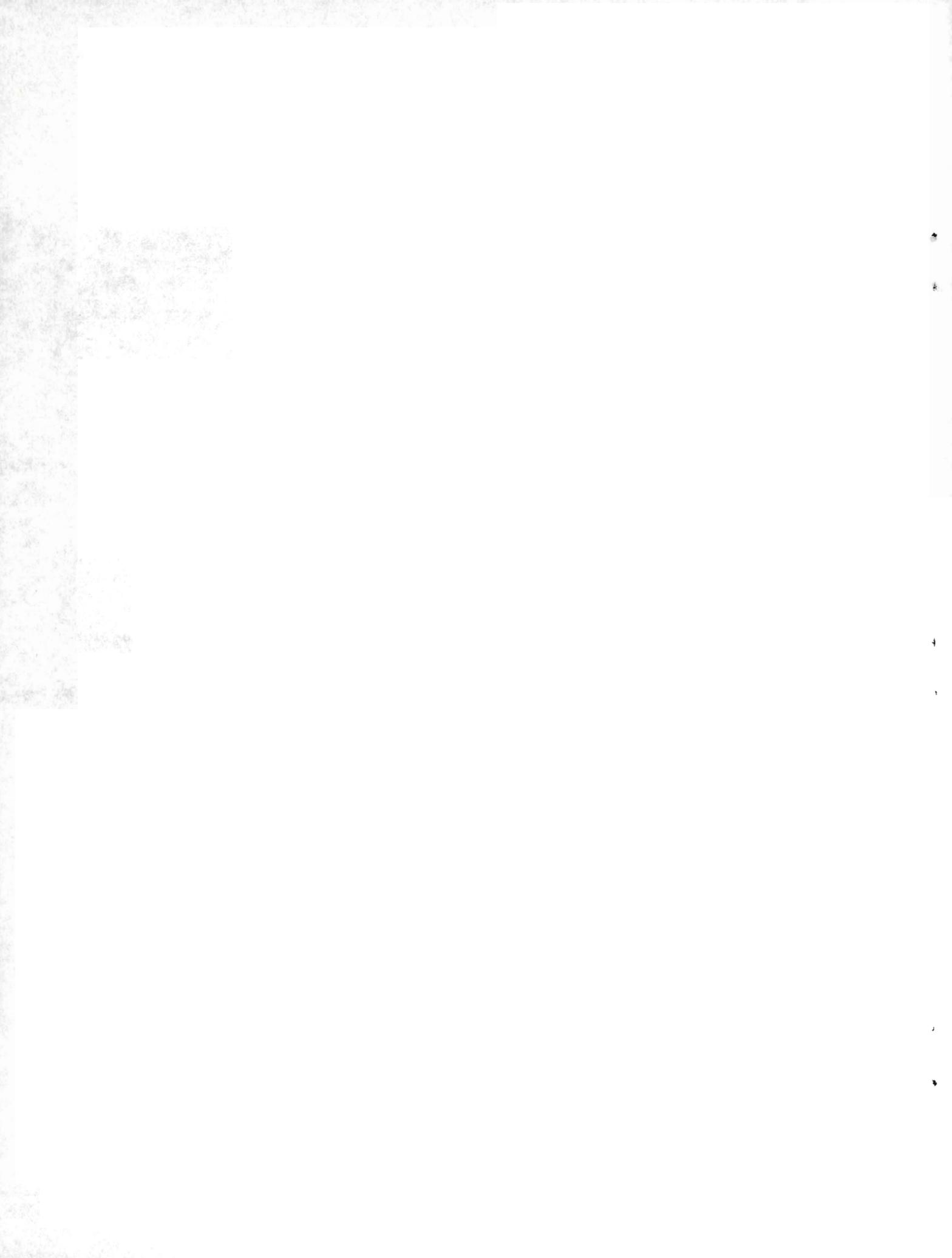
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