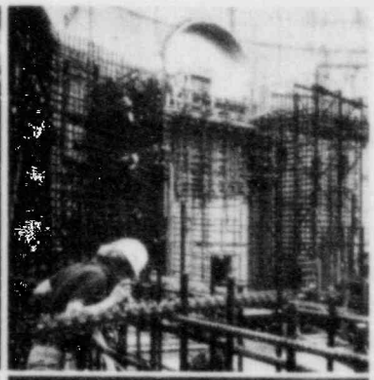
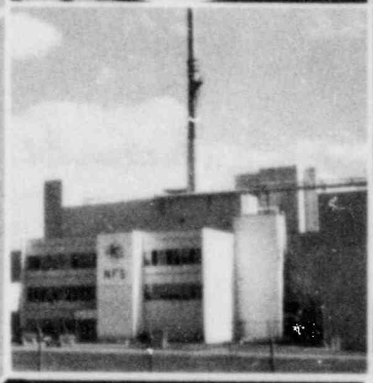
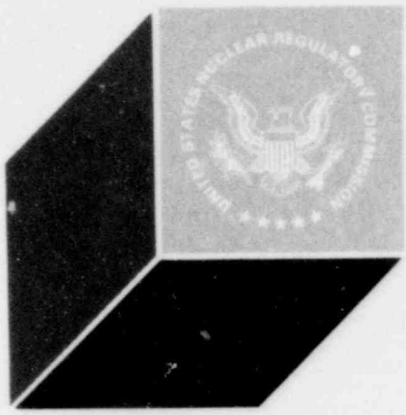
U.S. NUCLEAR
REGULATORY COMMISSION

1981
Annual Report





June 17, 1982

The President
The White House
Washington, D.C. 20500

Dear Mr. President:

This Annual Report for 1981 of the United States Nuclear Regulatory Commission is forwarded for your transmittal to the Congress, as required by Section 307(c) of the Energy Reorganization Act of 1974.

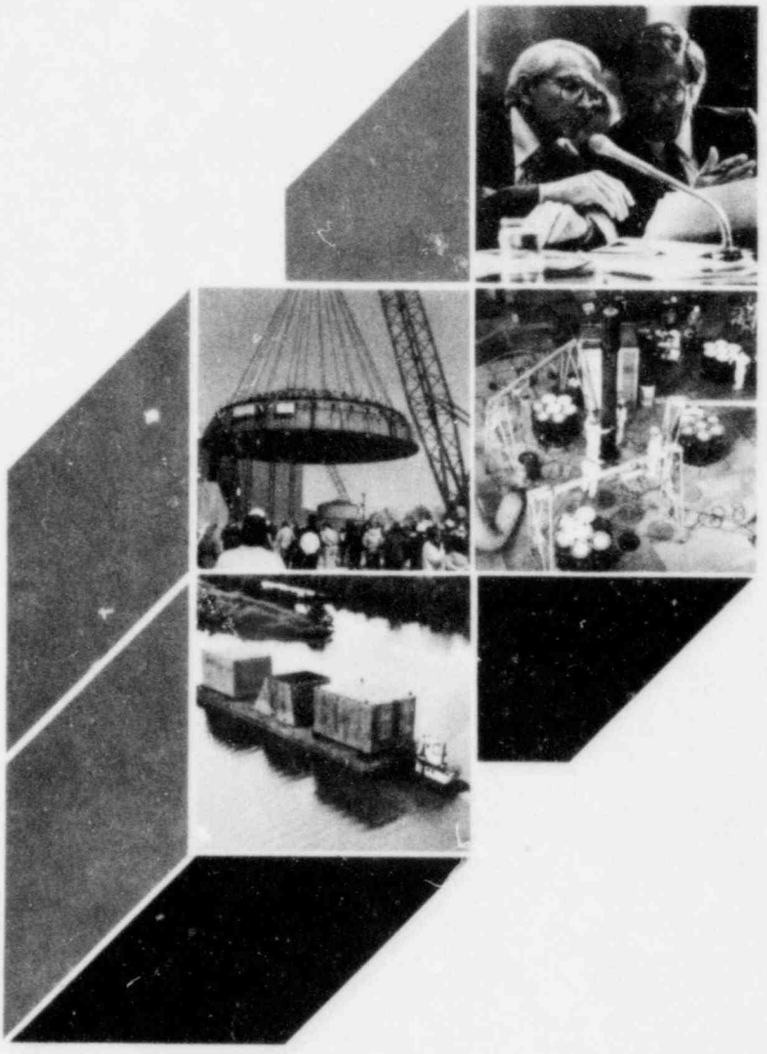
The report is devoted mainly to coverage of events and activities occurring in fiscal year 1981, with additional treatment of events after that period where circumstances warranted.

Respectfully

Nunzio J. Palladino

Nunzio J. Palladino
Chairman

1981 Annual Report



U.S. NUCLEAR
REGULATORY COMMISSION

Available from

GPO Sales Program
Division of Technical Information and Document Control
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

Table of Contents

Chapter 1 — NRC 1981—New Commission/New Policy

Chapter 2 — Reactor Regulation

Chapter 3 — Operating Experience

Chapter 4 — Nuclear Materials

Chapter 5 — Domestic Safeguards

Chapter 6 — Waste Management

Chapter 7 — Inspection, Enforcement and Emergency Preparedness

Chapter 8 — Cooperation With the States

Chapter 9 — International Cooperation

Chapter 10 — Nuclear Regulatory Research

Chapter 11 — Proceedings and Litigation

Chapter 12 — Management and Communication

APPENDICES:

Statutory Reporting Requirements Addressed

ENERGY REORGANIZATION ACT OF 1974, AS AMENDED

Section 307(c) directs the Commission to include in its Annual Report statements and descriptions concerning:

". . . the short-range and long-range goals, priorities, and plans of the Commission as they relate to the benefits, costs, and risks of nuclear power." (See Chapter 1 for overall statement. Specific goals concerning nuclear power reactors are also discussed in Chapter 2; operating experience in Chapter 3; fuel cycle in Chapter 4; safeguards in Chapter 5; waste management in Chapter 6; inspection, enforcement and emergency preparedness in Chapter 7; nuclear nonproliferation in Chapter 9; and nuclear regulatory research in Chapter 10.

". . .The Commission's activities and findings in the following areas—

"(1) insuring the safe design of nuclear power plants and other licensed facilities. . ." (For reactors, see Chapters 2 and 10; materials facilities, devices and transportation packages, Chapters 4 and 10; waste facilities, Chapters 4 and 10.)

"(2) investigating abnormal occurrences and defects in nuclear power plants and other licensed facilities. . ." (See Chapers 2 and 3.)

"(3) safeguarding special nuclear materials at all stages of the nuclear fuel cycle. . ." (See Chapters 5 and 10.)

"(4) investigating suspected, attempted, or actual thefts of special nuclear materials in the licensed sector and developing contingency plans for dealing with such incidents. . ." (Chapters 5, 7 and 10.)

"(5) insuring the safe, permanent disposal of high-level radioactive wastes through the licensing of nuclear activities and facilities. . ." (See Chapter 6.)

"(6) protecting the public against the hazards of low-level radioactive emissions from licensed nuclear activities and facilities. . ." (See Chapters 2, 4 and 10.)

Section 205 requires development of "a long term plan for projects for the development of new or improved safety systems for nuclear power plants" and an annual updating of the plan. (See Chapter 10.)

Section 209 requires the Commission to include in each Annual Report a chapter describing the status of NRC's domestic safeguards program. (See Chapter 5.)

Section 210 directs the Commission to submit "a plan providing for the specification and analysis of unresolved safety issues relating to nuclear reactors," and to include progress reports in the Annual Report thereafter concerning corrective actions. (See Chapter 2.)

NUCLEAR NONPROLIFERATION ACT OF 1978

Section 602 requires annual reports by the Commission and the Department of Energy to "include views and recommendations regarding the policies and actions of the United States to prevent proliferation which are the statutory responsibility of those agencies. . ." (See Chapter 9.)

ATOMIC ENERGY ACT OF 1954, AS AMENDED

Section 170i directs the Commission to report annually on indemnity operations implementing the Price-Anderson Act which provides a system to pay public liability claims in the event of a nuclear incident. (See Chapter 2.)

PUBLIC LAW 96-295

Section 303 directs the Commission to report annually a statement of—

"(1) the direct and indirect costs to the Commission for the issuance of any license or permit and for the inspection of any facility; and

"(2) the fees paid to the Commission for the issuance of any license or permit for the inspection of any facility." (See Chapter 12.)

1

NRC 1981— New Commission/New Policy

This seventh annual report of the U.S. Nuclear Regulatory Commission covers major actions, events and planning that occurred during fiscal year 1981, with some coverage of later events, where appropriate. As required by Section 307(c) of the Energy Reorganization Act of 1974, the report is submitted to the President for transmittal to the Congress.

Chapters of the report address the agency's various functions or areas of activity: regulating nuclear power plants (Chapter 2); evaluating reactor operating experience (Chapter 3); licensing nuclear materials and their transportation (Chapter 4); safeguarding nuclear plants and materials (Chapter 5); managing nuclear wastes (Chapter 6); inspection and enforcement (Chapter 7); cooperation with State governments (Chapter 8); international activities (Chapter 9); research and standards development (Chapter 10); hearings, decisions and litigation (Chapter 11); and administrative and public communications matters (Chapter 12). Each chapter presents a detailed review of program accomplishments during the report period, fiscal year 1981.

Important Organizational Changes

A number of major changes took place in the membership of the Nuclear Regulatory Commission during fiscal year 1981. Early in the year, Joseph M. Hendrie resumed the Chairmanship under appointment by President Reagan. Chairman John F. Ahearne, who had been appointed to the Chairmanship by President Carter, remained on the Commission. Upon the expiration of his term at the end of June 1981, Chairman Hendrie was succeeded by Nunzio J. Palladino as Chairman of the Commission. The subsequent appointment of Commissioner Thomas M. Roberts brought the Commission to its full complement of five members for the first time in nearly a year. (See Appendix 1 for NRC Table of Organization.)

During fiscal year 1981, a number of changes were made in the staff organization of the NRC. Two of the five "line" offices of the agency, the Offices of Nuclear Regulatory Research and Standards Development, were consolidated in April 1981 into a single Office of Nuclear Regulatory Research. This move brought into organizational proximity the related functions of standards-writing and regulatory research and permitted more effective use of staff resources.

A pivotal post was created in the Office of the Executive Director for Operations (EDO) just after the close of the report period, involving important new policy directives and staff reorganization. The reasons behind the move were twofold: to provide reassurance that priority among new requirements will be accorded those having greatest safety significance, and to enlarge the role of the NRC regional offices as key transmitters and receivers in the NRC's interaction with licensees. With the full title "Deputy Executive Director for Regional Operations and Generic Requirements," the new Deputy Director serves as Chairman of the Committee to Review Generic Requirements (CRGR), a newly established senior staff group charged with reviewing existing and proposed regulatory requirements to determine whether they contribute effectively to the protection of the public health and safety without imposing unnecessary burdens on licensee or agency resources. The Committee makes recommendations to the Executive Director for Operations (EDO) as to whether and to what extent each requirement should be imposed. Expanded operations of the NRC regional offices have also been brought under the aegis of the EDO, through the new Deputy Director.

Policy and Planning Guidance

The Commission's revised policy and planning guidance to the staff was developed during the latter

Nunzio J. Palladino, at left is congratulated by his predecessor as Chairman of the NRC, Joseph M. Hendrie, who administered the oath at the swearing-in ceremony. Mrs. Palladino held the Bible at the ceremony, which took place on June 24, 1981. Chairman Palladino's term began July 1.

half of 1981 and published in January 1982. The "U.S. Nuclear Regulatory Commission Policy and Planning Guidance 1982" (NUREG-0885, Issue 1) provides guidance to the staff on areas the Commission wants emphasized, as well as a comprehensive framework for routine NRC functions. Seven major objectives are defined and guides for their attainment are presented. These are summarized below, with references to chapters of this report shown parenthetically.

(1) *Safe Operation of Licensed Plants.* Strong measures will be taken to assure continued safety in the operation of licensed facilities. Operating experience will be given special attention, with priority on the collection, analysis and dissemination of safety-related operational data and the upgrading of the Licensee Event Report (LER) system (see Chapter 3). New emphasis also will be given to a long range NRC human-factors program, including the administration of qualifying and requalifying examinations for reactor operators to provide improved testing, and more effective evaluation of each utility's management to assure quality in its supervision of operators (see Chapter 2). NRC enforcement policy will be to assure that licensees who do not comply with requirements are subject to prompt and vigorous action, and that those who cannot maintain an adequate level of protection of public health and safety are not permitted to operate (see Chapter 7).

(2) *Near-Term Licensing Problems and Responses.* NRC regulatory processes must be efficient, cost-effective and free of unnecessary burdens on licensess. Decisions must be reached promptly. Hearings must be completed in a timely manner. Eleven months is suggested as a target for the interval between issuance of the final supplemental safety evaluation report and issuance of a nuclear power plant operating license.

(3) *Coordinating Regulatory Requirements.* Measures will be taken to control issuance of new requirements to reactor licensees. Risk-reduction potential and a positive contribution to safety will be over-riding considerations in the exercise of these controls. The new Committee to Review Generic Requirements in the Office of the Executive Director for Operations will help control and coordinate these requirements (see Chapters 2, 3 and 12).

(4) *Improving the Licensing Process.* NRC will prepare both revised internal procedures and new legislative proposals for streamlining the licensing process. To this end the Chairman appointed a Regulatory Reform Task Force, in November 1981, to develop and recommend both near and long term measures to improve the process. The task force will seek to meet four objectives: (1) to create a more effective and efficient vehicle for raising and resolving legitimate public safety and environmental issues regarding applications under review; (2) to develop means for more effective future use of NRC resources in licensing new plants; (3) to avoid regulatory uncertainty and the imposition of unjustifiable ec-

onomic burdens on utilities that may wish to build a nuclear plant; and (4), to accomplish the foregoing without impairing the protection of the public health and safety. Task Force proposals—both those requiring new legislation and those possible without it—are expected by June 1982. (See Chapter 2.)

(5) *Supporting New Initiatives.* The Commission is actively concerned with waste management in general and the cleanup of the Three Mile Island (TMI) nuclear power station in particular. In general, the NRC waste management program will be based on the premise that, in the absence of unresolved safety concerns, the NRC regulatory program will not delay implementation of the Executive Branch's program. NRC high-level waste management efforts will focus on the review of the Department of Energy's (DOE) site characterization activities and the development of methods to implement licensing criteria for high-level waste repositories. With respect to the TMI cleanup, the Commission regards it as one of its highest safety priorities. NRC will continue to monitor site cleanup activities and work with DOE to effect an expeditious removal of the damaged reactor core. (See Chapters 2 and 6.)

(6) *Improving Related Regulatory Tools.* A number of diverse areas of guidance are included under this heading. The first regulatory tool is a well articulated safety goal and related safety guidance emphasizing individual and societal risks that might arise from reactor accidents. The Commission issued a proposed safety goal policy statement shortly after the end of calendar year 1981 as a draft for public comment, with comments due by May 18, 1982. The draft statement focuses on one matter of special public concern: nuclear power plant accidents which may release radioactive materials to the environment. It notes the Commission's intent that accident risks for various initiating mechanisms be taken into account using the best current evaluation techniques. It also restates the Commission's belief that better means must be found for testing the need for regulatory requirements as a step toward more coherent and predictable regulation of nuclear plants. The intent of the policy statement is to clarify the Commission's views on an acceptable

Shown above is a public meeting of the U.S. Nuclear Regulatory Commission at its headquarters in Washington, D.C. The five Commissioners are seated at the far side of the table, facing the camera. They are, left to right, Thomas M. Roberts, John F. Ahearne, Chairman Nunzio J. Palladino, Victor Gilinsky, and Peter A. Bradford.

The 250th meeting of the Advisory Committee on Reactor Safeguards, shown above, took place February 5–7, 1981. The Committee, established in 1957 by statute, provides the NRC with advice regarding potential hazards of proposed or existing reactor facilities and the adequacy of proposed safety standards. Committee activities in fiscal year 1981 are covered in Chapter 2.

level of risk to public health and safety and on the safety-cost tradeoffs necessary to achieve it.

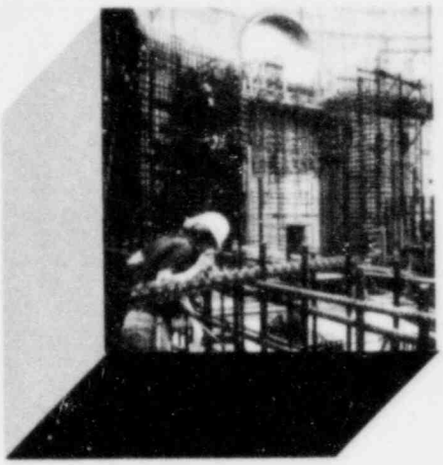
The second potentially valuable tool is *probabilistic risk assessment*, an approach used, among other things, for assessing the relative importance of various accident sequences, and assigning priorities to corresponding defenses. Risk assessment is also useful in licensing review and in the assessment of generic safety issues (see Chapter 10).

The third tool is an improved policy on siting of nuclear facilities. Although the guidance affirms that the adoption of an overall safety goal should precede new siting regulations, it also confirms the need for a *siting policy* that will take into account the engineered safety features in plant design and the radioactive inventory in a potential release. Publication of a proposed siting rule should take place by late 1983 (see Chapter 2).

The fourth tool of importance to assuring adequate protection of the public health and safety is *quality assurance*. The staff will encourage industry to be more aggressive in verifying the quality of each plant during design, construction and operation, and will also review NRC activity in promoting quality assurance and propose a plan for upgrading quality assurance programs throughout the agency early in 1982 (see Chapter 3).

Finally, among the tools to provide a firmer base for NRC regulatory action, the *research* program will continue to emphasize the assured safe operation of light water power reactors as its first priority and direct its long-range efforts to areas important in licensing and inspection activities, with future resources geared to accommodate Administration plans, such as the revived breeder reactor project (see Chapter 10).

(7) *Safeguards*. NRC will carry out its statutory licensing responsibilities to control exports of nuclear materials, and work with other nations in nonproliferation matters (see Chapter 9). Domestically, the Commission's policy and planning guidance reaffirms that safeguards equates to safety where public protection is concerned (see Chapter 5).



2 Reactor Regulation

The licensing of nuclear power plants is centered in the Office of Nuclear Reactor Regulation (NRR). This chapter covers NRR activities during fiscal year 1981 and comprises the following major sections: Status of Licensing; Improving the Licensing Process; Human Factors; Unresolved Safety Issues; Safety Reviews; Status of TMI-2 Facility; Protecting the Environment; Antitrust Activities; and the Advisory Committee on Reactor Safeguards.

Status of Licensing

Issuance of Operating Licenses

During fiscal year 1981, NRC licensing activity was mainly focused on applications for operating licenses for those nuclear power plants projected to be completed in 1981 and 1982. Four low-power licenses, authorizing fuel loading and low-power testing at a level up to five percent of full-power, and four full-power operating licenses were issued for the units listed in Table 1.

In some cases, there may be projected delays between construction completion as estimated by the utility and issuance of a full-power license. The costs of such delays are estimated monthly by the Department of Energy and are included in an NRC Monthly Status Report to Congress. These estimates are based on an assessment of the costs of replacement energy. They vary widely among the different units, ranging from about $6 to $31 million per month for one delayed unit. A research contract has been let with the Oak Ridge National Laboratory to delve in greater detail into the distribution of these costs. Computer codes are also developed at Oak Ridge for estimating the costs of plant investment and operation and maintenance, and these are being updated to include effects of new regulations and requirements.

To expedite the review of applications for operating licenses for plants scheduled to be completed in fiscal years 1981 and 1982, the NRC early in fiscal year 1981 initiated a licensing recovery plan (see "Improving the Licensing Process" below). As a result of this plan and of slippages in the dates estimated by utilities for completion of construction, the projected delay of plants was reduced from a total of 128 months in early fiscal year 1981 to 27 months at the end of the fiscal year. A total of 27 Safety Evaluation Reports and Supplements for 15 plants were issued during the fiscal year. Review schedules for plants to be completed in 1983 and later were established to preclude any projected delays.

NRR is reviewing all current applications for construction permits to assure that NRR schedules will be met for these applications.

No new applications for NRC construction permits for nuclear power plants have been received since 1978. During fiscal year 1981, utilities requested withdrawal of applications for construction permits for Montague 1 and 2 (Mass.), New Haven 1 and 2 (N.Y.) and Pilgrim 2 (Mass.) and announced cancellation of the construction of Forked River (N.J.), North Anna 4 (Va.), Jamesport 1 and 2 (N.Y.), Bailly (Ind.), and Pilgrim 2 (Mass.).

Hearings were held on license renewals for the following non-power reactors: the General Electric Testing Reactor (Cal.), reactors at the University of California at Los Angeles and the Armed Forces Radiobiology Research Institute (Md.)

Licensing Actions For Operating Reactors

The backlog of actions on operating reactors involves a number of amendment requests, orders, petitions, hearings, and multi-plant issues. As a result of the issuance of a "Clarification of TMI Action Plan Requirements" (NUREG-0737), the number of re-

THE LICENSING PROCESS

Obtaining an NRC construction permit—or a limited work authorization, pending a decision on issuance of a construction permit—is the first objective of a utility or other company seeking to operate a nuclear power reactor or other nuclear facility under NRC license. The process is set in motion with the filing and acceptance of the application, generally comprising ten or more large volumes of material covering both safety and environmental factors, in accordance with NRC requirements and guidance. The second phase consists of safety, environmental, safeguards and antitrust reviews undertaken by the NRC staff. Third, a safety review is conducted by the independent Advisory Committee on Reactor Safeguards (ACRS); this review is required by law. Fourth, a mandatory public hearing is conducted by a three-member Atomic Safety and Licensing Board (ASLB), which then makes an initial decision as to whether the permit should be granted. This decision is subject to appeal to an Atomic Safety and Licensing Appeal Board (ASLAB) and could ultimately go to the Commissioners for final NRC decision. The law provides for appeal beyond the Commission in the Federal courts.

As soon as an initial application is accepted, or "docketed," by the NRC, a notice of that fact is published in the *Federal Register*, and copies of the application are furnished to appropriate State and local authorities and to a local public document room (LPDR) established in the vicinity of the proposed site, as well as to the NRC-PDR in Washington, D.C. At the same time, a notice of a public hearing is published in the *Federal Register* and local newspapers which provides 30 days for members of the public to petition to intervene in the proceeding. Such petitions are entertained and adjudicated by the ASLB appointed to the case, with rights of appeal by the petitioner to the ASLAB.

The NRC staff's safety, safeguards, environmental and antitrust reviews proceed in parallel. With the guidance of the Standard Format (Regulatory Guide 1.70), the applicant for a construction permit lays out the proposed nuclear plant design in a Preliminary Safety Analysis Report (PSAR). If and when this report has been made sufficiently complete to warrant review, the application is docketed and NRC staff evaluations begin. Even prior to submission of the report, NRC staff conducts a substantive review and inspection of the applicant's quality assurance program covering design and procurement. The safety review is performed by NRC staff in accordance with the Standard Review Plan for Light-Water-Cooled Reactors, initially published in September 1975 and updated periodically. This plant states the acceptance criteria used in evaluating the various systems, components and structures important to safety and in assessing the proposed site, and it describes the procedures used in performing the safety review.

The NRC staff examines the applicant's PSAR to determine whether the plant design is safe and consistent with NRC rules and regulations; whether valid methods of calculation were employed and accurately carried out; whether the applicant has conducted his analysis and evaluation in sufficient depth and breadth to support staff approval with respect to safety. When the staff is satisfied that the acceptance criteria of the Standard Review Plan have been met by the applicant's preliminary report, a Safety Evaluation Report is prepared by the staff summarizing the results of their review regarding the anticipated effects of the proposed facility on the public health and safety.

Following publication of the staff Safety Evaluation Report, the ACRS completes its review and meets with staff and applicant. The ACRS then prepares a letter report to the Chairman of the NRC presenting the results of its independent evaluation and recommending whether or not a construction permit should be issued. The staff issues a supplement to the Safety Evaluation Report incorporating any changes or actions adopted as a result of ACRS recommendations. A public hearing can then be held, generally in a community near the proposed site, on safety aspects of the licensing decision.

In appropriate cases, NRC may grant a Limited Work Authorization to an applicant in advance of the final decision on the construction permit in order to allow certain work to begin at the site, saving as much as seven months time. The authorization will not be given, however, until NRC staff has completed environmental impact and site suitability reviews and the appointed ASLB has conducted a public hearing on environmental impact and site suitability with a favorable finding. To realize the desired saving of time, the applicant must submit the environmental portion of the application early.

The environmental review begins with a review of the applicant's Environmental Report (ER) for acceptability. Assuming the ER is sufficiently complete to warrant review, it is docketed and an analysis of the consequences to the environment of the construction and operation of the proposed facility at the proposed site is begun. Upon completion of this analysis, a Draft Environmental Statement is published and distributed with specific requests for review and comment by Federal, State and local agencies, other interested parties and members of the public. All of their comments are then taken into account in the preparation of a Final Environmental Statement. Both the draft and the final statements are made available to the public at the time of respective publication. During this same time period NRC is conducting an analysis and preparing a report on site suitability aspects of the proposed licensing action. Upon completion of these activities, a public hearing, with the appointed ASLB presiding, may be conducted on environmental and site suitability aspects of the proposed licensing action (or a single hearing on both safety and environmental matters may be held, if that is indicated).

The antitrust reviews of license applications are carried out by the NRC and the Attorney General in advance of, or currently with, other licensing reviews. If an antitrust hearing is required, it is held separately from those on safety and environmental aspects.

About two or three years before construction of the plant is scheduled to complete, the applicant files an application for an operating license. A process similar to that for the construction permit is followed. The application is filed, NRC staff and the ACRS review it, a Safety Evaluation Report and an updated Environmental Statement are issued. A public hearing is not mandatory at this stage, but one may be held if requested by affected members of the public or at the initiative of the Commission. Each license for operation of a nuclear reactor contains technical specifications which set forth the particular safety and environmental protection measures to be imposed upon the facility and the conditions that must be met for the facility to operate.

Once licensed, a nuclear facility remains under NRC surveillance and undergoes periodic inspections throughout its operating life. In cases where the NRC finds that substantial, additional protection is necessary for the public health and safety or the common defense and security, the NRC may require "backfitting" of a licensed plant, that is, the addition, elimination or modification of structures, systems or components of the plant.

Table 1. Nuclear Power Plant Licensing Action — Fiscal Year 1981*

Applicant	*Facility*	*Date Issued*	*Location*
LOW-POWER OPERATING LICENSES			
Alabama Power Co.	Farley 2	10/23/80	Houstan Co., Ala.
Duke Power Co.	McGuire 1	06/12/81	Mecklenburg Co., N.C.
Tennessee Valley Authority	Sequoyah 2	06/25/81	Hamilton Co., Tenn.
Pacific Gas & Electric Co.	Diablo Canyon 1	09/22/81**	San Luis Obispo Co., Calif.
FULL-POWER OPERATING LICENSES			
Alabama Power Co.	Farley 2	03/31/81	Houstan Co., Ala.
Public Service Electric & Gas Co.	Salem 2	05/20/81	Salem Co., N.J.
Duke Power Co.	McGuire 1	07/08/81	Mecklenburg Co., N.C.
Tennessee Valley Authority	Sequoyah 2	09/15/81	Hamilton Co., Tenn.

*No Limited Work Authorizations or Construction Permits for nuclear power plants were issued during fiscal year 1981.
**License suspended by the Commission on November 19, 1981, because of design errors. See discussion under "Quality Assurance," later in this chapter.

quired actions was increased significantly in fiscal year 1981. Approximately 1,900 actions were completed during the year, and 5,400 were pending at the end of the fiscal year. A schedule has been developed that calls for about 2,000 of these pending actions to be completed in fiscal year 1982. Funds for technical assistance contracts are to be used to support half of these projected completions.

In support of the proceeding for the restart of Three Mile Island Unit 1 (see Chapter 11), the staff issued safety evaluation reports on all actions specified in the Commission's Order of August 9, 1979, and on all post-TMI requirements from the NRC Action Plan that were scheduled for completion during fiscal year 1981. These efforts were supplemented by staff testimony on more than 100 specific hearing contentions that were litigated in the proceeding.

Review of Advanced Power Reactors

The Clinch River Breeder Reactor Plant, proposed for construction near Oak Ridge, Tenn., was under active safety and environmental review when the applicants—the Energy Research and Development Administration, Project Management Corporation and the Tennessee Valley Authority—following an energy policy message by the President on April 22, 1977, requested an indefinite suspension of the public hearing associated with the licensing of the facility. The hearing board granted this request, and the staff redirected its activities to bringing the safety review to a point where the licensing process could be resumed whenever necessary. Under legislation passed in 1981, the project has been reactivated. NRR has established a Clinch River Breeder Reactor Program Office to resume the staff safety and environmental reviews and related technical assistance efforts. The staff's reviews are expected to concentrate on issues outstanding at the time the reviews were suspended and changes that have occurred during the ensuring years. Among the latter are changes in the design of the plant, organizational and programmatic changes, and regulatory guidance and requirements that have been promulgated since the reviews were suspended.

The Fort St. Vrain Nuclear Generating Station near Platteville, Colo., has a high-temperature gas-cooled reactor with a capacity of 330 electrical megawatts. The steady-state power level has been restricted by the NRC to 70 percent of capacity pending completion of a test program. The facility has been authorized by the NRC to operate at full power for purposes of this testing.

The Fast Flux Test Facility of the Department of Energy near Richland, Wash., provides an intense source of fast neutrons for irradiating fuels and other materials in connection with research and development on advanced reactors. It is not subject to licensing by the NRC, but a safety review was performed by NRC staff under an interagency agreement. The facility achieved initial criticality in February 1980. In March 1981, a series of tests was completed which

verified that natural circulation of the coolant is a viable method of removing decay heat.

Improving the Licensing Process

After the Three Mile Island accident in March 1979, the NRC diverted a significant portion of its resources to identifying the lessons learned from that accident and determining what requirements should be imposed on existing and new facilities to ensure their safe operation. That effort culminated in the issuance of the TMI Action Plan approved by the Commission in June 1980. The development of the Action Plan and the searching reevaluation by the NRC of the safety of the 70 nuclear power plants already licensed to operate resulted in a pause in the issuance of new licenses until February 1980, when a license for fuel loading and low-power testing was issued for Sequoyah Unit 1.

The present picture is one of a licensing process which, after a major dislocation, is returning to greater predictability with an enhanced level of safety. However, the institution of new safety requirements has raised a number of potential issues in contested hearings for both construction permits and operating licenses. Some of these proceedings concern units whose construction has been substantially completed. Accordingly, a situation exists for the first time where a number of plants may be ready to operate before the completion of required adjudicatory hearings.

The Commission is taking a broad range of actions to eliminate unnecessary delay from the licensing process, including internal discipline of hearings, rule changes, improved management of agency resources, and legislative proposals. The objective throughout has been to increase efficiency without impairing the right of effective public participation, while assuring that the safety of licensed nuclear power plants remains the paramount consideration.

Conduct of Licensing Proceedings

In the late winter and early spring of 1981, the Commission conducted a review of the docket of the Atomic Safety and Licensing Board Panel and of the status of the proceedings before individual licensing boards. The Commission held a series of public meetings at which the major elements of the licensing process were examined in some detail. The outcome was the publication by the Commission on May 27, 1981, in the *Federal Register* (46 FR 28533) of a "Statement of Policy on Conduct of Licensing Proceedings," designed to provide guidance to NRC licensing boards in using management methods and other procedural devices to prevent unnecessary delay in the hearing process. The Commission directed the boards to set and adhere to reasonable time schedules; to consolidate interventions where appropriate, designating lead intervenors; to encourage negotiation prior to and during the hearing to resolve contentions, settle procedural disputes, and better define issues; to manage discovery through the use of fewer, more focused interrogatories and to supervise discovery directly so as to minimize unnecessary delay; and to hold settlement conferences for the purpose of narrowing or eliminating issues and of achieving resolution, wherever possible, of matters in controversy. The Policy Statement further provided that licensing boards should make timely rulings on all matters and should do so as early as practicable where the issue in question is crucial or potentially dispositive. The Commission stressed its expectation that decisions of licensing boards will not only continue to be fair and thorough, but also will be issued as soon as practicable after the submission of proposed findings of fact and conclusions of law.

The Commission next adopted rule changes designed to bring greater efficiency and timeliness to the licensing process. On May 28, 1981, the Commission published in the *Federal Register* (46 FR 28627) a rule eliminating appeal board review of decisions of licensing boards prior to their becoming effective. The rule was further modified on September 30 allowing low-power operation without either appeal board or Commission review of the licensing board decision under certain conditions (see Chapter 11).

On June 8, 1981, the Commission published in the *Federal Register* (46 FR 30328) several amendments to the Rules of Practice, designed to facilitate conduct of the adjudicatory proceedings on applications to construct or operate nuclear power plants. These amendments authorize the licensing boards to make oral rulings on written motions during the course of a prehearing conference or a hearing, preclude parties from filing responses to objections to a prehearing order unless the licensing board so directs, revise the schedule for filing proposed findings of act and conclusions of law, and permit summary disposition motions to be filed at any time during the course of the proceedings. Also on June 8, 1981, the Commission published in the *Federal Register* (46 FR 30349) for public comment proposed amendments that would require a person seeking intervention in formal NRC hearings to set forth the facts on which contentions are based and the sources or documents used to establish those facts, limit the number of interrogatories that a party may file on another party in an NRC proceeding, and permit licensing boards to require oral answers to motions to compel discovery and service of documents by express mail.

Elimination of Certain Issues From Part of the Licensing Process

On May 28, 1981, the Commission published in the *Federal Register* (46 FR 28630) amendments to its regulations to provide that, for purposes of the National Environmental Policy Act (NEPA), alternative sites will not be considered in operating license reviews for nuclear power plants and need not be addressed by operating license applicants in their environmental reports submitted to the NRC at the operating license stage. Alternative sites will continue to be considered at the construction permit stage. On August 3, 1981, the Commission published in the *Federal Register* (46 FR 39440) a proposal for similar action with regard to the need for the power to be generated by a nuclear power plant and alternative energy sources for generation of the power. The construction permit proceeding is the appropriate forum for the resolution of these issues. Further litigation on them appears to be unnecessary and avoidable.

On August 18, 1981, the Commission published in the *Federal Register* (46 FR 41786) for public comment a proposal to eliminate present requirements for review of financial qualification for construction permit applicants. Included was the question of whether to also eliminate these requirements for operating license applicants or to retain them to the extent that they require submission of information concerning the costs of permanently shutting down the facility and maintaining it in a safe condition. The proposed rule will reduce the effort required of the applicants and the NRC staff without reducing the protection of the public health and safety.

Management of NRC Resources

The NRC has taken a number of internal management measures intended to improve the utilization of existing resources for the timely completion of the staff's technical reviews. For the four months from March 15 through July 13, 1981, staff members of the Office of Nuclear Reactor Regulation (NRR) and certain staff members of the Office of the Executive Legal Director (ELD) were on a mandatory overtime work schedule. In order to free NRR personnel to perform technical reviews on licensing cases, some other NRR projects of lower priority have been delayed. Personnel have been transferred to NRR from other Offices within the agency to assist in reviewing casework, and some NRR assignments have been delegated to other NRC Offices. Personnel ceilings for NRR and ELD have been increased. NRR initiated an expedited recruitment program.

Additional funds were provided for technical assistance. The National Laboratories have been asked to perform additional technical assistance work in connection with case reviews, as well as assignments not related to casework. Contracts have been let with commercial firms for technical assistance with casework. The results will be to make more NRR staff time available for in-house operating license reviews. Also, additional members were added to the panel of the Atomic Safety and Licensing Boards, and the Boards in many cases were reconstituted to minimize schedule conflicts.

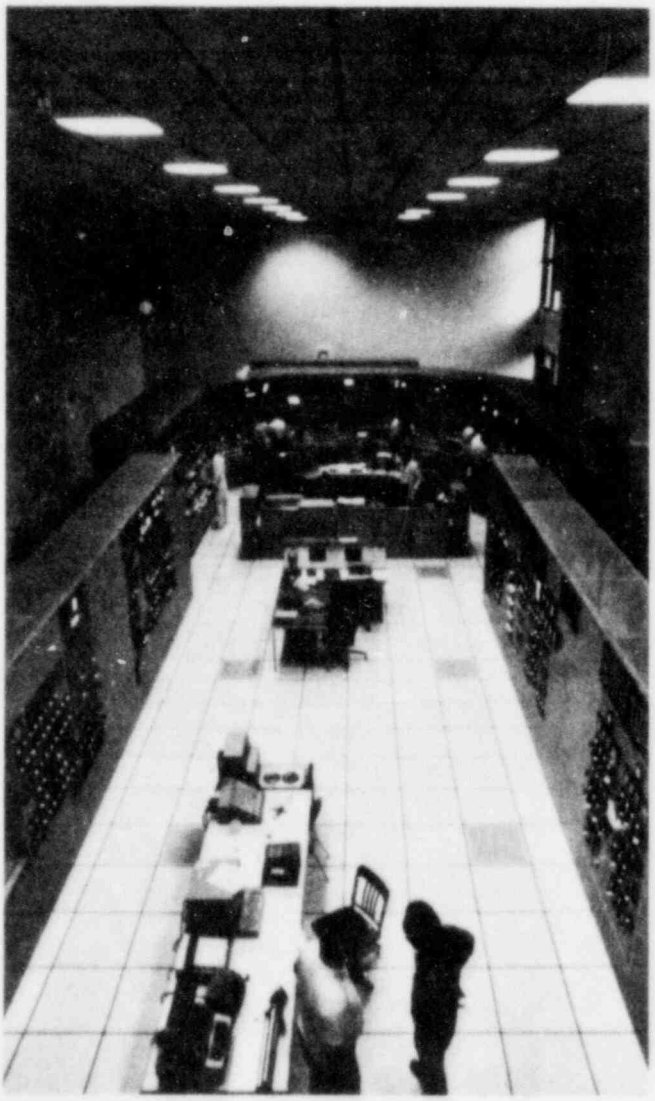
Legislative Proposals

The Commission forwarded two legislative proposals to the Congress in fiscal year 1981, with a view to eliminating actual or potential delay in the reactor licensing process. The first of these would overturn the adverse ruling in the recent decision of the United States Court of Appeals for the District of Columbia Circuit *Sholly vs. NRC*. In that case, a three-judge panel ruled that the NRC must hold a prior hearing on demand from any interested person before it can issue a license amendment that involves "no significant hazards consideration." The court's mandate continued to be stayed, in the meantime, by the decision of the Supreme Court to take review of the case. Unless the *Sholly* decision is overturned by the Congress or by the Supreme Court, it could require hearings on a number of the approximately 400 such amendments issued by the NRC each year.

The second legislative proposal would amend the Atomic Energy Act to authorize the Commission to issue an interim operating license permitting fuel loading and low-power operation and testing in advance of the conduct or completion of any required hearing. Such operation and testing would be limited to 5 percent of full power and would require a finding by the Commission that such action is necessary in the public interest in order to avoid the consequences of unnecessary delay in the operation of a completed nuclear power plant. In all respects other than the completion of the hearing, the Commission would have to find that all applicable requirements have been met prior to allowing such interim operations.

Human Factors

Increased emphasis on people-oriented aspects of the safety of nuclear power plants, which was initiated in fiscal year 1980, continued in fiscal year 1981. Significant progress was made in developing programs on control room evaluation, the design of a new safety parameter display system, improvement of emergency operating procedures, operator training



Shown above is the control-room simulator used for training operating personnel at the Watts Bar (Tenn.) nuclear power plant.

and qualifications, and organization and management of the plant staff and related corporate staff. In each of these areas, technical guidance and evaluation criteria were provided to the nuclear industry.

Reviews of Control Room Design

The TMI Action Plan provides for the formulation of guidelines to be used by each licensee and applicant in their detailed reviews of control room design and identification of design weaknesses. Draft guidelines (NUREG/CR-1580) were issued for public comment in August 1980 and a supplement (NUREG-0659) was published in March 1981. The supplement contained new draft guidelines for a review of control room systems to provide a frame of reference for relating the assessment of control room characteristics to the functional application and to the flow of operations within the control room.

In April 1981, public meetings were held in Bethesda, Md., to discuss NUREG/CR-1580, NUREG-0659, and NRC staff plans for publication of the complete set of guidelines for review of control room design. The meetings were attended by representatives of utilities, architect-engineer organizations, human factors consultants, and interested members of the public. Comments received during these meetings and written comments on the draft guidelines and the draft supplement were then used to develop a complete set of guidelines for review of control room design, which was published in September 1981 as NUREG-0700. Each licensee of an operating plant and each applicant for an operating license are expected to use these guidelines as the basis for a detailed review of control room design.

The NRC has continued to audit preliminary assessments of control room design submitted by applicants for operating licenses. During fiscal year 1981, reviews were conducted at the following plants: Watts Bar 1 (Tenn.), Susquehanna (Pa.), Comanche Peak (Texas), Zimmer 1 (Ohio), Shoreham (N.Y.), Fermi 2 (Mich.), Grand Gulf 1 (Miss.), Callaway 1 (Mo.) and St. Lucie 2 (Fla.). These applicants will be required to complete detailed reviews based on the guidance provided in NUREG-0700.

During fiscal year 1982, the first reports on review of control room design are expected to be received from licensees and applicants. The NRC is forming teams of engineers and human factors specialists to review these reports and, in some cases, to conduct on-site reviews. The staff, with the assistance of technical consultants, is developing criteria to be used in evaluating these reports. A draft version (NUREG-0801) of these criteria was issued for public comment in October 1981.

In conjunction with the upgrading of control room design, the TMI Action Plan provides for the installation of a Safety Parameter Display System (SPDS). The SPDS will display a minimum set of parameters which define the safety status of the plant. During fiscal year 1982, the first SPDS design will be submitted by licensees and applicants for NRC review. The staff, with the assistance of technical consultants, is developing acceptance criteria for evaluating these designs. A draft version (NUREG-0835) of the criteria was issued for public comment in October 1981. These acceptance criteria supplemented the functional criteria (NUREG-0696) which were issued in February 1981.

Improvement in Emergency Operating Procedures

As specified in the TMI Action Plan, the NRC staff has been reviewing the emergency operating pro-

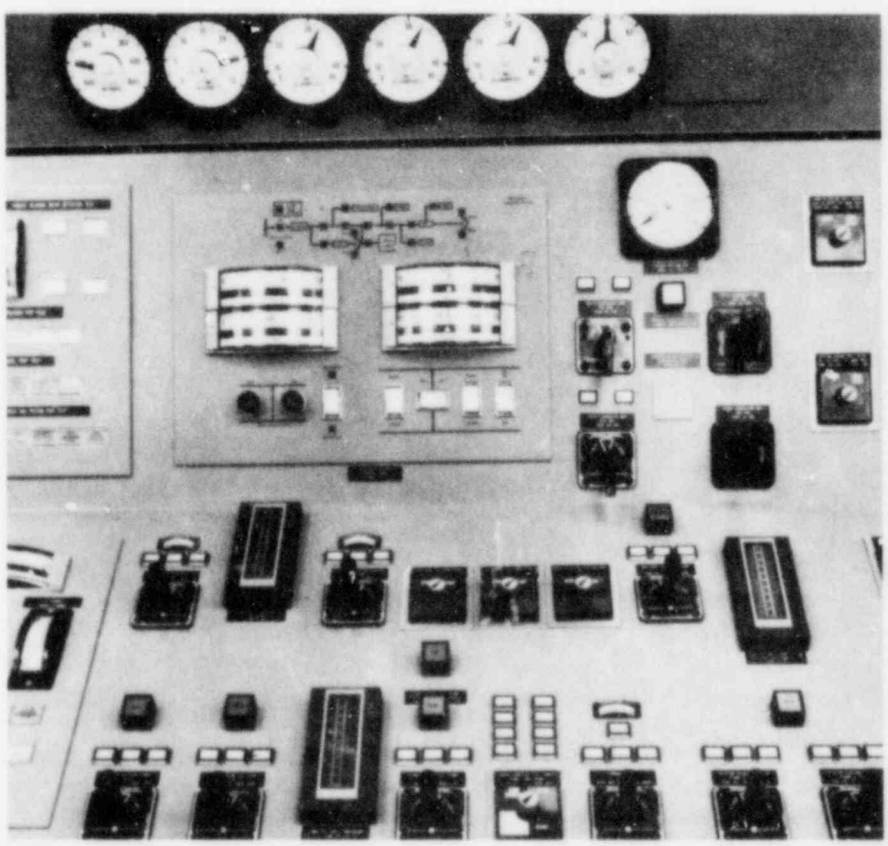
cedures set forth in applications on which licensing decisions are due in the near term. This is being done to ensure that short-term improvements in emergency operating procedures have been made and to provide the staff with an understanding of deficiencies in procedures so that more effective guidelines may be developed in the future.

To support long-term improvements in emergency operating procedures, the staff has prepared draft criteria for the preparation of such procedures and published them in June 1981 for public comment (NUREG-0799). These criteria were based on information gathered in a staff review of the literature, two contracted studies, and direct experience with the pilot monitoring program. NUREG-0799 outlines a thorough, systematic reanalysis of transients and accidents in support of the preparation of procedures. It recommends additional operator training and upgrading of the requalification program to ensure the familiarity of operators with the new procedures. NUREG-0799 is currently being revised to incorporate public comments and recent experience acquired in reviewing plant emergency operating procedures. The revised document is expected to be issued in the spring of 1982.

The approach to emergency guidelines and procedures before the TMI accident could be characterized as "event oriented." This means that the operator was supposed to diagnose and identify the ongoing accident and then use the emergency procedure written for that specific event. Proper operation of safety and control systems was usually implicitly assumed in the procedures. Thus, the pre-TMI procedures were most likely not applicable to transients and accidents with multiple failures and/or an unexpected sequence of events.

The purpose of the new technical guidelines on emergency operating procedures is to assist and guide the operator in diagnosing and properly mitigating any transients and accidents that are postulated to occur, including events with multiple failures. Instead of immediately diagnosing the accident, the operator responds to symptoms identified in the procedures and makes sure that all critical safety functions are maintained throughout the event. The operator actions may not be optimal for the most rapid recovery from a specific event, but their applicability to a broad spectrum of accidents provides increased protection against extensive reactor core damage and radioactive releases to the environment. This approach to guidelines for emergency operating procedures is called "symptom-oriented."

The utility owner groups for all four vendors have submitted draft guidelines and related background information. The NRC Office of Nuclear Reactor Regulation has started the review of the submittals and has asked the NRC Office of Nuclear Regulatory Research to perform supporting independent analyses.



Closeup of a section of the panel of the control-room simulator at the Palo Verde nuclear power plant under construction in Arizona, showing the various kinds of indicators on the panel.

Test of emergency procedures in the simulated control room at the Sequoyah nuclear power plant, demonstrating the difficulty of communicating while wearing protective equipment.

During the course of the review, several meetings have been held with the utility owner groups.

The analyses and guidelines for the General Electric Company utility owner group have been approved for trial implementation on six plants. The owner groups of the other vendors are still upgrading their submittals, taking NRC staff concerns into account. The approval of these guidelines is expected during the first half of 1982. To expedite the implementation of the plant-specific operating procedures, the utilities are developing their emergency operating procedures concurrently with the development of the guidelines.

Management Competence Of Utility Licensees

Draft guidelines for utility management structure and technical resources, issued in September 1980 as NUREG-0731 for public comment, are being revised. Comments received indicated a general view that the draft guidelines are much too prescriptive. Assistance will be sought from management and organization specialists in the process of revising NUREG-0731 to incorporate technically based guidance.

During fiscal year 1981, management audits were conducted by NRR of 13 applicants for operating licenses for the following nuclear power plants: San Onofre 2 and 3, Summer, Farley 2, Zimmer, LaSalle 1 and 2, Diablo Canyon 1 and 2, Susquehanna 1 and 2, Waterford 3, Comanche Peak 1 and 2, Fermi 2, Shoreham, Grand Gulf and Watts Bar. Management audits were also conducted of four applicants for construction permits for Allens Creek, Offshore Power Systems, Skagit and Pilgrim 2. In addition, NRR staff participated in management reviews conducted by the NRC Office of Inspection and Enforecement of five applicants for operating licenses for St. Lucie 2, Byron 1 and 2, Callaway 1 and 2, Wolf Creek and Palo Verde 1, 2 and 3. Preliminary mangement reviews also were conducted of two utility applicants for operating licenses in cases where the staff had been directed to make an early evaluation either prior to docketing the application (Shearon Harris 1, 2, 3 and 4) or to allow an early hearing on management issues (South Texas 1 and 2). During the year, the results of management audits were presented in public hearings for Three Mile Island 1 and Allens Creek.

Licensing of Personnel

The program for licensing reactor operators has been expanded. Assistance in administering the program is being provided by the NRC Region III office in Chicago and under contract with the Oak Ridge National Laboratory in Tennessee, the Idaho Nuclear Engineering Laboratory and the Pacific Northwest Laboratories in Washington. Under current plans, the cooperation of the other NRC regional offices in this program will be solicited.

During fiscal year 1981, the NRC issued 304 new operator licenses, 285 renewals and 46 amendments, bringing the total number of operator licenses in effect on September 30 to 1327. Similarly, 313 new licenses, 477 renewals and 55 amendments were issued for senior reactor operators, bringing the total number of senior operators to 1,684.

Revised criteria regarding experience, training and qualifications of reactor operators were established during fiscal year 1980 and fully implemented in fiscal year 1981. Proposed rule changes under consideration include additional formal education requirements for reactor operators, senior reactor operators and shift supervisors; greater NRC involvement in the requalification program, including the administration

of examinations; and more extensive use of simulators in initial training programs and requalification programs.

In June 1981, NRR staff presented several alternative proposals to the Commission for establishing requirements for the education, training and experience of licensed operators. The Commission directed the staff to establish a peer review panel of individuals to consider such proposals, conduct workshops, seek an industry proposal and recommend a course of action. This has been initiated and results are expected to be presented to the Commisison in the second quarter of fiscal year 1982.

Public Law 96-295 in Section 307(b) directed that a study be undertaken of the feasibility and value of licensing managers and senior licensee officers of nuclear power plants. This study has been initiated with technical assistance from the Oak Ridge National Laboratory and the Science Management Corporation. Information is being collected on the major aspects of utility managers' jobs; the education, training and experience necessary for managers; and concepts of how a licensing program for managers might be administered if found feasible. Data are being obtained from personnel of the NRC Office of Inspection and Enforcement, nuclear utility managements, executive assessment professionals, companies utilizing assessment techniques, associations that certify or license professionals, and other Federal agencies. The study is expected to be completed in early fiscal year 1982.

Program Plan

During fiscal year 1981, a comprehensive program was developed covering all aspects of utility management, technical resources, plant staffing and training, and validation of the NRC licensing examination process. The plan includes items in the TMI Action Plan in the general area of licensee qualifications. It provides an integrated approach to resolving these matters. The bulk of this program will get underway during fiscal year 1982.

Unresolved Safety Issues

Section 210 of the Energy Reorganization Act of 1974, as amended, requires, among other things, that the annual report of the Commission to the President

Table shows typical station organization at a nuclear power plant (as planned for Shoreham Unit 1, N.Y.).

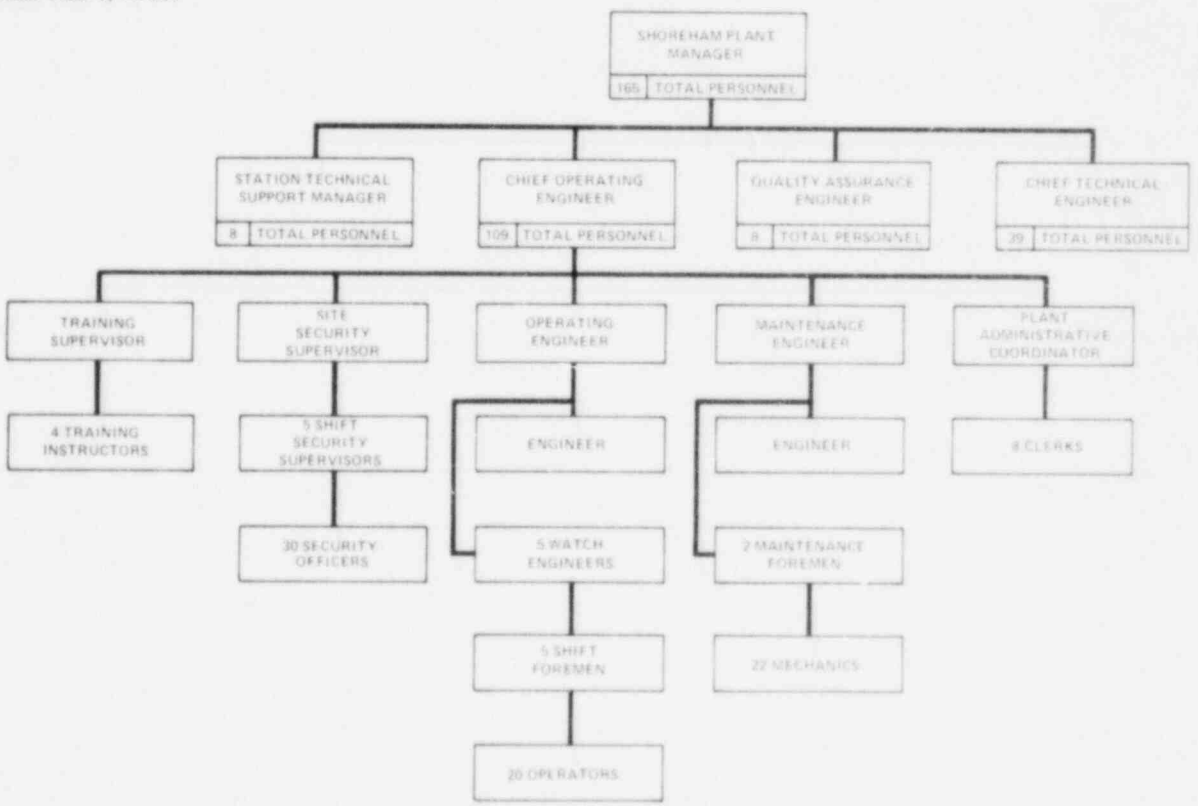


Table 2. Unresolved Safety Issues for Which a Final Technical Resolution Has Been Completed

Title		*Report Number*	*Date*	*Implementation Status*
A-2	Asymmetric Blowdown Loads	NUREG-0609	Nov. 1980	Additional licensee responses under review.
A-6	Mark I Short Term Program	NUREG-0408	Dec. 1977	Complete
A-7	Mark I Long Term Program	NUREG-0661	July 1980	Licensees are performing analyses and installing modifications in accordance with Commission order.
A-8	Mark II Containment Pool Dynamic Loads	NUREG-0808	Aug. 1981	Implemented as a part of the OL review of each Mark II containment.
A-9	Anticipated Transients Without Scram	NUREG-0460 Vol. 4	Sept. 1980	Three proposed rules issued for public comment[2]
A-10	Boiling Water Reactor Nozzle Cracking	NUREG-0619	Nov. 1980	Detailed implementation for each licensee in progress.
A-24	Qualification of Class IE Safety Related Equipment	NUREG-0588 Rev. 1	July 1981	Implementation included in rulemaking on environmental qualification in progress.[2]
A-26	Reactor Vessel Pressure Transient Protection	NUREG-0224	Sept. 1978	Complete
A-31	Residual Heat Removal	No Formal Report SRP 5.4.7[1] Rev. 2	1978	Implementation on operating reactors incomplete.
A-36	Control of Heavy Loads Near Spent Fuel	NUREG-0612	July 1980	Detailed implementation for each licensee in progress.
A-42	Pipe Cracks in Boiling Reactors	NUREG-0313 Rev. 1	July 1980	Licensee responses under review.

[1]SRP denotes Standard Review Plan (see NUREG-0800, Section 5.4.7, July 1981)
[2]The final rule will determine the licensing requirements.

and the Congress shall include progress reports on those items previously identified as "Unresolved Safety Issues" (USIs). The initial identification of these issues is described in the NRC report to Congress entitled, "NRC Program for the Resolution of Generic Issues Related to Nuclear Power Plants" (NUREG-0410, January 1978). Subsequently, 22 of these issues were selected by the Commission specifically because of their importance to the public health and safety in the NRC report to Congress entitled, "Identification of Unresolved Safety Issues Relating to Nuclear Power Plants" (NUREG-0510, January 1979). As the result of the TMI accident and considerable additional operating experience, the Commission identified four additional Unresolved Safety Issues in a report to Congress entitled, "Identification of New Unresolved Safety Issues Relating to Nuclear Power Plants" (NUREG-0705, March 1981). Previous NRC annual reports and this present account describe NRC's progress in resolving these issues.

SUMMARY OF STATUS

Eleven of the tasks associated with previously identified issues have now been reported as complete. Each of the 11 tasks for which a technical resolution has been achieved are presented in Table 2, along with their implementation status.

Each of the Unresolved Safety Issues under active consideration during 1981 is shown in Table 3. Final reports for two additional Unresolved Safety Issues were issued during 1981 (A-8 and A-24). A final report resolving a major part of one issue was also completed during 1981 (A-39). An NRC staff report providing a technical resolution has been issued "for

Table 3. Schedule for Resolution of Current Unresolved Safety Issues

Task No.	*Unresolved Safety Issue*	*Schedule for Issuing Staff Report "For Comment" in 1978 NRC Annual Report*	*Schedule for Issuing Staff Report "For Comment" as of Nov. 16, 1981*[2]	*Schedule for Issuing Final Staff Report as of Nov. 16, 1981*[2]
A-1	Water Hammer	Dec. 1980	Aug. 1982	Jan. 1983
A-3	PWR Steam Generator Tube Integrity	Early 1980	Nov. 1981	Mar. 1982
A-4	PWR Steam Generator Tube Integrity	Early 1980	Nov. 1981	Mar. 1982
A-5	PWR Steam Generator Tube Integrity	Early 1980	Nov. 1981	Mar. 1982
A-11	Reactor Vessel Material Toughness	July 1979	Complete Sept. 1981	Jan. 1982
A-12	Steam Generator and Reactor Vessel Supports	Aug. 1979	Complete Nov. 1979	Jan. 1982
A-17	Systems Interactions	Phase I — Sept. 1979	.....	.....
		Phase II — Sept. 1980		*
A-39	SRV Pool Dynamic Loads[1]	Oct. 1979	.....	Jan. 1982
A-40	Seismic Design Criteria	Phase I - 1979 Phase II - 1981	Oct. 1981	Jan. 1982
A-43	Containment Emergency Sump	Not Scheduled	June 1982	Nov. 1982
A-44	Station Blackout	Not Scheduled	Oct. 1982	March 1983
A-45	Shutdown Decay Heat Removal Requirements	Not Scheduled	.....	Oct. 1985
A-46	Seismic Qualification of Equipment in Operating Plants	Not Scheduled	.....	Dec. 1983
A-47	Safety Implications of Control Systems	Not Scheduled	.....	.....
A-48	Hydrogen Control Measures and Effects of Hydrogen Burns	Not Scheduled	.....	.....

[1]SRV denotes Safety Relief Valve
[2]See "Unresolved Safety Issues Summary: Aqua Book" (NUREG-0606, Vol. 3, No. 4, Nov. 16, 1981).

comment" for Task A-11, "Reactor Vessel Materials Toughness." The "for comment" reports describe the technical studies conducted by the NRC staff or its contractors and the safety conclusions that constitute the NRC staff's resolution of each of the issues. Public and industry comment is solicited and considered on each, and the final report includes a summary and assessment of all of the comments received.

The present schedule for the completion of work on each of the Unresolved Safety Issues is given in Table 3. Important elements in the implementation of these tasks are: (1) the provision of a public comment period following the issuance of the staff's technical resolution, followed by discussion and disposition of the comments received in a final report; (2) provision for the incorporation of the technical resolution into the NRC's Regulations, Standard Review Plan, Regulatory Guides or other official guidance; and (3) provision for application of the final technical resolution to operating plants.

A summary of the status of Unresolved Safety Issues is presented quarterly in NUREG-0606. Other generic safety and environmental issues are covered in the Generic Issues Tracking Systems, except that TMI Action Plan items are treated separately in an Action Plan Tracking System.

PROGRESS REPORTS

Given below are progress reports on each of the Unresolved Safety Issues under active consideration. For background on earlier phases of some of these issues, see the *1980 NRC Annual Report*, pp. 45-57.

Water Hammer

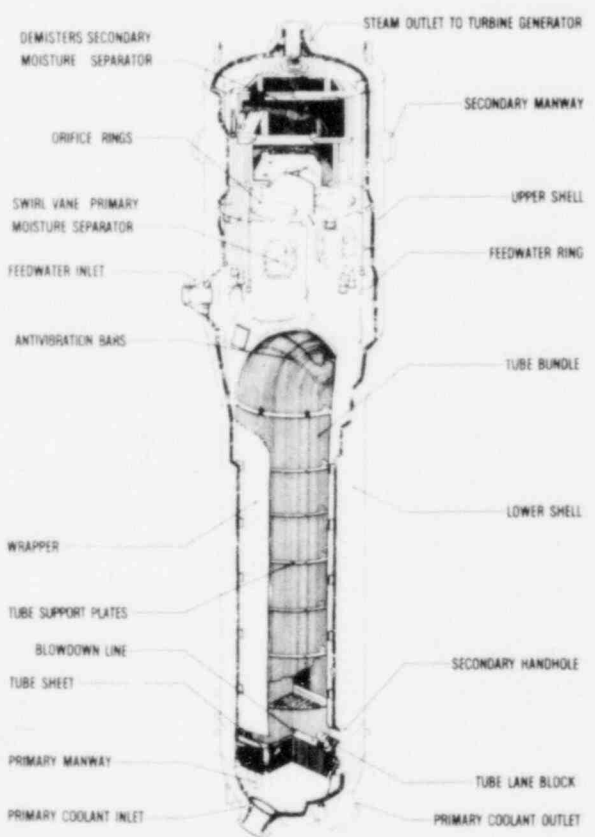
Water hammer events are high pressure pulses experienced by fluid systems. Water hammers can be induced by phenomena such as rapid valve closures, steam condensation or pump startup into empty lines. Commonly experienced water hammer phenomena are pipe rattle when water faucets are rapidly closed and steam heating system thumping from steam condensation effects. Water hammer is commonly experienced in chemical process industries and power plant piping which carries steam or water. Most water hammers are attributed to rapid condensation of steam, steam-driven slugs of water, pump startup into empty lines and operations which result in rapid valve closure. Since 1968, almost 150 water hammer events in nuclear power reactors have been reported. None of these has resulted in any release of radioactivity external to the plant, and for the great majority of events, damage has been confined to pipe supports and snubbers. The principal concern of this safety issue is the rather low probability that a water hammer event would result in failure of the reactor coolant system or would disable safety systems or a system which is needed for safe reactor shutdown and cooling following an initiating accident or malfunction of a different system or component.

The work on this task has been directed at the analysis of water hammer in several specific systems, including steam generator feedwater systems, and several technical reports have been issued summarizing this work. In 1981, Task A-1 was reassessed and a new resolution plan developed which consists of a comprehensive review of fluid systems design and a review of system operating procedures. Design factors and operational procedures which can result in system conditions which are conducive to water hammer events will be identified. As a result of this review, specific recommendations will be developed to reduce the number of water hammers and to minimize the severity of water hammer events. Completion of Task A-1 with publication of the final report is scheduled for January 1983.

PWR Steam Generator Tube Integrity

In plants employing pressurized water reactors, the primary coolant is kept under pressure sufficient to prevent boiling. This high-pressure water passes through tubes around which water circulates in a secondary system to produce steam to drive the turbine generator. The assembly in which the heat transfer takes place and steam is produced is the steam generator. The tubes within the steam generator are an integral part of the primary coolant boundary, keeping the radioactive primary coolant in a closed system, isolated from the environment. Maintenance of steam generator tube integrity is a primary concern, both during normal operation or during an accident. Discussions of specific problems associated with steam generator tube integrity occurring at operating reactors were provided in two reports: "Operating Experience with Recirculation Steam Generators" (NUREG-0523, January 1979) and "Operating Experience with Once Through Steam Generators" (NUREG-0571, March 1980).

In order to assure steam generator tube integrity, plant technical specifications require routine inservice



SERIES 51 STEAM GENERATOR

inspection of steam generators to be performed every 12 to 24 months. On plants where steam generator tubes have been extensively degraded, the NRC has imposed license conditions to increase the required frequency of inspection and to have severely damaged tubes removed from service. The conditions also require that, following inspection of steam generators and completion of any necessary repair programs by the licensees, the NRC must approve or concur in the restart of the facility. Safe operation is assured by the imposition of strict operating conditions, including the plugging of affected tubes and restricting allowable leak rates during normal operation.

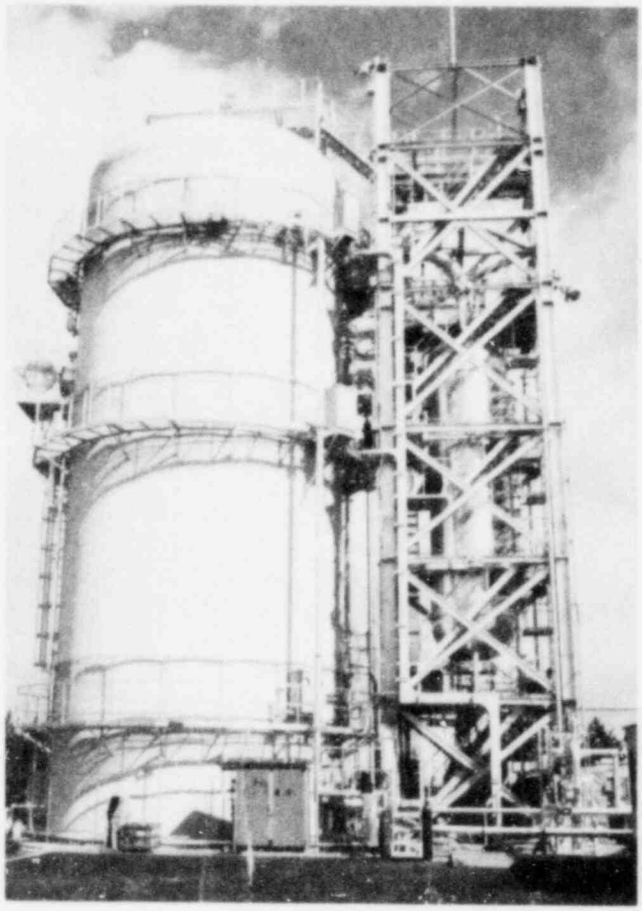
USI Tasks A-3, 4 and 5 were established to address tube degradation problems that have arisen in Westinghouse, Combustion Engineering and Babcock & Wilcox steam generators. A NUREG report presenting the results of the Generic Tasks was prepared and is expected to be published for public comment. The report presented an update of operating experiences and the results of technical studies in the areas of systems analyses, inservice inspection and tube integrity. Based on review of operating experience and results of the technical studies, the report establishes either the adequacy of existing criteria or improved criteria for ensuring safe and reliable steam generator operation. The new criteria will be implemented following incorporation of appropriate public comments. Implementation strategy and impact of new requirements also are discussed in NUREG-0844.

Steam generator tube degradation already occurring in operating plants will be difficult to completely arrest and some degradation is likely to continue to occur. Implementation of the requirements developed in the Generic Tasks A-3, A-4 and A-5 will not bring an end to steam generator tube degradation but will ensure safe steam generator operation with improved reliability.

(See discussion under "Steam Generators," later in this chapter.)

BWR MARK I and MARK II Pressure Suppression Containments

Boiling water reactor (BWR) pressure-suppression containment systems, designed by the General Electric Company are engineered to utilize a large mass of water (suppression pool) as a heat sink which will condense the steam and absorb the energy released from the reactor primary system in the event of postulated accidents or transients. The absorption of excessive energy by the stored water reduces the pressure in the containment and that, in turn, reduces the driving force that might lead to a release of fission products to the environment that may have escaped into the containment building from the primary system.



Full-scale multivent test facility in Japan for determining the response of the MARK II containment on boiling-water reactors to hydrodynamic loads resulting from use of a pressure-suppression pool to condense steam in case of a loss-of-coolant accident (Test A-8). At the left is a mockup of the containment, and at the right is a source of steam for use in these tests.

During the course of large-scale testing for an advanced design pressure-suppression containment (Mark III) and during in-plant testing of facilities with the Mark I containment design, new suppression pool hydrodynamic loads were identified which had not been considered in the original design basis for Mark I and Mark II plants. These additional loads result from the dynamic effect of air, or noncondensible gas, and steam being rapidly forced into the suppression pool during a loss-of-coolant accident (LOCA) or a safety relief valve discharge from the primary system.

The NRC staff has identified and initiated a number of generic tasks to review and evaluate the results of the industry programs and to develop criteria for licensing actions on individual plants using the Mark I and Mark II containment designs. The staff efforts involving Mark I containments have been concluded. Task A-6 was completed with the issuance of the "Mark I Containment Short-Term Program Safety Evaluation Report" (NUREG-0408, December 1977). Task A-7 was concluded with the issuance of "Mark I

Containment Long-Term Program Safety Evaluation Report" (NUREG-0661, July 1980). Necessary plant modifications to the original intended design safety margins are being implemented.

Mark II LOCA-related pool dynamic loads were reviewed as a part of the staff's Task A-8. In February 1981, the staff issued Supplement No. 2 to the report, "Mark II Containment Lead Plant Program" (NUREG-0487). This completed the Mark II Lead Plant Program. The report provides the NRC staff evaluation of the interim condensation oscillation and chugging loads proposed by the Mark II Owners Group for use in the evaluation of the first BWR plants with Mark II containments under review for operating licenses. These loads were developed by the Mark II Owners Group to address deficiencies in the original load specifications.

Technical resolution of Task A-8 was concluded with the issuance of the report, "Mark II Containment Program Load Evaluation and Acceptance Criteria" (NUREG-0808, August 1981). This report provides the results of the NRC staff's review of the LOCA-related pool dynamic loads proposed by the Mark II Owners Group that resulted from their Long-Term Program. Pool dynamic loads acceptable to the NRC staff for the evaluation of BWR Mark II facilities undergoing an operating license review are identified in Appendices A and C of NUREG-0808. The NRC staff will duly incorporate these appendices into the Standard Review Plan.

Task A-39 was established to deal with suppression pool dynamic loads resulting from actuation of safety/relief valves (SRVs). Task A-39 is a generic program for Mark I, II and III containments and is also responsible for establishing suppression pool temperature limits to ensure that the BWR plants will operate safely without reaching instability in the suppression pools during steam condensation. As a result of staff review and evaluation of industry experiments and analytical programs, acceptance criteria for the SRV-related safety issues were established.

The acceptance criteria related to the Mark I containments were incorporated in NUREG-0661. For the Mark II lead plants, acceptance criteria were established and published in NUREG-0487. Regarding the Mark II Long Term Program and the Mark III containments, the technical evaluation has been completed and a report, NUREG-0802, is being prepared for issuance in early 1982. Publication of this report will complete technical resolution of this issue.

Under Task Action Plan A-39, a report entitled "Guidelines for Confirmatory In-Plant Tests of Safety-Relief Valve Discharges for BWR Plants" (NUREG-0763) was issued in May 1981. Acceptance criteria for suppression pool temperature limits were established and published in a report entitled "Suppression Pool Temperature Limits for BWR Containments" (NUREG-0783, October 1981).

Anticipated Transients Without Scram

Nuclear plants have safety and control systems to limit the consequences of abnormal operating conditions. During the life of a nuclear power unit, "anticipated transients" are, by definition, abnormal operating conditions likely to occur one or more times. These are conditions such as a loss of feedwater, the loss of off-site power, the tripping of the turbine generator set, and the like. In some such cases, a rapid shutdown of the nuclear reaction—initiating a "scram"—is an important safety measure. If there were a potentially severe transient, and the reactor shutdown system did not function as designed, then an "anticipated transient without scram," or ATWS, would have occurred.

ATWS safety issues have been under study by the AEC, NRC and the nuclear industry for a number of years. Details on the safety significance of ATWS and prior actions taken by NRC and industry in response to its safety issues may be found in the *1980 NRC Annual Report*, p. 50.

In June 1981, the Commission directed that three alternative proposed rules be published for public comment. These proposed rules were published in the Federal Register in November 1981 (46 FR 57521), with the comment period extending through April 1982.

Reactor Vessel Material Toughness

Nuclear reactor pressure vessels are required to have adequate margin against fracture in the presence of relatively large postulated flaws. This requirement is imposed for conservatism even though extensive, periodic inservice inspection programs provide protection against the presence of such flaws.

For the service time and operating conditions typical of current operating plants, reactor vessel fracture toughness provided adequate margins of safety against vessel failure. Further, for most plants the vessel material properties are such that adequate fracture toughness can be maintained over the life of the plants. However, results from a reactor vessel surveillance program indicate that up to 20 older operating pressurized water reactor pressure vessels were fabricated with materials that will have marginal toughness after comparatively short periods of operation. This issue of "Reactor Vessel Material Toughness" has been designated as Task A-11.

The fundamental goals of Task A-11 are to provide an improved engineering method to assess the safety margin in RPVs and to develop appropriate new licensing safety criteria for use in the evaluation of normal, transient or postulated accident conditions. The results are applicable to older reactor pressure vessels that will eventually have marginal material toughness. Relatively large amounts of pre-fracture

plastic deformation can be expected at high temperatures, even in pressure vessel steels of low toughness. The new evaluation method employs advanced elastic-plastic fracture mechanics concepts. The basis for this improved methodology was published in a report, "A Treatment of the Subject of Tearing Instability" (NUREG-0311, July 1977).

Using the foundation of the tearing modulus concept, which had been developed principally under NRC sponsorship, analytic relationships were obtained which provided approximate solutions to the problem of Reactor Pressure Vessel fracture with assumed flaws. This method of elastic-plastic fracture mechanics analysis is presented in the report, "Resolution of the Reactor Vessel Materials Toughness Safety Issue," Volumes I and II (NUREG-0744, issued for comment, September 1981). The method provides an acceptable means for all commercial nuclear power reactor licensees to meet the requirements of 10 CFR Part 50, Appendix G, Section V.B, regarding the need to demonstrate adequate margins for continued safe operation. The staff will consider comments received and issue a final report in 1982.

Fracture Toughness of Component Supports

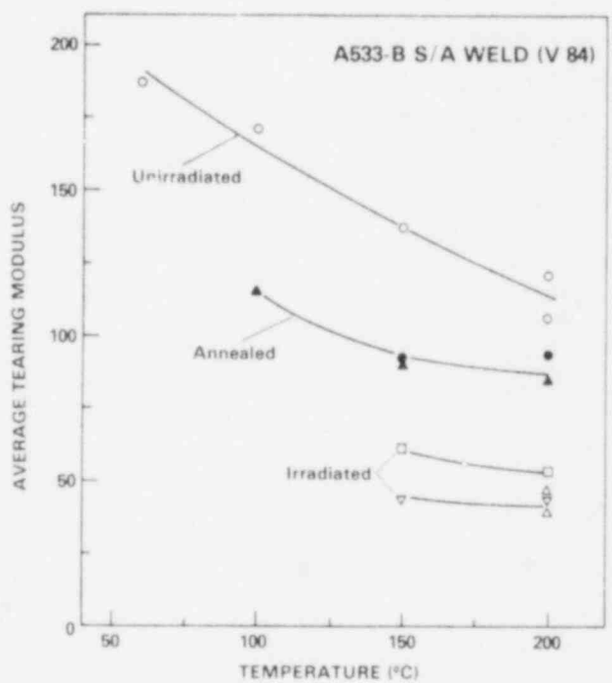
During the course of NRC licensing review for two pressurized water reactors (North Anna Units 1 and 2), several questions were raised regarding the potential for low fracture toughness of the steam generator and reactor coolant pump supports. The specific technical concern was the capability of the supports to maintain their structural integrity under accident conditions. At first, both the material fracture toughness and the tendency for lamellar tearing were considered. Together, the issues were the basis for the Unresolved Safety Issues, Task A-12, "Potential for Low Fracture Toughness and Lamellar Tearing in PWR Steam Generator and Reactor Coolant Pump Supports."

Regarding the lamellar tearing issue, results of an extensive literature survey by Sandia Laboratories, Albuquerque, N.M., revealed that, although lamellar tearing is a common occurrence in structural steel construction, virtually no documentation exists describing inservice failures due to lamellar tearing. Accordingly, research is recommended to provide a more complete evaluation of lamellar tearing. This research is being sponsored by the Electric Power Research Institute (EPRI). The staff concluded that action by licensees and applicants regarding lamellar tearing may be deferred until the research program has been completed.

The fracture toughness of a material is its capability to absorb energy without failure or damage. Generally, a material is considered "tough" when the material has a sufficient safety margin to withstand loading to its design limit in the presence of flaws. Toughness also implies that under specified conditions the material has the capability to arrest the growth of a flaw.

With respect to the issue at North Anna, there was concern that not enough attention might have been paid to the selection of materials for fabricating the steam generator and reactor coolant pump supports. Inadequate toughness (accompanied by the combination of low operating temperature, presence of flaws, and non-redundancy of critical support members) could result in failure of the support structure under postulated accident conditions. The North Anna issue was resolved to the satisfaction of the NRC staff when the licensee agreed to raise the temperature of certain materials in the steam generator supports to a minimum of 225 degrees F any time the reactor coolant system is pressurized above 1000 psig throughout the life of the plant.

Because materials and designs similar to the North Anna facility were used in other plants, review of this matter was incorporated into the NRC Program for Resolution of Generic Issues as Task A-12. Sandia Laboratories was contracted to assist the staff in reviewing information obtained from the affected licensees and applicants. Sandia provided a final report which was the basis for NUREG-0577, presenting the technical resolution to Task A-12. NUREG-0577, issued for comment in October 1979, described the technical issues, the technical studies performed by the staff's technical positions on frac-



Temperature dependence of the average tearing modulus of an A533-B submerged-arc weld deposit in unirradiated, irradiated, and post-irradiated annealed conditions. A higher tearing modulus means a greater fracture toughness.

ture toughness of PWR steam generator and reactor coolant pump supports and the staff's plans for implementing its technical positions.

The implementation plan was augmented by letters to licensees and applicants issued on May 19 and 20, 1980. Comments received by the NRC on NUREG-0577 and on the May 19 and 20 letters included serious objections from affected utilities with respect to the necessity for complying in the manner directed by the May 20 letter. In response, the NRC agreed, in a meeting on August 27, to delay implementation of Task A-12 until the Electric Power Research Institute (EPRI) could present alternate methods for compliance with staff requirements. In a December 17, 1980 meeting, the results of EPRI efforts to develop alternative ways of meeting requirements of the staff's technical positions were discussed. The NRC staff concluded that the fracture mechanics analysis proposed by EPRI was a feasible approach but was not presented in enough detail to be approved as a generic method.

Soon after receiving the EPRI report, the NRC was asked by the Atomic Industrial Forum (AIF) Subcommittee on Material Requirements to hold the final report on Task A-12 in abeyance pending submission of additional data and recommendations by the Subcommittee. The AIF presented these recommendations on A-12 implementation at a meeting of the ACRS Subcommittee on Metallic Components in May 1981. As a result of these meetings, the NRC staff is considering some of the industry recommendations and is proceeding with the work necessary for publishing the final NUREG report.

Systems Interactions In Nuclear Power Plants

The staff review of systems interactions is no longer being pursued under Task A-17, but rather under TMI Action Plan, Item II.C.3, Systems Interactions. The status of this program is discussed below, under "Systems interaction" in the section on "Safety Reviews."

Environmental Qualification of Safety-Related Electrical Equipment

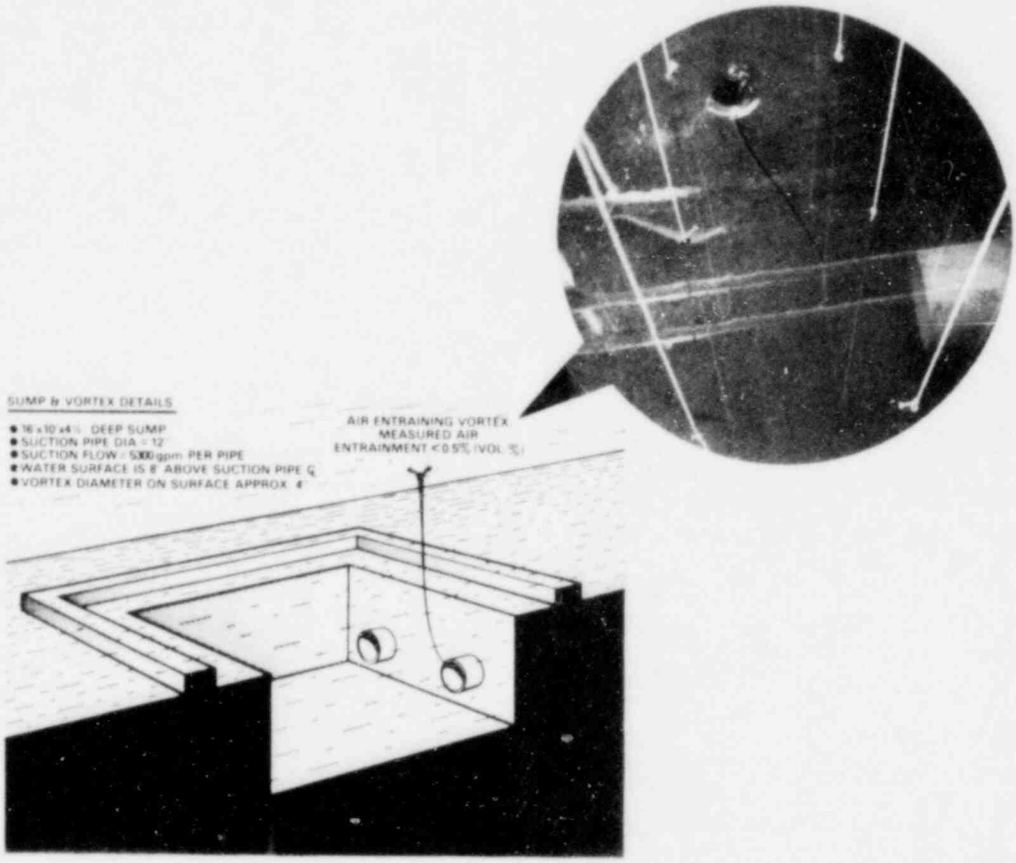
Safety systems are installed at nuclear plants to mitigate the consequences of postulated accidents. Certain of these postulated accidents could create severe environmental conditions inside the containment, such as high temperature, humidity, pressure, and radiation levels. The most serious such accident would be a high-energy pipe break in the reactor coolant system piping or in a main steam line. In order to assure that electrical equipment in safety systems will perform its function under accident conditions, the NRC requires, as part of the General Design Criteria, that such equipment be qualified to perform in the environment associated with the accident. The process of clarifying the criteria has given rise to certain questions regarding the adequacy of qualification tests and analyses. Generic Task A-24 was established to address this question for those plants which (1) received a construction permit Safety Evaluation Report (SER) after July 1974, or (2) are currently under review for an operating license which received a construction permit SER before July 1974.

As part of this activity, a report was issued for comment entitled "Interim Staff Position on Environmental Qualification of Safety-Related Electrical Equipment" (NUREG-0588, December 1979). On May 23, 1980, the NRC issued an Order establishing criteria to be used for the environmental qualification of safety-related electrical equipment. This act resulted in Commission Orders for modification of license to all reactor licensees, on August 29 and October 24, 1980. The orders directed that the provisions of NUREG-0588 and the "Guidelines for Evaluating Environmental Qualification of Class IE Equipment in Operating Reactors," (issued by the Division of Operating Reactors on November 13, 1979) form the requirements to comply with General Design Criterion No. 4 in Appendix A of 10 CFR Part 50 which addresses environmental qualification. These positions are applicable to plants that are or will be in the OL review process, as well as for the operating plants. The staff has developed a proposed rule incorporating these positions, which was issued for public comment in December 1981.

Several aspects of equipment qualification are being pursued at this time by the NRC staff and the nuclear industry on a generic basis. One such activity is a continuing process of revising and upgrading industry standards by providing more detailed guidelines for implementing the basic requirements. Task A-24 was completed with the issuance of Revision 1 of NUREG-0588 in July 1981. This report incorporated public comments and provided clarification and additional guidance to industry in complying with NRC requirements.

Seismic Design Criteria

NRC regulations require that nuclear power plant structures, systems and components important to safety be designed to withstand the effects of natural phenomena such as earthquakes. There are a number of plants with construction permits and operating licenses issued before current regulations in this area were in place. For this reason, the seismic designs of various plants are being reviewed again to assure that they represent no undue risk to the public. Generic Task A-40 is intended to support re-evaluation of the seismic design of operating reactors and to develop requirements for licensing new plants.



TYPICAL ALDEN RESEARCH LABS
FULL SCALE SUMP TEST

Phase I includes a number of studies related to the seismic response to earthquakes of structures, systems and components. These studies, performed under NRC-sponsored contracts, were completed by October 1979. In 1980, reports on site-specific response spectra were published as part of Phase I. A report on "Recommended Revisions to Nuclear Regulatory Commission Seismic Design Criteria" (NUREG/CR-1161, May 1980) provided background information and analyses supporting the recommendations. Revised drafts of related sections of the Standard Review Plan and Regulatory Guides were also completed.

Phase II of Task A-40 pertains to numerical modeling of earthquakes at the source, analysis of near-source ground motion and attenuation of high-frequency ground motion. Subtask studies by NRC contractors were completed in 1980. An analysis of near-source ground motion and the state-of-the-art review of earthquake source modeling has been published in a report, "State-of-the-Art Study Concerning Near-Field Earthquake Ground Motion" (NUREG/CR-1340, August 1980). A NUREG report, "Guidelines for Seismic Analysis and Review of Nuclear Power Plants" will be issued in 1982, presenting staff conclusions and recommendations.

Containment Emergency Sump Reliability

Following a postulated loss-of-coolant accident (LOCA), such as a break in the reactor coolant system piping, the water flowing from the break would be collected in the emergency sump at the low point in the containment. This water would later be recirculated through the reactor system by the emergency core cooling system (ECCS) pumps to maintain adequate core cooling. This water would also be circulated through the containment spray system to remove heat and fission products from the containment. Loss of the ability to draw water from the emergency sump could therefore disable the emergency core cooling and containment spray systems.

Resolution of this Unresolved Safety Issue (Task A-43) is being pursued through: (1) a DOE/Sandia-funded experimental program at the Alden Research Laboratory (ARL) that is testing full-scale sump designs to determine the hydraulic performance, and (2) evaluations of various types of insulation employed in nuclear power plants that might lead to debris generation under a LOCA condition and of the subsequent effect on sump performance. The hydraulic and debris aspects, when combined, provide a means for assessing containment sump performance for long term cooling.

The ARL program has provided full-scale data in fiscal year 1981 demonstrating that sump vortex formation has not significantly affected sump hydraulic performance. Measurements show that air entrainment levels (even with air-core vortices) are generally less that 1-2 percent. Figure 1 illustrates a typical ARL sump test and results. The research also revealed that selective sump design features (e.g., pipe separation, pipe distance from wall, etc.) are not major factors in sump performance; rather, sump performance might better be viewed as dependent on a minimum suction pipe submergence depth to prevent air ingestion. A third conclusion is that vortex suppressors of very simple design can be used to suppress sump vortexing and air ingestion.

Findings from nuclear plant insulation and debris evaluations reveal that a large number of plants utilize reflective-metallic insulation, and that this type of insulation does not lead to significant pump screen blockages under assessed LOCA conditions. Some of the older plants employ other types of insulation such as mineral fiber and fiberglass. Evaluations of selective plants has revealed that, in some cases, calculated levels of screen blockages may degrade sump performance.

Based on the investigative efforts of fiscal year 1981, the overall assessment emerging for USI A-43 is that this generic issue is not as severe as previously believed, but it is aniticipated that a few plants might require plant-specific attention. Resolution of this issue is targeted for early in fiscal year 1983.

Station Blackout

In keeping with the "defense-in-depth" safety strategy, electrical power essential to the effective performance of certain safety systems at nuclear power plants must be supplied by at least two independent redundant sources called "divisions." For example, the systems used to remove decay heat to cool the reactor core following a reactor shutdown are among the safety systems which must have uninterrupted electric power supply to meet safety requirements. Each independent division for supplying electricity to safety systems includes an off-site alternating current (ac) power connection, an on-site standby emergency ac power supply (usually one or more diesel-electric generators), and on-site direct current (dc) sources. The issue of station blackout involves a study of whether or not nuclear power plants should be designed to accommodate a complete loss of all a.c. power (i.e., a loss of off-site sources and all on-site emergency diesel sources).

A technical program has been initiated to determine the likelihood and potential accident risks of a loss of alternating current (ac) electrical power for a broad spectrum of nuclear power plant designs. The results of this work will be used to determine if changes in licensing criteria are necessary, and if so, to identify requirements for preventive or mitigative measures. Task Action Plan A-44 describes the program for resolving this issue, scheduled for completion in March 1983. The technical resolution of this issue involves an extensive reliability analysis of ac power supplies, an evaluation of potential accident sequence probabilities and consequences, and plant response analyses. Technical assistance is currently being provided by Oak Ridge National Laboratory in the area of ac power supply reliability analysis and by Sandia National Laboratories for accident sequence evaluation. The analyses of plant phenomenological response to the most likely station blackout accident sequences are being performed as part of the Severe Accident Sequences Analysis (SASA) program.

The first program effort completed was a preliminary probabilistic analysis to aid in the identification of any operating nuclear plants with abnormal susceptibility to a station blackout accident which would involve reactor core damage. No such plants have been identified. However, limitations inherent in this preliminary study are such that a high level of confidence cannot be accorded these results. Another program task nearing completion involves the plant response analyses. Current results show that a nuclear plant an cope with a station blackout of up to several hours or more without sustaining core damage. However, additional independent, but interactive, plant malfunctions could shorten the time period in which ac power must be restored to avoid core damage. The balance of the technical studies are scheduled for completion by July 1982.

During the period in which the station blackout program is being performed, several regulatory actions have been taken to add greater assurance of the safety of operating nuclear plants. These include a requirement that at least one independent cooling train capable of removing decay heat independent of ac power be included in operating nuclear power plants. Licensees have also been required to establish emergency operating procedures and training programs appropriate to cope with a station blackout. Additionally, near-term operating license applicants have incorporated requirements for enhanced diesel generator reliability.

Shutdown Decay Heat Removal Requirements

Under normal operating conditions, power generated within a reactor is removed as steam to produce electricity via a turbine generator. Following a reactor shutdown, a reactor produces insufficient power to operate the turbine; however, the radioactive decay of fission products continues to produce heat (so-called "decay heat"). Therefore, when reactor shutdown occurs, measures must be available to remove decay heat from the reactor to ensure that high temperatures and pressures do not develop which could jeopardize the reactor and the reactor coolant system. Accordingly, all light water reactors (LWRs) share two common decay heat removal requirements: (1) to provide an adequate means of transferring decay heat from the reactor coolant system to an ultimate heat sink, and (2) to maintain sufficient water inventory inside the reactor vessel to ensure adequate cooling of the reactor fuel. The reliability of a particular power plant to perform these functions depends on the frequency of initiating events that require or jeopardize decay heat removal operations and on the probability that required systems will respond to remove the decay heat.

One of the most crucial factors in the safety of nuclear reactors is the reliability of the systems used for decay heat removal following the shutdown of the reactor for any reason. The results of the Reactor Safety Study (WASH-1400) indicated that the overall probability of core meltdown in the first generation of large commercial LWRs was about 50-times higher than had been expected in WASH-1270 (about 5×10^{-5} as compared to 1×10^{-6} per reactor year). Insufficient reliability of the decay heat removal systems, particularly in response to small-break, loss-of-coolant accidents (LOCAs), was shown to be responsible for a substantial portion of the overall probability of core meltdown.

The principal means for removing the decay heat in a pressurized water reactor (PWR) under normal conditions immediately following reactor shutdown is through the steam generators using the auxiliary feedwater system. In addition to the WASH-1400 study mentioned above, later reliability studies and related experience from the accident at Three Mile Island have reaffirmed that the loss of capability to remove heat through the steam generator is a significant contributor to the probability of a core-melt accident.

The overall purpose of Task A-45 is to evaluate the adequacy of current licensing design requirements in order to ensure that Light Water Reactors (LWRs) do not pose an unacceptable risk involving failure to remove shutdown decay heat. The objective will be to develop a comprehensive and consistent set of safe shutdown cooling requirements for existing and future LWRs, including the study of alternative means of shutdown decay heat removal and of diverse systems dedicated only for this purpose.

Although many improvements to the steam generator auxiliary feedwater system were required of the reactor manufacturers by the NRC following the TMI-2 accident, the staff feels that providing an alternative means of decay heat removal could substantially increase the plant's capability to deal with a broader spectrum of transients and accidents thereby reducing overall risk to the public. Consequently, under Task A-45, the staff is investigating alternative means of decay heat removal in PWR plants, using existing equipment or devising new methods. This Unresolved Safety Issue will also entail investigation of the need and possible design requirements for improving reliability of decay heat removal systems in boiling water reactors (BWRs).

Seismic Qualification of Equipment in Operating Plants

There is recognized need to verify the functional capability of safety-related nuclear plant equipment when subjected to a seismic event. The General Design Criteria for Nuclear Power Plants states that structures, systems and components important to safety will be designed to withstand the effects of natural phenomena, such as earthquakes, without a loss of capability to perform their safety function (10 CFR Part 50, Appendix A, Criterion 2). It also states (Appendix B, Section III) that design control measures shall provide for verifying the adequacy of design (i.e., to qualify the equipment) by the performance of a suitable testing program. Today's equipment is seismically qualified by analysis and/or testing. Analyses alone are acceptable only if the necessary functional operability of the equipment is assured by its structural integrity alone; if not, testing is required. The "seismic input" motion to the equipment is specified by a design response spectrum. Since commercial nuclear power plants were first introduced, changes have been made in seismic qualification criteria and in the analytic and experimental methods used to qualify equipment. Therefore, seismic resistances of existing equipment installed in operating plants vary considerably, and some equipment may not meet the current seismic qualification criteria. In this event, the seismic qualification of this equipment must be reassessed to assure its safe performance during and after a seismic event.

The objective of this Unresolved Safety Issue (Task A-46) is to develop guidelines to assess the capabilities of mechanical and electrical equipment in operating nuclear power plants to perform their intended safety function during and after a seismic event. The Task Action Plan to resolve this issue involves the review of past and present criteria and methods used to qualify structurally and operationally the generic groups of equipment important to plant safety.

The various methods are now being assessed regarding their advantages and disadvantages, including conservatisms, functional deficiencies, and inconsistencies with current qualification criteria. Present and potential methods for requalifying equipment now in service are being identified. When these efforts are completed, initial conclusions and guidelines will be established and the balance of the study program will be developed in detail. This will include studies to determine acceptable procedures of requalifying equipment in operating plants. Analytical, laboratory and in situ qualification methods will be developed. Two specific sets of guidelines for the regulatory staff will then be generated. The first will assist the staff in judging the adequacy of the methods used to seismically qualify safety-related mechanical and electrical equipment. The second set will establish acceptable methods to requalify seismic-related safety equipment in operating plants.

Safety Implications of Control Systems

Although the safety systems are designed to provide protection regardless of the failure of control systems, there is a recognized potential for accidents or transients being made more severe as a result of certain control system failures or malfunctions. These kinds of failures may occur independently or as a result of the accident or transient under consideration and are in addition to any control system failure that may have initiated the event. Although it is generally believed that control system failures are not likely to cause the kind of loss of safety function which could lead to serious events or conditions that safety systems are not able to deal with, in-depth studies have not been performed to support this belief.

This Unresolved Safety Issue (Task A-47) calls for in-depth evaluations of control systems that are typically used only during normal plant operation—those whose operation has not been assumed to mitigate postulated design basis accidents.

The definition of the tasks to be performed under Task A-47 was initiated in the summer of 1981. Several subtasks are currently being developed to study these non-essential control systems. One such study is to evaluate overall transients in the steam generators (in PWRs) and/or in the reactor vessel (in BWRs) and to identify any control system failures that can contribute to such transients. Another activity is to identify any control system failures that can contribute to a reactor vessel overcooling transient. In addition, evaluations will be performed to study the effects of a loss of selected non-essential power supply busses that operate these control systems. The objective of these studies will be to determine and define the need for preventative and/or mitigative design measures to accommodate such failures or transients.

The risk of an accident that would affect a particular control system—and the effects of the control system failures—will differ from plant to plant. Therefore, it is unlikely that fully generic resolutions to these concerns will be developed. However, a feasible objective is to define criteria that can be used for the plant-specific reviews.

Hydrogen Control Measures and Effects Of Hydrogen Burns on Safety Equipment

Postulated reactor accidents that result in a degraded or melted core can entail the generation and release into the containment of large quantities of hydrogen. Following a loss-of-coolant accident in a light water reactor plant, combustible gases, principally hydrogen, may accumulate inside the primary reactor containment, as a result of:

(1) Metal-water reaction involving the zirconium cladding of fuel elements.

(2) Radiolytic decomposition of the water in the reactor core and the containment sump.

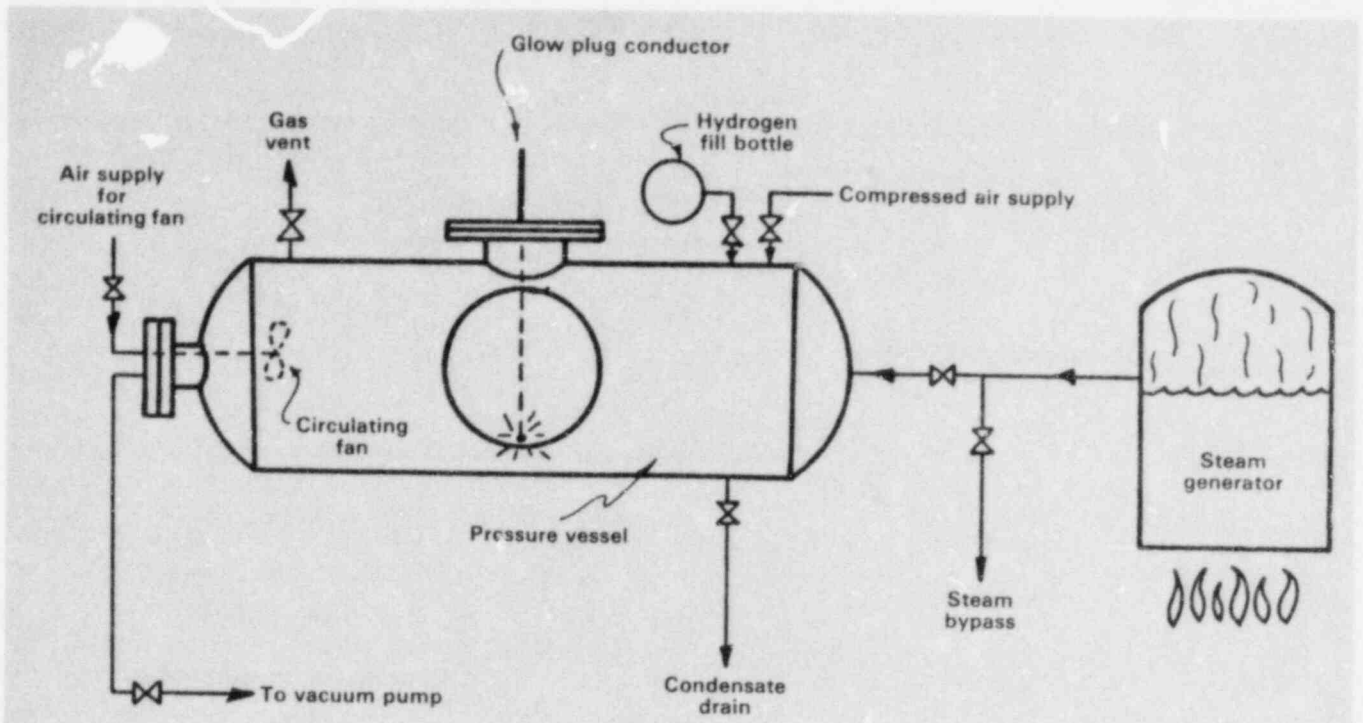
(3) Corrosion of certain construction materials by the spray solution.

(4) Synergistic chemical, thermal and radiolytic effects of post-accident environmental conditions on containment protective coating systems and electric cable insulation.

The accident at TMI-2 resulted in a metal-water reaction which involved hydrogen generation well in excess of the amounts specified in 10 CFR Part 50.44. As a result, it became apparent to the NRC that additional hydrogen control and mitigation measures would have to be considered for all nuclear power plants. Subsequently, the Commission determined that a rulemaking proceeding should be undertaken to define the manner and extent to which hydrogen evolution and other effects of degraded core must be taken into account in plant design. An advance notice of the rulemaking proceeding on degraded core issues was published in the *Federal Register* on October 2, 1980.

Because completion of this rulemaking may require a number of years, a set of interim actions relative to hydrogen control requirements were developed. These interim measures are described in a rule published in the December 2, 1981 *Federal Registers*.

The interim measures constitute the Interim Rule. The Interim Rule is in two parts; the first was issued in effective form as a final rule on December 2, 1981 (46 FR 58484), and the second was issued as a proposed rule on December 23, 1981 (46 FR 62281). The final portion of the interim rule requires that boiling light-water nuclear power reactors with a Mark I or Mark II type of containment shall be provided with



Facility for testing hydrogen iginition at the Lawrence Livermore National Laboratory (Task A-48)

an inerted atmosphere by May 4, 1982 or six months after initial criticality. The proposed portion of the interim rule requires that PWR reactors with ice condenser containments (such as Sequoyah) and BWR reactors with Mark III containments be required to use improved hydrogen control systems and that all light-water nuclear power reactors not relying upon an inerted atmosphere for hydrogen control be required to show that certain important safety systems would function during and following hydrogen burning. The amount of hydrogen to be assumed in the design of the improved hydrogen-control systems and in the analyses of safety systems during a hydrogen burn corresponds to that released to the containment with a metal-water reaction of 75 percent of the fuel cladding in the active fuel region.

A separate rule, issued on January 15, 1982 (47 FR 2286), addresses hydrogen control for construction permit and manufacturing license applications. This rule incorporates provisions that would require additional hydrogen control systems for all currently pending construction permit and manufacturing license applications. It requires that the hydrogen control system accommodate larger hydrogen releases than the companion rule for operating license applications and operating reactors, i.e., up to a 100 percent fuel cladding metal-water reaction.

All nuclear plants with ice condenser containments are to be equipped with a "glow plug" system. The staff's evaluation of glow plug or distributed ignition systems for ice condenser plants has been based on programs of analysis and testing. The initial testing program of the glow plug igniter, sponsored by the ice condenser owners' group, successfully demonstrated the capability of the proposed igniters to initiate combustion of various hydrogen-air-steam mixtures and showed that the igniters were sufficiently durable to perform their function in a severe environment. Independent testing of the igniters, performed for the NRC by the Lawrence Livermore National Laboratory, verified the reliability of the proposed igniters over a range of accident conditions. As a result of the testing and analysis of distributed ignition systems, the staff has approved their use as an interim measure for the Sequoyah, McGuire and D. C. Cook ice condenser plants. Final approval of the ignition systems was conditioned upon the utilities' completion of a research program designed to demonstrate that adequate safety margins are provided by the proposed igniter systems for a spectrum of degraded core accident scenarios. More extensive testing sponsored by the ice condenser owners has been under way to investigate various combustion phenomena and the process of hydrogen mixing in containment.

The results of this testing were not available at the close of the report period.

During 1981, the first proposals of additional hydrogen control systems for Mark III containments were submitted to the NRC. Mississippi Power and Light Co., an operating license applicant, has proposed the use of an igniter system, similar to those installed in ice condenser plants, for the Grand Gulf Nuclear Plant, which employs the Mark III containment.

The NRC, at the close of the report period, was in the process of reviewing the analysis and testing performed to demonstrate the adequacy of the proposed igniter sytems for a Mark III containment. Houston Lighting and Power Co., a construction permit applicant, has proposed the use of a post-accident inerting system for the Allens Creek plant. This system requires the injection of large quantities of carbon dioxide into containment to prevent the burning of hydrogen. The Houston Lighting and Power Co. will be required to submit to NRC the results of tests and analyses demonstrating acceptability of the post-accident inerting system within two years of issuance of the construction permit.

Safety Reviews

The review of safety aspects of nuclear power plants is discussed below for general programs that involve a number of reactor systems in numerous plants and for specific concerns that involve a particular system, safety feature or plant.

GENERAL PROGRAMS

Standard Review Plan

During fiscal year 1981, Standard Review Plans were revised to satisfy three major objectives. The first of these is to assure congruence of the Standard Review Plan with the regulations of the NRC, i.e., to more clearly identify which requirements are to be satisfied in each phase of the review process and to collectively show that all requirements are met. The second objective is to describe more fully how each requirement shall be satisfied. In this effort, the acceptance criteria employed by the NRC to determine satisfaction are amplified and clarified along with extensive use of regulatory guides, codes and standards, and NUREGs. The third objective is to incorporate in to the Standard Review Plan the many new and revised regulatory positions established in the past two years, primarily as a result of the Three Mile Island accident in March 1979.

Throughout fiscal year 1981, intensive staff effort was required in support of these objectives in order to ensure that the revised Standard Review Plan, in each of its 220 sections, would conform with the current NRC regulations, regulatory guides and previously approved staff requirements and positions—including the TMI action plans. As a conclusion of this effort, the NRC published in July 1981 a report of this revision, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants: LWR Edition" (NUREG-0800).

Normally it is anticipated that 20 to 30 sections of the Standard Review Plan will be reviewed or modified in a year. Because of the urgency of reviewing all sections of the SRP in fiscal year 1981, the following four ground rules served to guide (and limit) the types of changes to be permitted under the interim procedure for revising the SRP as approved by the Director of the Office of Nuclear Reactor Regulation:

(1) Incorporation of references to already-approved regulatory requirements to establish congruence.

(2) Incorporation of TMI-related requirements that have been established through other approval mechanisms.

(3) Minor clarifications and editorial corrections.

(4) New positions that have been approved by the Director, NRR, as being so clearly needed that a public comment period would cause undue delay in imposing them.

Under these procedures, nine new sections were added in which no public comment was required; and a reduction of six other sections, deletion or combination with other closely related sections, was accomplished. In the coming year, staff effort will resume attention to those changes in the SRP where public comment will be invited.

TMI Action Plan

As discussed on pages 66-67 of the *1980 NRC Annual Report*, the accident at Three Mile Island caused the NRC to review its regulatory and licensing requirements for reactors with an operating license or under application for an operating license. The results of studies and investigations of the cause of the accident identified a number of changes (or studies of possible future changes) in regulatory requirements for nuclear power reactors. Those items, approved by the Commission as additional requirements, are documented in NUREG-0737, "Clarification of TMI Action Plan Requirements," dated October 31, 1980. The additional requirements and their schedule for implementation were based on the conclusions of post-accident investigations, the signifi-

cance of the safety issue involved, and the availability of equipment to satisfy the item. Immediate actions were required and completed by licensees and, in certain cases, will be supplemented by longer term, more stable improvements.

There are approximately 140 discrete actions approved for implementation by operating reactor licensees and applicants. Of these, 30 have already been completed for all affected facilities. The remaining items are scheduled for completion over the next two years.

In consonance with the NRC objective for improved procedures, programs and policies, the additional licensing requirements are the subject of proposed rulemaking. Final resolution of these additional TMI-related requirements should be promulgated in 1982.

An Action Plan Tracking System (APTS) has been established to monitor the status of the many action items in the TMI Action Plan. This system provides a computer tabulation in summary fashion of significant information related to each issue and is updated at quarterly intervals.

Systematic Evaluation Program

The Systematic Evaluation Program (SEP) is an ongoing program to assess the adequacy of design and operation of older operating reactors, to compare them with current safety criteria, and to provide the basis for integrated and balanced equipment backfit decisions. Phase I of the program, the establishment of guidelines, techniques and review areas to be evaluated, has been completed. A total of 137 issues were identified to be reviewed for each plant. Phase II, review of the 10 oldest operating reactors has commenced. (Originally 11 plants were to be reviewed, but one has shutdown until 1986.) The reviews of individual issues on each plant are nearing completion and the integrated assessment of the Palisades Nuclear Power Plant is scheduled to be completed in July 1982. The remaining assessments are to be completed by June 1983. The SEP Phase II program was redirected in June 1981 to increase licensee participation during the review of individual issues on their facilities. Nearly 250 safety analysis reports on individual issues were submitted by licensees at year's end. This has improved the efficiency of the NRC staff review. This approach may also be applied to subsequent plant reviews during SEP Phase III.

SEP Phase III will also provide documentation on how operating reactors compare to current safety criteria. Plants will be reviewed in smaller groups and, to insure that issues of significant safety benefit are considered for each group, an annual review of significant safety issues will be conducted to coincide with selection of the next group of plants to be reviewed. Probabilistic risk assessment evaluations will be cooordinated with the deterministic review of safety issues in SEP Phase III by coordinating the SEP Phase III reviews with the National Reliability Evaluation Program (NREP).

Quality Assurance

Quality Assurance (QA) provides the necessary managerial and programmatic control to assure that nuclear power plants are designed, constructed and operated in a manner such that public health and safety is not endangered. Each NRC licensee is reponsible for assuring that its nuclear power plants are built and operated safely in conformance with the NRC regulations which include the requirement for a QA program. Through this QA program, all organizations performing work that is ultimately related to the safety of plant operation are required to conduct work in a preplanned and documented manner, independently verify the adequacy of completed work, provide records that will confirm the acceptability of work and manufactured items and assure that all individuals performing the work are properly trained and qualified.

The specific QA responsibilities of the NRC include developing criteria and guides for judging the acceptability of nuclear power plant QA programs; reviewing the descriptions of QA programs of each licensee, and its principal contractors, to assure the existence of sufficient mangerial and programmatic controls; and inspecting selected activities to assure effective implementation of the QA program. The NRC requires appropriate upgrading of deficient QA programs and uses enforcement authority as necessary to achieve proper implementation.

Serious construction problems, attributed in part to improper implementation of QA programs, have been experienced by several utilities holding construction permits for nuclear power plants. Among the problems were weld deficiencies, voids in concrete placement, and inadequate foundation preparation causing building settlement. The NRC reevaluated the QA programs at those plants to determine where controls needed to be strengthened in order to correct and preclude recurrence of such problems.

In late September 1981, Pacific Gas & Electric Co., the licensee for Diablo Canyon Nuclear Power Plant Unit 1, notified the NRC that an error had been detected in the seismic design of supports for equipment and piping located in the containment annulus. Subsequent investigations by the NRC and the licensee revealed the existence of additional errors. On the basis of this information, the Commission concluded that the licensee's quality assurance program was not effectively and adequately implemented to control the design of the affected plant items and on

November 19, 1981, ordered the suspension of the license issued on September 22, 1981, to load fuel and conduct tests at up to 5 percent of rated power, which had not taken place. Pacific Gas & Electric Co. was requested to conduct an independent program of verification of various design activities, both of the company itself and of engineering-service contractors, to provide assurance that safety-related work was properly performed and to implement corrective action as necessary. This work is presently underway and is anticipated for completion in 1982.

Through the NRC topical report program, the industry has adopted standardized QA programs which obviate the need for a review on each new project. As of the end of fiscal year 1981, a total of 38 topical reports from manufacturers of nuclear steam supply systems, architect-engineering firms, constructors, utilities and related organizations have been found acceptable by the NRC.

Following the TMI accident, additional QA requirements (concerned with structures, systems and components covered by the QA program; staffing and qualification levels of the QA organization; and involvement of the QA organization in quality affecting activities) were identified in new regulatory guides and rules. Docketed QA program descripitons of pending construction permit and manufacturing license applications were upgraded to meet the new requirements.

The Standard Review Plan for QA was revised to incorporate new QA requirements in areas of involvement of upper management in the QA activities, upgrading the qualifications of QA managerial personnel, improving the content of implementing procedures, staffing of QA organizations with qualified people and clarifying QA organizational responsibilities.

Regulations have required organizations involved in the design, fabrication, testing, use and repair of transportation packages for radioactive material to develop QA programs meeting NRC requirements. During fiscal year 1981, approximately 20 QA program descriptions were evaluated and found acceptable bringing the total of satisfactory programs to approximately 368, since the review of such programs was initiated by the staff in 1979.

Two new rules addressing specific aspects of the QA program have been proposed. One rule requires applicants to notify the NRC of any changes that may take place in a previously accepted QA program. The other rule, which designates the applicability of a QA program (as described in Appendix B to 10 CFR 50) to items that are "important to safety" (as given in Appendix A to 10 CFR 50), is currently under review. Another activity under way includes developing QA acceptance criteria for the review of QA programs for design and construction of waste repositories for high-level waste.

Equipment Qualification

The program to upgrade the qualification of safety-related equipment used in nuclear power facilities is currently being implemented. Licensees have submitted information to the NRC for the qualification of safety-related electrical equipment exposed to "harsh" environment, resulting from postulated loss-of-coolant accidents, high-energy line breaks, and core damage. This action was in response to IE Bullentin 79-01B and its attached guidelines. The review of this information has been completed. A large part of the information has been incorporated into the Equipment Qualification Data Bank for cross referencing and cross checking.

The Commission Order CLI-80-21, dated May 23, 1980, required the staff to complete safety evaluation reports (SERs) for all operating plants by February 1, 1981. The Order also required that by no later than June 30, 1982, all safety-related electrical equipment in all operating plants be qualified. An extension of this deadline is under consideration by the Commission. The current regulations for equipment qualification are embodied in the General Design Criteria (GDC) one, two, four, and 23 of Appendix A and Sections III and XI of Appendix B to 10 CFR Part 50. More detailed guidance related to methods, procedures and guidelines for demonstrating this capability have been set forth in various industry standards and in NRC regulatory guides.

All of the SERs have been issued by NRR. The staff evaluations showed that equipment qualification sometimes was unclear or inadequately documented. In some cases, installed equipment was not qualified to conditions commensurate with expected service conditions. Corrective actions and documentation are being accomplished by the licensees.

An Equipment Qualification Program Plan has been proposed by NRC staff to upgrade the qualification of mechanical and electrical safety-related equipment in operating facilities and new plants. It deals with environmental, seismic and dynamic qualification testing programs, rulemaking activities and research in support of the program. Various tasks are outlined, along with projected costs, milestone completion schedules and manpower requirements.

Fire Protection

Following the fire at the Brown's Ferry Plant in March 1975, the NRC initiated a review of the fire protection programs for all operating plants and for plants not yet operational. As a result of this review, the minimum requirements for specific aspects of fire protection for operating plants were added as Appendix R to 10 CFR Part 50. Guidelines for plants now being licensed have been revised to include these re-

quirements. The approved fire protection program is a condition for licensing.

Several operating plants have requested exemptions for specific areas of their plants from certain Appendix R requirements. Evaluation of these requests will be completed by 1983.

Several licensees petitioned the Commission to stay the backfit requirement of 10 CFR 50.48 until a judicial review of these requirements could be made. The Commission denied the petition. The Circuit Court was then requested by the same licensees to review the Appendix R requirements. The Circuit Court has the case under review.

An audit program to review the fire protection at operating plants at three year intervals has been developed by the Office of Inspection and Enforcement.

Reliability and Risk Assessment

The integration of reliability and risk assessment into the regulatory process on a broad scale will be accomplished by the National Reliability Evaluation Program (NREP), to be implemented on a phased schedule on all operating reactors starting in fiscal year 1983. During fiscal year 1981, the NRC staff has participated in two separate efforts to develop procedures guides for performing these probabilistic risk assessments in a comprehensive and scrutable fashion. The methodology development effort is expected to be completed in fiscal year 1982.

As part of the proposed Interim Rule on Construction Permit and Manufacturing License Applications, the staff required applicants to develop programs for performing probabilistic risk studies within two years of issuance of a construction permit, with the goal of improving the reliability of core and containment cooling functions. Guidelines were issued on potential areas where reliability improvements would be considered based on the result of the risk study. Risk/reliability programs were reviewed and approved for four license applications. In a separate action, the staff identified Millstone Unit Three as a plant under construction in a high-population-density site and required the applicant to perform a risk study which would be reviewed as part of the consideration of an operating license several years hence. The staff has been routinely reviewing reliability studies for auxiliary feedwater systems of pressurized water reactors, as submitted by applicants for operating licenses.

An independent generic evaluation was made of a concern that stemmed from an abnormal occurrence in one of the boiling water reactors at the Browns Ferry nuclear plant in June 1980, when about half of the control rods failed to insert fully during a scram (reactor shutdown). During scram, the control rods are hydraulically inserted in the reactor core. Hydraulic discharge lines from the control rods penetrate the primary containment and come together in the Scram Discharge Volume (SDV) in the reactor building. A large unisolated pipe break in the SDV could result in continuous loss of reactor coolant and melting of the reactor core if left unattended for an extended period of time. To prevent this, decisions would have to be made in the control room to reset the scram signal or to follow a depressurization procedure. Decision "trees" (step-by-step diagrams) were devised to quantify the probability of operator failure to carry out these actions. The result of the study regarding the estimated frequency of such an event, combined with the estimated probability of corrective operator action, provided an important basis for the judgment that this type of an event is not a significant contributor to the probability of core melt. Consequently, the only action taken by the staff was to assure that adequate procedures and instrumentation are available to cope with such an event.

Systems Interaction

The staff program of systems interaction was initiated in May 1978 with the definition of Unresolved Safety Issue A-17 and was intensified by Item II.C.3 of the Three Mile Island Action Plan. The concern arises because the design, analysis and installation of systems are frequently the responsibility of teams of engineers with functional specialties—such as civil, electrical, mechanical or nuclear. Experience at operating plants has led to questions of whether the work of these functional specialists is sufficiently integrated to enable them to minimize adverse interactions among systems.

Staff efforts on systems interaction during fiscal year 1981 were directed principally toward surveying available methods and developing preliminary guidance for the performance of comprehensive analyses and reviewing the results of a recent analysis of the Diablo Canyon and San Onofre facilities in California for potential seismic-initiated interactions. The staff also completed the acceptance review of a program for a comprehensive analysis of systems interaction to be performed at Indian Point Unit 3 in New York.

During the coming year, the staff will complete development of regulatory guidance for application in pilot analyses of systems interaction planned at some new plants nearing completion of construction. The staff will also be evaluating the conduct of the Indian Point-3 analysis scheduled to begin in November 1981 and will be reviewing the results of that effort.

SPECIFIC CONCERNS

Occupational Radiation Exposures

An analysis of the occupational radiation exposures at operating light water reactors (LWR's) for

1980 shows that there were significant increases in total person-rem doses in 1980 when compared with previous years. In 1980, there were 68 LWR's which had completed at least one full year of operation by the end of the year (an increase of one over the total number operating in 1979). Of this number, 26 were boiling water reactors (BWR's) and 42 were pressurized water reactors (PWR's).

Some of the 1980 dose statistics for these plants are:

- BWR's averaged 1,136 person-rems/reactor in 1980, a 55 percent increase over the 1979 average of 733.
- PWR's averaged 578 person-rem/reactor in 1980, a 13 percent increase over the 1979 average of 510.
- The overall LWR average in 1980 was 791 person-rems/reactor, a 33 percent increase over the 1979 average of 593.
- The total collective occupational dose for LWR's in 1980 was 53,797 person-rem, a 35 percent increase over the 1979 total of 39,759 person-rems.

Reasons for increases for BWR's given by plant Radiation Protection Managers included seismic-hanger inspections and changes, snubber corrections, masonry wall modifications, removal of cladding on feedwater piping, and torus and drywell modifications. An official of the General Electric Company attributed the major increases for BWR's to modifications of Mark I toruses and replacement of certain stainless steel components that showed intergranular stress corrosion cracking.

NRC staff is developing a plan for resolution of safety issues that assesses benefits and costs, including occupational radiation exposures resulting from installation of equipment or changes in operating procedures. The Offices of Nuclear Reactor Regulation and Inspection and Enforcement have agreed that the process for development of generic orders, bulletins and information notices will include consideration of potential occupational radiation exposures.

Pressurized Thermal Shock Of PWR Vessels

Severe reactor system overcooling which could be followed by repressurization of the reactor vessel can result from a variety of causes. These include instrumentation and control system malfunctions and postulated accidents such as small break loss-of-coolant accidents (LOCAs), main steamline breaks or feedwater pipe breaks. Rapid cooling of the reactor vessel internal surface causes a temperature distribution across the reactor vessel wall. This temperature distribution results in thermal stress. The magnitude of the thermal stress depends on temperature differences across the reactor vessel wall.

Pressure vessel thermal shock has been a concern for many years because cold emergency core coolant is injected during a large loss-of-coolant accident. Based on a series of thermal shock experiments conducted at Oak Ridge National Laboratory (ORNL) and on fracture mechanics analyses, it has been concluded that a postulated flaw would not propagate through the reactor vessel wall during a large LOCA and the vessel integrity would be maintained.

As the result of operating experience and transient analysis, it is recognized that there could be transients in pressurized water reactors in which the reactor vessel could be subjected to overcooling at the same time primary system pressure remained high. In those pressurized thermal shock transients, the reactor vessel would be subjected to pressure stresses superimposed upon the thermal stresses. In order to define what conditions would be necessary to propagate a flaw through the entire vessel thickness under those conditions, a number of steps were taken by the staff beginning in early 1980. These included defining the cooldown transients of interest and their likelihood of occurrence, developing a computer code to perform the thermal transients and fracture mechanics analyses, and planning for pressurized thermal shock tests in the Heavy-Section Steel Technology Program at ORNL. As long as the fracture resistance of the reactor vessel material remains high, such transients will not cause failure. After the fracture toughness of the vessel is reduced by neutron irradiation, severe thermal transients could initiate fairly small flaws near the inner surface, and they could result in significant cracking. The vessels of concern are those which have a history of high radiation exposure and are made of material that has a high sensitivity to radiation damage.

Several overcooling transients have occurred in operating PWRs, the most severe of which was a transient at the Rancho Seco Nuclear Plant on March 20, 1978. The staff has concluded that the Rancho Seco vessel was not damaged to the extent that its expected service life was reduced because the transient occurred very early in plant life, when the fracture toughness of the reactor vessel had not been significantly affected by irradiation.

Based on review to date, the staff has concluded that no immediate licensing actions are required for operating reactors. The conclusions and supporting information developed by the utilities are consistent with the NRC staff position. This is true for both the potential severity of the problem and the time scale upon which industry and NRC action is needed. Although no immediate licensing actions are needed, a program has been initiated to fully resolve this concern within the next few years.

Auxiliary Feedwater Systems

Pressurized water reactors are equipped with auxiliary feedwater systems which are designed to deliver coolant to the steam generators when the main feedwater system is unavailable, or when the amount of feedwater required is too small to conveniently utilize the main feedwater system. For most plants, the auxiliary feedwater system has a dual function, being used for normal startup and shutdown and also to provide secondary cooling during transients and accidents—such as loss of main feedwater pumps, loss of off-site power, loss of all alternating current (AC) power, main steam or main feedwater line breaks, and small break primary loss-of-coolant accidents. For operating plants the system would typically consist of one turbine-driven and one or more motor-driven pump trains.

Prior to the Three Mile Island accident, evaluations of auxiliary feedwater systems were performed based on the acceptance criteria and review procedures of the standard review plans and on branch technical positions. The review sought assurance that the auxiliary feedwater systems had been designed to withstand the effects of natural phenomena (e.g., earthquakes, tornados) and the effects of missiles, pipe whipping and environmental effects that may result from equipment failures, that the system possessed suitable redundancy, and that it could be powered from diverse sources so that at least one train would be operable on loss of both on-site and off-site AC power.

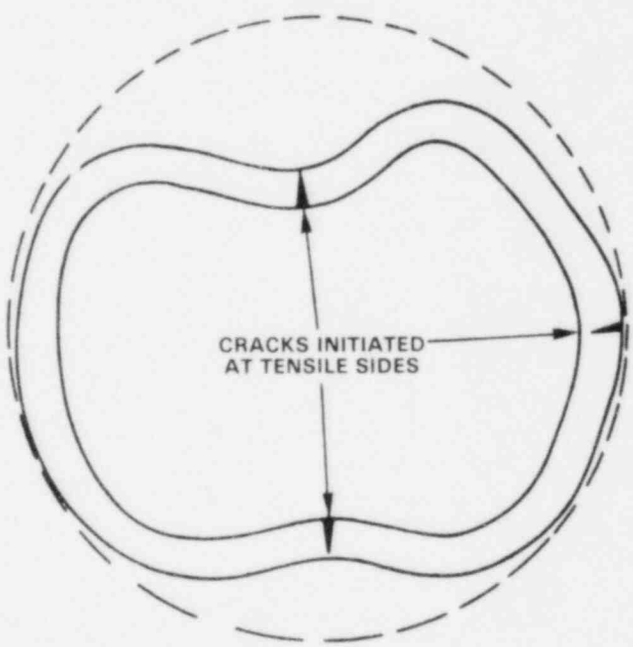
The Three Mile Island accident and subsequent investigations and studies highlighted the importance of auxiliary feedwater systems in the mitigation of transients and accidents. The staff reevaluated the auxiliary feedwater systems for all operating plants. This effort included, in addition to a deterministic review, a reliability analysis using "event tree" and "fault tree" logic techniques, with particular emphasis on a determination of potential failures which could result from human errors, common causes, single-point vulnerabilities and test and maintenance outages. These in turn resulted in both generic and plant-specific, short-term and long-term recommendations. Safety Evaluation Reports have been prepared for auxiliary feedwater systems in all Westinghouse and Combustion Engineering operating reactors. Safety Evaluation Reports for the Babcock and Wilcox operating reactor auxiliary feedwater systems have either been completed or are in preparation. Combined deterministic and reliability reviews of the auxiliary feedwater system are also being performed for plants under operating license review. It is expected that implementation of the staff recommendations based on the combined deterministic and reliability review will result in improved reliability of auxiliary feedwater systems.

Steam Generators

Significant developments affecting PWR steam generators since July 1980 were the following:

Flushing of the tubesheet crevices and reduced temperature operation at Point Beach Unit 1 (Wis.) appear to have been successful in reducing the rate of "intergranular attack" and stress corrosion cracking of the steam generator tubing in the tubesheet crevices. Point Beach Unit 1 has operated without significant leakage since January 1979. Steam generator inspections performed in December 1980 and July 1981 continued to show a decreasing trend in the occurrence of newly degraded tubes. The operation of this unit continues to be subject to a portion of the operating restrictions imposed by Orders dated November 30, 1979 and April 4, 1980.

Sleeving repairs of approximately 7,000 steam generator tubes at San Onofre Unit 1 (Cal.) have been completed. The unit has been approved for six months operation following which it must be shut down for its next steam generator inspection. Extensive repairs of the San Onofre Unit 1 steam generators became necessary as the result of widespread intergranular attack at the top of tubesheet elevation. Hot and cold water flushing of the steam generator secondary sides, stricter control of secondary water chemistry and reduced temperature operation have been implemented to retard the rate of further tube degradation. The advantage of sleeving as opposed to



Above is cross section of dented tube showing location of leakage in the steam generator of Turkey Point Unit 4 (Fla.).

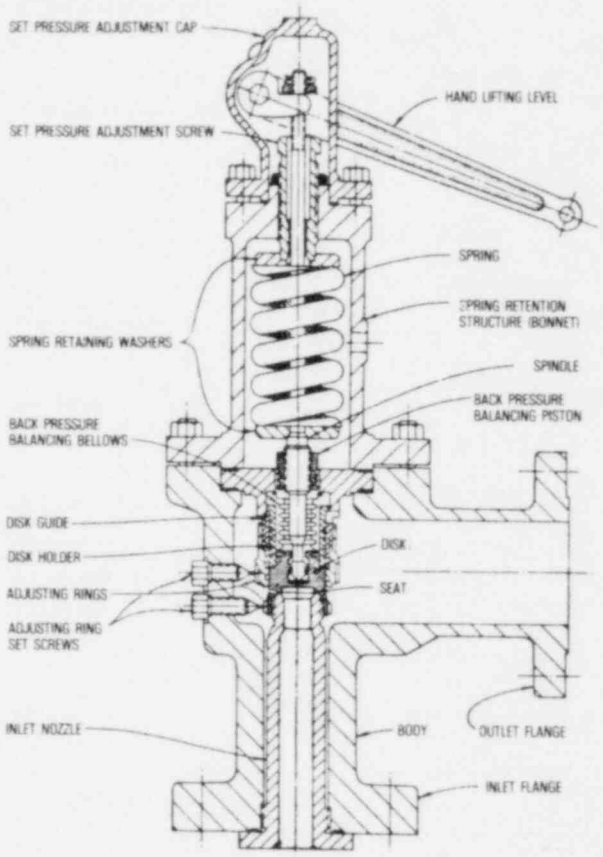
more conventional plugging repairs is that sleeving allows the tube to remain in service. Sleeving repairs are one method by which the useful life of severely degraded steam generators can be prolonged. This repair method is not applicable to tubes severely degraded by denting.

Extensive denting-related degradation of steam generator tubing at Surry Units 1 and 2 (Va.) and Turkey Point Units 3 and 4 (Fla.) has necessitated the replacement of the steam generators at these facilities. Steam generator replacement at Surry Units 1 and 2 has been completed. Hearings by the Atomic Safety and Licensing Board regarding steam generator replacement at Turkey Point Units 3 and 4 have been completed and Unit 3 is currently undergoing replacement. Replacement of the Turkey Point Unit 4 steam generators is now scheduled for the fall of 1982. In the interim and prior to replacement, Turkey Point Unit 4 is operating under restrictions imposed by the NRC.

Steam generator inspections performed in August 1980 and May 1981 resulted in the finding of 108 and 182 tubes, respectively, with pluggable indications at H.B. Robinson Unit 2 (S.C.). This brings the total number of tubes plugged to 857 or 8.8 percent of total number of tubes in the steam generators. A large number of these indications have occurred within the tubesheet crevice and are attributed to intergranular attack and stress corrosion cracking similar to what has occurred at Point Beach Unit 1. However, a large number of the indications have also been observed above the tubesheet on both the hot and cold leg side (believed to be phosphate wastage corrosion) and in the U-bend. Laboratory examination of U-bend specimens removed from the field revealed the U-bend indications to be wall thinning rather than cracks.

Trojan Unit 1 (Ore.), Cook Unit 2 (Mich.), and Zion Unit 1 (Ill.) experienced small steam generator tube leaks attributed to stress corrosion cracking in the small radius U-bends. In addition to these units, North Anna Unit 1 (Va.) and Farley Unit 1 (Ala.) have previously been affected by small radius U-bend cracking. The occurrence of U-bend cracks has generally been confined to row-1 tubes. However, tube inspections of the Zion Unit 1 steam generators in February 1981 resulted in the finding of row-2 indications in addition to row-1 indications. At Trojan Unit 1, where numerous row-1 U-bend leaks have occurred previously, the remaining unplugged row-1 tubes have been plugged as a preventive measure. In cooperation with the Portland Gas and Electric Co., Westinghouse Corporation has performed an intensive analysis of U-bend specimens removed from Trojan steam generators to establish the cause and safety significance of the U-bend cracks. Their findings are currently under review by the NRC staff.

Arkansas Unit 1 (Ark.) and Rancho Seco Unit 1 (Cal.) were shut down on September 5, 1980, and May 17, 1981, respectively, with steam generator tube leakage. Subsequent inspections revealed the leaking tubes to be in the vicinity of the open inspection lane. The causal mechanism is believed to be circumferential cracks propagated by fatigue. Similar fatigue cracks have been observed previously at Oconee Units 1, 2 and 3 (S.C.).



A spring-loaded safety valve is shown above. Height of the valve may be three to four feet.

Performance Testing of Valves

In response to NRC requirements specified in reports NUREG-0578 and NUREG-0737, generic test programs for safety and relief valves were established by utility owners groups.

The program for pressurized water reactors is being conducted by the Electric Power Research Institutute in facilities of Duke Power Co. at the Marshall Steam Station, Wyle Laboratories at Norco, Cal., and Combustion Engineering at Windsor, Conn. On the basis of review of test results to date, the NRC staff has concluded that the program represents a fully responsive effort to meet NRC requirements. Since the available test data have not uncovered problems with safety and relief valves that are con-

sidered significant to the safety of operating plants, the Commission has approved extension of dates for completion of testing from July 1, 1981, to April 1, 1982, for pressurized water reactors.

The generic test program for safety and relief valves of boiling water reactors was conducted by General Electric with testing performed at the Wyle laboratory in Huntsville, Ala. This program provided for qualification of valves and associated discharge piping for low pressure water conditions expected during alternate shutdown cooling. Final test results were transmitted to the NRC in late September 1981. On the basis of a preliminary review, the NRC staff has tentatively concluded that all valves tested were qualified for the low pressure test conditions.

Ultimate Capacity of Containment

During the course of a postulated severe accident, loss of both natural convection cooling and the emergency core cooling system (ECCS) could lead to reactor core dry-out, heat-up and eventual melt-down. This will result in a number of phenomena or physical processes, such as hydrogen generation and steam explosion which can threaten the integrity of the containment building.

The basic function of a containment structure is to limit or restrict the release of radioactive materials in case of a loss-of-coolant-accident (LOCA). The containment structure is designed to withstand the effects of a LOCA, but not necessarily those of a degraded core. Therefore the capability of containment structures to withstand an accident beyond the design basis has become a licensing concern.

It is a well known fact that containment structures have inherent strength to resist forces beyond the design basis; however, such strength has never been realistically assessed.

The task of assessing the containment capacity beyond design basis is accomplished in various ways:

(1) Through a technical assistance program contract with the Los Alamos National Laboratory, the capacity of the reinforced concrete containments of Indian Point Units 2 and 3, as well as the prestressed concrete containments of Zion Units 1 and 2, has been assessed. Also through a contract with the Ames National Laboratory, the capacity of the steel containments of McGuire Units 1 and 2 and Sequoyah Units 1 and 2 has been evaluated. In the evaluation of the capacities of these containments (concrete as well as steel), the actual materials' strengths have been used, taking into consideration the variability in those strengths. To assure a conservative estimate, lower bound values of containment capacity have been used.

(2) Pending applications for construction permits and manufacturing licenses are required to assess the containment capacity for such accidents. This has been done on the Pilgrim Units 1 and 2, Allens Creek, and Skagit/Hanford Units 1 and 2. The assessment is based on the American Society of Mechanical Engineers (ASME) Code, Section III, Stress or Strain Allowables.

(3) Through the revision to Section 3.8.1 and 3.8.2 of the Standard Review Plan (SRP), the requirement of evaluating containment capacity beyond the design basis has been added.

(4) Through a small computer program the staff is able to assess the approximate lower bound capacity of any type of containment quickly. This program uses simplified analysis based upon identification of simple failure modes, such as first yielding of containment shell. This approach gives a quick, preliminary evaluation of the containment's ultimate capacity and can provide a basis for licensing decisions.

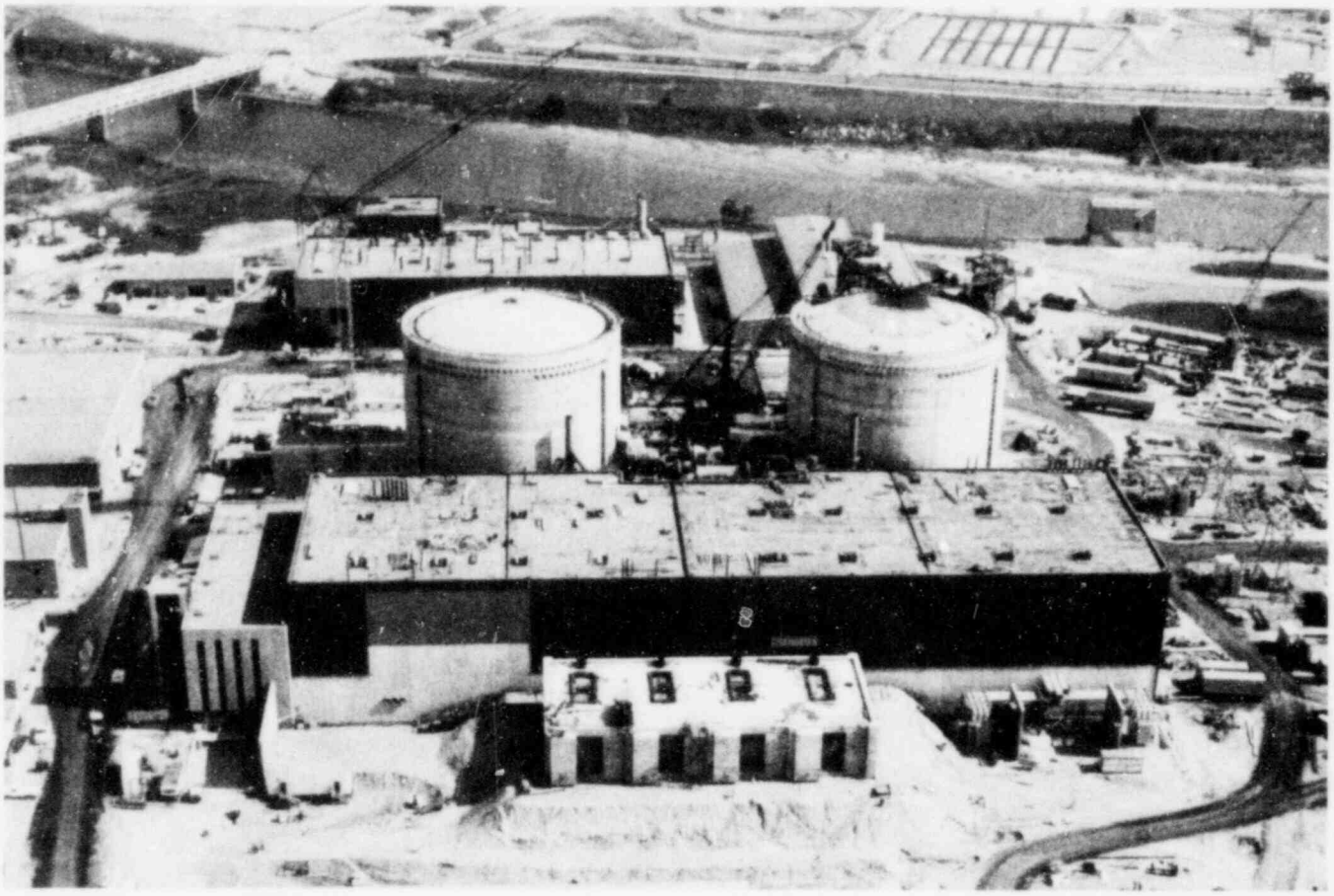
Mitigation Features for Zion And Indian Point Facilities

A study of the Zion and Indian Point facilities was undertaken by the Office of Nuclear Reactor Regulation (NRR) in 1981 to determine whether practical design features for mitigating the consequences of core melt accidents would significantly contribute to safety. The Zion and Indian Point nuclear power plants were selected for this study because of the high population density in the vicinity of both sites. The findings of this program and a parallel program to address overall safety at these facilities will form the technical basis for recommendations to the Commission on whether or not to require changes in design features for these facilities.

The utilities operating Zion and Indian Point are participating in both programs. The results of the Zion safety study were submitted to the NRC on September 17, 1981. The results of the Indian Point safety study will be submitted in 1982. The NRC will not issue a final report on this subject until it reviews the submittals from the utilities. The staff presented the first part of its preliminary conclusions in report NUREG-0850 published in November 1981 for consideration and comment by interested parties.

Structural Design Audits

During fiscal year 1981, NRC staff performed structural design audits of the following plants: Co-



The Midland nuclear power plant (Mich.) with the diesel generator building in the foreground, showing a 20-foot layer of sand which was piled up around and within the building for a period of seven months to compress the poorly compacted fill material beneath the structure. Behind the generator building is the turbine building, and behind that the two reactor containment buildings.

manche Peak, Waterford, Palo Verde, Clinton, Watts Bar, St. Lucie, Fermi 2 and Midland. The objectives were:

(1) Investigation of the manner in which the applicant has implemented the structural design criteria that he has committed to use for the facility.

(2) Detailed review of the key structural design calculations.

(3) Identification and assessment of the safety significance of the areas where the plant structures were designed using methods other than those recommended by the NRC Standard Review Plan (SRP).

The audit meetings took place at the offices of the applicant or the architect-engineer and required about five working days per plant. The audit team consisted of two to three staff members, occasionally accompanied by a staff consultant assisting the staff in the review of the plant license application.

During the audit the applicants were requested to present the structural calculations for all or most of the "seismic Category I" structures. The review of the calculations involved all phases of design i.e., establishing of the loads, development of mathematical models, formulations of the computer analysis input, interpretation of the computer printout, proportioning of structural members, verification of correspondence of the engineering drawings with results of the analysis.

The staff believes that audits are the most effective way for the staff to perform an in-depth review of structural design aspects of a plant. Implementation of such audits has resulted in shortening the review time needed for licensing and significantly added to the safety of many nuclear facilities.

The audits are also beneficial from the point of view of streamlining and shortening public hearings. Since prospective intervenors are invited to the audit meetings, many questions which might be brought up at meetings of the Advisory Committee on Reactor Safeguard (ACRS) or at public hearings can be discussed and resolved during the audits, thus potentially reducing the overall period needed for completing public hearings.

Foundations

During construction of the Midland nuclear power plant, the engineered earth fill that was placed beneath safety-related structures and pipelines was not properly controlled, and the required degree of compaction was not attained. As a result, several buildings and foundations supported on soil fill have settled and cracked. The utility has proposed a number of remedial engineering solutions to correct or repair affected facilities.

The remedial measure adopted for the diesel generator building was soil surcharging. The area inside and around the building was loaded with a 20-foot layer of sand, which was removed after a period of seven months. This compressed the poorly compacted fill material beneath the structure in order to reduce its future settlement. Since surcharging in 1979, the building has settled only a small additional amount.

The utility has proposed to underpin the service water structure by extending the exterior foundation walls through the unsuitable fill down to the competent glacial soil beneath the fill. Installation of the underpinning will require sequential excavation of segments of the fill and replacement by concrete so that only small portions of the existing foundation walls will be unsupported at a given time during the period of remedial work.

Support for the southern part of the auxiliary building is also to be provided by underpinning walls. For this operation, vertical shafts beside the building and tunnels beneath the adjacent turbine building will be used to gain access under the auxiliary building. This construction operation will also utilize a freeze-wall curtain to supplement construction of dewatering wells in controlling the ground-water level.

The utility's proposed underpinning plans are currently being reviewed by the NRC staff and its consultants and is the subject of an ongoing hearing.

Masonry Walls

During the review of the Trojan nuclear plant, structural deficiencies were found in some masonry walls. NRC investigation disclosed that the type of deficiency identified could exist at other facilities, so a bulletin was issued on May 8, 1980, to alert licensees to the potential problem.

The Standard Review Plan (SRP) current in fiscal year 1981 did not provide specific acceptance criteria for the design adequacy of masonry walls, and the present commercial codes do not call for provision against extreme events in masonry wall design. Masonry design is addressed and included in the revised SRP published in July 1981. However, performance under very unlikely events—such as the Safe Shutdown Earthquake (SSE) or severe pipe rupture—must be considered in order to assure a safety level in the walls, consistent with other seismic "Category I" structures. To achieve this goal, the staff has developed "SEB Criteria for Safety-Related Masonry Wall Evaluation," based on in-house expertise, work experience gained through review with licensees and other consultants, up-to-date test data and integration of available design codes to the extent possible.

The criteria have been used in the design adequacy review of masonry walls in operating license applications and existing walls in operating plants such as LaSalle, Salem, Diablo Canyon, Farley, Clinton, Byron/Braidwood, Shoreham, Watts Bar, Fermi, Zimmer, Point Beach and Pilgrim.

The development of the criteria and their application in the safety evaluation of these plants have contributed significantly to timely completion of the NRC licensing work. Currently the criteria are being used by the Franklin Institute, under NRC contract, to conduct technical evaluations of masonry walls in some 50 operating plants.

Control of Heavy Loads

Overhead cranes are used to lift heavy objects at various places in nuclear power plants, including the spent fuel pool vicinity, in both PWRs and BWRs. If a heavy load such as a spent fuel shipping cask, should drop onto stored spent fuel in the pool, or if other heavy loads were to be dropped in the reactor core, there could be a release of radioactivity to the environment. In a similar manner, a heavy load drop could damage the equipment required for safe shutdown, thus jeopardizing a plant's ability to achieve safe shutdown.

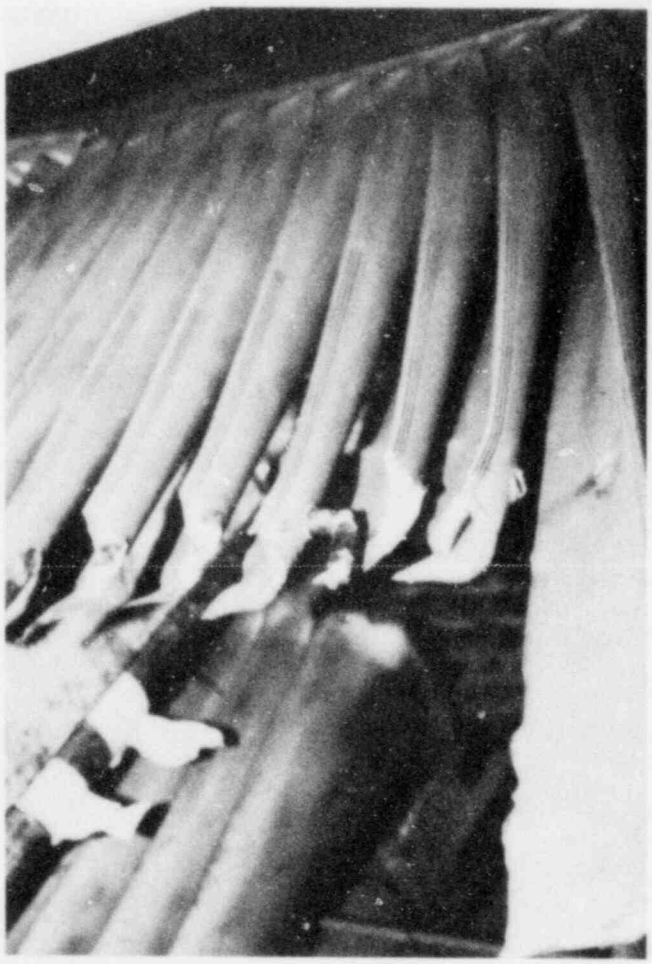
As noted in the *1980 NRC Annual Report*, 160 letters on this generic problem were sent on December 22, 1980, to operating plants, applicants for operating licenses and holders of construction permits. An adequate response required that an evaluation be performed on all heavy load handling systems using the criteria in NUREG-0612. This effort was divided into two phases (Phase I provides interim protection until Phase II is completed). Phase I consists of a general review of load handling policy and procedures for all the licensees to provide additional assurance that load handling operations are conducted in a manner that reduces the possibility of potentially hazardous load handling accidents. Phase II includes the specific design features and proposed modifications to determine whether all reasonable measures have been taken to assure that the combination of the likelihood and consequences of a heavy load handling accident is reduced to an acceptable level and meets the intent of NUREG-0612. Responses were being received and reviews were in progress on those received by the close of the report period. Phase I is to be completed by September 1983 and Phase II by October 1985.

Turbine Cracks

In February 1980, the NRC informed licensees using turbines made by the Westingouse Electric Corporation that stress corrosion cracks were being found in the keyway and bore areas of low pressure turbine discs of that manufacturer. Because such cracks were considered to increase the probability for disc failure, NRC requested that affected licensees perform ultrasonic inspections of their low pressure turbine discs.

All Westinghouse low pressure turbines at operating nuclear plants have now been inspected, at least once, for keyway and bore cracks. Indication of one or both types of these cracks have been found at 20 plants. Although all factors related to the cracking have not been positively established, operating experience indicates that both initiation and growth are related to disc temperature and material characteristics.

Westinghouse has recently completed an in-depth review of the disc cracking phenomenon and has developed a method to determine safe inspection and re-inspection schedules. NRC has evaluated the proposed approach and has concluded that inspection schedules developed using these recommendations will provide an acceptably high degree of assurance that discs will be inspected before cracks can grow to a size that could cause disc failure at speeds up to design overspeed.



Blades were ruptured in the 14th stage of a low-pressure turbine during operation of Unit 1 of the Millstone nuclear power plant (Conn.) at 30 percent power, on April 21, 1981. The blades have a length of 43 inches. The pieces broken off were confined by the turbine housing and did no external damage.

Turbine Missiles

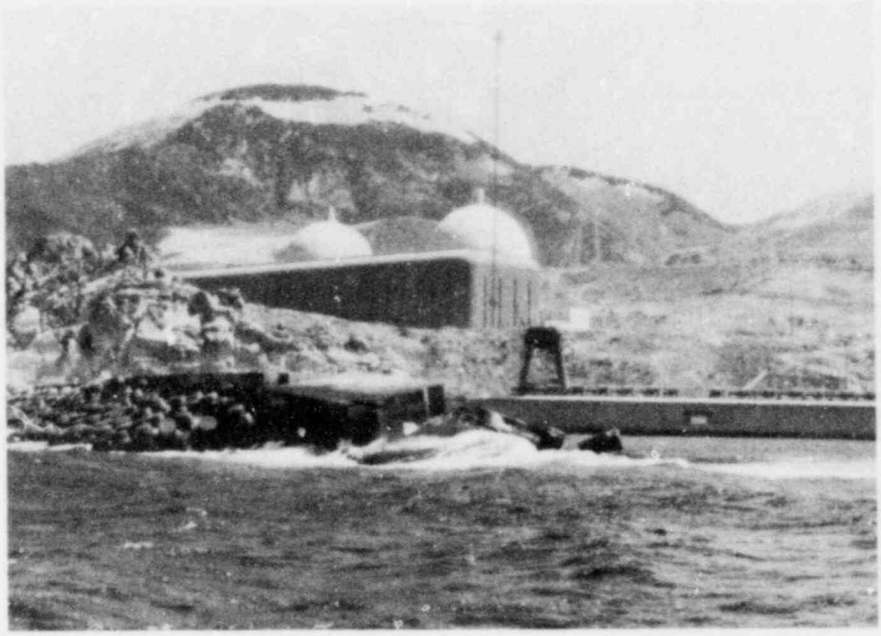
The resistance of nuclear power plant barriers and structures to large missiles which may be generated by turbine disc failures is currently being evaluated. The Electric Power Research Institute (EPRI) is conducting independent full-scale and reduced-scale tests in order to validate analysis procedures and provide assurance that barriers designed to resist turbine missiles are competent. In addition, risk analysis procedures for alternative plant layouts and barrier configurations are being developed. EPRI's overall objective is to "identify and quantify the conservatisms in current estimates of turbine missile risk in nuclear power plants."

The results of these efforts will be useful in assessing the potential protection afforded by particular barriers and also in more accurately determining the factors in probabilistic analyses of the turbine missile threat.

Natural Phenomena

NRC regulations require that nuclear power plant structures, systems and components important to safety be designed to withstand the effects of natural phenomena such as earthquakes without loss of capability to perform their safety functions. In seismic analyses for those plants, the practice has been to use vibratory ground motions from earthquakes occurring under a wide range of geologic and seismologic conditions not specific to a particular site. This method has been used because of the small amount of earthquake strong-motion data. As the data base for strong earthquakes has increased over the past few years, it has become more feasible to obtain data that match the conditions at a specific site as regards earthquake size, distance to the epicenter of the earthquake and site geology (soil or rock). Nuclear power plants using site-specific ground motions for design or for evaluation, which have recently been or are currently being reviewed, include Bellefonte 1 and 2, Sequoyah 1 and 2, Watts Bar 1 and 2, Fermi 2, Midland 1 and 2 and Clinton 1 and 2.

When the Verona Fault was postulated to exist in trenches at the Vallecitos Nuclear Center near Livermore, Cal., in 1977, the NRC staff ordered the General Electric Test Reactor to be shut down. The licensee was directed to show cause why the suspension of operation should not be continued. A hearing by



Damage to the end of a breakwater at the Diablo Canyon (Cal.) nuclear power plant can be seen in the center foreground. To the right is the structure for the intake of cooling water. Above left is the turbine building and the domes of the two reactor buildings.

an Atomic Safety and Licensing Board ended on June 10, 1981, and a decision by the board is expected soon.

When Mount St. Helens, a volcano in southwestern Washington, erupted in May 1980, the impact on the four nuclear plant sites in the Pacific Northwest was insignificant; a trace of ash fell at the Hanford site and no ash was detected at the other sites. Subsequent eruptions through September 6, 1981, have also had insignificant impacts at the sites. The operator of the Trojan plant, 35 miles away, is to be notified by the U. S. Geologic Survey in the event of a possible eruption and is prepared to initiate precautionary measures at the facility. The Geologic Survey is undertaking a study for the NRC of potential impacts of volcanic eruptions on nuclear power plants.

During the week of January 26, 1981, a breakwater protecting the intake cove of the Diablo Canyon nuclear power plant, located on the Pacific coast near San Luis Obispo, Cal., was damaged by storm waves. The breakwater serves a safety function of protecting the cooling-water intake structure during an ocean flooding event. The NRC staff, the utility and their consultants are evaluating the causes of the breakwater damage and the implication with respect to plant safety. The Coastal Engineering Research Center of the U. S. Army Corps of Engineers has provided assistance to the NRC staff in evaluating the damage to the breakwater. A scale model (1 to 45) of the offshore region near the breakwater has been constructed by the utility for testing to resolve the problem.

Methods for calculating the temperature and water loss of cooling ponds and spray ponds are presented in NUREG-0693 of November 1980 and NUREG-0733 of August 1981. These ponds are used as ultimate heat sinks at nuclear power plants. The calculation methods rely on long-term off-site and short-term on-site meteorological data and several sophisticated computer codes to simulate pond performance under adverse conditions and are expected to improve significantly the reliability of the results.

Off-Site Hazards

Events involving military, industrial or transportation accidents near a nuclear power plant potentially can damage or otherwise degrade safety-related plant structures and equipment. The concern is that an off-site accident may be sufficient to initiate an on-site accident and result in a radiological release. This was recognized in the early licensing reviews, and a substantial amount of licensing review effort has been directed at developing review methodology and acceptance criteria.

Licensing requirements with respect to off-site hazards have a minimal level of definition within the guidelines of 10 CFR Part 100. The requirement in its present form states that events and conditions outside a nuclear plant are one of the factors to be used in evaluating a site. This rather broad criterion covers a large variety of man-made activities which may pose a threat to a nuclear plant. Principal hazards include explosions, fires, toxic gases and missiles. An attempt to develop some simplified site selection criteria based on the "standoff distance" concept was initiated in support of the proposed rulemaking on revision of Reactor Siting Criteria (see *1980 NRC Annual Report*, pp. 70-71). Preliminary results of specific hazard studies indicate that the majority of them are not amenable to a simple standoff distance rule. This is due to the large variability found in the

hazard severity and frequency of occurrence from site to site and from event to event. In view of the difficulty in establishing reasonable standoff distance criteria, alternate concepts are being considered. Currently, an effort has been started, in support of the proposed rulemaking, to provide a technical base for defining and characterizing off-site hazards and risk acceptance criteria. This will permit the consideration of including specific requirements within the revised 10 CFR Part 100 with respect to each principal type of hazard.

STATUS OF TMI-2 FACILITY

Since the accident at Three Mile Island Unit 2 (TMI-2) on March 28, 1979, the NRC has continued to monitor the situation there. Activities related to that facility during fiscal year 1981 are summarized below.

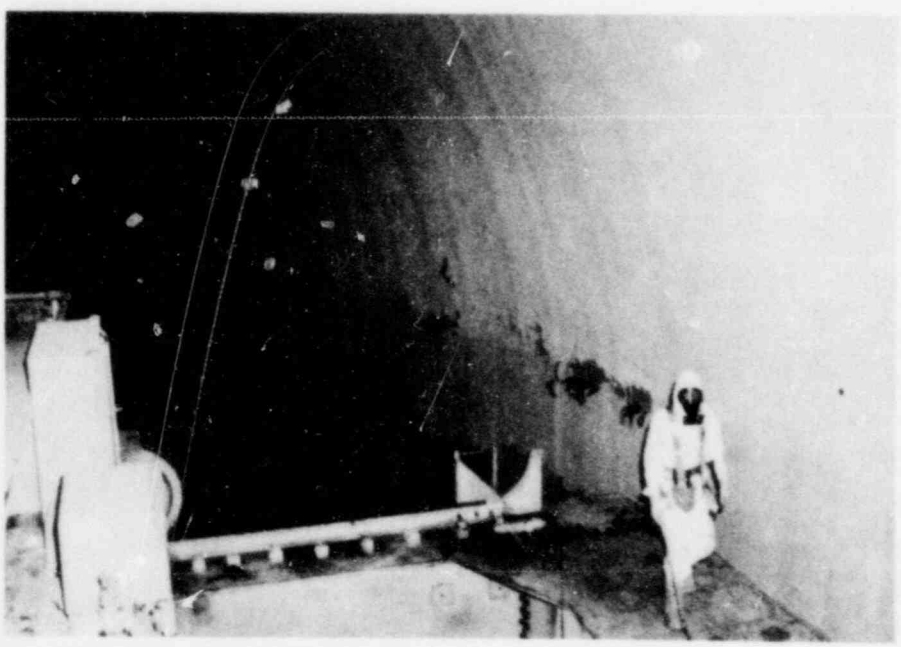
On-Site Situation

Coolant System. As noted on page 15 of the *1980 NRC Annual Report*, the TMI-2 reactor coolant system was placed in natural circulation, with decay heat removal to the condenser via sub-atmospheric boiling in the "A" steam generator, on April 27, 1979. This cooling mode was maintained with gradually decreasing flow and eventually only cyclic flow in the reactor coolant system until November 6, 1980, when a test was initiated to determine if the TMI-2 reactor would be adequately cooled only by heat losses to the reactor building ambient ("loss-to-ambient" cooling mode). The reactor building ambient is being maintained by the reactor building fan coolers. The test was completed on December 9, 1980, when the reactor cooling mode was returned to cyclic natural circulation with heat rejection to the condenser. Evaluation of the test data showed that the reactor's decay heat (presently approximately 30 kw) could be safely and adequately removed by operating in the loss-to-ambient cooling mode, which was resumed on January 5, 1981, and has continued since. This is a particularly desirable mode for removing the reactor decay heat since operating in this cooling mode permits several previously required cooling systems to be de-energized (e.g., circulating water system, main steam system and the "A" generator, condensate and feedwater systems, main condenser and auxiliary boiler), thus decreasing the plant's dependence on electrically activated equipment.

Reactor Building Entries. A total of 15 manned post accident entries have been made into the Unit 2 reactor building. To date, activities inside the reactor building have focused primarily on gathering post-accident data.

The entries have permitted identification of the physical and radiological conditions inside the reactor building. However, decontamination and repair work has been limited to testing specific critical components. An overall detailed plan and schedule for reactor building decontamination and fuel removal has not been established pending analysis of data obtained from inside the reactor building and resolution of licensee fiscal problems.

The reactor building entries have not identified any major mechanical damage. Surface contamination and electrical problems, particularly on the polar



Survey in progress of the polar crane inside the reactor building of Three Mile Island Unit 2.

crane, appear to be the most troublesome for future TMI-2 cleanup operations. It has been demonstrated that industry-proven decontamination methods may be used to decrease contamination and radiation levels inside the reactor building. The existing radiation levels on the upper floor (refueling floor) of the reactor building are not prohibitive (in the range of 50 - 100 millirem per hour as of the end of fiscal year 1981), in terms of worker accessibility for reactor vessel head and fuel removal.

Once an adequate level of TMI cleanup funding is established, the licensee will begin refurbishing the polar crane. This activity is a prerequisite to removal of the missile shield athe eactor head and to reactor disassembly. Some degree of processing and decontamination of reactor building sump water will have to be performed before other recovery work can proceed. The physical condition of the fuel—perhaps the most crucial issue in the recovery process—will not be determined until the reactor vessel head is removed and the core region is inspected visually.

Containment Integrity. Because there is a potential for leakage of radioactive water from TMI into the groundwater and eventually into the Susquehanna River, the NRC staff requested the licensee to conduct a monitoring program to detect any leakage. This program has continued since early 1980 (see the *1980 NRC Annual Report*, p. 20) and consists primarily of periodic sampling, analysis and testing of water from a series of monitoring wells strategically located around the TMI facility. An increase of radioactive nuclide concentrations above those normally occurring as background levels would indicate a possible source of leakage from the TMI facility.

Since the spring of 1981, the licensee has instituted an expanded program to assess the containment integrity. In addition to groundwater monitoring, the Containment Integrity Assessment Program includes radiation monitoring of the reactor building tendon access gallery, the cork seals between building structures and the containment outer wall, and the measurement of sump water levels in the containment.

During 1980, several groundwater sample readings indicated higher than normal background levels of radioactive nuclide concentrations (i.e., tritium, cobalt and cesium). Followup investigations, including the identification of radioactive nuclides with potential leakage sources, determined that the source of leakage was probably from the borated water storage tank (BWST), and not from the reactor building. The licensee has acted to prevent further leaks from the BWST and has constructed a catch basin to collect any that should occur. Subsequent samples showed reduced concentrations of cesium and cobalt, trending down to background levels. Other parts of the containment integrity assessment program have also confirmed that there is no indication of radioactive water leakage from the containment.

EPICOR-II Spent Resin Liners. The Commission's October 6, 1979 Memorandum and Order directing the use of the EPICOR-II system for decontaminating the intermediate-level contaminated water (*1979 NRC Annual Report*, pp. 23-24) included a provision requiring that spent EPICOR-II resins not be shipped off-site unless solidified. The requirement for solidification of the EPICOR-II spent resins was based on the understanding that solidification of resin wastes:

(1) would help immobilize the radionuclides after disposal,

(2) would eventually be required by all the burial sites.

(3) would be a practical way to meet the then existing burial site requirement that the wastes contain no free liquids, and

Removal from waste storage of a liner from the first stage of EPICOR-II for shipment to the Battelle Columbus Laboratories for examination.

(4) would help ensure there were no leaks or spills during the shipment of the wastes.

However, on February 19, 1981, the licensee requested that the requirement for solidification of spent EPICOR-II resins be waived and that those spent resin liners which are similar to normal reactor resin wastes be disposed of by shallow land burial at a commercial disposal site. The NRC staff reviewed the licensee's request and concluded that 22 second and third stage EPICOR-II spent resin liners could be safely disposed of by burial at a commercial burial facility in an unsolidified but dewatered condition. NRC approval to dispose of these 22 liners in this manner was issued on March 25, 1981. The last of these liners was shipped from the TMI site to the U.S. Ecology burial site at Richland, Wash., on June 27, 1981, where all 22 liners were successfully disposed of.

The remaining EPICOR-II spent resin liners consist of 50 prefilters (first stage liners), most of which are unique and unlike those routinely generated and disposed of by other nuclear power plants. The requirement to solidify the resins in these liners was also waived and a Department of Energy (DOE) program of research and development on waste characterization is underway to examine and characterize the condition of one of these liners and its contents at a DOE contractor facility. It was decided that not solidifying the resins in these 50 liners would also be appropriate, so as not to foreclose future options for handling and eventual disposal of these wastes.

The liner (PF-16) selected for examination was shipped from TMI to the DOE contractor laboratory (Battelle Columbus Laboratories in West Jefferson, Ohio) on May 19, 1981. PF-16 was one of the older and more heavily loaded of the 50 first stage EPICOR-II liners used to process the accident-generated water collected in the Unit 2 auxiliary building. Examination of PF-16 was initiated immediately upon receipt and will continue for approximately two years. This research and development effort, which is designed to fully identify the conditions in the EPICOR-II liners, will aid in the development of technology for safely processing highly contaminated organic and inorganic resins. Specific program work includes analysis of resin degradation and gas generation, radioactivity loading profiles, corrosion of liner internals, characterization and radioactivity elution studies on resin core samples and cement solidification testing.

Decontamination of High-Activity Water. As a result of the March 28, 1979, accident at Three Mile Island Unit 2, over three quarters of a million gallons of high-activity waste water (i.e., radionuclide concentrations greater than 100 microcuries-per-milliliter) were generated. This water is currently contained in the reactor building sump (approximately 700,000 gallons) and the reactor coolant system (approximately 95,000 gallons). In order for the cleanup to proceed, a method was needed to reduce the radionuclide concentrations in the water contained in the reactor building sump and reactor coolant system. In a letter dated April 10, 1980, the licensee formally submitted its Technical Evaluation Report (TER) and requested permission to operate an underwater demineralization system. The Submerged Demineralizer System (SDS) described in the licensee's TER was designed to provide controlled handling and treatment of the highly contaminated waste water generated during the accident.

The SDS is designed to operate underwater in one of the spent fuel pools of TMI Unit 2. It consists of a liquid waste treatment subsystem, a gaseous waste treatment subsystem and a solid waste handling subsystem. The liquid waste treatment subsystem is designed to decontaminate the high-activity waste water by filtration and ion exchange. The primary components of the liquid waste treatment subsystem include two filters, and two parallel trains of four identical inorganic zeolite-filled ion exchange vessels. In the event that additional cleanup of the effluent from SDS is required, it can be recycled through SDS or polished with the EPICOR-II system.

The volume of solid waste generated during system operation (spent ion exchange media) is expected to be minimized by loading the inorganic zeolite resin to high levels (up to 60,000 curies or higher). Solid waste generated during SDS operation will be stored underwater in the same spent fuel pool while awaiting offsite shipment. Due to the unique character and nature of the zeolite wastes, the Department of Energy will take possession of and retain these wastes to conduct a research, development and testing program on waste immobilization. Other solid wastes generated during SDS operations are expected to be suitable for commercial land disposal.

The NRC staff review of the SDS formally started when the licensee submitted the TER on April 10, 1980. Due to a number of design changes and technical questions from the staff, formal NRC approval of the SDS was not given until June 1981. On June 18, 1981, the licensee was directed to promptly commence and complete processing of the remaining intermediate level contaminated water (less than 100 microcuries-per-milliliter) in the auxiliary building tanks and the highly contaminated water in the reactor building sump and the reactor coolant system.

As of August 9, 1981, the remaining 100,000 gallons of intermediate level water was completely processed. The licensee started processing the high activity water in September 1981. The approval to operate SDS does not include water disposal. All processed water will be stored in existing onsite tanks. Decisions related to the disposition of processed water will be made by the Commission at a future date.

NRC - DOE Memorandum of Understanding. On July 15, 1981, the NRC and DOE signed a Memorandum of Understanding (MOU) which formalized the working relationship between the two agencies with respect to the removal and disposition of solid nuclear wastes generated during the cleanup of TMI-2. This action represents a significant step toward assuring that the TMI site does not become a long-term waste disposal facility. This MOU covers only solid nuclear wastes; it does not cover liquid wastes resulting from the cleanup activities.

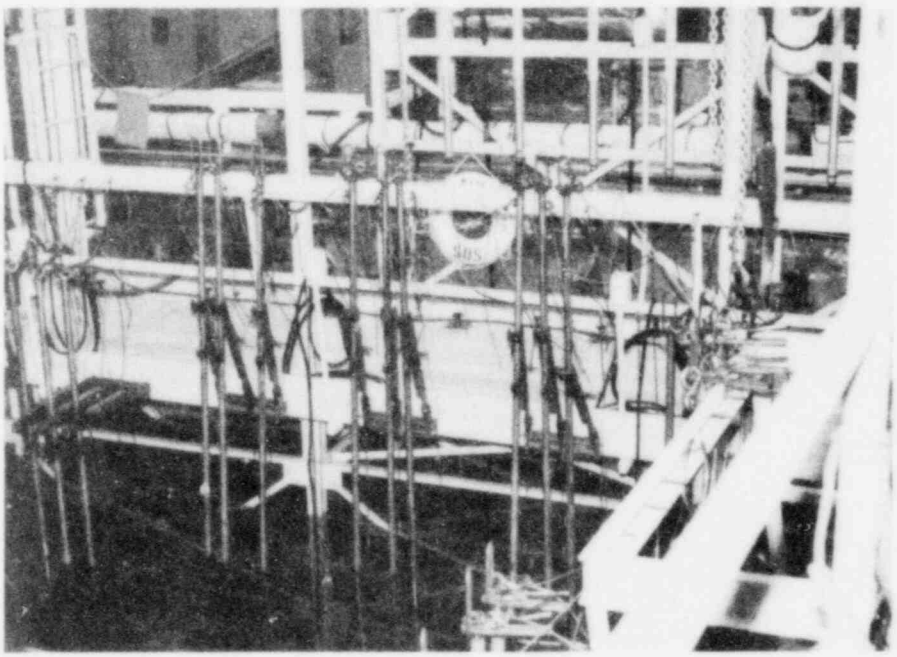
The MOU addresses the following three basic categories of TMI-2 wastes: (1) Wastes determined by DOE to be of generic value in terms of beneficial information to be obtained from further research and development activities (the MOU calls for DOE to perform such activities at appropriate DOE facilities); (2) wastes determined to be unsuitable for commercial land disposal because of high levels of contamination, but which DOE may also undertake to remove, store and dispose of on a reimbursable basis from the licensee; and (3) wastes considered suitable for shallow land burial which are to be disposed of by the licensee in licensed, commercial low-level waste burial facilities.

The MOU specifically highlights currently identified TMI-2 wastes, e.g., EPICOR-II system wastes, submerged demineralizer system wastes, reactor fuel wastes, etc. However, the agreement also anticipates future modifications in the MOU may be necessary to cover radioactive waste materials which are identified as the cleanup progresses.

NRC Activities

The Final Programmatic Environmental Impact Statement. On February 27, 1981, the NRC staff issued, on schedule, the Final Programmatic Environmental Impact Statement (PEIS) related to decontamination and disposal of radioactive wastes resulting from the TMI accident. The issuance of the final statement (NUREG-0683) followed an extensive 90-day comment period during which comments were received from the public and from other agencies of the government on the Draft Programmatic Environmental Impact Statement issued on August 14, 1980. The final statement considered all of those comments, as well as the questions and comments raised by members of the public during the 31 meetings with the public, media and local officials held by the NRC staff. These meetings were held in the vicinity of the TMI site in Pennsylvania and Maryland to discuss cleanup issues and the draft PEIS. The final PEIS includes the NRC staff's responses to nearly 1,000 comments the staff received on the draft statement. The final PEIS has the benefit of additional data obtained from several containment entries as well as additional evaluations on cleanup alternatives. The final PEIS reaffirms the major conclusions of the draft statement that the decontamination of the TMI-2 facility, including the removal of the nuclear fuel and radioactive wastes from the TMI site, is necessary for the long-term protection of public health and safety, and that methods exist or can be suitably adapted to perform the cleanup operations with minimal releases of radioactivity to the environment. Further, the final PEIS concludes that the only environmental impact that may be of significance would be the cumulative radiation doses to the cleanup workers (see page 17 of the *1980 NRC Annual Report* for discussion of the draft PEIS).

On April 27, 1981, the Commission issued a policy statement endorsing the final PEIS and concluded



The Submerged Demineralizer System for decontamination of highly radioactive water was installed at Three Mile Island Unit 2 in the spent fuel pool, which was filled with water for shielding from radiation.

that the PEIS satisfies the Commission's obligations under the National Environmental Policy Act. The policy statement also stated that, as the licensee proposes specific major decontamination activities, the staff will determine whether these proposals, and associated impacts that are predicted to occur, fall within the scope of those already assessed in the PEIS. With the exception of the disposition of processed accident-generated water (the Commission will decide this issue), the staff may act on each major cleanup activity if the activity and associated impacts fall within the scope of those assessed in the PEIS. The staff will keep the Commission informed of staff actions prior to staff approval of the major activity. In addition , the Commission's policy statement declared that the cleanup should be expedited and activities carried out in accordance with the criteria in Appendix R of the PEIS which limits the doses to off-site individuals from radioactive effl··ents resulting from cleanup activities. These effluent limits are numerically identical to those design objectives of radioactive effluents for operating power reactors contained in Appendix I of 10 CFR Part 50. The criteria of Appendix R of the PEIS for TMI-2 cleanup activities are more restrictive than those for the operating power reactors, since the Appendix R values are limits that cannot be exceeded, whereas, for operating power reactors, they are design objectives to be met on the "as low as reasonably achievable" principle. On June 26, 1981, the NRC staff amended the Environmental Technical Specifications of the TMI-2 license to incorporate the criteria in Appendix R of the final PEIS as limiting conditions of the cleanup operations.

Advisory Panel on TMI Cleanup. The NRC's Advisory Panel for the Decontamination of Three MIle Island Unit 2 was formed by the Commission in October 1980 to provide advice on major stages of the cleanup. The 12-member Panel has been headed since its creation by the Chairman of the Dauphin County (Pa.) Commissioners, and includes local citizens, local and State governmental officials and scientists. In 1981, the Panel provided recommendations related to radioactive waste processing, storage and disposal to the Commission. The Commission subsequently concurred in these recommendations. In addition to soliciting views from members of the public, the Panel has been interacting with Congress and other federal agencies to assure the safe and expeditious cleanup of TMI-2.

Site Office. The NRC has continued its on-site presence at the Three Mile Island Site. The Three Mile Island Program Office in Middletown, Pa., physically located in offices on-site and in Middletown proper is comprised of 15 full-time technical personnel, three full-time secretaries, a part-time clerk and supportive cooperative students and summer interns. The personnel are detailed mainly from two NRC staff offices and are supported by region-based inspectors and by other NRC technical staff. Part-time assistance has also been provided by foreign assignees from Italy and Taiwan.

Day-to-day review of all licensee activities that pertain to the cleanup of Unit 2 is provided by this staff. Review and direction of the overall Unit 2 cleanup and review of all detailed implementing procedures are provided. From October 1, 1980, to September 30, 1981, a total of approximately 750 procedures were prepared by the licensee and submitted to the NRC for review and approval, with an average turnaround time of less than three working days.

Information flow is a major responsibility of the Site Office. A Weekly Status Report, containing pertinent reactor and radiological and environmental information, is prepared and distributed to all NRC offices. This report is also distributed to the public, with copies available at the Middletown office. The Middletown office is open and staffed on a regular basis, including evening hours, to provide the public an opportunity to remain informed of the cleanup progress. Information is also supplied to the public by press releases, television and radio interviews and direct response to both written and oral public concerns. Information exchange meetings are also held periodically with officials of the Department of Energy and the Environmental Protection Agency.

Financial Aspects of Cleanup

Funding by GPU. There are several actual or potential sources of funds available to GPU companies for TMI-2 cleanup. The first is insurance proceeds. The availability of these funds has been accelerated in time by the insurers, and the total coverage of $300 million was available as of late August 1981. Based upon a reduced pace of cleanup activity, this coverage will probably be exhausted by the end of 1983. The second source, potentially, is revenues allowed through rates set by the Pennsylvania Public Utility Commission (PaPUC) and the New Jersey Board of Public Utilities (NJBPU). The PaPUC, however, at this point has prohibited Metropolitan Edison Company (Met Ed) from using funds from its customers for TMI-2 cleanup purposes. A third source is short-term credit under a revolving credit agreement with a consortium of banks. Since GPU and its subsidiaries are unable to issue any stocks or bonds, bank credit constitutes its only outside source of credit. However, amounts available from this source of funds are becoming increasingly limited and are dependent upon the amount of progress in other developments affecting the GPU companies.

As of August 1981, all three GPU operating subsidiaries have pending rate increase cases before their

respective public utilities commissions. Each of the companies has applied for a two-stage increase. The stage I requests are intended to recover amounts for the future operation and capital costs of TMI-1. From the viewpoint of assisting in the cleanup of TMI-2, TMI-1's return to service would constitute a significant milestone. The combination of the financial effect of this unit's operation with adequate rate relief would partially restore Met Ed's net income to pre-accident levels. Met Ed also anticipates that the return of TMI-1 to a normal generating level would result in savings of energy costs.

A substantial portion of the amounts requested for stage II of the GPU companies' rate increase petitions seek recovery of TMI-2 capital and cleanup costs. The PaPUC and the NJBPU have consistently denied the companies' recovery of costs for this purpose.

(As of October 1, 1981, the banks and GPU renegotiated the terms and conditions of the revolving credit agreement. While the agreement is renewed to December 31, 1982, severe limitations and conditions on credit availability are also expected should certain events favorable to GPU not occur.)

Proposals for Sharing Costs. Several proposals have been made for the sharing of costs necessary to clean up the damaged TMI-2 facility. On July 9, 1981, Governor Richard Thornburgh of the Commonwealth of Pennsylvania proposed that the estimated $760 million in additional funds necessary to clean up TMI-2 be shared as follows: 25 percent by the nuclear industry; 25 percent by the Federal Government; GPU contributing 32 percent; remaining insurance accounting for 12 percent; and the Commonwealth of Pennsylvania and the State of New Jersey participating at 4 percent and 2 percent, respectively. The NRC and other Federal agencies are reviewing these cost sharing proposals. The NRC is also continually monitoring the financial condition of the GPU companies.

GAO Report. In August 1981, the General Accounting Office (GAO) issued a report entitled "Greater Commitment Needed to Solve Continuing Problems at Three Mile Island." The principal findings set forth in the report are summarized below:

- Replacement power for the TMI units is available, but future system reliability is questionable unless funds are made available to increase construction and maintenance above present restricted levels.

- The financial condition of GPU continues to deteriorate, and unless sufficient rate relief is granted to restore its financial credibility, its future as a provider of electric power is in doubt.

- Cleanup of TMI-2 is technologically feasible, but the uncertainties surrounding the source of the funds needed for the task and the regulatory environment in which it must be done have yet to be resolved.

- The expeditious cleanup of TMI-2 and the benefits that can be derived are significant enough to warrant the financial participation of several parties, rather than putting the entire burden on any one entity.

- State officials in Pennsylvania and New Jersey should take the leadership role in assembling the financial assistance needed for the cleanup.

- On-site property insurance coverage needs to be increased to levels that the Nuclear Regulatory Commission (NRC) determines to be adequate if other utilities are to avoid the financial and operational stress suffered by GPU in the event of another major accident.

- Better defined regulatory guidelines for nuclear accident recovery efforts are needed to minimize the delays and added costs that have occurred at TMI-2.

Based on the above findings, the GAO made two recommendations to the NRC which are listed below:

- Because another nuclear accident at an underinsured utility company could seriously affect public health and safety, GAO recommends that NRC closely follow the current efforts of the insurance and utility industries to increase insurance coverage to what it determines to be an acceptable level. GAO further recommends that no later than December 31, 1981, NRC assess the progress being made. This assessment should include an evaluation of the insurance available in the private sector and a determination as to whether a mandated insurance coverage program is necessary. (Regarding this recommendation, the Nuclear Regulatory Commission approved publication of a proposed rule for public comment on August 18, 1981, that, if approved as a final rule, would require power reactor licensees to provide the maximum amount of property insurance available.)

- To mitigate future regulatory constraints on nuclear accident cleanup activities, GAO recommends that NRC establish a set of guidelines that would facilitate the development of recovery procedures by utility companies in the event of other nuclear reactor accidents.

Protecting the Environment

Siting of Nuclear Power Plants

In August 1978, the Nuclear Regulatory Commission directed the staff to develop a general policy statement on nuclear power reactor siting. A Siting Policy Task Force formed for that purpose submitted its report to the Commission in August 1979, setting forth the following broad goals pursuant to a firm, clear siting policy:

(1) To strengthen siting as a factor in defense-in-depth by establishing requirements for site approval that are independent of plant design consideration.

(2) To take into consideration, in site assessment, the risk associated with accidents beyond the design basis (Class 9) by establishing population density and distribution criteria.

(3) To require that sites selected minimize the risk from energy generation.

The 1980 NRC Appropriation Authorization (Public Law 96-295, June 30, 1980) directed that NRC develop and promulgate demographic criteria for nuclear facility siting, including maximum population density and population distribution for zones surrounding the facility. The Congress provided guidance by stating that the NRC should develop these demographic standards so as not to preclude further siting of nuclear reactors in any region of the United States.

In order to formulate the demographic criteria, the NRC initiated a contract with the Sandia National Laboratories to assist in establishing a technical basis for such criteria. The Sandia study has three major elements. The first deals with consequences of severe accidents. Using an updated CRAC code a spectrum of severe reactor accidents was examined for effects such as acute fatalities, acute injuries, latent concerns and interdiction of land and crops.

The second element of the studies, performed by Dames and Moore under subcontract to Sandia, related to the impacts of demographic siting criteria on availability of land suitable for siting of nuclear power plants. This was done by examining a range of demographic criteria in combination with major environmental and engineering requirements bearing on siting such as:

(1) Restricted Lands: those areas in which the development of a nuclear power plant is difficult due to legal constraints or the predominance of wetlands.

(2) Seismic Hardening: the additional cost or difficulty of compliance with seismic design criteria assumed to be measured by the maximum expected (50 year) horizontal ground acceleration expressed in fractions of gravity (g).

(3) Site Preparation: a relative measure of the ruggedness or topographic character expressed as an index which indicates the percentage of land with access and construction difficulty.

(4) Water Availability: an index reflecting the relative cost of obtaining water for cooling from both surface and ground water sources.

The latter three cost data were further combined to yield information regarding overall environmental suitability.

The third element of the Sandia studies examined the potential magnitude and range of the socioeconomic impacts that might result from more remote locations, compared with existing nuclear sites. This portion was prepared by Battelle Human Affairs Research Centers. It described the socioeconomic consequences of current reactor siting, and how the magnitude of the socioeconomic effects varies with site location. The study briefly reviewed the literature on the social impacts of rural industrialization generally, along with case studies of nuclear siting, particularly in rural areas. An empirical analysis of variation in demographic and economic activity at selected current nuclear power reactor sites was provided across a range of site locations. A related issue, the effects of site location on the costs associated with the installation and operation of high voltage power transmission lines, was also discussed.

Results of the above mentioned studies were to be used in preparation of the proposed revision to 10 CFR Part 100, Reactor Site Criteria.

Socioeconomic Impacts of Nuclear Plants

In April 1981, NRC published a two-volume report entitled "Migration and Residential Location of Workers at Nuclear Power Plant Construction Sites" (NUREG/CR-2002). This report is the culmination of a two-year effort to understand the dynamics of bringing a large number of power plant construction workers into a community—the action considered to be the single greatest source of adverse local socioeconomic impact.

The research resulted in a series of equations which can be used to forecast the need to add workers to the local work force in constructing a nuclear power station, and to predict the residential communities in which these new workers would choose to live. A follow-up study to evaluate the feasibility of combining the model presented in NUREG/CR-2002 with the analytical capabilities of the Department of La-

bor's Construction Labor Demand System—in order to project labor demand and worker immigration—was completed for NRC by the Employment Standards Administration of the Department of Labor.

The accident at TMI in March 1979 raised concerns about the potential for adverse effects from nuclear plant operation on residential property values and the housing market. To determine the market effects of the accident, the NRC contracted with the Institute for Research and Land and Water Resources of Pennsylvania State University. After an analysis of 583 actual market sales of homes in the TMI area from 1977 through 1979, the researchers concluded that the accident had no measurable effects on the value of single family residences within a 25-mile radius of the plant, or in any particular direction from the plant, or on value-classes of property. The report also concluded that the plant had no measurable effect on residential property values for a two-year period prior to the accident. Further, although a sharp decline in the number of sales within 10 miles of the plant occurred after the accident, the real estate market returned to near normal conditions within four to eight weeks. These finding are documented in NUREG/CR-2063, "Effects of the Accident at Three Mile Island on Residential Property Values and Sales."

In an effort to understand the full range of socioeconomic impacts under differing circumstances, the NRC contracted with Mountain West Research Inc., of Tempe, Ariz., to conduct a series of 12 nuclear-plant case studies and to analyze the impacts, utilizing a cross-site comparative methodology. At the end of the report period, 11 of the 12 case studies had been sent to NRC in draft format, and an outline for the cross-site comparisons had been developed. Each of the case studies evaluated the impact of nuclear plant construction and operation on employment, income, population growth, housing and settlement patterns, government and selected public services, and social structure and perceptions. An early 1982 publication date is anticipated for both the case studies and the analysis of impacts across sites.

In early 1981, the NRC contracted with Brookhaven National Laboratory (BNL) to assess changes in land use and population in the vicinity of operating nuclear power stations. Two important components of this research were a statistical analysis of population change and a survey of local and State land planning officials. The latter effort involves a mail survey to determine the presence of land planning around nuclear plants, the extent to which the power station has altered land development trends, the need for additional land use controls and perceived obstacles to planning. In addition, the NRC and BNL will implement a series of case studies which serve to highlight important aspects of population change and land use development around nuclear stations.

NRC contracted with the U.S. Bureau of Economic Analysis (BEA), Department of Commerce, to perform a study on the "Methodology and Results of Assessing Regional Economic Consequences of Accidents." The purpose of the study is to refine NRC's ability to simulate the regional economic impacts of nuclear power plant accidents on a plant-specific and site-specific basis. BEA is modifying its Regional Input-Output Modeling System (RIMS) for the study by analyzing simulated accidents using CRAC results. A related study, "Socioeconomic Consequences of Nuclear Power Reactor Accidents," was begun in fiscal year 1981 by Pacific Northwest Laboratories under contract to NRC. The study will result in a fuller understanding of and ability to analyze the broad range of socioeconomic consequences of accidents including environmental, commercial, legal, health and institutional impacts.

At the request of the Atomic Safety and Licensing Board conducting a hearing on the restart of Three Mile Island Unit 1, the U. S. Geological Survey produced five specialized maps. Two depicted population density, one within a distance of 20 miles and the other within a distance of 50 miles from the TMI site. Two other maps at matching scales depicted land use and land cover. The fifth map, a mosaic of 7.5-minute quadrangle maps, has become the model from which maps have been produced for all nuclear power plants with operating licenses. These maps are primarily for use in emergency planning and response and are located in Federal, State, local and licensee emergency facilities.

Radioactive Releases

Normal Operation. The operating license for a nuclear power plant requires that the licensee monitor and report the quantities of radioactive materials released to the environment in effluents. An analysis was made during fiscal year 1981 of the reported operational data on effluents from 66 reactors, spanning approximately 300 reactor-years of operation. This analysis shows that the annual releases of radioactive materials in effluents predicted in the preoperational environmental impact statements were generally consistent with those reported during operation. This analysis also provides a basis in operational experience from which effluent predictions may be improved.

A program for measurements of in-plant source terms of radioactive emmissions has been conducted for NRC by EG&G Idaho, Inc. The primary objective was to provide operational data that can be used in evaluating waste treatment systems of nuclear power plants and in calculating the quantity of radioactive materials released in liquid and gaseous effluents; the purpose is to assure that the releases are as low as is reasonably achievable. A summary report

of the measurements obtained at the first four pressurized water reactors (Zion, Ft. Calhoun, Turkey Point, and Rancho Seco) was published as NUREG-0017, "Calculation of Releases of Radioactive Materials in Gaseous and Liquid Effluents from Pressurized Water Reactors," April 1976. During fiscal year 1981, measurements were made at a fifth pressurized water reactor (Prairie Island). Because similar data for boiling water reactors are unavailable, a decision has been made to obtain measurements at such a reactor, as the sixth plant in the program, beginning in early 1982.

Postulated Accidents. In accordance with the NRC Statement of Interim Policy of June 13, 1980, the NRC staff issued, during fiscal year 1981, eight draft and seven final environmental statements at the operating license stage that consider the potential environmental impacts of serious reactor accidents. In these statements, which are issued pursuant to requirements of the National Environmental Policy Act of 1969, the potential consequences to the public of serious accidents (so-called Class Nine accidents) have been based on probabilistic risk assessment techniques. These accidents involve significant degradation of the fuel and failure of the containment. For all of the evlauations, site-specific data on atmospheric dispersion characteristics, population, land use and preliminary emergency plans have been combined with probabilities of each class of severe accident and associated releases of radioactive materials. The probabilities of accidents, representing either a Boiling Water Reactor or a Pressurized Water Reactor, have been revised and improved relative to those used in the Reactor Safety Study (WASH-1400).

In general, these statements show that the consequences of serious reactor accidents could be severe, but the probability of such accidents occurring is very small. The risk of such accidents, measured by multiplying their probability by their consequences, is quite small relative to other kinds of accidents experienced by society.

Two reports (NUREG-0771 and NUREG-0772) were published in fiscal year 1981 concerning the quantity of radioactive material estimated to be released during reactor accidents. The reports reflect the NRC's activities on this subject occasioned by recent research findings which suggest that iodine, one of the radiologically important materials produced in the fission process, may exist in the reactor core in a much less volatile form (i.e., as cesium iodine) than heretofore assumed. The reexamination of the assumptions concerning fission product releases during postulated accidents indicates that the releases may be substantially smaller than previous estimates for some accident sequences. However, large uncertainties concerning the behavior of various fission products during and following severe accidents remain, demonstrating the need for continued research in this area.

A guide for mathematically modeling the transport of radionuclides in the environment is being prepared by the National Council on Radiation Protection and Measurement, with participation by NRC staff and the collaboration of the Battelle-Columbus Laboratory. NRC staff has been working on a guide for liquid pathway analyses following a postulated core-melt accident. NRC has sponsored a study by the Argonne National Laboratories on methods of interdicting ground water contaminated with radioactivity in the case of such an accident. The first phase of the study has focused on slurry walls and other barriers to ground water migration.

Environmental Impacts of Cooling Systems

Great Lakes. An indirect benefit of the NEPA review process occurs when operational experience at existing power plants is fed back into the design and siting process, as well as back into the environmental impact assessment process. In this way, past successes and failures are drawn upon in a positive way and the lessons learned are applied to future actions and environmental planning. To these ends, NRC staff has evaluated the operational impacts of two nuclear plants on the Great Lakes: the closed-cycle cooling Davis-Besse Nuclear Power Station on the western basin of Lake Erie in Ohio and the once-through cooling Point Beach Nuclear Plant on northwestern Lake Michigan in Wisconsin. The results are published in two NRC technical reports: NUREG-0720 (Davis-Besse) and NUREG-0816 (Point Beach).

Midwestern Rivers. In addition, the NRC contracted with an outside consultant, Environmental Science and Engineering, to review and assess the nonradiological environmental operating data for three on-line nuclear generating stations. The three stations are all located in midwestern, riverine habitats, so that the findings of the review and assessment could be generalized and applied to future stations located in similar habitats.

The three stations considered in this report are Fort Calhoun Station, Unit 1, in Washington County, Neb.; Cooper Nuclear Station, in Nemaha County, Neb.; and Duane Arnold Energy Center (DAEC), Unit 1, in Linn County, Ia. Fort Calhoun and Cooper Stations are located on the banks of the Missouri River and utilize cooling systems of the once-through type. DAEC is located on Cedar River and utilizes force-draft evaporative cooling towers to dissipate waste heat. Cooling system make-up water is withdrawn from, and discharged to, the Cedar River. (The results of the study are published in a four-volume NRC technical report (NUREG/CR-2337).)

These reports evaluate the operational impacts of the power plants on the biotic and fishery resources

of the lakes and rivers. Case-specific and regional analyses are made. The impacts projected in the preoperational Final Environmental Statements are compared with the impacts actually observed during operation. The assessments utilize recent advances in techniques for determining sampling design adequacy for fish impingement studies and for estimation of losses to the fishery from entrainment of fish eggs and larvae. Beneficial effects to the fisheries of the water bodies are recognized and discussed. Siting and design features of each power plant are evaluated in relation to observed impacts and/or benefits.

Mississippi River. The problems of locating protected structures in the Mississippi River floodplain have resulted in the installation of a novel intake system at the Grand Gulf Nuclear Station (Miss.). The radial well infiltration system built to serve the station also has substantial environmental advantages.

The intake draws water from the alluvial aquifer and the Mississippi River through a series of radial collector wells located along the shoreline. As built, this structure, which provides station makeup water, consists of six radial wells (three operating, three planned for Unit 2 use) located along the shore of the Mississippi River. Each radial well is a large, circular reinforced-concrete caisson, installed vertically, and extending down into the alluvial sediment adjacent to the river. Twelve horizontal, screened, 16-inch-diameter pipes, called laterals, extend outward radially from the lower portion of the caisson about 60 meters (200 ft) into the alluvial sediment. Water comes both from the river by induced infiltration and from the alluvial aquifer into the radial collectors. This water is then pumped to the plant by two vertical plant service water pumps installed on the operating floor of each well (at floor elevation 29.3 meters (96 ft). The collector-well system is designed to supply a flow of about 2.7 cubic meters per second (95 cfs).

Because water is not removed directly from the river, no impingement or entrainment of aquatic organisms will occur. Impacts to fisheries due to impingement and entrainment losses at cooling water intakes can be significant in highly productive water bodies. The Grand Gulf system avoids such losses.

Estuaries. Settlements reached in EPA proceedings, under the National Pollutant Discharge Elimination System (NPDES) permit program, resulted in the issuance of modified NPDES permits for the Brunswick (N.C.) and Indian Point (N.Y.) plants during 1981. As modified, the permits allow continued operation of these estuarine-sited power plants with once-through cooling in lieu of conversion to closed-cycle (i.e., cooling tower) systems, as had been required by the NRC-issued operating licenses. Action has been taken in both cases to amend the licenses to reflect the settlements and modified NPDES permits; this action will conclude two of the more controversial case reviews regarding cooling system alternatives. The interagency cooperation which evolved in the EPA hearing proceedings provided valuable experience in the handling of complex licensing issues.

Endangered and Threatened Species

Under provisions of the 1978 Amendments to the Endangered Species Act, the NRC is required to provide a biological assessment of the potential for impact to endangered or threatened species or designated critical habitat. These assessments are performed during the course of the operating license review and submitted to either the Fish and Wildlife Service or the National Marine Fisheries Service.

Leather-back turtle (Dermochelys coriacea) known to nest occasionally on beaches near the St. Lucie (Fla.) nuclear power plant.

During 1981, biological assessments were prepared for the Grand Gulf Nuclear Station (Miss.), the Turkey Point Nuclear Plant (Fla.), the Virgil C. Summer Nuclear Station (S.C.), and the St. Lucie Nuclear Plant (Fla.).

For those endangered or threatened species on which the station could have an impact, a review of current literature on life history, behavior, mortality rates and population size was conducted. The station was described in detail and the impact to the local population from station constructional activities and operation was quantified. These impacts were then used to assess the impact of the station on the continued existence of the species.

The two most significant assessments during 1981 were performed on the American crocodile and on all five species of marine turtles that are found in Florida waters. The impact of the steam generator replacement program at the Turkey Point Nuclear Plant site on the American crocodile revealed that the six to 16 individuals residing within the plant site represent a significant portion of the extant U.S. population of this species. The results of the assessment concluded that the steam generator repair program would not have any adverse affect on this population. Furthermore, it was concluded that the isolation and habitat afforded by the presence of the plant appears to contribute to the continued existence of this subpopulation.

Marine turtles, principally green turtles and loggerheads, have been known to nest along the ocean beach at the St. Lucie Nuclear Plant site. Beach nesting studies have been conducted by Florida Power and Light since 1971. Since commencement of Unit 1 operation in 1976, green and loggerhead turtles have become entrapped in the intake canal and some mortality has been reported. The utility has conducted a capture-release and tagging program in the intake canal since Unit 1 began operation, and this information has been helpful in the understanding of the life history of these species.

Antitrust Activities

As required by law since December 1970, the NRC has conducted prelicensing antitrust reviews of all applications for nuclear power plants and certain other commercial nuclear facilities. These reviews assure that the issuance of a particular license will neither create nor maintain a situation inconsistent with the antitrust laws. The NRC holds a hearing whenever one is recommended by the Attorney General and also considers whether antitrust issues raised by the NRC staff or intervenors should be subject to a hearing. Remedies to antitrust problems usually take the form of conditions attached to licenses. Such license conditions may result either from hearings or from non-hearing negotiated settlements.

Antitrust hearings are held separately from those on environment, health and radiological safety matters. So that antitrust reviews do not delay NRC licensing decisions, applicants are required to submit specified antitrust information to the NRC at least nine months, but not earlier than 36 months, before other parts of the construction permit applications are filed for acceptance review. Additionally, NRC performs antitrust reviews prior to issuing operating licenses to determine whether significant changes in applicants' activities have occurred since the construction permit antitrust reviews which would necessitate an antitrust hearing.

Since the inception of NRC's antitrust program, 91 initial construction permit antitrust reviews have been performed. Based on these reviews, the Department of Justice recommended 17 for hearing, 24 for "no hearing" because applicants agreed to antitrust license conditions, and 50 for "no hearing" without need for conditions. In addition to these reviews, NRC has reviewed and sought advice from the Department of Justice in 42 cases in which additional applicants are seeking part ownership participation in nuclear plants for which the initial applications had been reviewed previously. No hearings have been recommended for these additional applicants.

In its antitrust program, NRC has reviewed over 170 private, public and cooperative utilities, which account for approximately 85 percent of total kilowatt hour sales in the United States. The NRC has reviewed approximately 75 of the top 100 utilities, ranked by kilowatt hour sales, in the United States. The NRC staff has completed operating license reviews of 14 applications in which it found no significant changes to have occurred since the construction permit review and is currently reviewing 15 others.

In addition, the Commission has sought the Attorney General's advice in three applications for operating licenses in which petitioners requested the Commission to make a significant change finding. In two of those cases, South Texas and Comanche Peak, the Attorney General recommended a hearing after the Commission had made a significant change finding. Although most of the parties involved have reached a settlement in these cases, there are still some outstanding issues and the records have not been closed. In the third case, Virgil C. Summer, the Attorney General declined to furnish advice unless the Commission first made a finding that significant antitrust changes had occurred subsequent to the construction permit review.

On June 26, 1981, the Commission denied the petition of Central Electric Power Cooperative, Inc., for an affirmative "significant change" finding in the matter of the operating license application for the Virgil C. Summer Unit 1. In denying the petition, the

Commission set forth three criteria to be used by the Staff during its operating license antitrust reviews in evaluating whether significant changes had occurred. These criteria were that:

(1) the changes had occurred subsequent to the previous construction permit antitrust review; (2) the changes were related to the activities of the Licensee; (3) the changes had antitrust implications that would likely warrant some Commission remedy.

During the *Summer* proceeding, the Commission delegated to the staff the authority to make the significant changes determination. In 1981, proposed rules regarding the procedures to be used for the determination were codified and offered for public comment. The comments have been received and it is expected that a final rule will be published in early 1982.

Negotiation is continuing regarding two NRC issuances of notices of violation for alleged noncompliance with antitrust license conditions—against the Cleveland Electric Illuminating Company and the Mississippi Power and Light Company. Although the licensees denied the allegations in each instance, they agreed to attempt to negotiate a settlement.

On April 24, 1981, the Atomic Safety and Licensing Board, appointed to conduct the antitrust proceeding with regard to Florida Power and Light Company's application to construct the St. Lucie 2 nuclear power plant, approved and implemented a settlement agreement reached by the NRC staff, the Department of Justice and the applicant. The sole intervenor in the case, a group of Florida cities, has not agreed to the settlement and is seeking a hearing to consider unresolved antitrust issues. In addition, a privately-owned entity sought and was denied intervention in the construction permit proceeding and further requested that the Director of Nuclear Reactor Regulation force the applicant to comply with certain license conditions. That request was denied on the basis that the petition relied on an affirmative finding by the Federal Energy Regulatory Commission which had not yet been made.

On June 30, 1981, the Atomic Safety and Licensing Appeal Board both affirmed and modified the decision of the Atomic Safety and Licensing Board in the antitrust proceeding dealing with Alabama Power Company's application to operate the Farley nuclear plant. The Appeal Board decision ordered license conditions providing ownership access to the plant to a generation and transmission cooperative and transmission services to the cooperative and municipalities in the applicant's service area.

On June 9, 1981, the Atomic Safety and Licensing Board appointed to conduct the antitrust proceeding with respect to Pacific Gas and Electric Company's application to construct the Stanislaus 1 Nuclear Unit, denied a motion by the applicant and by NRC staff to suspend discovery and, on July 13, 1981, denied the applicant's request to certify the motion to the Atomic Safety and Licensing Appeal Board. Thus, discovery continues in the Stanislaus antitrust proceeding.

Advisory Committee On Reactor Safeguards

The Advisory Committee on Reactor Safeguards (ACRS), established in 1957 by statute, provides the Commission advice on potential hazards of proposed or existing reactor facilities and the adequacy of proposed safety standards. The Atomic Energy Act of 1954 also requires that the ACRS advise the Commission with respect to the safety of operating reactors, and, in accordance with Public Law 95-209, the ACRS is required to prepare an annual report to the Congress on the NRC Safety Research Program.

The ACRS reviews requests for preapplication site and standard plant approvals, each application for a construction permit or an operating license for power reactors, test reactors, spent fuel reprocessing plants, waste disposal facilities and any matter related to nuclear facilities specifically requested by the Department of Energy.

Because the ACRS is a statutory body of advisors to the Commission, its input and advice relate directly to statutory responsiblities of the NRC for the public's health and safety. The ACRS membership, appointed from the scientific and engineering disciplines, includes individuals experienced in chemical engineering, electrical engineering, mechanical engineering, structural engineering, reactor operations, reactor physics and environmental health.

During fiscal year 1981, the Committee prepared the following reports to the Congress and Congressional Oversight Committees:

- The Committee's Annual Report to the Congress for fiscal year 1982 on the review and evaluation of the NRC's Safety Research Program (NUREG-0751).
- A reply to specific questions raised by the Honorable Alan K. Simpson, Chairman of the Subcommittee on Nuclear Regulations, Senate Subcommittee on the Environment and Public Works, concerning the NRC's Safety Research Program.

Members of the Committee also provided testimony to the Senate and House Oversight Committees on the proposed NRC Safety Research Budget for fiscal year 1982 and related safety concerns.

The Committee was also called on to prepare special reports to the NRC, individual commissioners, and others on a variety of issues, including:

- Comments on questions posed by the Honorable Morris K. Udall concerning issues raised by the Browns Ferry 3 partial failure to scram.
- Near-term construction permit requirements.
- The State of Technology Report on Fission Product Iodine.
- The Nuclear Regulatory Commission's Long-Range Research Program, fiscal year 1983-1987.
- Responses to inquires concerning the safety implications of control system failures.
- Comments on the Nuclear Regulatory Commission Safety Research Program Budget for fiscal year 1983.
- Comments on the NRC Waste Confidence Rulemaking.
- Comments on the proposed Nuclear Data Link.

The Committee prepared a major report containing a proposal for an approach to quantitative safety goals for nuclear power plants and two reports on new safety concepts for future construction.

A highlight of this year's activities was the resumption of licensing activities with respect to construction permits and operating licenses and resulting activities by the Committee and the designated project subcommittees, including site visits.

The Committee's activities during the report period reflected the increased licensing activity within the Commission.

In addition to its reports on licensed reactors (as on the restart of TMI-1), construction permit and manufacturing License applications, and operating license applications, the Committee provided advice to NRC on 16 proposed rules, criteria, or regulatory guides, including:

- Proposed Rule on Siting Criteria.
- Proposed Rule on Disposal of High-Level Waste in Geologic Repositories.
- Proposed Rule on Licensing Requirements for Land Disposal of Radioactive Waste.
- Proposed Rule on Fire Protection.

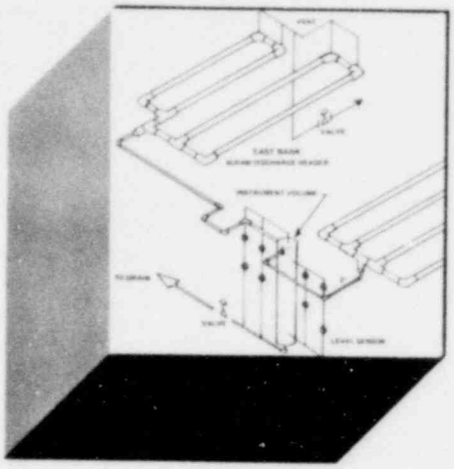
Other special reports were provided to the Commission during fiscal year 1981 on such subjects as:

- Seismic Qualification of Auxiliary Feedwater Systems.
- Instrumentation to Detect Inadequate Core Cooling.
- Emergency Plans During and After Natural Events.
- Regulatory Staff Studies on DC Power Supply.
- Requirements at Nuclear Power Plants and on Fission Product Behavior During LWR Accidents.

Under the provision of Public Law 96-567, "Nuclear Safety Research, Development and Demonstration Act of 1980," the Committee provided a report to the Department of Energy on that agency's first draft in response to P.L. 96-567.

In performing the reviews and preparing the reports, the ACRS held 12 full committee meetings. In addition, 116 subcommittee and working group meetings were held and eight site facility visits were made.

The ACRS Vice-Chairman, two Committee members and the ACRS Executive Director visited Japan to discuss a number of safety-related issues, including proposed improvements in light-water cooled and moderated nuclear power plants; use of probabilistic assessment in the regulatory process; and Japanese experience and criteria related to the design, construction and operation of Liquid Metal Fast Breeder Reactors. The group visited several research and test facilities and discussed seismic research and testing.



3 Operating Experience

NRC continually studies reports of operating experience at nuclear power plants to learn about problems related to their structural design and operating procedures. Assessment of the causes and consequences of abnormal events assists in developing preventive and mitigative measures, and in understanding unforeseen cause-effect relationships between events.

NRC licensees must report unplanned operational events which have safety implications. Some events must be reported within one hour via dedicated direct phone lines, and all unplanned events are reported on in writing within a few weeks. The written reports, called Licensee Event Reports, are evaluated by several NRC offices, including the Office for Analysis and Evaluation of Operational Data. Some reports may merit treatment as "abnormal occurrences," a categorization which will be discussed later in this chapter. Generic or widespread problems may call for further study as "unresolved safety issues," such as those described in Chapter 2. This chapter describes some of the more significant experiences reported by NRC licensees during 1981 and the NRC responses toward understanding and acting on the causes and implications of such events. Both the nature of the events and the actions taken, in most cases, involve highly technical terminology, much of which has been omitted in this report in the interests of space and readability. Technical details on each item discussed, however, can be obtained from the Director, AEOD.

On June 1, 1981, the NRC entered into a cooperative arrangement with the nuclear industry's Institute of Nuclear Power Operations (INPO), and the Department of Energy's Nuclear Safety Analysis Center (NSAC), covering the collection and feedback of data on nuclear power plants. In addition to the collection of operational data, and its computerized data storage and retrieval, the agreement provides for input of foreign operational information, and for special screening of significant events.

In August 1981, the NRC adopted a document entitled "Operational Safety Data Review," establishing guidance for reviewing operating experience and for taking the actions necessary to maintain required safety margins. It defines a system of staff actions to collect, evaluate and feed back operational data, and sets forth an agency-wide program for the handling of operational safety data.

In February 1980 NRC had placed new and more stringent notification requirements on operating reactor licensees. (See *1980 NRC Annual Report*, p. 81.) They required licensees to notify NRC's Operations Center in Bethesda, MD, within one hour of certain significant events, and provided for a dedicated direct telephone line for this purpose. The NRC staff reviews each event reported under the new rule to determine such things as the adequacy of short-term corrective actions, the need for possible action at other plants or for additional action at the reporting plant, and to identify events appropriate for classification as reportable "Abnormal Occurrences."

NRC routinely disseminates this information throughout the agency and to other power plant licensees — the latter in the form of Information Notices, Circulars and Bulletins (See Chapter 7 for a description of these documents.)

ANALYSIS AND EVALUATION OF OPERATIONAL DATA

The focal point in the NRC staff for the extraction of safety lessons from operating experience and the communication of these lessons throughout the industry is the Office for Analysis and Evaluation of Operational Data (AEOD). (The activity of AEOD is detailed on pp. 90-91, *1980 NRC Annual Report*.) In January 1981, AEOD's responsibility was extended to include the handling of the Licensee Event Report

(LER) system, described above, and to take over the publication of two documents: the "Power Reactor Events" report, published bi-monthly, and the quarterly "Report to Congress on Abnormal Occurrences."

Integrated Operational Experience Reporting System

Studies of the accident at Three Mile Island Unit 2 (TMI) focused attention on the importance of collecting and evaluating operational experience data, while other studies, notably one by the NRC Advisory Committee on Reactor Safeguards identified weaknesses in the existing program (NUREG-0572, "Review of Licensee Event Reports").

The reporting concept initially envisioned by the Commission involved the collection by NRC of detailed technical descriptions of significant events as well as component reliability data, both types of data being essential to the NRC mission. However, it became clear during 1981 that NRC might be able to obtain the reliability data without direct responsibility for its collection, since the INPO Board of Directors decided in June 1981 to assume management and funding responsibility for the Nuclear Plant Reliability Data System (NPRDS), and for developing criteria for use in management audits to assess the system's adequacy. (The NPRDS is the collection mechanism for engineering and failure data on safety-related systems and components at operating nuclear plants.)

For its part, NRC will participate on an NPRDS Advisory Committee, periodically assessing the information produced by NPRDS, and seeing to it that the information is available to the Commission. If essential reliability data are not forthcoming from NPRDS, however, the Commission would then consider alternatives, including resuming the rulemaking to make reliability data reports mandatory.

AEOD TECHNICAL STUDIES— SELECT CASES

As noted in the 1980 report, NRC's Office of AEOD screens each LER. During the 1981 report period, that office conducted more than 25 engineering evaluations of operational events and potential generic operational problems. A number of case studies were completed, and recommendations for follow-on actions — including revised requirements — were prepared. A sampling of several individual case studies completed during 1981 are presented below.

Safety Concerns Associated with Pipe Breaks in BWR Scram System

Since the Browns Ferry 3 partial failure to scram on June 28, 1980 (see *1980 NRC Annual Report*, pp. 88-90), NRC has studied the scram discharge volume (SDV) subsystem of BWR scram systems extensively with respect to potential conditions which may cause a loss of scram capability. However, it was found that little review effort had been given to postulated SDV system pipe break failures.

Prompted by this finding, NRC in 1981 undertook a thorough safety review of the scram system design with regard to the implications of leaks and loss of integrity, and some important additional issues and safety concerns have been raised. For example, if an SDV system pipe breaks during a reactor scram, termination of the resultant reactor coolant blowdown outside primary containment would depend on the closure of non-redundant (scram outlet) valves. The closure principle and design arrangement of these valves do not provide high confidence that closure will always be assured. Furthermore, a concern was raised that in the event that the pipe break is not isolated, the current plant emergency operating procedures may not adequately address the possibly concurrent need to keep the core covered while protecting against the potential loss of emergency cooling (ECCS) equipment.

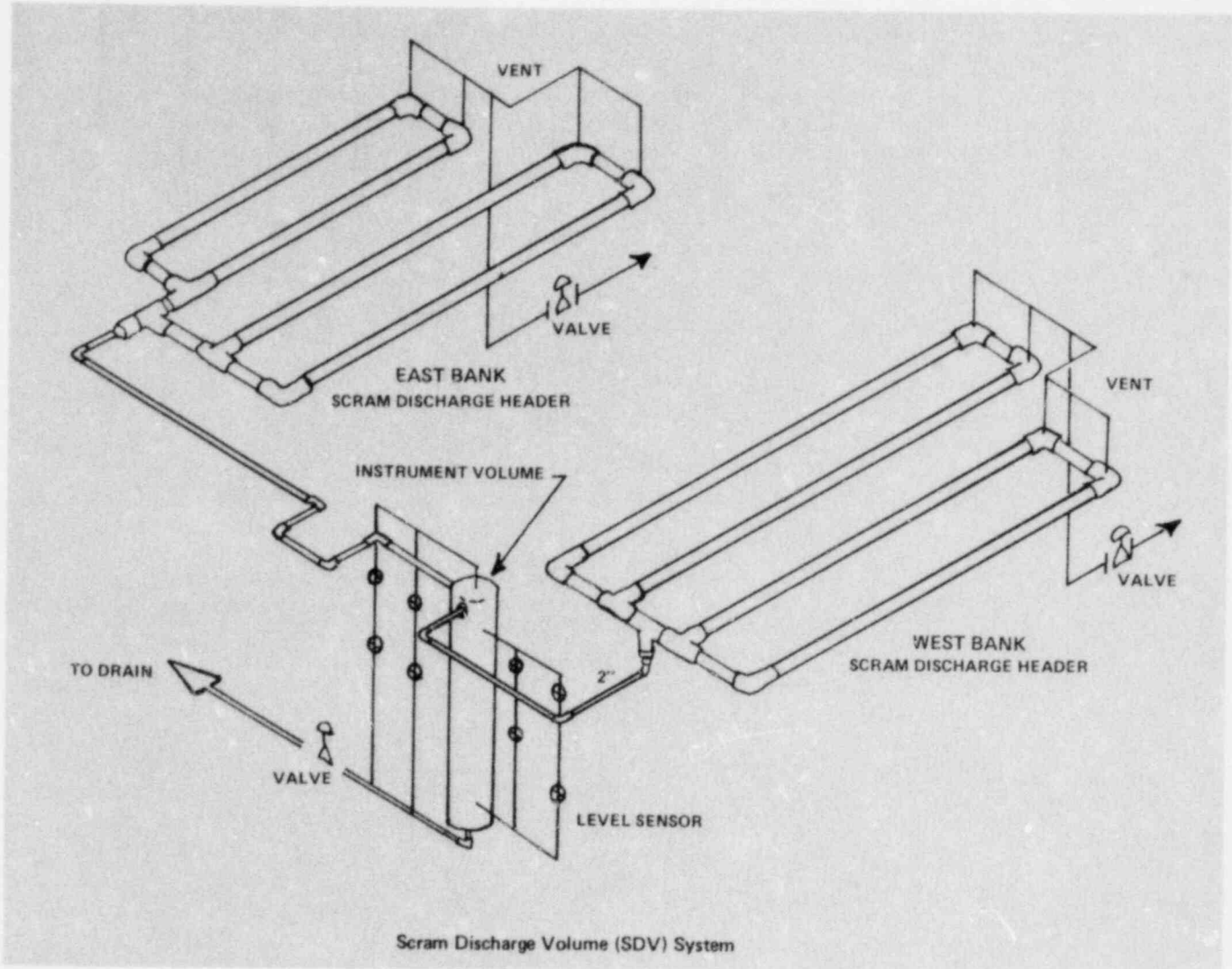
Failure to isolate an SDV system pipe break also raised serious concerns regarding long-term decay heat removal, since the break itself may threaten the operation of ECCS equipment. After detailed evaluation of this overall situation, the NRC issued in August 1981 NUREG-0803, "Generic Safety Evaluation Report Regarding Integrity of BWR Scram System Piping," for comment. All responses had not been received by the close of the report period.

The Millstone Unit 2 Loss of 125V DC Bus

A case study of the event a Millstone Unit 2 that occurred on January 2, 1981, was undertaken because the event — which was initiated by an operator's mistakenly de-energizing one of the station 125V dc buses — involved the following incidents:

- A partial loss of normal offsite power.
- A complete loss of control room annunciators.
- The inoperability of both emergency diesel generators (one of them due to an independent failure).
- A loss of several indicators in the control room.
- An ineffective pressurizer spray through the normal spray system.

The evaluation of the event did not identify any safety concerns or the need for any further action by



Scram Discharge Volume (SDV) System

Above is a diagram of the Scram Discharge Volume System discussed on the preceding page, under "Safety Concerns Associated with Pipe Breaks in BWR Scram System." Attention was focused on the potential consequences of system failure by an incident at the Browns Ferry (Ala.) nuclear power plant.

the NRC other than those already being considered in the generic safety task A-30, "Adequacy of Safety Related DC Power Systems" and the Unresolved Safety Issue A-44, "Station Blackout." However, the study resulted in a number of recommendations which are under evaluation by other NRC offices to determine the need for specific licensee action. These recommendations include the potential need to:

- Revise procedures of operating plants to address the recovery from a loss of a dc bus event by including the effects of re-energizing the lost bus.
- Inform plant operators of problems that could be encountered when diesel generators are running in an emergency mode, and add corrective actions in appropriate procedures to counter these problems.
- Make plant operators aware that during partial pump operation certain pump combinations may exist which will not provide adequate spray flow to the pressurizer.
- Familiarize plant operators with the potential for non-equilibrium pressurizer behavior when normal spray flow is unavailable.
- Familiarize operators with core conditions that produce significant quantities of non-condensibles.

Loss of Service Water at Calvert Cliffs

The Calvert Cliffs May 20, 1980 loss-of-service-water event involved the loss of both redundant trains of the safety-related service water system when the system became air bound, as a result of the fail-

ure of a non-safety-related instrument air compressor aftercooler.

The consequences of this event were minor. Nonetheless, this event, involving the failure of a single non-safety-related component causing the disablement of both redundant trains of the safety-related service water system, is significant because it involved two fundamental aspects considered in the design of safety-related systems:

- Interaction between safety and non-safety-related systems and components.
- Common cause failure of redundant safety systems.

The review of this event revealed no immediate safety concerns. However, it identified a potential need to reevaluate (1) certain assumptions used in analysis of the steam generator tube ruptures; (2) the assumptions regarding atomospheric dump valve operability on selected two-loop PWRs; and (3) the assumptions regarding the isolation provisions at the interface between the safety and non-safety-related portions of service water systems. These study recommendations are currently under review by other NRC offices to determine the need for specific licensee action.

ABNORMAL OCCURRENCES— UPDATE FROM FISCAL YEAR 1980

(For a description of NRC's requirements, under law, to report Abnormal Occurrences, see p. 82, *1980 NRC Annual Report*

The quarterly report to the Congress on abnormal occurrences for the period July-September 1980 was published too late for inclusion in the *1980 NRC Annual Report*. A summary of the occurrences covered in that report follows.)

Failure of Salt Water Cooling System

On March 10, 1980, San Onofre Unit 1 experienced failure of the salt water cooling system (SWCS). If this system is inoperable, the reactor is required to be shut down. In this event, two redundant safety-grade pumps and a third, safety-related pump in the SWCS were lost, and the plant staff failed to shut down the plant as required. However, there was no accident or release of radioactivity.

NRC analysis confirmed that either in normal shutdown during residual heat removal (RHR) or under certain steam line break conditions, the loss of the SWCS can seriously degrade safety functions if prompt corrective actions are not taken, and that damage to the pumps in the charging, RHR, and reactor cooling systems in this event could have resulted. The complete loss of the SWCS and the adequacy of alternative cooling pathways had not been thoroughly analyzed prior to the event. The licensing process has traditionally not required analyses of the loss of complete safety systems caused by such interactions.

The plant was being operated with an instrument air system contaminated with desiccant particles, a problem which had contributed to at least one previous valve failure and was a suspected cause of other valve problems such as sluggish operation. The desiccant may have contributed to the failure of an isolation valve to open on one of the SWCS pumps.

Analysis indicated that the equipment failures might have resulted from deficiencies in the licensee's preventive maintenance program and his noncompliance with the requirements for pump and valve testing. These had been identified to the licensee following a February 1979 inspection by the NRC. As a result of this inspection, the licensee was cited in January 1980 for noncompliance with requirements for testing of pumps and valves and a number of deficiencies related to the preventive maintenance program. The NRC requested the licensee to further assess the implications of a loss of SWCS during postulated accidents.

The NRC met with the licensee in October 1980 to discuss the evaluations conducted and the corrective actions. Based on the inspection of this event, the licensee was cited with infractions of NRC regulations for failure to shut the plant down when both salt water cooling pumps and the auxiliary salt water cooling pumps were inoperable.

Improper Use and Inadequate Control Of Radiopharmaceuticals.

On July 31, 1980, the Nuclear Regulatory Commission's Region III office in Glen Ellyn, Illinois, was informed that patients of Lakeview Hospital in Wauwatosa, Wisconsin had, since 1976, routinely received double the prescribed dose of radiopharmaceuticals for diagnostic scans. The hospital holds an NRC license, originally issued in 1959 and last renewed in 1979, to possess radioactive isotopes for medical diagnostic procedures.

NRC investigations revealed that the licensee staff was routinely administering more than the prescribed doses of radiopharmaceuticals to 20 or 30 patients per month, most of them age 65 and over, for brain, bone, liver, spleen and lung scans in which technetium-99m (Tc-99m) was part of the scanning agent. The doses administered were generally twice that prescribed. The highest dose administered was 42 millicuries of Tc-99m DTPA for a brain scan, instead of the 15 millicuries which the hospital's written protocol prescribed. (DTPA is diethylenetriamine pentaacetic acid.) This would have resulted in a whole body dose of 840 millirems, and a dose to the critical

organ - urinary bladder - of 23 rems. (A normal chest x-ray is equal to a whole body dose of 20 to 50 millirems.) The NRC believes the increased dosages were unnecessary because they did not result in any corresponding benefit to the patients.

According to hospital technicians, the purposes of the dosage increases were to decrease scanning time from about 30-45 minutes to about 15-20 minutes and to obtain brighter images before the patients moved. This was done despite available alternative means to accomplish the same purpose without subjecting the patients to unnecessary radiation.

In addition to the misadministrations, the NRC investigation identified several items of noncompliance with the license, including failure to keep accurate records, inadequate equipment calibration, and inadequate radiation surveys. The licensee cooperated in the investigation and took prompt actions to correct the deficiencies. These included the suspension and later removal of two employees, and the cessation of all licensed activities when the NRC suspended the license. Patients requiring nuclear procedures were referred to a nearby county medical complex and, in September 1980, the licensee submitted new procedures. In October 1980, the license suspension was rescinded and the licensee's corrective actions were incorporated into the license.

The NRC asked the Department of Justice to review the matter. The case was resolved by a precharging agreement which eliminated the need for criminal charge. In return for not being prosecuted, the individual principally responsible agreed to renounce certification as a nuclear medical technician and not seek reinstatement for two years. The individual acknowledged the practice of using dosages twice as large as specified in hospital procedures, misrecording the dosages, and directing subordinates to do the same.

ABNORMAL OCCURRENCES — FISCAL YEAR 1981.

(Reports for the third and fourth quarters, April-June and and July-September 1981, were not available for coverage in this report.)

Flooding of Reactor Containment Building

On October 17, 1980, workers entering Conslidated Edison Company's Indian Point Unit 2, located in Westchester County, New York, found a significant amount of water inside the pressurized water reactor containment building. The flooding had caused the failure of the power range nuclear detector, and this was the original reason repairmen entered the containment building. About 125,000 gallons of water accumulated, and the cavity under the reactor vessel was nearly filled, wetting the lower 9 feet of the reactor vessel and submerging stainless steel conduits and instrument thimbles located below the vessel. Leaks in service-water piping and containment cooling fans were identified as sources of the water.

Evaluations have indicated that there was no damage to the reactor vessel or other components in the reactor vessel cavity. However, continued operation in such abnormal conditions as the undetected accumulation of water in the containment represents some degree of decreased safety.

The licensee has installed alarms in the control room to indicate both increasing containment sump levels and activation of submersible pumps in the reactor cavity, repaired the service water leaks, installed special bushings on sump pump control floats to prevent their binding, and repaired containment sump water level indicators. The licensee also replaced the fan cooling coils prior to return to power.

The NRC issued an Information Notice to provide holders of operating licenses and construction permits with the details of this occurrence. On November 21, 1980, an IE Bulletin directed licensees to take specific short-term actions and to report back to the NRC. In addition, licensees with plants similar to Indian Point 2 were directed to describe their specific controls to preclude similar events. NRC evaluated the reports and determined that immediate, extensive corrective actions were not required at other plants. However, the NRC is making a long-term review of the adequacy of present NRC requirements for system leakage detection and identification.

The NRC imposed a $210,000 civil penalty on the licensee. The licensee contested the action and the NRC referred the matter to the Attorney General for collection.

Inadvertent Disconnection Of Station Batteries

On January 6, 1981, the NRC was notified by Consumers Power Company (Michigan) that the breaker from both station batteries to the 125-volt DC buses at its Palisades (PWR) Nuclear Power Plant in Van Buren County had been inadvertently opened for about one hour.

The event occurred when the plant was operating at 99 percent power. Since the plant was in normal operation, DC power was supplied by the AC system through battery chargers. Therefore, DC power never was interrupted. Nevertheless, a loss of offsite power during that hour, assuming the absence of manual action, would result in the loss of control power and block the automatic transfer of power to the onsite diesel generators. The result would be a complete station blackout which would persist until the battery breakers were manually closed. During this time the

ability of the plant to remove decay heat would be severely restricted. Moreover, since the tripping of battery breakers is not annunciated in the Palisades control room, it could lead to a common mode failure which would be difficult to diagnose, and thus inhibit the operator's ability to take corrective action. An inordinate amount of time could be spent bringing the plant to normal decay heat removal.

NRC found that the batteries were disconnected because two electricians failed to follow test procedures which call for placing the two battery chargers (which had been in standby) in service and placing the two operating battery chargers in standby. The electricians incorrectly disconnected the batteries while connecting the two additional battery chargers. This resulted in an incorrect operating configuration where all four battery chargers were in service, supplying the two 125-volt DC buses (two battery chargers connected to each bus), and the batteries were disconnected.

When the error was discovered by the licensee at the conclusion of the test procedure, the batteries were again connected to the plant's DC buses. The licensee is planning to install annunciators in the control room that will alert the operator whenever a station battery has been disconnected from its bus.

The test procedure was examined by the NRC and found to be adequate. The electricians had a copy of the procedure, had performed the test previously, and had been briefed on the work by their supervisor prior to beginning the test.

Because there had been several previous incidents of licensee personnel errors involving safety-system valves, short-term measures required by the NRC included verification of safety work by a second individual, daily checks of plant operations by licensee management, additional training of plant personnel, and a study of the need for control room indicators to show battery circuit operability. These measures were confirmed by an Immediate Action Letter issued by NRC Region III on January 9, 1981, and a Notice of Violation was issued to the licensee on June 12, 1981. In addition, an Information Notice titled "Degraded DC Systems at Palisades," was issued on March 13, 1981 to all holders of operating licenses and construction permits.

Occupational Overexposures

On February 2, 1981, Automation Industries, Inc., reported possible overexposure to the thumbs of two individuals at their Nuclear Encapsulation Facility in Phoenixville, Pennsylvania. Automation Industries, Inc., is a licensed manufacturer of sealed radioactive sources for use in industrial radiography. For shipment, the sources are placed in a shielded container and cleaned of any loose surface contamination. In this preparatory operation, the licensee's cleaning procedure called for an individual to remove the sources from the shielded position, thus exposing his thumb and finger to a pencil-like beam of radiation of sufficient intensity to cause overexposure. As a result, two employees may have received hand exposures in excess of regulatory limits prior to 1980, possibly for as long as seven years, although the doses were such that either no injury was evident or was so slight as to be ignored. During the summer of 1980, the licensee received a shipment of iridium-192 which carried higher than normal loose contamination. Almost simultaneously, one of the licensee's major customers set more stringent contamination limits for sealed sources shipped under the contract. Both required more thorough source cleaning and that fact subsequently resulted in the doses which exceeded the threshold for visible radiation injury.

The employees stated that the first symptoms of injury developed sometime around July 1980. The first symptom noticed was dryness of the skin at the nail area of the right thumb. One employee went to his doctor in July 1980 and the symptom was diagnosed as a fungus infection. The condition worsened over the summer with swelling, bleeding, sensitivity, and cracking of the right thumbnail developing in September and October 1980. The other employee stated that he developed redness of the skin and cracking of the thumbnail toward the latter part of December 1980. The right index finger and, to a lesser degree, other fingers, developed symptoms of dryness and flaking. Despite the two employees' requests for medical assistance on January 19, 1981, the licensee did not summon its medical consultant until February 2, 1981.

During the NRC investigation, inspectors identified a third individual who had also been involved, although he had no sign of visible radiation injury. The third employee had been hired after the licensee became aware of the overexposure problem of the two employees. NRC estimates said that the three individuals received extremity doses of about 25,000, 7,000, and 1,000 rems, respectively, in 1980.

The NRC also determined that the licensee did not report these overexposures in a timely manner. The licensee was aware that the first two employees had radiation injuries to their hands in November of 1980 but did not report this to the Commission until February 2, 1981. NRC regional inspectors also concluded that the licensee intentionally concealed the problem from the NRC during a routine inspection on January 21, 1981, by instructing one employee to wear gloves to hide the condition of his hands and not to speak to the NRC inspectors.

The licensee has completely revised procedures for cleaning and wipe testing sources and has provided fingertip dosimetry to the appropriate personnel. The licensee has revised the management of the facility and radiation safety program. A radiation safety con-

sultant has been employed to assist in the review of the licensee's program and to implement an audit program.

Upon being notified by the licensee of the overexposures on February 2, 1981, the NRC Region I office conducted special investigations of the licensee during the period of February 3-18, 1981, covering circumstances pertaining to the overexposures and to the licensee's notification of suspected radiation overexposure to employees. Three items of noncompliance were identified: exposure in excess of regulatory limits of 10 CFR 20.101(a) to the hands of three individuals; failure to provide required dosimetry; and failure to make the the required immediate notification.

NRC suspended the license on February 17, 1981, but reinstated it on March 6, 1981, after the licensee submitted changes in the management of the facility and its radiation safety program together with revised procedures for cleaning and wipe testing sources. Frequent inspections will be performed by Region I inspectors to ensure the effective implementation of the licensee's commitments.

Agreement State Abnormal Occurrences

Overexposure of Radiographers. Weatherby Engineering Company of Corpus Christi, Texas, reported that on July 8, 1980, two employees received overexposures from a 72 Ci Ir-192 source left in a source guide tube. One received 75 rem and the other received 198 rem. The two employees, who were neither qualified as radiographers nor listed on the Weatherby license, were instructed to make photographic exposure of a weld. They were unsupervised, since company radiographers were working nights. The exposure was made, the camera supposedly surveyed and the equipment, including the guide tube, returned to storage—the camera in a shielded vault and the guide tube and crankout assembly on a rack in the darkroom. The Radiation Safety Officer was nearby doing paperwork for about two hours that evening. Radiographers from another company doing work for Weatherby discovered the source was missing when they borrowed the camera the following morning. The building was evacuated, the guide tube was removed from the darkroom and the source was recovered.

During investigation by the State agency, it was determined that the employee who set up the shot did not know how to make the proper source connections. When he attempted to retract the source, it remained in the guide tube. No film badge readings were available, as the film badge contract had been cancelled. Re-enactment of events indicated that the employee received a whole body exposure of 75 rem. The calculated whole body dose to the safety officer, sitting about one foot from the source for two hours, was 198 rem. Thirty-one other personnel in the building the evening after the shot received doses ranging from 0.9 to 4.0 rem.

The individual who received the 75-rem exposure displayed no immediate clinical symptoms of radiation overexposure, no erythema or blood anomalies. The one who received 198-rem exposure showed some chromosomal aberration, a sperm count lower than normal (38 million/ml), a melanoma in one eye, some pain in his legs and buttocks. A bone marrow sample was taken, but no blood anomalies were disclosed. The medical report did not corroborate the earlier reports regarding this second individual.

The State agency's investigation revealed numerous items of noncompliance with regulatory requirements. The source was impounded and the radioactive materials license was suspended for 90 days. The licensee did not contest the license suspension and has subsequently submitted proposed corrective actions. These were adjudged adequate and the license has been reinstated.

In another overexposure incident in Texas, Technical Welding Laboratory, Inc. of Houston, reported that on August 14, 1979, a radiographer received a whole body exposure of 35 rem while working around a 40 Ci Ir-92 source stuck in a guide tube.

While performing radiography work, he noticed the film was turning out dark. He switched cameras and placed the original camera in the storage vault. The source guide tube and crankout assembly were put in the radiography truck. He encountered difficulty in disconnecting the source from the drive cable, and it was assumed the source was left out of the camera at this time. The next morning an individual checking survey meters noticed excessive readings in the office area. The radiation source was located in the guide tube in the truck. It was recovered and placed in the camera.

The overexposure occurred while transporting the source to and from various jobs and during a half-hour period the radiographer spent in the darkroom, about two feet from the source.

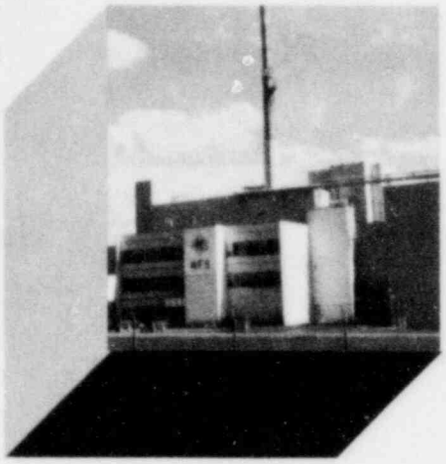
Both the calculated exposure and film badge exposure indicated a whole body exposure of 35 rem and about 41 rem to the hands. Failure to make a radiation survey following the source disconnect difficulty was the principal cause of the incident. Reading the pocket dosimeter at the end of the job would have alerted the radiographer to the problem and prevented at least part of the overexposure. The unsatisfactory film exposures also should have indicated a possible exposed source.

The licensee held a safety meeting with its personnel to stress the proper method of handling radiographic material. The radiographer involved was removed from radiography work. The State agency identified several items of noncompliance which the licensee satisfactorily addressed.

Inadequate Security. On September 24, 1980, Coastal Testing Laboratory of Pasadena, Texas, reported that a Soiltest, Inc., Model NIC-5 moisture density gauge containing 10 mCi Cs-137 and 60 mCi Am-241 was stolen. The source was shielded at the time of the theft.

The licensee contacted the police and local media and began canvassing the immediate area. Police recovered the gauge that afternoon at an elementary school about four blocks from the site. A ten year old boy admitted taking the range. The source still was in the shielded position, and the boy apparently did not receive any significant exposure.

The licensee held a safety meeting with all employess during which source security was stressed. The State agency cited the licensee for several items of security-related violations. An adequate response was received from the licensee.



4
Nuclear Materials

Regulation of the possession, use and disposition of nuclear materials is administered by the NRC's Office of Nuclear Material Safety and Safeguards through three major programs: the fuel cycle and material safety program, including transportation, discussed below; the safeguards program (including the safeguarding of facilities), discussed in Chapter 5; and the waste management program (including uranium recovery operations), discussed in Chapter 6.

The fuel cycle and material safety activities covered in this chapter include licensing and other regulatory actions concerned with (1) purification and conversion of uranium ore concentrates (after mining and milling) to uranium hexafluoride, (2) conversion of the uranium hexafluoride (after enrichment in Government-owned diffusion plants) to ceramic uranium dioxide pellets and their fabrication into fuel for light water nuclear reactors, (3) production of naval reactor fuel, (4) storage of spent reactor fuel, (5) transportation of all types of nuclear materials, and (6) production and use of reactor-produced radioisotopes ("byproduct material").

Among actions in these areas during fiscal year 1981, the NRC:

- Completed 17 major and 98 minor licensing actions dealing with uranium fuel.
- Completed 99 transportation packages - design certification reviews.
- Acted on 5, 151 applications for new byproduct material licenses and amendments and renewals of existing licenses, and completed 125 evaluations of sealed sources and devices containing radioactive materials.
- Conducted 35 post-licensing visits to observe the operations of materials licensees.
- Completed the review of terminated AEC licenses to identify possible contaminated sites, and continued evaluating suspect sites to determine if action should be taken to protect the public.

Fuel Cycle Actions

EVALUATING SITES FOR RADIOACTIVITY

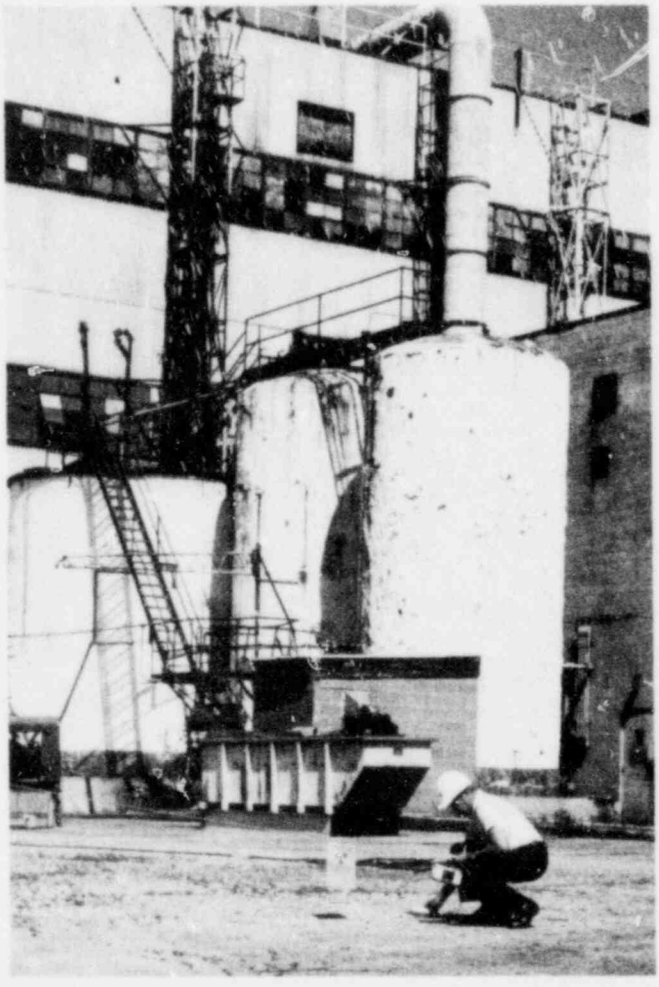
The NRC continued in 1981 with the evaluation of sites of former radioactive material operations to determine if corrective action should be taken to protect the public. Oak Ridge National Laboratory and the NRC staff completed their joint evaluation of approximately 20,000 old docket files (see *1980 NRC Annual Report*, p. 106). Fewer than 50 sites were identified for further evaluation.

As described in the 1980 report, radiological surveys continued at the unlicensed West Lake landfill in St. Louis County, Mo., and a section of Reed-Keppler Park in West Chicago, Ill. The West Lake survey was completed in 1981 and a report was being prepared at year's end. The Reed-Keppler survey will be completed in 1982. NRC also awarded a contract to Oak Ridge Associated Universities for radiological surveys at several formerly licensed sites with known or suspected contamination. Surveys at Ballod Associates (formerly Stepan Chemical Co.), Maywood, N.J.; at Velsicol Chemical Co. (formerly Michigan Chemical Co.), St. Louis, Mich.; and at Futura Chemical (formerly Cotter Corp.), St. Louis, Mo. were completed. Also completed was a survey of fourth site, Kress Creek in West Chicago, Ill., that never was licensed, but apparently became contaminated by the run-off of water from the nearby Kerr-McGee plant.

Residual Thorium or Uranium

Some sites contaminated with residual thorium and uranium wastes have relatively large amounts of contaminated soil. However, the concentrations are low enough to justify storing the contaminated soil on-site or disposing of it on privately owned lands, rather than transporting it to licensed disposal sites, which have limited disposal capacities and restrictions on receipt of long-lived wastes.

Because no guidelines exist for the disposal or storage of such thorium and uranium wastes on privately owned lands, the NRC staff published a Branch Technical Position which identifies acceptable options for disposal or on-site storage. It relates the concentration of radionuclides in the wastes to acceptable options ranging from unrestricted use of the property to deed restrictions and limited use, as well as temporary on-site storage pending the availability of a disposal site.



The NRC has identified acceptable options for the disposal of on-site wastes at those plants where residual thorium and uranium have contaminated the soil. The Kerr-McGee thorium plant at West Chicago, Ill., above, is an example.

Fuel Plant License Application Withdrawn

On December 31, 1979, Westinghouse Electric Corporation applied for a special nuclear material license from NRC to authorize the possession and use of low enriched uranium for the purpose of fabricating fuel for light water reactors. The proposed plant was to be located near Prattville, Alabama, and in accordance with 10 CFR Part 51, an environmental impact statement was initiated in connection with the Westinghouse application. However, prior to NRC's issuance of the draft environmental impact statement, Westinghouse decided not to build the facility for "business reasons."

Decommissioning of Certain Fuel Cycle Facilities

Several of the major nuclear materials licensees have announced plans to shut down operations and decontaminate their facilities and grounds so they can be released for unrestricted use. These include the plutonium facilities of Kerr-McGee, Cimarron, Okla; Westinghouse, Cheswick, Pa.; Babcock and Wilcox, Leechburg, Pa.; Exxon Nuclear, Richland, Wa.; and General Electric, Vallecitos, Cal.; as well as the uranium facilities of Texas instruments, Attleboro, Mass.; United Nuclear Corp., Wood River Junction, R.I.; Kerr-McGee, Cimarron, Okla.; and Nuclear Fuel Services U-233 facility in Erwin, Tenn.

Current procedures require that each licensee provide the NRC with a comprehensive radiological survey report after decontamination as proof that any residual contamination is below the level specified for unrestricted use. The NRC then performs an independent survey to verify the licensee's survey findings. If residual contamination exceeds the NRC criteria, the licensee must decontaminate further. If the facility meets the criteria, the staff prepares a report which includes a technical justification for releasing the facilities, equipment and grounds for unrestricted use prior to termination of the license by NRC. The licensee is then informed that the license is terminated and the premises can released for unrestricted use.

Decommissioning of the plutonium facilities involves disposal of transuranic (TRU) wastes from decontamination procedures. Presently, no commercial low-level radioactive waste disposal site will accept TRU waste. This may require licensees to temporarily store these wastes on-site until a disposal site becomes available. Final determinations on these licenses will depend on the resolution of this problem.

United Nuclear Corporation's Uranium Recovery Facility at Wood River Junction, R.I., now being decommissioned, has presented unique problems. Since it was licensed in 1964, it has been extracting high-enriched uranium from scrap materials generated by various U.S. Government agencies and contractors. Some of the material processed was from zero-power

critical experiments containing small quanities of fission products. The liquid waste generated from the uranium processing was stored in plastic-lined lagoons. One such liner developed a leak and some of the liquid percolated through the sandy soil, contaminating an aquifer. Although the contamination was restricted to a small area in the aquifer, and was well below acceptable concentration levels for discharge to unrestricted areas, this particular situation has been the focus of much public concern. Accordingly, a ground monitoring program, required by the license, will continue until the license is terminated.

Radiological Contingency Planning

NRC continued a program to obtain radiological contingency plans from its major fuel cycle and materials licensees as part of the required site emergency preparedness planning. Sixty-three licensees selected under criteria of the program were ordered either to submit radiological contingency planning information or to reduce their possession limits below disignated threshold levels. (The bases for selection are set forth in NUREG-0767, "Criteria for the Selection of Fuel Cycle and Major Materials Licensees needing Radiological Contingency Plans.")

Of licensees receiving orders, about one-half indicated they will reduce their possession limits. The others submitted radiological contingency plans. Reviews will be completed in the spring of 1982. The NRC also initiated a rulemaking proceeding to codify these contingency planning requirements, of the orders and to extend them to cover off-site emergency preparedness planning, and to apply them to other licensees as appropriate. An Advanced Notice of Proposed Rulemaking was published June 3, 1981. A proposed rule is anticipated in early 1982, and a final rule late that year.

SPENT FUEL STORAGE

Nuclear power plant licensees continued to increase capacities of spent fuel storage pools at reactor sites and to ship irradiated fuel from sites with filled pools to others where room is available. Interest also continues in proposals for off-site facilities dedicated to spent fuel storage.

Movements Between Reactors

The evidentiary hearing on the Duke Power Company's application for the transfer of spent fuel from its Oconee Nuclear Station to the McGuire Nuclear Station in North Carolina was completed in 1980 (see *1980 NRC Annual Report*, p. 104). The Atomic Safety and Licensing Board had rejected the application in an October 1980 decision, and both the applicant and the NRC staff elected to appeal this decision. On August 10, 1981, an appeal board reversed the initial decision and authorized the license amendment sought in the application.

Away-from Reactor Storage

The proceeding on General Electric Company's application for renewal of its spent fuel storage license for the Morris Operation (formerly the Midwest Fuel Recovery Plant) at Morris, Ill., continued through 1981 (see *1980 NRC Annual Report*, p. 104). After the promulgation in November 1980 of a new rule (10 CFR Part 72) entitled "Licensing Requirements for the Storage of Spent Fuel in an Independent Spent Fuel Storage Installation"), the Commission directed that the Morris license renewal matter should proceed under that rule. In July 1981, the NRC staff issued its Safety Evaluation Report which was favorable to continued storage of spent fuel at Morris. At the end of the report period, the Illinois Attorney General was the only remaining contestant to a license renewal, but no evidentiary hearing on the case had yet been scheduled by the licensing board.

Dry Storage of Spent Fuel

Because it may offer a more flexible and economic approach, dry storage of spent nuclear fuel is being considered as an alternative to the water pool storage used now, and a method called "dry cask storage" appears to be emerging as the leading possibility. This is due, in part, to Department of Energy research on a steel-lined concrete silo and to the development in the Federal Republic of Germany of a new transportation and storage cask made of cast modular iron. Letters of intent have been received from Gesellschaft Fuer Nuklear Service, gmbH (GNS) and Ridihalgh, Eggers and Associates to submit topical reports on dry cask storage designs for safety review during calendar year 1981. The GNS topical report is expected in January 1982. A copy of this report will be made available for public examination in the NRC Public Document Room at 1717 H Street, N.W., Washington, D.C.

OTHER FUEL CYCLE ACTIVITIES

West Valley, N.Y., Facility

The West Valley Demonstration Act authorizing the Department of Energy (DOE) to undertake high-level waste solidification at the West Valley, N.Y., site was signed into law in October 1980 (see *1980 NRC Annual Report*, p. 106). Ten months later, in August

The worker at left is using instruments to probe for radioactivity during open pit mining for uranium. Sandstone deposits break up into sand during the mining process and small amounts of radon-222 escape into the atmosphere. NRC sponsors research to measure the quantity of radon released from these kinds of operations.

1981, the NRC received a joint application from the New York State Energy Research and Development Authority and the DOE to amend the West Valley provisional operating license. The amendment authorizes the transfer of the facility to DOE for conduct of the high-level radioactive waste demonstration project. At the completion of the project, the facility would revert to the licensees. Under an NRC-DOE memorandum of understanding signed in September, DOE is responsible for the safe conduct of the project, but the NRC will perform an independent oversight role to assure the health and safety of the public. So far, the staff has reviewed a DOE draft environmental impact statement on alternatives for the management of liquid wastes presently in underground tanks and has participated in a public hearing on that draft.

The staff also completed a series of analyses of the potential effects of severe tornadoes and earthquakes on the reprocessing plant and found that no undue risks would be posed. These results will be published as NUREG-0581. Meanwhile, scheduling difficulties have delayed implementation of an NRC project to inspect and evaluate the condition of the high-level waste storage system at the site. The project covers the design and procurement of equipment and development of procedures for the conduct of photographic and ultrasonic examinations of portions of tank walls, now scheduled for 1982. (see also Chapter 6, "Waste Management.")

Safety Analyses of Plutonium Plants Completed

During 1981, the NRC staff completed safety analyses of the six plutonium processing and fuel fabrication plants licensed to possess and process five or more kilograms of unencapsulated plutonium (see *1980 NRC Annual Report*, p. 105) The final three analyses, completed during the year, cover the General Electric facility at the Vallecitos Nuclear Center in Pleasanton, Cal. NUREG-0866); the Atomic International Nuclear Fuels Development Laboratory near Santa Susana, Cal. (NUREG-0867); and the Battelle Memorial Institute facility at West Jefferson, Ohio. (The summary will be published in early 1982.)

Appeal Board Hearing on Radon

Radon-222, a naturally radioactive gas, is formed from the decay of uranium. Although it has a half-life of only 3.8 days, it accumulates in uranium ores in the ground and is released in mining operations. Additional radon forms during milling, then continues to be formed in mill tailing waste piles. Intervenors in reactor licensing cases have contended that the long-term health effects of radon-222 might be severe enough to outweigh the benefits of nuclear power.

An Appeal Board hearing was held in February 1980 to resolve the radon issue as it related to several reactor licensing cases. In May 1981, in a partial decision, the Board found that staff estimates of radon releases in uranium mining and milling were accurate and were fairly apportioned to the nuclear reactors for which the mined uranium would provide fuel (13 NRC 487 (1981) ALAB-640). The Appeal Board also said that intervenors would be given an opportunity to present additional evidence before the Board made a final decision. In September 1981, the Board noted that additional hearings would be held if intervenors could show that expert opinion existed which differed

from the earlier findings that radon from mining and milling causes a background radiation increase so small that it has a neglible impact on the health effects (14 NRC 632 (1981) ALAB-654). A 60-day period was provided to allow submission of such information.

Low-Level Waste Contingency Storage

Recent cutbacks in disposal capacity for low-level radioactive waste and continuing uncertaintly about the future of some waste disposal sites resulted in a variety of measures by utilities. These include planning for on-site contingency storage of low-level wastes, ranging from the use of idle space in existing buildings to the construction of special structures. The planned time periods for contingency storage run from a few months to four or five years. NRC regulations permit some changes in facilities or procedures without prior Commission approval if no change of technical specifications or unreviewed safety questions are involved, and some utilities used those provisions. For other utilities, operating license amendments or separate licenses are needed for on-site contingency storage. The latter include the Tennessee Valley Authority (TVA) for its Browns Ferry and Sequoyah Nuclear Plants, and the Pennsylvania Power and Light Company for its Susquehanna Steam Electric Station. At year-end the NRC staff was conducting environmental and safety reviews of these proposals.

Byproduct Material Licensing

Reactor-produced radionuclides are used extensively throughout the United States for civilian and military industrial applications, basic and applied research, the manufacture of consumer products, civil defense activities, academic studies, and medical diagnosis, treatment and research. The NRC's evaluation and licensing program is designed to assure that these activities will not endanger public health and safety.

The NRC administers approximately 9000 material licenses. The agency took more than 5000 licensing actions during fiscal year 1981. Of these, 650 were on applications for new licenses, 3700 concerned license amendments, and 850 were license renewals. In addition to the NRC licenses, some 12000 licenses are administered by 26 states which have authority over certain materials under regulatory agreements with the NRC. (see Chapter 8).

As of January 28, 1981, licensees were required to obtain specific NRC approval before burying low-level radioactive waste. Previously, they had been allowed to bury small quantities of their own radioactive waste without such approval. The NRC staff predicted that relatively few licensees would be affected by the new rule, and, to date, less than ten have requested this authorization.

In late 1980, a two-year Regional Licensing Pilot Program in Region III (Glen Ellyn, Ill.) was completed, and in January 1981, another licensing office was established in Region I (King of Prussia, Pa.).

INDUSTRIAL LICENSING

Industrial Radiography

Radiography, the process of imaging with radiation for the nondestructive testing of materials, is widely used in both industrial applications and basic research. Radiation passes through the object to be examined and the object's image is recorded on film. Encapsulated gamma radiation sources are used in determining structural defects in metallic castings and welds, and encapsulated neutron sources are used to produce radiographs of hydrogenous materials. Occasionally, beta emitters are used to examine thin films and low density materials. Industrial radiography involving large gamma radiation sources is, potentially, one of the more dangerous activities regulated by the NRC. In 1981, NRC regulated about 350 radiography licensees. Some 272 licensing actions on, radiography including 34 new licenses, 152 amendments, and 86 renewals, were completed during the year.

Gauging Devices

Approximately 1200 material licensing actions completed by the NRC in 1981 dealt with portable and fixed gauging devices, such as thickness gauges, level gauges and moisture density gauges. A simple thickness gauge consists of a radiation detector with a radiation level indicator. The object being measured passes between the radiation source and the detector, and the amount of radiation passing through the object and reaching the detector shows the density and thickness of the object on the indicator. When only one surface of an object is available for measurement, gauges utilizing backscatter and x-ray fluorescence may be used. Measurements made with radioisotopes gauges include the thickness of paper products, fluid levels in oil and chemical tanks, moisture and density of soils and materials at construction sites, and in manufactured items such as satellites and missiles. These devices are designed to present minimal radiation hazards during their use, and little workers training and experience are required to use them.

Gas Chromatography

The second largest number of licenses issued were for low-energy beta sources used in gas chromatography devices. Gas chromatography is one of the most useful methods available for identifying the constituent elements of substances. It is used to determine the components of complex mixtures such as petroleum products, smog and cigarette smoke, and in biological and medical research to identify the components of complex proteins and enzymes.

Well Logging

Nuclear techniques are used extensively in exploration for oil, gas, coal, and mineral deposits. Few scientific endeavors have undergone more constant and sweeping change than the well logging industry. What was originally little more than a correlation tool for the geologist has become an indispensable data source for the log analyst, the geologist, the engineer, the geophysicist, and the well drilling contractor. The "log" is a continuous record of the value of physical parameters as a function of depth in a drilled hole. An instrument package (the probe or sonde) is lowered to the bottom of a drilled hole at the end of a cable which transmits power to the sonde and data signals to the surface. In the case of nuclear logs, the sonde may contain a sealed gamma or neutron source, or detection instruments to trace the positions of radioactive tracer materials previously placed in the well in drilling fluid, cement, etc.

NRC and the Agreement States license many private firms to possess radiation sources for oil and gas well logging, as well as mineral well logging operations in thousands of new and previously drilled wells. About 82 of these actions were completed in 1981.

Consumer Products

Consumer products containing small quantities of radioactive materials which were evaluated and authorized for manufacture and distribution by the NRC in 1981 included backlit tritium watches, static eliminators, smoke detectors, false teeth, tritium exit signs and ceramic tableware and tile. The NRC authorizes the distribution of such products if careful evaluation indicates they will present a minimal risk to public health and safety. About ten new licenses were issued during fiscal year 1981 for distribution of consumer products.

In October 1980 the NRC issued a report, "Environmental Assessment of Consumer Products Containing Radioactive Material," (NUREG/CR-1775) which assessed the impact of certain consumer products on the environment. The report covered ionization chamber smoke detectors, radioluminous timepieces, static eliminators, dental products, and incandescent gas mantles, among other products, with each product evaluated independently. The report concluded that NRC policy is based on sound radiological health principles, and that exposures from products approved for distribution do not exceed small fractions of the dose limits recommended for all sources. An NRC-contractor study completed in April 1981, assessed current NRC policy and criteria for approving consumer products containing radioactive material, and recommended that NRC regulations be made consistent with existing safety criteria, labeling and reporting requirements. At year's end the staff was reviewing its consumer products policy and regulations.

MEDICAL AND ACADEMIC LICENSING

The NRC issues licenses to hospitals and physicians for the use of radioactive materials in diagnosing and treating patients. Academic institutions use radioactive materials for education and biomedical research. The facilities, personnel, program controls and equipment described in each application are reviewed to ensure the safety of the public, patients and occupationally exposed workers. During 1981, in its ongoing program to reduce the regulatory burden on its licensees, NRC has taken several actions designed to assist both medical and academic licensees without affecting the health and safety of individuals.

Nuclear Medicine

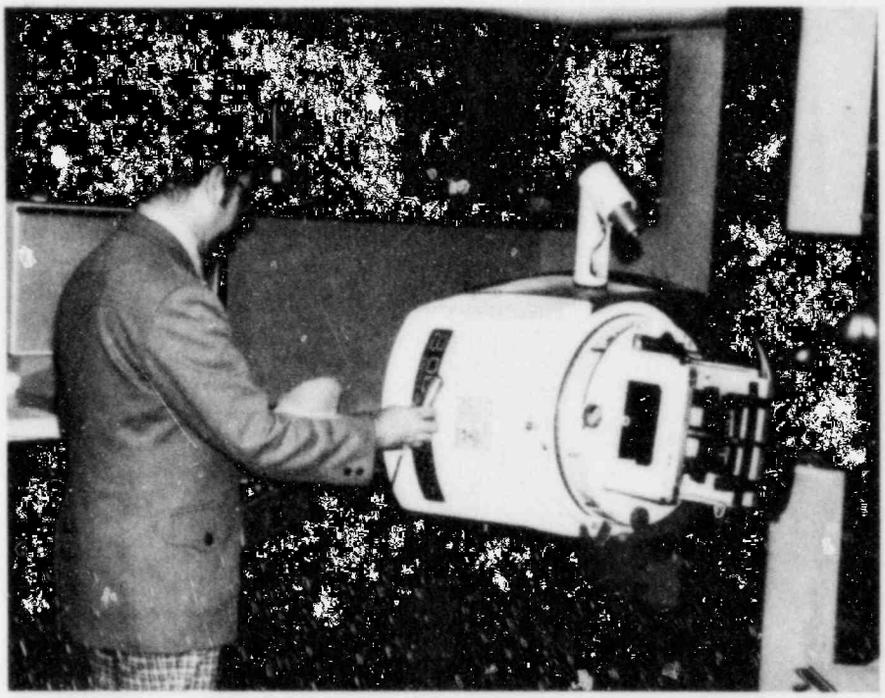
Nuclear medicine involves both diagnostic procedures and therapeutic treatment of patients.

Diagnostic procedures include both *in vitro* tests (the addition of radioactive materials to laboratory samples taken from patients) and *in vivo* tests (direct administration of radioactive drugs to patients).

Therapeutic treatment procedures include the use of liquid radioactive drugs to treat certain medical conditions such as hyperthyroidism. In the radiation therapy mode called brachytheraphy, encapsulated or sealed radiation sources are placed directly on or in the patient's body to treat cancer. Teletherapy treats patients at a distance with radiation from a sealed radioactive source, usually cobalt-60.

Educational Uses

NRC issues licenses to academic institutions for educational purposes. The licensed activities include receipt of radioactive material, classroom demonstrations by qualified instructors, supervised laboratory



An NRC inspector measures the external radiation levels on a teletherapy device at an Illinois hospital. Use of nuclear materials by medical laboratories, hospitals and academic institutions is licensed by the NRC.

research by students, the use of plutonium-beryllium neutron sources, and the use of source material in subcritical assemblies.

Reducing Low-Level Wastes

The shortfall in commercial low-level radioactive waste disposal capacity, combined with increased costs for commercial disposal, is reported to have curtailed some research and development uses of radioisotopes at medical and academic institutions. NRC has taken actions to enable these licensees to reduce the volume of radioactive waste which must be sent to commercial burial sites.

One new regulation permits five curies per year of tritium and one curie per year of carbon-14 to be released into sewer systems, in addition to the one curie per year gross that was allowed previously. Another allows scintillation fluids and animal carcasses containing less than 0.05 microcuries per gram of tritium or or carbon-14 to be disposed of as non-radioactive waste, and, since they are estimated to constitute 52 percent of the waste now going to commercial low-level waste burial grounds, institutions may realize savings of as much as $13 million in packaging and disposal costs alone.

A new license condition is being written into medical and academic licenses, as they are amended, to allow radioactive material with half-life less than 65 days to be held for a minimum of 10 half-lives and monitored to ensure that its radioactivity cannot be distinguished from background radioactivity before disposal as ordinary trash.

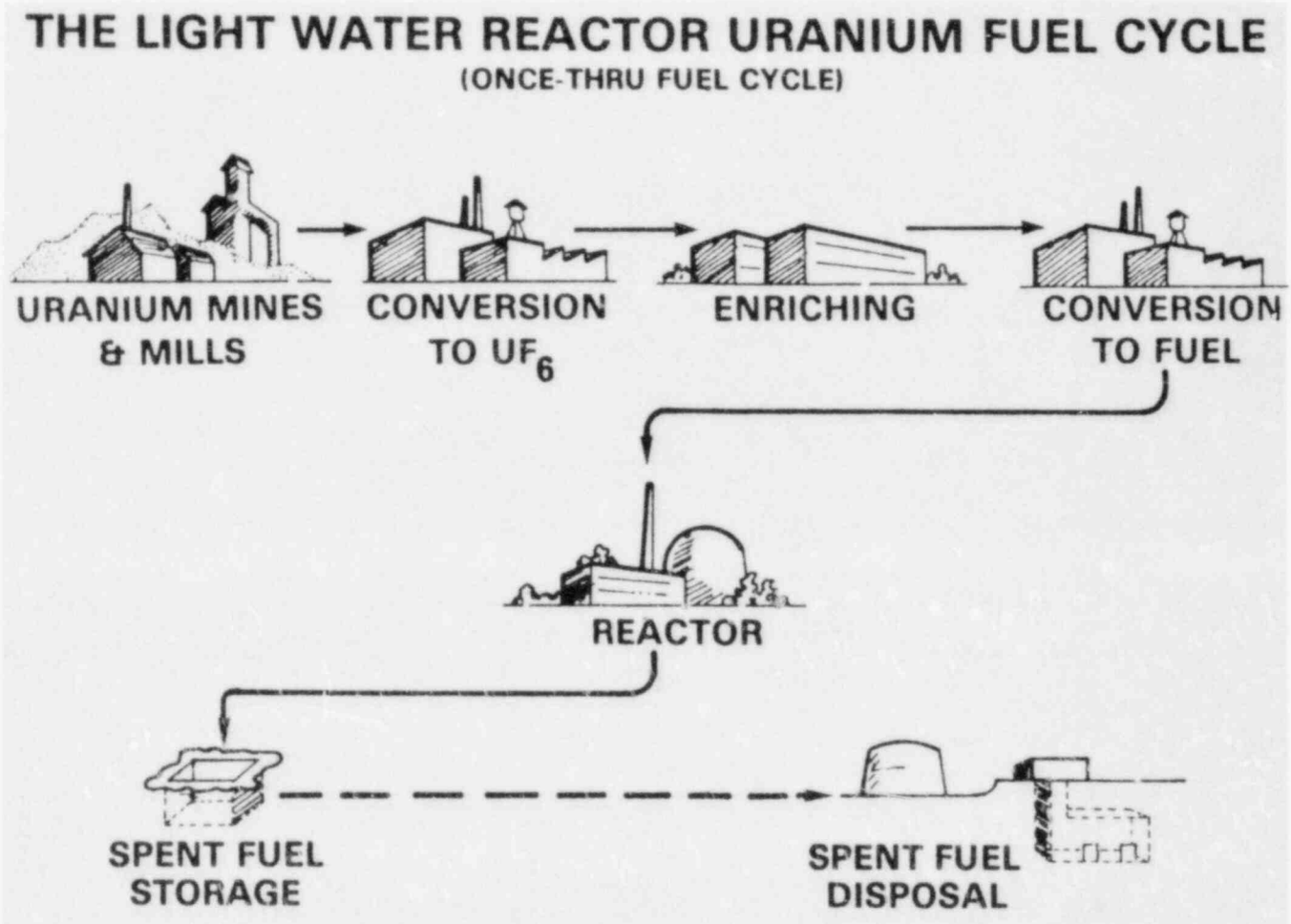
Treatment with Sealed Sources

Sealed sources that produce high radiation fields are used in teletherapy to treat cancer. A teletherapy unit provides shielding and collimation to direct the radiation to the affected part of the patient's body. Much smaller sealed sources are implanted directly into the tumor area (brachytherapy), which limits the radiation field so as to spare healthy tissue from radiation damage. NRC licenses the use of these sources as it licenses the nuclear medicine procedures.

Advisory Committee on The Medical Uses of Isotopes

A meeting of NRC's Advisory Committee on the Medical Uses of Isotopes (ACMUI) was held in Chicago on August 31, 1981. The ACMUI is an 11-member panel of physicians and consultants retained by NRC to provide expert advice concerning regulation of the medical uses of byproduct material. At this meeting, the Committee:

- Approved the publication of new training and experience criteria for physicians who wish to be named in NRC licenses that authorize medical uses.
- Reviewed and approved several medical specialty board certification programs as providing acceptable evidence of training and experience. This will simplify the licensing process for many applicants.



The NRC regulates five of the seven steps in the uranium fuel cycle. The exceptions are the mining and the enrichment of the uranium. Conversion of uranium into a chemical form suitable for enrichment; conversion of enriched uranium into fuel elements for use in reactors; and the recovery, storage and disposal of spent fuel are regulated by the NRC Office of Nuclear Materials Safety and Safeguards.

- Received a staff summary of reports involving misadministration of radiation or radiopharmaceuticals to patients, and
- Provided comments on staff plans to simplify the medical licensing process and to allow physicians greater flexibility in choosing the route of administration for diagnostic radioactive drugs.

Preprinted Renewal Applications

The NRC is streamlining license renewal applications for certain medical licensees, using preprinted forms and sample procedures from the medical licensing guide. If successful, the method may be expanded to include certain industrial licenses, and the preprinted applications may eventually be prepared by computer. As part of a trial program, the first preprinted applications were mailed on July 15, 1981. Participation is voluntary.

Sealed Source and Device Design Evaluation

The NRC licenses the manufacture, distribution and use of sealed sources and devices containing radioactive material after verifying their radiological safety. The staff reviews each source as to design, manufacture, testing and quality control, based on information obtained from the license applicant or the manufacturer. To avoid duplication and delay in processing license applications, NRC encourages manufactures to register each source and device design. After completing the health and safety review, NRC verifies that the source or device is acceptable for licensing. License applicants can refer to a simple model number instead of submitting design information and test data at each stage of the licensing process. During 1981, NRC registered 108 new source and device designs.

In a related activity, the NRC contracted for a study of the procedures for documenting and recover-

ing registration information on sealed source designs. The resulting contractor reports recommended an upgraded manual control system for backup data and an automated system for recovery of registration information needed daily. Development of these programs is expected during 1982. A companion effort addresses procedures which will improve the compatibility of NRC and Agreement State reviews.

Transportation Of Radioactive Materials

The Federal Government regulates the transportation of radioactive materials primarily through the NRC and the Department of Transportation (DOT). State governments also regulate such transportation under certain circumstances. NRC and DOT partition their regulatory responsibilities in a Memorandom of Understanding. For international shipments, DOT is the designated U.S. authority for implementing the International Atomic Energy Agency (IAEA) standards, and NRC advises DOT on technical matters.

Packaging Standards and Actions

Quality Assurance Guides. NRC issued for public comment two draft regulatory guides on quality assurance programs for packaging used in the transport of radioactive material. One on packaging for spent fuel, high-level waste, and plutonium was issued in March. The other, dealing with certain forms of radioactive material, was issued in June.

Use of Spent Fuel Cask Suspended. On at least seven occasions between August 1980 and July 1981, an irradiated fuel cask built to a Model No. NFS-4 design displayed surface contamination exceeding DOT regulations. In July 1981, the NRC suspended use of the cask until users provide reasonable assurance that excessive contamination will not occur in future shipments. (See also *NRC 198 Annual Report*, p. 107.)

Second Air Package Certified. In September 1981, the NRC certified a second design for a plutonium air transport package. The first was certified in 1978 (see *NRC 1978 Annual Report*, p. 81). The new package (Model PAT-2) will be used to transport safeguards samples containing gram quantities of plutonium from various locations around the world to the IAEA laboratory in Austria. It can resist severe accidents, including a crash of a high-speed jet aircraft, and can withstand crushing, puncturing, slashing, severe fire, and deep underwater immersion.

ACRS Review. In response to an NRC request, the Advisory Committee on Reactor Safeguard's Subcommittee on Transportation of Radioactive Materials met with the staff in March, May and October 1981 to review staff procedures for certifying package designs. The review will be completed in 1982.

IAEA Regulations. NRC continued to try to resolve comments on a revision of its transportation regulations to make them compatible with IAEA standards (see *NRC 1980 Annual Report*, p. 109), an effort which entails consideration of anticipated changes in IAEA regulations scheduled to be issued in 1983. Members of the NRC staff participated in March and October 1981 IAEA meetings on the development of the 1983 IAEA rules as part of this project.

Inspection of Shipments

Since late 1979, the NRC has subjected its licensees to DOT regulations governing the shipment of radioactive materials (see *NRC 1980 Annual Report*, p. 107). The number of enforcement cases due to violations of regulatory requirements decreased from 1980 to 1981 as the result of improved shipping practices and NRC enforcement policy, which includes NRC recognition of State permit suspensions of waste shippers' burial permits and civil penalties as applicable enforcement actions. (See also Chapter 7.)

Surveillance Program Shift. The joint NRC/DOT State transportation surveillance program described in

NRC inspects each import or export shipment of special nuclear material at its point of entry or departure. Above NRC inspectors and transport security personnel attend to a transfer of a plutonium shipment from a cargo plane to a truck which will take the material to a U.S. facility.

Chapter 8 saw a shift in emphasis from data collection to inspection and enforcement emphasis in 1981, with the DOT administering and funding the program.

Pre-Shipment Notification

In December 1980 the NRC published a proposed rule providing for advance notic to governors of States through which spent reactor fuel or radioactive wastes posing potentially significant hazards is to be transported. In December 1981, a final rule was approved for publication in the *Federal Register.* Of the estimated 400,000 packages of radioactive waste and spent fuel shipped each year, only a few hundred are deemed to pose a potentially significant hazard and, thus, to require advance notice to the States.

Emergency Response Planning

DOT, FEMA and representatives of industry and State governments continued the development of a model emergency response planning program for use by carriers and shippers in responding to transportation-related radiological emergencies.

Work toward development of a data base and an analysis program for transportation-related accidents also continued through 1981. Analysis of the statistical distribution, health effects, and the relationship to emergency response is underway, and a final report on the project is targeted for 1982.

The NRC continues to participate with FEMA, DOT, DOE, EPA and FDA to develop emergency response guidance for State and local governments. NRC staff assisted DOT in developing a training package, "Handling Radioactive Materials Transportation Emergencies," which has been furnished to each NRC regional office for training purposes. (For a discussion of NRC emergency preparedness activities associated with reactor regulation, see Chapter 7. Transportation risks and research are discussed in Chapter 10.)

Environmental Statements

Several generic environmental statements have been prepared to support NRC regulations on the transportation of radioactive materials, and as 1981 closed, work was under way to update and improve them. The documents cover transportation to and from reactors (WASH-1238), transportation through the fuel cycle (WASH-1248 and NUREG-0116), and the transportation of radioactive materials in the United States in 1975 (NUREG-0170). Another study will attempt to develop a system for collecting data on significant transportation incidents involving radioactive materials as an extension of the system of recording incident frequency statistics.

5 Domestic Safeguards

Section 209 of the Energy Reorganization Act of 1974, as amended, calls for NRC to include in each Annual Report to Congress a chapter describing the status of NRC's domestic safeguards program for the protection of certain nuclear materials and facilities.

SCOPE OF NRC PROGRAMS

The Atomic Energy Act of 1954 and the Energy Reorganization Act of 1974 direct the NRC to regulate the safeguards provided by certain nuclear facilities and activities to assure protection of the public health and safety and the national defense and security. To accomplish this, NRC sees that measures are taken to deter, prevent and respond to the unauthorized possession or use of special nuclear material, and to the sabotage of nuclear facilities. In general, safeguards for fuel cycle facilities emphasize protection against theft or diversion of special nuclear material (SNM), while those for powers reactor stress protection against radiological sabotage.

NRC safeguards regulations during 1981 were applied to licenses for 22 fuel cycle facilities and 2 spent fuel storage facilities, selected transportation activities, 72 power reactors and 71 non-power reactors described in the 1980 Annual Report. The transportation activities involved about 73 shipments of spent fuel and 41 shipments of strategic special nuclear material (SSNM) during the year.

NRC/IAEA Interaction. On December 24, 1980, the Commission published regulations necessary to implement the US/IAEA Safeguards Agreement. In February 1981, the IAEA selected the Trojan reactor in Oregon, the Rancho Seco reactor in California and the Exxon fuel fabrication plant in Washington as the first facilities for the application of safeguards under the Agreement. Routine reporting of accounting data by NRC was initiated on March 31, 1981 for all three facilities. The first IAEA inspections were conducted at EXXON in March 1981 and at the two power reactors in May 1981.

STATUS OF SAFEGUARDS IN 1981

Fuel Cycle Facilities

Of the 24 licensed facilities, six had actual holdings of formula quantities of strategic special nuclear material (SSNM) at the beginning of the year, which obligated them to meet the requirements of the revised Physical Protection Rule. Two of these six facilities have either reduced, or are in the process of reducing, holdings to less than formula quantities requiring a lower level of protection. Appropriate plans have been submitted delineating protection programs consistent with the revised posture of these facilities. Another facility temporarily discontinued operations and assumed a "storage facility" configuration. A protection plan was submitted and approved for this facility.

Review of the physical protection plans for production activities at five facilities was essentially completed, with final approval for four of these expected within the calendar year. A plan for the facility which is presently in a storage mode is expected in the Spring of 1982, prior to resumption of production there.

Fuel cycle licensees possessing, using, or transporting less than formula quantities of special nuclear material (Category II and III) are subject to the requirements of 10 CFR 73.67, "Licensee Fixed Site and In-Transit Requirements for Physical Protection of Special Nuclear Material of Moderate and Low Strategic Significance." During 1981, 14 of 24 fixed-site physical protection plans and 10 of 20 transportation plans were reviewed and approved. (Note: Category II material includes between 1 kg and 5 kg of highly enriched uranium, between 500 grams and 2 kg of plutonium, and 10 kg or more of uranium enriched between 10 percent and 20 percent. Category III material includes between 15 grams and 1 kg of

highly enriched uranium, between 15 grams and 500 grams of plutonium, less than 10 kg of uranium enriched between 10 percent and 20 percent, and 10 kg or more of uranium enriched to less than 10 percent.)

In addition to physical protection, fuel cycle facilities licensed to possess more than one effective kilogram of special nuclear material are required to maintain rigid material control and accounting programs. As of September 30, 1981, there were 22 such facilities, and the types and levels of activity at these facilities varied from active decommissioning to full scale production. Licensing activity for material control and accounting centered around review and approval of license amendments and decommissioning plans and the review of proposed material control measures to support revised physical protection rules.

The Nuclear Fuel Services' (NFS) highly enriched uranium facility at Erwin, Tennessee, resumed operations in January 1980 following a three-month shutdown to investigate and reconcile inventory differences. Nine physical inventories have been conducted between January 1980 and August 31, 1981, and the inventory differences for all nine have fallen within acceptable limits. Finally, action on the Natural Resources Defense Council's hearing request, cited in the 1980 Annual Report, is pending the results of proceedings concerning the type of hearing to be held.

Inspection and Enforcement at Fuel Cycle Facilities. During fiscal year 1981, NRC conducted 212 hours of on-site inspection at two facilities authorized to possess formula quantities of unirradiated SSNM in an unsealed form. The inspections revealed no items of noncompliance with safeguards requirements. (See table 1 for a summary of inspection activity at fuel cycle facilities.) A program designed to aid in determining the significance of one or more noncompliances on the effectiveness of the safeguards system has been implemented.

Transportation

Spent Fuel Shipments. In July 1980, the NRC implemented several important changes in requirements for the protection of licensed spent fuel shipments (See *1980 NRC Annual Report*, pp. 117-118.) The staff is continuing to review a Department of Transportation rule on routing of radioactive material shipments to determine the applicability of DOT's routine criteria to spent fuel.

During 1981, NRC approved 25 routes over which 75 spent fuel shipments were made. Except for several short delays caused by mechanical problems corrected at the scene or nearest truck stop, no incidents or accidents occurred which involved these shipments.

In NRC's fiscal 1981 appropriation legislation, Congress emphasized development of improved regulatory requirements for safeguarding the transportation of spent fuel. As part of its response, NRC conducted special reviews of such safeguards. During the reporting period, two spent fuel shipments were reviewed. These reviews included field examinations of the hardware and procedures used in conducting actual shipments. Possible regulatory improvements were identified and are undergoing NRC review.

Prohibitions Against Spent Fuel Shipments. Four jurisdictions (Illinois, Michigan, New York City and the Ogdensburg, N.Y. Bridge Authority) have passed laws or written rules which effectively stopped shipments of spent fuel within those jurisdictions.

Two of these actions interrupted international shipments. One State legislature passed a law prohibiting the importation of spent fuel into the State for storage unless it originated in a State with which it had a reciprocal agreement. The governor vetoed the law, but the veto was overridden by one vote. Subsequently, a U.S. District Court Judge in Chicago ruled that the law was unconstitutional.

SSNM Shipments. Three export shipments of formula quantities of SSNM (Category I nuclear materials) were made during the report period.

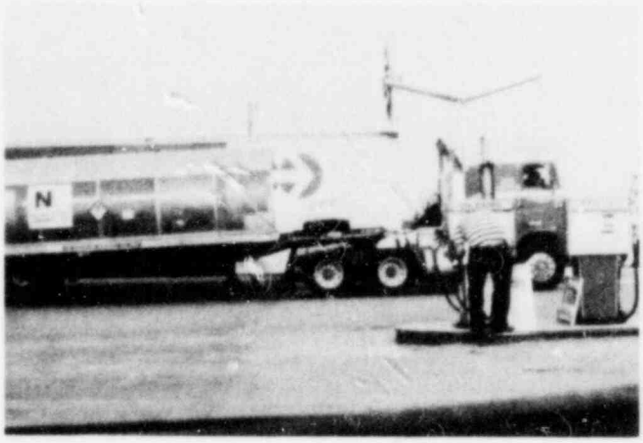
Requirements for more stringent security measures to protect Category I materials shipments (10 CFR Part 73.25, "Performance Capabilities for Physical Protection of Strategic Special Nuclear Material in Transit"; and 10 CFR 73.26, "Transportation Physical Protection Systems, Subsystems, Components and Procedures") became effective on March 25, 1980. These requirements, which were to be fully implemented on March 25, 1981, contained a provision stating that significant physical modification of major equipment could extend implementation to late September 1981. Accoringly, no shipments were made during the reporting period which would have required armored escort vehicles. The primary carrier involved in the transport of Category I materials has indicated that an alternative to using two armored escort vehicles will be submitted for consideration. Two companies have submitted plans which have been approved.

Shipment Route Surveys. In fiscal year 1981, NRC safeguards teams continued to conduct field surveys of transportation routes proposed for shipment of spent nuclear fuel or significant amounts of

Table 1. Summary of Safeguards Inspection Visits—FY 1981

	Number of Licensees Inspected	*Number of Inspection Visits*	*Percent of Visits That Were Unannounced*	*Percent of Visits Resulting in Findings of Noncompliance*	*Manhours of Inspection Effort*	*Number of Noncompliance*
FUEL FACILITIES						
Strategic (Formula Quantity)	13	97	61	21	6,592	37
Nonstrategic (Less than Formula Quantity)	5	22	77	27	1,329	11
TOTAL	18	119	64	22	7,921	48
REACTORS						
Power						
Group 2	7	13	100	23	665	8
Group 4	78	216	82	47	8,576	230
TOTAL	85	229	83	45	9,241	238
Nonpower						
Group 2	13	14	100	7	230	2
Group 5	9	9	100	0	74	0
TOTAL	22	23	100	4	304	2
REACTOR TOTAL	107	252	84	42	9,545	240
SHIPMENTS						
Formula Quantity	2	2	0	0	212	0
OTHER	17	43	79	9	1,220	7
GRAND TOTAL	144	416	78	33	18,898	295

[1]Based on information of 11-02-81.



A truck carrying spent reactor fuel stops for servicing enroute to a laboratory where the spent fuel will be analyzed. At right, the escort maintains continuous surveillance from within the cab of the escort vehicle.

SSNM. During these surveys the teams worked with local law enforcement agencies to increase their awareness and knowledge of the shipments and to identify local law enforcement contacts who can be called upon for assistance, if needed. As a by-product of the NRC staff surveys, licensees transporting nuclear materials also receive this information.

During the fiscal year, NRC teams worked 23 routes through 24 States for shipment of SSNM and spent nuclear fuel. The teams collected data, traveled approximately 6,000 route miles, and consulted some 160 local and State law enforcement agency representatives along the routes. The NRC staff continued to distribute the brochure entitled "Information Package on Spent Nuclear Fuel Shipments for Law Enforcement Agencies" to help familiarize law enforcement officials with details concerning nuclear shipments.

Transport Inspection and Enforcement. In fiscal year 1981, the NRC continued to determine the adequacy of transportation safeguards both by evaluating physical protection plans for material in transit and by inspecting selected shipments. All domestic shipments and the domestic segements of import and export shipments of formula quantities of SSNM were inspected. Shipments were inspected at the point of origin, in transit, during intermodal transfers, during temporary storage and at the final destination. No items of non-compliance were noted. (See Table 1 for a summary of transportation inspection activity.)

Reactor Safeguards

Power Reactors. No major changes were made in the requirements for physical security at power reactors during fiscal year 1981; however, the Commission is considering a series of measures designed to provide additional assurance against acts of sabotage by people working inside facilities. One is a proposal for determining the trustworthiness of personnel authorized entry to nuclear power plants.

Accelerated reviews were initiated for processing physical security plans received from firms applying for licenses to operate power reactors. Six of these plans were approved during 1981. Action has been virtually completed to discontinue the temporary measures used to compensate for delays in installing and operating specific items of security equipment at facilities.

In March 1981, the NRC began a special effort to reduce the backlog of power reactor operating license approvals caused by safeguards reviews. This effort included the temporary reassignment of nine staff members to the review of security plan modifications for operating reactors and new security plans for reactors coming on line. About one staff year was devoted to this effort. Through this and other efforts the NRC ensured that no new reactor operating licenses were delayed by safeguards reviews.

The NRC staff further refined techniques and plans for a program to review the effectiveness of safeguards regulations at a representative sample of operating power reactors. Efforts during the report period included two field tests at an operating reactor of the detailed assessment methodology. A variant of this methodology also was employed to assist in reviewing the Beaver Valley Nuclear Power Station's proposed safeguards program modifications after a June 6, 1981, valve mispositioning incident. Temporary reassignment of staff to reduce the reactor safeguards licensing backlog caused a reduction in the effort originally planned to develop this program.

Non-Power Reactors. All licensees of non-power reactors have implemented the general physical security requirements regulations relating to physical pro-

tection of plants and materials (10 CFR Part 73.40(a)).

Nineteen of 36 plans submitted by non-power reactor licensees in response to 10 CFR 73.67 for the protection of unirradiated special nuclear material at their facilities have been approved. All remaining plans are scheduled for review during fiscal year 1982.

Inspection and Enforcement at Reactors. NRC inspection and enforcement activity provides a means for judging the effectiveness of safeguards. In addition, NRC has implemented a program to aid in determining the effect that a noncompliance, or combination of noncompliances, would have on the effectiveness of the physical protection system. The NRC expended 9,241 hours in on-site safeguards inspections at power reactors during Fiscal Year 1981, and these revealed 238 items of noncompliance with safeguards requirements.

Contingency Planning and Threat Assessment. Safeguards contingency plans deal with threats, thefts and sabotage relating to licensed special nuclear materials and nuclear facilities. The NRC has concluded memoranda of understanding with such agencies as the Federal Bureau of Investigation, the Department of Energy, the National Security Agency, the Federal Aviation Administration, and the bureau of Alcohol, Tobacco, and Firearms for information exchange and coordinated response actions. During 1981, the NRC conducted a staff exercise with the FBI to clarify the respective roles and procedures of the two agencies with regard to nuclear safety matters, law enforcement activities and the dissemination of information about a safeguards emergency.

As part of its continuing threat assessment effort, the staff again updated its "Safeguards Summary Event List" (NUREG-0525) in September 1981. This list provides data on nine categories of safeguards-related events involving licensed nuclear materials and facilities. This year's update includes statistical analyses of event data for the first time.

The "Communicated Threat Credibility Project" continues to provide guidance in investigating the credibility of communicated threats and for providing advice to the DOE, the NRC, the FBI and other concerned agencies during an actual or perceived emergency arising from nuclear extortion threats.

In March 1981, the NRC staff published "People-related Problems Affecting Security in the Licensed Nuclear Industry" (NUREG-0768). This report discusses problems in security forces at licensed nuclear power reactors and fuel fabrication facilities, and suggests options to eliminate them or minimize their effect. These options are being reviewed.

SAFEGUARDS REGULATORY ACTIVITIES AND ISSUES

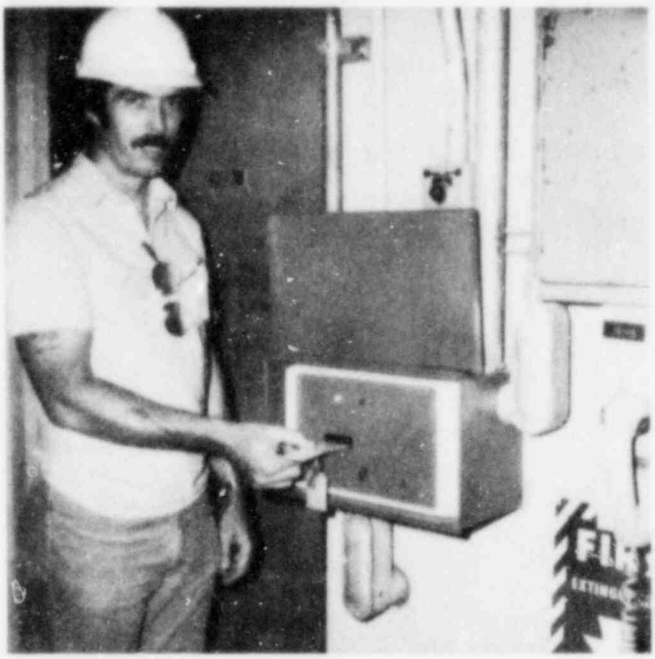
During fiscal year 1981, the NRC developed and adopted several regulations designed to improve nuclear safeguards. The resolution of major safeguards issues is an important NRC activity and will continue beyond 1981.

Material Control and Accounting Reform Amendments

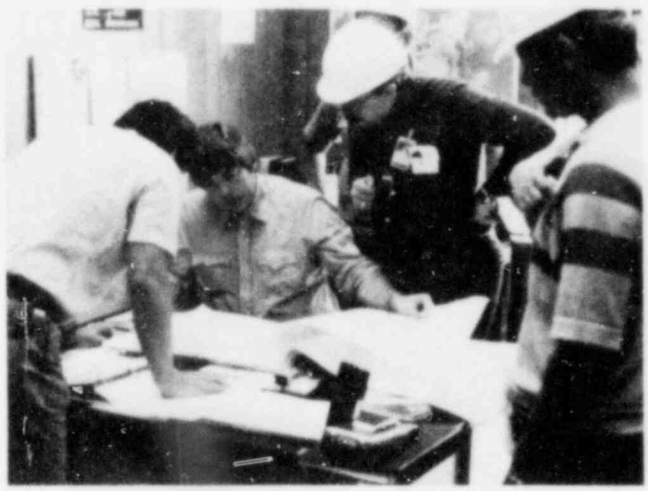
In the past, the NRC has depended on a combination of procedural material controls and physical inventory accounting to detect losses of nuclear material from fuel cycle facilities. The physical inventory process has certain drawbacks, however, that limit its usefulness. Material balances based on physical inventories must generally be performed on a limited frequency because of the time required to complete and reconcile them. Indications of material loss may not, therefore, be available rapidly enough to permit an effective response. In part, because they are available only with limited frequency, the inventory difference statistics generated by the physical inventory process have historically been difficult to interpret and to relate to the possibility of material loss.

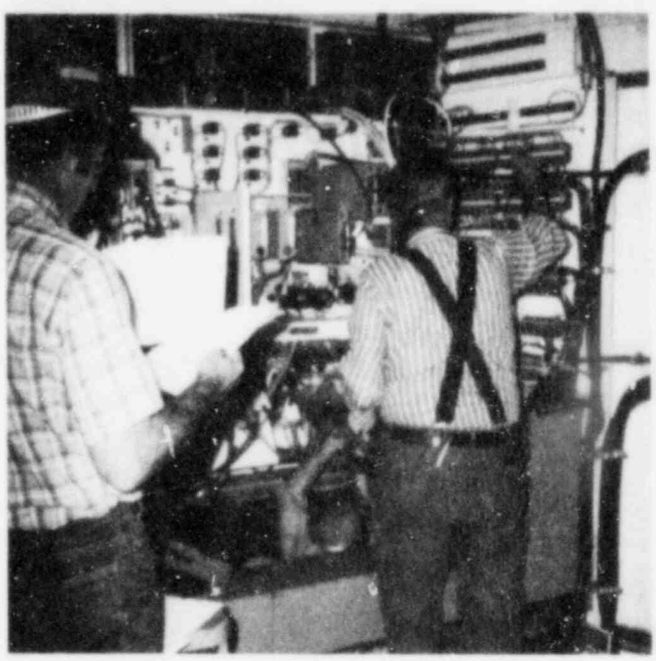
In response to these concerns, the NRC has published an advanced notice of rulemaking that identifies several alternatives for the reform of existing material control and accounting regulations. If adopted, the new regulations, referred to as the MC&A Reform Amendments, would apply to licensed fuel cycle facilities possessing at least five formula kilograms of strategic special nuclear material (SSNM). The goals of the MC&A reform Amendments are to: (1) provide for timely detection of the possible loss of strategic quantities of SSNM, (2) provide for rapid determination of whether an actual loss has occurred, (3) facilitate the recovery of lost material in the event of an actual loss, and (4) provide for long-term assurance that no significant loss has occurred. The reform amendments are structured in terms of quantitative performance goals that licensees would be allowed to satisfy with methods of their choice. Present MC&A regulations will be relaxed in certain respect if the Reform Amendments are implemented.

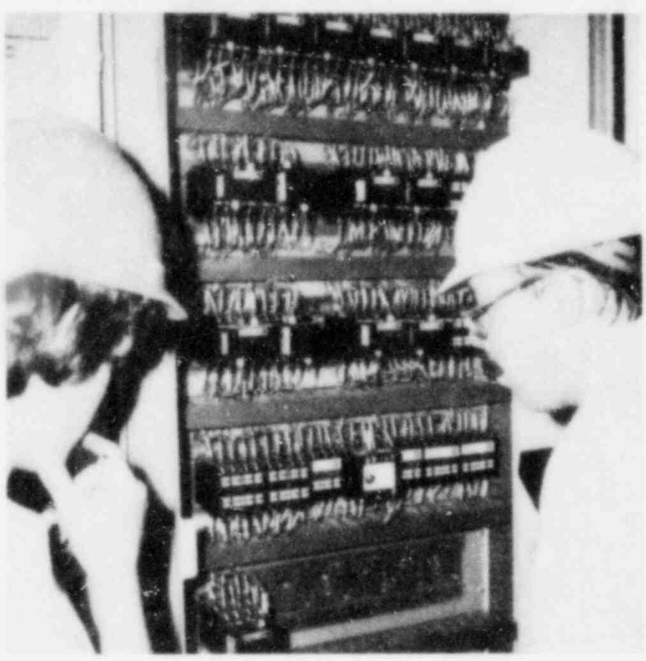
Reform of MC&A Requirements for Low-Enriched Uranium Fuel Cycle Facilities. At present, there is little difference between MC&A regulations applied to fuel cycle facilities handling SSNM and those handling only low enriched uranium (LEU). Steps were taken during the year to identify safeguards requirements that might be unnecessarily stringent as applied to LEU facilities, where the LEU is



Teams of safeguards staff members continued field testing of the regulatory effectiveness of their review method. Pictured here, clockwise from the photo immediately below, are NRC and plant personnel (1) coordinating the team's schedule, (2) examining a safety system relay cabinet, (3) observing maintenance on rear of control room panel, and (4) checking the key card-operated areas control system.







enriched to 5 percent or less in the isotope U-235. The objective of these activities is to develop more cost-effective MC&A regulations for LEU facilities.

Protection of Unclassified Information. A new rule on the protection of unclassified safeguards information became effective in October 1981. The rule defines the types of information to be protected and establishes conditions for access to such information. The objective is to prevent unauthorized disclosure of measures used by licensees to protect certain nuclear facilities and transport activities involving a formula quantity of strategic special nuclear material.

Classified Safeguards Information. NRC's Classified Safeguards Program described in the 1980 Annual Report (see p. 124) provides for the classification of safeguards information held by licensees processing a formula quantity of non-self-protecting Strategic Special Nuclear Material (SSNM). The program deals with the classification of information on material control and accountability, physical protection at fixed sites and in-transit protection of such SSNM, as well as information on vulnerabilities or plans for SSNM protection. Such information is classified only if its disclosure could significantly assist a

malevolent individual or group in acquiring or using SSNM. Specific rules are described in 10 CFR Part 95.

Several licensees are potentially subject to inspection by IAEA representatives under the US/IAEA Safeguards Agreement, and, since the inspectors are foreign nationals not normally authorized access to U.S. Government classified information it has been necessary to revise Part 95 to set the conditions and procedures for their access to such information. NRC efforts in 1981 were largely directed toward refining Part 95 and to the coordination and approval of specific facility security plans of affected licensees for their implementation of the Classified Safeguards Program.

Physical Protection of In-Transit SNM of Moderate Strategic Significance. In June 1981, amendments were proposed to physical protection regulations for SNM of moderate strategic significance to improve capabilities for early detection of attempted theft of this material in transit. The proposed rule requires the use of locked cargo compartments and temporary storage areas, as well as frequent telephone contact during transit periods. Previously, final amendments were published to allow the NRC to order delays in certain Category II shipments to limit the possibility of theft of two such shipments in transit at the same time.

Physical Protection Requirements for Category I Non-Power Reactors. Proposed amendments have been developed to replace interim physical protection requirements for non-power reactor licensees authorized to possess five formula kilograms or more of SSNM. These interim requirements were approved at the time the Physical Protection Upgrade Rule was published to permit the completion of technical studies to help determine whether these non-power facilities should be required to fully implement the upgrade rule. Under the proposed amendments, non-power reactor licensees authorized to possess formula quantities of SSNM would not be required to implement the upgrade rule. However, the amendments would require licensees to protect material in their possession at least at the level required for SNM of moderate strategic significance, regardless of the amount of material possessed having external radiation dose rates in excess of 100 rem/hr at an unshielded distance of three feet. Licensees formerly were exempted from protecting this material on the basis of the deterrent value of the radiation hazard. During periods when they possess five formula kilograms or more of SSNM with dose rates which do not exceed the 100 rem/hr level, licensees will be required to implement additional physical protection measures. When combined with certain reactor and fuel design features, these measures will provide a level of protection comparable to that provided similar material at fuel cycle facilities. Since most licensees can avoid implementing the additional requirements indefinitely by maintaining the radiation dose rate levels of the fuel they possess above the 100 rem/hr level, the proposed amendments are considered less burdensome than requiring licensees to implement the upgrade rule requirements on a continuous basis.

Spent Fuel and High-Level Waste Transportation Safeguards. An interim final rule on the protection of spent fuel shipments became effective in July 1980. The staff is evaluating ongoing research to determine the need for changes in that rule. One research program was completed during 1981. Two others, one conducted by DOE, are expected to be completed by early 1982. The interim rule may be revised or rescinded in 1982, depending on the results of analysis of the research.

The NRC is complying with a new Federal statute which requires promulgation of regulations regarding notification to governors of the transport of spent fuel through a State. This notification will provide the governor with advance information on each spent fuel shipment in his State. (See Chapter 4.) Regarding transient shipments of spent fuel, the NRC continues to analyze the alternatives involved in providing safeguards protection, and possible regulatory changes to implement such protection. A decision on transient shipments of spent fuel also will be keyed to the results of ongoing research.

The NRC is continuing efforts to estimate the potential hazards of sabotage or theft at high-level nuclear waste storage sites and during transportation. A program to analyze safeguards needs for transportation of high-level waste began in 1981. Radioactive dispersal hazards could be similar to those resulting from sabotage of spent fuel. The results of these analyses will enable the staff to determine what safeguards measures, if any, should be required for nuclear waste activities.

Power Reactor Safeguards. The NRC has developed a draft Access Authorization Rule to provide for industry-run personnel screening programs. It will apply to those persons seeking unescorted access to nuclear power reactor vital areas. The Access Authorization Rule covers background investigations, psychological evaluations, and behavioral observations. Implementation of the Access Authorization Rule will include the verification of employment data submitted by security force applicants. The NRC plans to publish the proposed rule in 1982, and a final rule is expected in fiscal year 1983.

The Commission addressed two other issues during the year concerning power reactor physical security safeguards. They related to physical "pat-down" searches at protected area portals and the designation and protection of vital areas. Proposed amendments

have been designed to complement each other and the Access Authorization Rule. The Commission intends to publish these reactor safeguards rule amendments and the Access Authorization Rule concurrently.

SAFEGUARDS RESEARCH, STANDARDS AND TECHNICAL ASSISTANCE

Development of Standards

Clarifying or updated safeguards regulations were developed in 1981 on the following subjects: clearance requirements for access to special nuclear material; and elimination of requirements for certain NRC licensees to submit safeguards design information for the IAEA. Guidance on implementing the regulation that requires the reporting of events affecting physical security, was issued as Regulatory Guide 5.62 in March 1981. A draft regulatory guide describing methods acceptable to the NRC for providing physical protection for scheduled and unscheduled transient shipments was issued for comment in September 1981. Final publication is expected in 1982.

Access Authorization Rule

In response to a 1980 Commission directive, the NRC staff developed studies (NUREG/CR-2075 and 2076) providing the technical basis for a rule and supporting guide for authorizing unescorted access to protected and vital areas of nuclear power reactors. The NUREGS were published in July 1981, and the guide is expected to be published for public comment in 1983.

Special Nuclear Material Accountability

NRC projects on the detection of possible losses of special nuclear material in manufacturing operations focus on small units within a licensed facility and on shortening detection times, and are aimed at providing guidance for licensee implementation. In 1981, the Monsanto Research Corp. Mound Facility in Ohio completed a project called the "Controllable Unit Approach" which will result in a manual for licensee use. The project report is due in 1982. Two other material control and accounting approaches that would meet projected requirements were under contractor development with draft reports received and reviewed by the staff during the year. The first of these focused on meeting requirements without extensive plant redesign, and the second on meeting them assuming that both plant redesign and state-of-the-art measurement technology would be available options. Complementing this effort was a contractor study to provide an acceptable approach for licensee use in predicting their process holdup and thus reduce the uncertainty of reported losses in real time.

Improved Safeguards Measurement Methods

The state-of-the-art of methods used to perform accountability measurements of special nuclear material was advanced by the completion of two comprehensive reference documents. The first, a safeguards measurement handbook (NUREG/CR-2078), describes the capabilities and limitations of measurement methods currently in use. The other, NUREG/CR-0602, documents the principles and application of, as well as the difficulties associated with nondestructive assay measurements. In addition, six regulatory guides dealing with the measurement of plutonium and enriched uranium lodged in pipes, etc., nondestructive assay of special nuclear material in scrap and waste, measurement of plutonium in scrap by spontaneous fission detection, and the nondestructive assay of uranium were revised.

To provide a better understanding of factors that introduce uncertainty in nondestructive assay measurements, the NRC initiated a project in 1981 to identify and quantify major sources of measurement system variability and to develop techniques that can be used to minimize such variability.

Statistical Treatment Of Accountability Data

The rigorous treatment of data associated with the accountability of special nuclear material was the subject of a study that investigated appropriate criteria to be applied in considering bias corrective alternatives (NUREG/CR-2205). The effects that certain simplifying assumptions can have on the calculation of the variance of the inventory differences were published as NUREG/CR-1975.

New methods for conducting and verifying inventories using statistical sampling plans were investigated in 1981. In support of efforts to develop a statistical test powerful enough to detect diversion over several loss scenarios, a bivariate test was evaluated, and the project report will be published in 1982. In addition, several significant projects to improve the statistical treatment of accountability data were started in 1981. They include a three-year effort to update and improve currently used standards for the treatment of accounting data, and a study addressing cumulative shipper/receiver differences which will provide guidance on problems involved in correspondent shipper/receiver accounts.

Babcock & Wilcox's Naval Nuclear Fuel Division in Lynchburg, Va., is one of 19 fuel cycle facilities authorized to possess formula quantities of SSNM. By the end of 1981, this plant was one of only three such facilities that actually possess formula quantities.

Safeguards Research And Technical Assistance

In fiscal year 1981, about $9.1 million was spent on safeguards research and technical assistance. Approximately $3.6 million was spent on research projects (long-term comprehensive efforts). The remaining $5.5 million was spent on technical assistance projects (short-term efforts supporting operational assignments).

The NRC safeguards research program consists largely of contractor programs and staff activities supported by contractor effort, all coordinated through the agency's Safeguards Technical Assistance and Research (STAR) Coordinating Group, and approved by the Safeguards Program Area Manager of the Office of Nuclear Material Safety and Safeguards.

The safeguards technical assistance program includes projects which are conducted by the major NRC program offices to support their operational missions. Examples of these technical assistance projects include:

- *The "Transparent Armor Testing" project.* Undertaken to develop and validate a new standard for transparent armor to be used in the protection of power reactors and fuel cycle facilities. Through demonstrations, the project will provide assurance that the types of transparent armor used by NRC licensees provide adequate protection against the armament specified in NRC's design-basis threat.

- *The "Nuclear Power Plant Vital Area Definition" project.* Based upon information obtained from the Final Safety Analysis: Report and from site visits, nuclear power plants are analyzed to determine those plant areas where sabotage could expose the public to radiation in excess of acceptable limits. This analysis includes construction of a detailed sabotage "fault tree" for each nuclear plant, reduction of the fault tree to logic equations, and solution of the logic equations to an ordered list of the combination of locations where successful sabotage might be accomplished. To date, this method has been applied to 58 domestic reactors.

- *The "Development of an Advanced Material Accounting System Simulation Model" project.* This effort has led to the development of the "Automated Material Accounting Statistics System" (AMASS) which enables an independent evaluation of MC&A material balance and process data. This methodology extends the framework in general use by including provisions for modeling multiple sources of short-term and long-term systematic measurement system errors, permitting covariance analysis, and by estimating the contribution to the inventory difference from unmeasured process variability. The model is general in the sense that it can be applied to any linear algebraic sum of components and thus can be applied, in addition to inventory difference analysis, to the analysis of other relevant safeguards statistics such as shipper-receiver difference. This methodology is

computerized and has been successfully applied in fiscal year 1981 to the evaluation of the inventory difference performance at three licensed fuel cycle facilities. Documentation of AMASS consists of a user/analyst manual, a systems manual, and a report developing from first principles the mathematical theory.

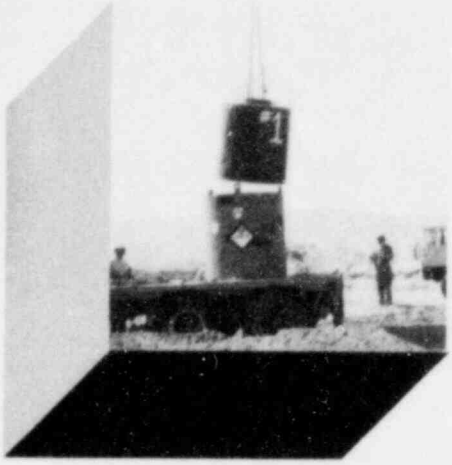
• Evaluation Methodologies

During 1981, the NRC continued to work on computer-based evaluation methodologies to support safeguards licensing. One methodology that analyzes adversary sequence interruptions (Aggregated Systems Model) was applied to alternative plant designs. A second technique (Safeguards Vulnerability Analysis Program), utilizing Boolean equations to identify unprotected adversary paths, was used to assess two NRC-licensed facilities. Evaluation methodologies in support of reactor safeguards included investigation and analysis of methods for ranking the vital areas within operating reactors, development of automated procedures for the preparation of reactor sabotage fault trees, and studies of methods of estimating the time and resources required to sabotage vital components. The NRC also supported studies to optimize defense strategies, to perform dynamic analyses of insider movements required to sabotage vital components, and to support NRC needs for vital area indentification.

• Improved Inspection Methods

The NRC continued the development of improved safeguards inspection methods to be used by NRC field inspectors. (See p. 125, *1980 NRC Annual Report*). Inspector guidance on computer systems used for security (NUREG/CR-2288) was published, and the inspector training program was updated.

As noted, each of the major program offices with safeguards interest participates in the planning and implementing of NRC's domestic safeguards contractual program. The Safeguards Technical Assistance and Research Coordinating (STAR) Group, which has members from each cognizant office, provides interoffice coordination for the program. The STAR Group reviewed and approved 52 research and technical assistance projects during Fiscal Year 1981.



6 Waste Management

The goal of the national nuclear waste management program is to isolate from the biosphere all types of existing and future nuclear wastes emanating from military and civilian activities — including spent fuel from the once-through nuclear fuel cycle — in order that there will be no significant threat to public health and safety or to the environment. The NRC is responsible for providing and implementing regulations and criteria that will ensure that the disposal methods developed for certain types of radioactive waste are consistent with the achievement of this goal of safe, long-term waste disposal. The Department of Energy (DOE) has the statutory mandate and "lead responsibility" for developing technologies and programs for the handling, treatment, storage, transportation and disposal of commercial high-level wastes and all defense-generated wastes. The overall performance objective for disposal of radioactive wastes (e.g., defining the maximum allowable release of radionuclides to the biosphere) will be established by the Environmental Protection Agency (EPA) in its environmental radiation protection standards.

The NRC's nuclear waste management activities are managed and coordinated by the Office of Nuclear Material Safety and Safeguards (NMSS). These activities cover the regulation of all NRC-licensed source, byproduct and special nuclear material waste, including uranium mill tailings. The functions of NMSS include:

- Developing the criteria and framework for regulating high-level waste management, including the technical bases for licensing, and licensing actions for high-level waste repositories.
- Licensing and regulating low-level waste disposal facilities and providing the technical support for such regulation.
- Licensing and regulating uranium recovery facilities and associated mill tailings. (These operations include uranium mills, heap-leaching facilities, ore-buying stations, solution mining and byproduct uranium recovery.)

In 1981, the NRC staff continued to focus on developing, improving and implementing regulations for the safe management and disposal of radioactive wastes. In the high-level waste area, NRC released a regulation for permanent repositories in two parts: one specifying procedures for license application review, and the other outlining the technical criteria to be used in evaluating an application (10 CFR Part 60). The procedural portion was published in the *Federal Register* as a final rule on February 25, 1981 (46 FR 13971). Technical criteria for licensing geologic disposal were published for public comment as a proposed rule on July 8, 1981 (46 FR 35280). The staff continued to develop accompanying regulatory guides and to improve its technical expertise in preparation for the receipt of DOE Site Characterization Reports and a high-level waste repository license application.

For low-level wastes, the NRC staff continued developing comprehensive licensing criteria, promulgating as a proposed rule a low-level waste regulation (10 CFR Part 61) in July 1981 (46 FR 38081), and issuing a draft environmental impact statement in support of the rule. In addition, the Commission published in final form amendments to 10 CFR Part 20 that permit licensees greater leeway in disposing of certain marginally radioactive biomedical wastes previously sent to low-level waste burial grounds. The NRC continued to assess the health, safety and environmental protection aspects of NRC-licensed low-level waste management activities, and waste management problems and practices such as those posed by the Three Mile Island reactor wastes.

In fulfilling its responsibilities to regulate the construction, operation and decommissioning of uranium recovery facilities, NRC continued to issue, amend and review licenses, began implementing EPA's re-

vised Environmental Radiation Protection Standards for Nuclear Fuel Cycle Facilities (40 CFR Part 190) and prepared to implement NRC's Uranium Mill Licensing Requirements (10 CFR Part 40). Both regulations are currently the subject of lawsuits brought by representatives of the uranium milling industry. In addition, NRC continued to develop regulatory guides to aid licensees in meeting the broad performance objectives for mill tailings management established in 10 CFR Part 40, and to carry out its responsibilities under Title I of the Uranium Mill Tailings Radiation and Control Act of 1978 to review and concur in DOE's remedial action program at inactive tailings sites. (In an amendment to NRC appropriations legislation for fiscal year 1982 (P.L. 97-88), Congress has prohibited implementation or enforcement of 10 CFR Part 40, Appendix A, issued in October 1980. In the same amendment, Congress directed NRC to continue mill tailings reviews utilizing criteria in effect prior to October 1980.)

The Waste Management Review Group (see *1980 NRC Annual Report*, pp. 127-8), which is responsible for coordinating all NRC waste management technical assistance and research projects, reviewed project descriptive summmaries and statements of work for 91 technical assistance and research projects in 1981.

HIGH-LEVEL WASTE PROGRAM

Regulatory Development

Publication of the procedural portion of 10 CFR Part 60 as a final rule on February 25, 1981, was a significant step toward completing the development of regulations for the management of high-level waste. NRC also released the technical portion of 10 CFR Part 60 as a proposed rule on July 8, 1981 (46 FR 35280).

The first rule outlines the procedures which the Commission will follow in considering an application for a repository license from the DOE and includes specifications for reports, tests, inspections and enforcement. It also sets forth provisions for consultation and participation in the license review by State, local and Indian tribal governments.

A total of 34 groups and individuals commented on the procedural rule, as proposed. Most of the commenters were generally supportive of the principles and procedures outlined; however, a number of changes and clarifications were made in the final rule in response to comments received.

The proposed technical rule contains siting, design, and performance criteria for a geologic repository; design and performance criteria for the package which contains the waste; and criteria for monitoring and testing programs, performance confirmation, quality assurance and personnel training and certification. In order to compensate for the uncertainty in predicting the behavior of geologic systems over long periods of time, the Commission has proposed a conservative multi-barrier approach. In this approach, the Commission views the repository to be composed of three major barriers: (1) the waste package, (2) the engineered repository structure, and (3) the site and its environs. The proposed technical rule would establishes minimum performance objectives for each of these major barriers. The rationale for the performance objectives and the environmental impact assessment supporting this rulemaking have been published separately and are available for public review.

The public comment period on the rule closed November 5, 1981.

Regulatory Guidance

In order to provide guidance to DOE on acceptable methods to satisfy the requirements of 10 CFR Part 60, the NRC staff is developing a number of regulatory guides, dealing first with site characterization, which is the initial step in the licensing procedure. The procedural rule requires DOE to submit a Site Characterization Report at an early stage in the site selection process. A draft standard format and content guide for a site characterization report was published for public comment in the *Federal Register* on April 22, 1981 (See *1980 NRC Annual Report*, p. 129), and the final version reflecting public comments was scheduled for issuance in early 1982.

The licensing procedures also require DOE to submit semiannual progress reports during the period of site characterization. These will incorporate new data and information, including plans to characterize any new issues or site characteristics. A draft standard format and content for the semiannual progress reports will be issued in 1982 and a final report published in 1983.

Format content regulatory guides will also be published for the Environmental Report and Preliminary Safety Analysis Report to be submitted in the application for a high-level waste repository. These guides are scheduled for completion in late 1984. In addition, NRC plans to develop technical quidance on the design of waste packages, repository siting and design, and performance assessment (See *1980 NRC Annual Report*, p. 129). In preparing technical guidance, NRC is working closely with DOE, the technical community, and others to identify potential problems and uncertainties early. The guidance may take various forms, such as NRC technical positions or action on DOE topical reports. Development of the mechanisms for early identification of uncertainties will help assure that the licensing of waste repositories to provide for adequate protection of the public will not be unnecessarily delayed.

Review of DOE Site Investigations

During 1981, NRC initiated several early reviews of DOE site screening investigations. As DOE begins significant screening activity in any area, the NRC begins onsite review of DOE's investigations with an emphasis on ensuring that DOE is acquiring the appropriate data to support a decision to select a site for in-depth characterization. NRC review activities also include evaluations of the technical information available on the geologic and hydrologic characteristics of each area, as well as reviews of DOE reports describing exploration programs and techniques and containing data collected during screening activities. During 1981, NRC technical staff visited a volcanic tuff site at the Nevada Test Site, a basalt rock site at the Hanford Reservation in Washington, and two sites in bedded salt: the Paradox Basin in Utah, and the Palo Duro area in Texas.

The NRC continued to upgrade its review capability by sponsoring research on waste forms and packages, rock mechanics, repository siting and design, performance assessment, and borehole and shaft sealing.

Other Interagency Efforts

During the report period, NRC continued to participate in a number of interagency high-level waste management programs initiated in previous years. These activities are outlined below.

The Earth Sciences Technical Plan is a multi-year plan of the U.S. Geological Survey and DOE to resolve the major technical issues related to the development of a geologic repository high-level waste (See *1980 NRC Annual Report*, p. 140). In 1981, NRC staff participated in working group meetings and reviewed and commented on drafts of the plan.

The Environmental Protection Agency (EPA) standard for the overall performance objective of the disposal of radioactive wastes is in draft form. The current draft standard sets limits on the amounts of radionuclides which are reasonably likely to be released from a repository, and sets other limits on less likely releases. For the NRC to compare a license application to such a standard, it will be necessary to assess the performance of the entire repository, including the probability and consequences of a variety of future events. In anticipation of the release of the draft standard for comment, NRC has initiated a technical review. The NRC will perform trial assessments of repository sites now being considered by DOE. The NRC will review the numerical values in the standard to determine whether NRC health effects models show them to be reasonable and whether NRC repository models show them to be achievable.

The Materials Characterization Organization (MCO) was established by DOE "to provide an unbiased, referencable basis for identifying properties and establishing test methods of nuclear waste materials." The NRC's participation is aimed at ensuring that the MCO products will provide at least the materials information which the NRC will require in a license application.

The preparation of a comprehensive national plan for radioactive waste management was called for by former President Carter in his policy statement of February 12, 1980 (see *1980 NRC Annual Report*, p. 128). The statement assigned lead responsibility to DOE to develop and coordinate the activities of relevant Federal agencies in preparing the plan. NRC staff contributed to and provided comments and critiques on several drafts. DOE completed a fourth working draft in March 1981, which was widely distributed for comment.

The State Planning Council, established by Executive Order in conjunction with former President Carter's February 12, 1980 policy statement, was comprised of State, local, tribal and Federal representatives to advise the President on nuclear waste issues. The NRC Chairman represented the Commission as a non-voting member on the Council, which expired in August 1981. The Council's final report to the President contained recommendations on all aspects of siting storage and disposal facilities, on the appropriate State and local role in repository siting and licensing and on proposed Federal regulations and planning efforts. The NRC's participation was limited to providing advice and assistance on request.

The West Valley Demonstration Project Act, signed into law on October 1, 1980, directs DOE to carry out a project to demonstrate solidification techniques which can be used for preparing high-level radioactive waste for disposal. (See *1980 NRC Annual Report*, p. 130 and Chapter 4 of this Annual Report.) DOE is to make arrangements for informal review and consultation by the Commission, and has been specifically directed, by a Memorandum of Understanding between DOE and NRC, to consult with the Commission with respect to the waste form and containers for permanent disposal and for the NRC to monitor the activities under the project for the purpose of assuring public health and safety.

The NRC continued staff work in 1981 on the generic rulemaking proceeding to reassess its degree of confidence that radioactive waste produced by nuclear facilities will be safely disposed of, to determine when such disposal will be available and whether such wastes can be safely stored until they are disposed of (44 FR 61372, October 25, 1979). (See *1980 NRC Annual Report*, pp. 130, 131.) This rulemaking has been initiated in response to the decision of the U.S. Court of Appeals for the District of Columbia Circuit in *State of Minnesota vs NRC*, but it also is a continuation of previous proceedings conducted by the Commission (42 FR 34391, July 5, 1977). Ap-

proximately 65 parties notified the Commission of their intent to participate in this proceeding. Of these, 32 filed written statements of position with the Commission. Twenty of the participants filed cross-statements. On November 6, 1981, the Commission issued a second pre-hearing memorandum and order which called for oral presentations by the participants in early 1982.

LOW-LEVEL WASTE PROGRAM

Regulatory Development

NRC continued in 1981 to develop low-level waste regulations, regulatory guides to amplify the regulations, and a supporting environmental impact statement (EIS). On July 24, NRC published 10 CFR Part 61 as a proposed rule (46 FR 38081). The draft EIS, published in the fall of 1981 (NUREG-0782), provides a basis for decisions on the performance objectives and technical and financial criteria set forth in Part 61. The proposed rule represents the culmination of several years of effort. In developing it, the Commission provided many opportunities for public comment and review of the staff's approaches to the problem, and for discussion among the various groups interested in low-level waste. In February 1980, the Commission published an advance notice of availability of a preliminary draft regulation, to help ensure wide distribution and early public review and comment (45 FR 13104). In addition, NRC sponsored four regional workshops during 1980 to provide a broad base of input from the States, public interest groups, the industry and others on the issues to be addressed in the Part 61 rulemaking. (See *1980 NRC Annual Report*, p. 131.)

The proposed Part 61 divides the task of protecting the public health and safety into two time frames for low-level waste disposal: the short-term protection of workers and the general populace during the operation of a disposal facility, and the long-term protection of the public after operations cease. Assuring safety over the long-term involves three considerations: (1) protection of individuals from inadvertent intrusions into the site and from coming in contact with the waste at some point in the future; (2) protection of the general public from potential releases to the environment; and (3) stability of the disposed waste and the site to eliminate the need for ongoing maintenance.

The proposed rule provides licensing procedures, performance objectives and technical criteria for licensing facilities for the land disposal of radioactive waste. The regulations include a classification of waste; institutional, administrative and procedural requirements for licensing; and technical requirements for the siting, design, waste form operations and closure activities for a near-surface disposal facility. The rule will establish requirements for NRC licensees and will be the basis for Agreement State regulations, since State regulations must be compatible with NRC rules.

NRC has identified a need for nine regulatory guides to supplement the regulations regarding licensing of near-surface disposal facilities for low-level radioactive wastes. The staff began work on a number of these guides during 1981, all of which are expected to be completed by late 1983. They include Standard Format and Content of Application for Near Surface Disposal; Site Closure, Stabilization and Post-Operational Surveillance; Waste Classification; Waste Form; Standard Format and Content of Environmental Report for Near Surface Disposal; Site Characterization and Suitability; Site Monitoring; Facility Design and Operation; and Funding of Closure and Post-Operation Care.

To improve the basis of regulatory development, NRC funded research in 1981 in the areas of volume reduction, low-level waste form criteria, trench capping and subsidence, site suitability and hydrology. NRC staff has met periodically with DOE staff to compare, integrate and coordinate the agencies' respective low-level waste programs.

Low-Level Waste Licensing

While most low-level waste disposal activities are regulated by Agreement States (see Chapter 8), NRC has licensed the disposal of Special Nuclear Material (SNM) at commercial burial sites in Hanford, Wash., and Barnwell, S.C. In addition, NRC has authority over the commercial burial site at Sheffield, Ill. (Illinois is not an Agreement State). The NRC license covering the disposal of SNM at Hanford was renewed in November 1981; however, the operator has refused to accept SNM since November 1979, and no SNM has been disposed of under the renewed license. The NRC SNM license for Barnwell was renewed September 15, 1981.

All licensed capacity at the Sheffield site has been filled and no wastes have been buried there since April 1978. Temporary storage and treatment of low-level wastes at the site have also ceased. Ongoing activities at the site include site and environmental monitoring, site maintenance and site security to assure the protection of the health and safety of the public. Closure of the site and termination of the license are issues currently before an Atomic Safety and Licensing Board. A license termination decision will not be made until the hearings are completed.

Actions on the part of the host States for the three low-level waste disposal sites in 1980 highlighted regional imbalance in the distribution of such sites (See *1980 NRC Annual Report*, p. 132). Congress enacted

the Low-Level Radioactive Waste Policy Act (P.L. 96-573) in December 1980, establishing a Federal policy that each State is responsible for providing low-level waste disposal capacity for radioactive waste generated within its borders, with the exception of Federal waste from defense or research and development activities. In response, more than 20 states have completed or are conducting studies of their requirements for low-level waste management.

While neither the NRC nor any Agreement State has received an application for a new low-level waste disposal site this year, the Commission is prepared to accept new applications or requests for assistance from Agreement States resulting from State activities pursuant to the Low-Level Radioactive Waste Policy Act.

Assistance to Agreement States

In its continuing program of assisting Agreement States, the NRC provided technical assistance during 1981 to the State of Washington in support of its regulatory efforts. NRC also helped South Carolina by performing an environmental assessment of the site.

The NRC has budgeted resources to assist Agreement States in future licensing and regulatory actions regarding both existing sites and new applications, including health, safety and environmental assessments for proposed sites, should the States request them.

In January 1981, the NRC announced a policy of allowing States to enter into limited agreements with NRC in the Agreement States Program, permitting States to regulate low-level waste only (46 FR 7540).

Other Activities

In response to public concerns, the NRC has begun an assessment of NRC licensees generating significant low-level waste in terms of volume and/or radioactivity, in order to identify possible ways to reduce or eliminate potential management or disposal problems. NRC also continued funding research on the unique waste disposal problems posed by the accident at Three Mile Island.

URANIUM RECOVERY AND MILL TAILINGS

Licensing Activities

In regulating the construction, operation and decommissioning of uranium recovery facilities, NRC continued to issue, amend and review licenses, began implementing EPA's revised Environmental Radiation Protection Standards for Nuclear Fuel Cycle Facilities (40 CFR Part 190) and prepared to implement NRC's Uranium Mill Licensing Requirements (10 CFR Part 40).

During 1981, NRC staff completed 19 major license amendment reviews, with work proceeding on an additional 18; completed two license renewal reviews with eight in process; and completed four new application reviews, with seven more in process. The staff performed 125 reviews of operating facilities' safety and environmental data reports. On the basis of these reviews, license amendments were issued where appropriate. The staff is in the process of reviewing 53 additional reports. In addition, NRC issued 15 license amendments to bring operating mills within NRC jurisdiction into compliance with EPA standards.

Of the 42 uranium recovery facilities licensed at the end of 1981, 15 were uranium mills; 10 were heap leach/ore buying station byproduct recovery facilities; 14 were research and development solution mining operations; and 3 were commercial solution mining activities.

The NRC's Uranium Mill Licensing Requirements, issued in October 1980 (45 FR 65521) focus primarily on tailings disposal as required by the Uranium Mill Tailings Radiation and Control Act of 1978 (UMTRCA) (See *1980 NRC Annual Report*, p. 133). The regulations are based on the evaluations of costs and health risks contained in the Generic Environmental Impact Statement on Uranium Milling (NUREG-0706, September 1980) and provisions of UMTRCA. They are also based on actual licensing experience using interim tailings management performance objectives. Through the use of interim criteria, conditions at existing NRC licensed mills have been upgraded, and for the most part meet the new NRC requirements.

Shortly after the release of the regulations, representatives of the uranium mining industry filed a lawsuit in the 10th Circuit Court of Appeals in Denver, Colo., claiming they are too costly and impracticable. In late April 1981, the industry filed a motion to stay the effectiveness of the regulations until the litigation has been settled. The Court ruled on this motion in favor of the Commission. However, Congress has included language in the 1982 NRC appropriations legislation that prohibits NRC from implementing or enforcing 10 CFR Part 40 during fiscal year 1982. In the interim, NRC is applying pre-October 1980 standards on a case by case basis.

The EPA radiation standards (40 CFR Part 190) — which became effective for uranium milling facilities beginning in December 1980 — provide limits for the radiation doses received by members of the public from the nuclear fuel cycle. They require that the dose limit to any member of the public from uranium milling facilities be limited to an annual radiation dose equivalent to 25 millirems to the whole body, 75 millirems to the thyroid, and 25 millirems to any

other organ. NRC has evaluated the prospects for meeting the EPA standards at each NRC licensed uranium milling facility and has tentatively determined that implementation of the standards is practicable. In March 1981, the NRC issued orders to the 14 operating NRC-licensed uranium mills to implement them. The first stage of implementation involves assessing true off-site exposures through environmental monitoring, and will be accomplished by requiring the quarterly reporting for a one-year period of all environmental monitoring data and dose assessments.

The American Mining Congress filed a petition with the NRC to stay implementation of 40 CFR Part as required by 10 CFR Part 20. This petition has been denied by the Commission.

Regulatory Development

Since the regulations on uranium milling are cast primarily in the form of broad performance objectives, NRC is developing regulatory guides to provide more specific information about how to evaluate performance and meet objectives. NRC staff initiated work on a number of these guides during 1981, in areas such as basic site characterization techniques and methods for evaluating groundwater protection at tailings disposal sites. Work continued on updating and completing guides on other topics such as occupational health and safety at uranium mills and standard format and contents for various applications and reports required by the regulations. Overall, NRC plans to complete approximately 20 regulatory guides within the next few years.

Technical Assistance to Agreement States

UMTRCA established a number of new requirements related to the Agreement States regulatory program. These requirements include: application and enforcement of state standards equivalent, to the extent practical, to NRC and EPA standards; land ownership requirements; and various procedural requirements, such as preparation of an independent documented environmental assessment and the opportunity for public participation. These new requirements became fully effective in November 1981. The Commission has indicated that in its view the mill tailings regulations promulgated in October 1980 are a valid baseline for equivalent state standards and are considered practicable to implement in Agreement States. In order to retain regulatory authority over tailings, the Agreement States had to have upgraded their programs, in accordance with the requirements of UMTRCA, and entered into amended agreements with NRC by November 1981. The effectiveness of this provision of UMTRCA, however, has been delayed to October 1, 1982 by an amendment to NRC's appropriations legislation.

None of the Agreement States met the November 8, 1981 deadline to have amended agreements with the NRC and therefore, as required by UMTRCA, prior to the enactment of P.L. 97-88 on December 4, 1981, the Commission gained responsibility to regulate mill tailings. In early November, the Commission issued a general license to authorize uranium mill operators in Agreement States to possess and dispose of mill tailings. This general license was intended to be an interim measure (to preclude technical violations of the Atomic Energy Act) until the Agreement States enter into amended agreements or until Congressional action negates the November 8, 1981 deadline. Three Agreement States, Colorado, Washington, and Texas, could have amended agreements within several months. New Mexico, which also has active milling operations, submitted a draft proposal for NRC comment. (See Chapter 8 for further discussion.)

In addition, the UMTRCA, as amended, requires that the Agreement States implement these requirements to the maximum extent practicable prior to November 1981. The NRC staff has been providing technical assistance to several of the States in connection with their preparation of written independent environmental assessments in support of major licensing actions. In 1981, the NRC staff completed 16 technical assistance cases and is working on an additional five for Agreement States.

Remedial Action at Inactive Sites

The NRC continued to provide review and concurrence on major actions in DOE's Uranium Mill Tailings Remedial Action Program (UMTRAP) at inactive tailings sites as required by Title I of UMTRCA (see *1980 NRC Annual Report*, pp. 133-4). The NRC staff also provided input and comments on a number of DOE plans and draft documents. In April 1981, NRC provided formal concurrence in the DOE final remedial action plan for the Fire Station No. 1 vicinity property at Salt Lake City, the first and only such project under way. At years end, a second review for the Central Valley Water Reclamation Facility, also in Salt Lake City, had been initiated. NRC provided staff representation on panels to receive views on remedial action alternatives at public meetings in Utah, Colorado and Pennsylvania in May, June and July of 1981, to be followed by formal NRC input to the preparation of environmental impact statements for remedial action at processing sites in these States. NRC provided such input to the Salt Lake City Vitro site EIS scope in August. In addition, on October 19, 1981, the NRC concurred in a DOE/Colorado cooperative agreement. In March, DOE and NRC formally agreed that NRC would participate as a "cooperating agency" in UMTRAP NEPA activities as defined by the Council on Environmental Quality's

regulations. DOE and NRC also reached agreements regarding interagency working relationships in the execution of UMTRAP.

In conformance with a provision in the fiscal year 1980 Supplemental Appropriations and Recission Bill Report (No. 96-829), the NRC has developed, in consultation with South Dakota, the EPA, the Department of Housing and Urban Development and the Tennessee Valley Authority (TVA), a program to evaluate off-site contamination near an inactive uranium mill, now owned by TVA, in Edgemont, S.D. The program will determine the number of off-site locations where tailings have been used and what remedial action is necessary. During 1981, NRC has reviewed existing radiological monitoring data and has conducted additional monitoring at 561 structures to identify those structures requiring specific remedial actions to assure the health and safety of the occupants. To date, a total of 45 properties have been identified which have tailings and will need remedial action in order to meet the EPA radiation protection standards.

7

Inspection, Enforcement And Emergency Preparedness

The year 1981 was a time of evaluation, adjustment and reorganization planning for NRC's inspection and enforcement programs, which had already been significantly reoriented during 1980. A major part of the inspection staff was reassigned from regional offices as bases of operations to resident inspector stations at nuclear sites to better balance the inspection effort. In addition, as part of a general reorganization of the Office of Inspection and Enforcement, the NRC emergency preparedness function was consolidated within that office in November 1980.

Statistical highlights of NRC inspection and enforcement activity during 1981 included some 6,775 inspections and the imposition of 37 civil penalties totalling nearly $1,37 million. Eighteen orders to cease and desist operations or to modify, suspend or revoke licenses also were issued.

The NRC IE staff undertook separate team appraisal programs to improve the detection of significant management control problems and to assess health physics programs at uranium mill sites, as well as deploying a network of thermoluminescent dosimeters at 55 reactor sites involving about 50 TLDs per site at a distance out to ten miles.

In the enforcement area, NRC responded to new legislative authority which increases the fines NRC can levy by implementing an interim enforcement policy and increasing its inspection and enforcement staff from 846 to 975. About 78 percent of that total is assigned to the five regional offices.

NRC inspections are conducted to determine if licensees are complying with NRC requirements, identify conditions that may adversely affect the public, gain information used in issuing, denying or amending permits or licenses, and determine the adequacy of quality assurance programs. Enforcement actions are taken when licensee operations do not meet NRC requirements in these areas. As a consequence of enforcement actions, licensees must correct the problems and take measures to prevent their recurrence; this could include changes in quality assurance programs, if necessary. The NRC routinely communicates information regarding such inspections and enforcement actions to other agencies and branches of the government, to licensees and to the public, as appropriate.

THE INSPECTION PROGRAM

NRC conducts routine inspections to determine if licensees are complying with license requirements and NRC regulations. These inspections include direct verification of licensee activities such as: reviewing procedures; checking records; conducting interviews; observing tests; examining construction and control-room activities; and making direct measurements. NRC conducts reactive inspections that respond to reports of conditions or events which appear to justify the agency's involvement. Such reports may come from routine inspections, from applicants, licensees, contractors or suppliers, or from licensee employees or members of the public.

Reactor inspections cover all phases of nuclear power plants from preconstruction activities through decomissioning. Research and test reactors are also inspected. In addition, NRC inspects the quality assurance programs of those who supply safety-related equipment, components and services, as well as radiological safety and safeguards programs for fuel facilities and materials licensees.

Resident Inspector Program

During the report period, the NRC achieved a major goal of the resident inspector program by assigning at least one inspector to every site with an oper-

Table 1. Inspections Conducted in FY1981

Program	*Number of Licenses*	*Number of Inspections*
Power Reactor Construction	93	1,669
Operating Power Reactors	82	1,931
Other Reactors	84	85
Fuel Facilities	50	222
Materials	8,769	2,261
Vendors	300	181
Safeguards	274	426

ating power reactor and every site where construction activities are in progress.

On September 30, 1981, a total of 124 inspectors were assigned to 79 sites: 49 operating reactor sites, 14 where reactors were in preoperational testing, and 16 with power reactors under construction. In addition, one resident inspector is assigned to the Nuclear Fuel Services fuel facility at Erwin, Tenn.

A significant portion of the 1981 resident inspection effort at operating reactors was directed toward verifying that licensees had completed the activities specified in the TMI Action Plan (NUREG-0660), with particular attention to those applying for or receiving licenses during 1981. The inspection effort is normally increased for facilities nearing the operating license stage, and these were the first facilities to be completed since the TMI accident. These special efforts were in addition to the routine inspections requiring licensees to demonstrate that they are operating their plants safely and that they meet regulatory requirements.

In 1982, and beyond, NRC will continue to assign at least one resident inspector to sites with power reactors in operation or in preoperational testing. Additional resident inspectors will be assigned to sites where licensee performance and/or plant design indicate that additional efforts are needed and if personnel are available. Resident inspectors also will be assigned to each site where plant construction is well advanced or where special construction problems exist.

Reporting Defects and Noncompliance

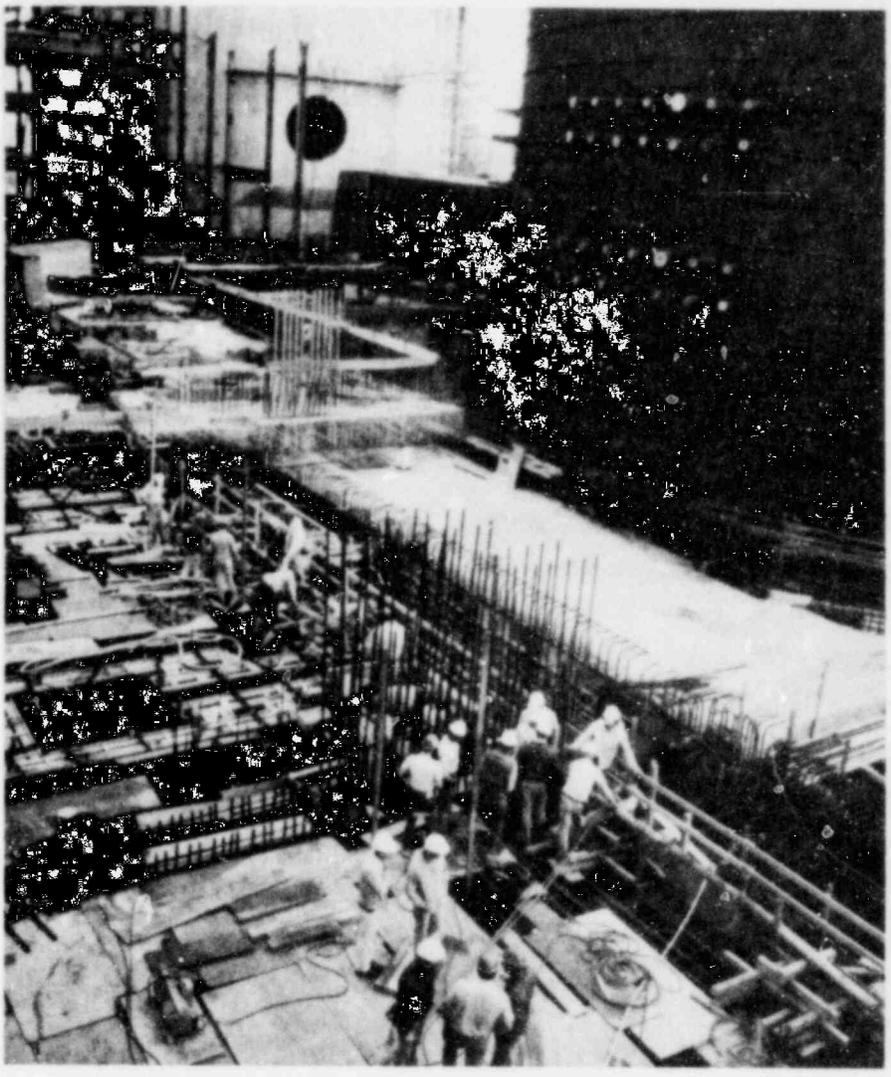
Some 158 industry reports of noncompliance or of defects were received by the NRC during 1981 for review and assessment as to the seriousness of deficiencies, the adequacy of the proposed corrective action, and the possibility of generic problems. In addition to these assessments, NRC inspectors seek to ensure that appropriate corrective action has been taken.

Inspection Program Revisions

Following a detailed NRC staff review, the agency's inspection program was revised so that safety verification would receive the highest priority. During the past few years, the NRC found itself unable to complete all of its established routine preventative inspections at every reactor in operation and under construction, nor could it be sure the inspections which were completed were those most closely realted to nuclear safety. The main reason for this expanded workload was the accident at Three Mile Island, although budget limitations, recruiting difficulties, and reductions in the number of technical inspectors are contributed.

The revised program specifically permits the extent and frequency of inspections to be adjusted according to licensee performance, while continuing to require some inspections across the full range of licensee activities. With respect to reactors under construction, the review resulted in a trial program in which teams of five or six regional inspectors were used to determine whether the team approach would help indentify the kind of management control problems that have affected several construction plants during the past two years.

The trial program results were positive, and steps have been taken to utilize this option as a supplement to the routine construction inspection program when appropriate. Other new program goals include improving routine construction inspections, determining whether inspections performed by outside groups (such as the Institute for Nuclear Power Operations) can be used to supplement NRC efforts, and con-



NRC regional and resident inspectors were on hand April 14, 1981, to witness the first concrete pour at the Marble Hill (Ind.) nuclear plant in 20 months. All safety-related work at the plant had been halted in August 1979 because of quality assurance and construction management problems. The NRC staff permitted resumption of some safety-related work—piping and electrical installations—in December 1980.

ducting additional inspections during preoperational and startup testing.

During 1981, ten major performance appraisal inspections were conducted by NRC at operating nuclear power plants and more are scheduled for 1982. In addition to supplying NRC management with an overall perspective of the licensee management controls at these facilities, the appraisals also assess the adequacy of the regular inspection program of the regional offices. At the end of 1981 the headquaters staff was evaluating the health physics inspection program and the program for reactors under construction to determine what improvements are needed.

Equipment Qualification Program

The testing and inspection program to determine whether electrical, instrumentation and control equipment can withstand severe and adverse environments environments continued in 1981.

NRC contractors completed three independent verification tests in 1981. One additional test was in progress at year's end. The NRC staff reviewed test plans and witnessed licensee-sponsored tests for seven different types of equipment during the year. These test activities were continuing as 1981 ended. The agency also signed an agreement with the Institute of Electrical and Electronics Engineers, Inc., to initiate an accreditation program for testing organizations. The NRC staff continued to participate in the writing and development of suitable standards and procedures for the accreditation program — work which included preparation of a proposed rule to require testing organizations that perform nuclear equipment qualifications to be accredited by the IEEE system.

The staff also initiated a modified Information Notice System to advise the industry of adverse qualification test results reported to the Commission. These notices will be issued periodically as new information is received.

RADIATION PROTECTION ENVIRONMENTAL MONITORING

Health Physics

The Reactor Health Physics Appraisal Program inspections initiated in 1980 were completed in early 1981. These special appraisals involved more than 20,000 man-hours of on-site inspection time by 44 NRC health physicists and 24 contractor health physicists.

They identified a number of radiation protection weaknesses similar to those found at TMI, and, as a result of the appraisals, the licensees concerned have agreed to make improvements. In addition, the NRC is developing more specific guidance on what constitutes an adequate radiation protection program, and IE is conducting followup inspections to ensure that significant weaknesses have been corrected. Based on the findings from the health physics appraisal of 48 operating nuclear power sites, several conclusions may be drawn.

- All of the radiation protection programs were judged to be at least acceptable for continued operations while significant findings were being corrected. No instances were identified where the immediate health and safety of workers or the public were threatened.
- The weakness most frequently observed at facilities was the inadequate qualification and training of radiation protection technicians, and within this area, a lack of depth of technical training, together with a lack of knowledge of plant systems and operations, was most common.
- The greatest cause of weaknesses in radiation protection programs can probably be traced to general "attitudes" toward radiological safety. Management too often considers the radiation protection group more of a routine service organization than a support function to be integrated in the fabric of all operations; hence funding, staffing and management backing were frequently provided at minimum levels. Foremen and supervisors in other departments tended to feel that the burden of assuring radiological safety rested almost entirely on the radiation protection group, rather than understanding that the responsibility is properly that of all line management.
- Findings that areas were in need of improvement, of course, reflected concern that programs and performance were not up to the standards expected and required of the nuclear industry, but it must also be emphasized that many aspects of the radiation protection programs were excellent and a large number of knowledgeable and dedicated health physics personnel were performing their functions in an outstanding manner.

The sucess of the reactor health physics appraisals and a need for a similar review at uranium mills led to the initiation of a similar program at uranium mills. It should be completed early in 1982 and should enable NRC to identify the weaknesses which should be addressed in new or revised radiation protection plans and inspection manuals.

At right is Tom Tongue, senior resident inspector at the Dresden (Ill.) nuclear power plant, looking in on the control room during inspection tour of the plant.

Table 2. New Sites Manned by Resident Inspectors - FY 1981

Facility	*Location*	*Licensee*
Millstone Nuclear Power Plant Unit 3	New London County, Conn.	Northeast Nuclear Energy Company
Byron Nuclear Power Plant Unit 1	Ogle County, Illinois	Commonwealth Edison

Direct Radiation Monitoring Network

The Thermoluminescent Dosimeter (TLD) Direct Radiation Monitoring Network, initiated during 1980 to measure radiation levels in the environment around nuclear power plants, went into full operation in 1981 around 55 sites, including all operating reactors and five others expecting operating licenses in the near future. (See pp. 141 and 142, *1980 NRC Annual Report.*) It is anticipated that periodic reports on program results will commence in calendar year 1982.

Effluent Measurements

Each of the five regional offices has now been equipped with mobile laboratories containing computer-based gamma spectroscopy system. (See photos, p. 143, *1980 NRC Annual Report.*) As part of routine inspections, effluent and radwaste can be independently analysed and the measurements compared to licensee results.

Environmental Measurements

Under agreements with NRC, 18 State agencies collect and analyze environmental samples including air particulates, and radioactivity in water and vegetation. The State analyses are then compared to the data compiled by licensees in an evaluation of their capabilities to make proper radioactivity measurements.

Aerial Measurements

NRC funds a portion of the extensive Department of Energy (DOE) Aerial Measurements Services program. This program is contracted with EG&G Inc., by DOE and involves making aerial photographic and radiological surveys of NRC reactor, fuel facility and mill sites. The surveys which are performed prior to and during operation and upon decommissioning, provide baseline radiological data for use in the event of accidents as well as in evaluating the environmental impact of an operating facility.

ADDITIONAL INSPECTIONS

Safeguards Inspections

NRC's safeguards inspections program addresses licensees who must control, account for, and protect special nuclear material (SNM) against theft and sabotage. The program consists of physical security (PS) inspections, designed to assure that licensees adequately protect facilities and their contents, and ma-

Radiation specialist Thomas Thompson collects a TLD radiation meter and replaces it with another. Thompson is at one of a network of TLD stations around the San Onofre nuclear power plant near San Clemente, Cal.

terial control and accounting (MCA) inspections that are designed to assure that licensees adequately control and account for the material in their possession.

At reactor sites, safeguards inspections focus on physical security since sabotage with the potential for radiological consequence is the primary threat. The program for fuel facilities is similar except that resources are allocated more heavily to PICA inspections since SNM diversion is the primary threat. The inspection program for transportation covers domestic shipments and the domestic segments of export shipments of formula quantities of SNM. Inspections are conducted at points of origin, in-transit, during intermodal transfers, during temporary storage, and at the point of destination or embarkation, and address both the physical security and material control and accounting procedures as appropriate. The NRC inspection program for research and specilty facilities, primarily associated with education, medical, and industrial activities, is similar to the one for reactors, focusing equally on licenseee material control and accounting and physical security activities.

The inspections evaluate a licensee's capability to meet safeguards requirements by examining controls over conditions that might threaten the public. The program, documented by written guidance, generally involves three categories of effort:

(1) Direct verification of licensee performance by observation and independent measurement.

(2) Review of licensee system and procedures to assure that they are in conformance with requirements, are technically sound, and are properly implemented.

(3) Analysis of records and interviews with licensee personnel to confirm that required actions are routinely followed.

Licensee, Contractor And Vendor Inspection Program

NRC continued in 1981 with inspections of nuclear steam system suppliers, architect-engineers and vendors of safety-related components performed by inspectors from the agency's Region IV (Dallas) office. Part of the overall vendor inspection effort was shifted from product manufacturers to the design and software vendors, reflecting greater recognition of the safety importance of the design function and a declining workload of hardware manufacturers. NRC also established a new reactive section to provide a response capability for items reported from facility sites that require followup action at the vendor. This followup activity addressed more than 250 individual items during 1981.

Independent Measurement Verification Program

NRC's independent measurement/verification of licensee and contractor activities in 1981 included 11 destructive-type tests. In addition to its radiation measurement vans, NRC used a new mobile van having a comprehensive non-destructive examination (NDE) capability in 1981 to independently examine facility systems and structures to confirm the examinations of licensees. The van was used at two reactor facilities and at one major vendor during the year.

Response Activities

During 1981, NRC continued to assign engineers with special knowledge of reactors designed by specified nuclear steam system suppliers to bring greater expertise to bear on events, and to ensure prompt notification to the NRC Operations Center when appropriate. These engineers review events on a "real-time" or nearly "real-time" basis and provide expert advice to regional offices. Immediately after each significant event, they provide an overview of the generic or plant specific importance of the event—items which may result in the NRC Office of Inspection and Enforcement issuing a bulletin, circular or information notice. (See following section.) Such events also can lead to incorporation of additional requirements into the licensing process. The engineers also review licensee event reports and reports responding to licensee requirements set forth in specific regulations, as well as day-to-day events. Engineering analyses are then available to the regional offices for use in emergencies.

BULLETINS, CIRCULARS AND INFORMATION NOTICES

NRC periodically issues Bulletins, Circulars and Information Notices to licensees and holders of construction permits. During 1981, NRC Bulletins, Circulars and Information Notices were issued at a slower rate than in prior years, with the number of Bulletins reduced by 77 percent, Circulars by 38 percent, and Information Notices by 19 percent.

These reduced numbers reflect more stringent criteria in determining whether an issue is significant enough to merit industry-wide communication, and recognition that the NRC may have been overburdening licensees and construction permit holders with requirements of marginal safety impact. The same philosphy led to the formation, late in 1981, of the "Committee for Review of Generic Requirements."

Bulletins are used primarily to communicate with industry on matters of generic importance or serious safety significance i.e., if an event at one reactor raises the possibility of a serious generic problem, an NRC Bulletin may be issued requesting licensees to take specific actions and requiring them to submit a written report describing actions taken and other in-

formation NRC may need to assess the need for further actions.

A prompt response by affected licensees is required and failure to respond appropriately may result in an enforcement action, such as an order for suspension or revocation of a license. When appropriate, prior to issuing a Bulletin, the NRC may seek comments on the matter from the industry (Atomic Industrial Forum, nuclear steam system suppliers, vendors, etc.), a technique which has proven effective in bringing faster and better responses from licensees. Bulletins generally require one-time action and reporting. They are not intended as substitutes for revised license conditions or new requirements.

Circulars notify licensees of actions NRC recommends be taken. Although written responses are not required, the licensees are asked to review the information and implement the recommedations if they are applicable to their facility.

Information Notices are rapid transmittals of information which may not have been completely analyzed by NRC, but which licensees should know. They require no acknowledgement or response, but recipients are advised to consider the applicability of the information to their facility.

ENFORCEMENT

The severity of NRC enforcement actions varies according to the seriousness of the problem and the licensee's previous compliance record. The NRC uses three types of enforcement actions, all described in detail in earlier annual reports. (See p. 144, *1980 NRC Annual Report*.) In summary, they are:

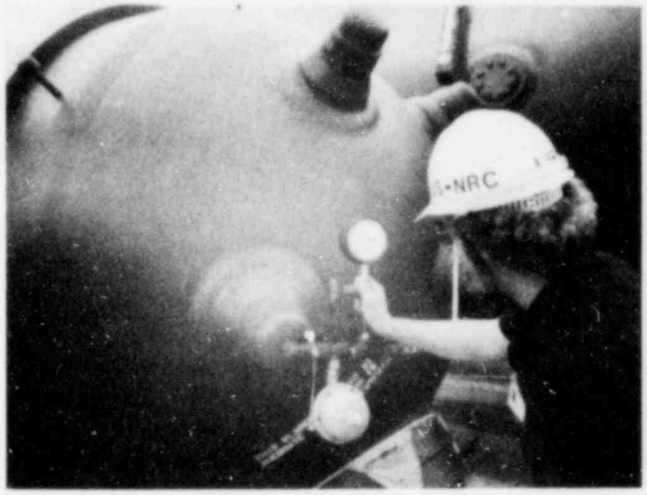
Notices of Violation are issued for all instances of noncompliance with NRC requirements. Civil penalties are issued in cases of significant or repetitive noncompliance or when a Notice of Violation has not been effective. Orders to cease and desist operations, or to modify, suspend, or revoke licenses are issued to cover extremely serious cases.

Tables 3 and 4 document the actions taken under these categories in fiscal year 1981.

New Enforcement Policy

Public Law (96-295) enacted in June 1980, which gave the Commission authority to increase civil penalties, resulted in the publication on October 7, 1980 of a Proposed General Statement of Policy and Procedure for Enforcement Actions.

The proposed policy calls for stronger enforcement measures so that non-compliance is more expensive than compliance, and seeks to prohibit operations by licensees who fail to meet adequate levels of protection. The NRC staff held public meetings in December 1980 in five metropolitan locations to explain the proposed policy and obtain public comments.



An NRC inspector examines a gauge atop a pressurizer in a storage area at Marble Hill (Ind.) nuclear power plant.

The policy has been revised to allow the NRC staff wider discretion in enforcement decisions; to reduce vulnerability of licensees who identify and correct problems; to clarify certain violations, and to resolve past inconsistencies in the severity of penalities. The revised policy will be implemented in 1982.

INVESTIGATIONS

An important adjunct to NRC's inspection effort is the investigative program which covers not only in-depth probes of irregularities revealed during inspections, but also investigations of incidents, accidents, allegations, or any unusual circumstances occurring at or related to NRC licensed facilities or activities. A heightened public awareness and interest in nuclear power has resulted in an increase in the number of allegations received by NRC. Each allegation must be carefully investigated to determine its possible impact upon the public health and safety.

Investigations are conducted by experienced investigative personnel assigned to the staffs of the regional administrators at NRC's five regional offices. Since the investigations often are technical in nature, involving several scientific or engineering disciplines, the investigator works with the technical personnel who may be assigned to provide assistance.

NRC investigators also maintain liaison with Federal, State, and local law enforcement agencies and work closely with them on investigations of mutual interest. In 1981, IE investigators conducted investigations into allegations ranging from the falsificaiton of records to the willful violation of NRC rules, regulations and license conditions.

Table 3. Civil Penalties Imposed During FY1981

Licensee	*Amount*	*Reason*
Consumers Power Company Jackson, MI (Palisades Nuclear Power Station)	$450,000 (Reported as pending a hearing in FY80)	Operation of Palisades reactor for extended period with containment integrity violated. Agreement reached whereby licensee paid $225,000.
Washington Public Power Supply System Richland, WA (Washington Nuclear Project 2)	$59,500 (Reported as pending in FY80)	Noncompliance items in quality assurance program. Licensee paid the $59,500 penalty.
Superior Industrial X-Ray Co. Blue Island, IL (Radiographer)	$9,800 (Reported as pending in FY80)	Noncompliance items relating to a radiographic exposure device being left unattended. Order issued imposing a mitigated penalty of $9,050 which the licensee paid.
Nuclear Pharmacy, Inc. Chicago, IL (Radiopharmaceutical Supplier)	$5,700 (Reported as pending in FY80)	Noncompliance items relating to exposure of an individual. Licensee paid $4,200. Order issued, imposing the remaining $1,500, which the licensee paid.
Boston Edison Company Boston, Ma (Pilgrim Station)	$13,000 (Reported as pending in FY80)	Noncompliance items involving failure to follow procedures. Order issued imposing the $13,000 penalty which the licensee paid.
Minnesota Mining and Manufacturing Co. St. Paul, MN (Radioactive Material Supplier)	$2,000 (Reported as pending in FY80)	Noncompliance items relating to the transportation of radioactive waste materials. Order issued imposing the $2,000 penalty which the licensee paid.
Power Authority of the State of New York New York, NY (James A. FitzPatrick Nuclear Power Plant)	$48,000 (Reported as pending in FY80)	Noncompliance items in the physical security area. Order issued imposing the $48,000 penalty which the licensee paid.
Power Authority of the State of New York New York, NY (Indian Point Unit 3)	$12,000 (Reported as pending in FY80)	Noncompliance items relating to whole body and extremity exposures of personnel. Order issued imposing a mitigated penalty of $11,000 which the licensee paid.
Atomic Disposal Company Tinley Park, IL (Waste Material)	$2,000 (Reported as pending in FY80)	Noncompliance items relating to transportation of radioactive waste material. Order issued imposing the $2,000 penalty which the licensee paid.
Rio Algom Corporation Moab, UT (Uranium Mill)	$7,100	Noncompliance items relating to health and safety. Order issued imposing a mitigated penalty of $6,100, which the licensee paid.
Arkansas Power and Light Co. Little Rock, AR (Arkansas Nuclear One, Units 1&2)	$21,500	Noncompliance items relating to failure to implement effective management controls. The licensee paid the penalty.
Commonwealth Edison Company Chicago, IL (Dresden Units 2 and 3)	$40,000	A violation relating to inattention to duty by operators while at the controls of the reactor. A hearing was requested but an agreement was reached whereby the licensee paid $18,000 and withdrew the hearing request.
DePaul Hospital Cheyenne, WY (Medical Program)	$500	Violation involving loss of a molybdenum 99/technetium 99m generator. The licensee paid the penalty.
Niagara Mohawk Power Corp. Scriba, NY (Nine Mile Point Unit 1)	$225,000	Violation based on alleged material false statements. The licensee paid a mitigated penalty of $215,000

Consolidated Edison of New York New York, NY (Indian Point Unit 2)	$210,000 (pending)	Violations relating to the flooding of the reactor containment and failure to report. The licensee did not pay the imposed penalty and the matter has been referred to the Department of Justice.
Pharmatopes, Inc. Washington, D.C. (Radiopharmaceutical Supplier)	$7,550	Violations relating to the extremity exposure of an individual and other health and safety matters. Licensee paid the mitigated penalty of $7,050.
Commonwealth Edison Company Chicago, IL (Dresden Units 1, 2 and 3)	$4,000	Violation relating to shipment of radioactive waste material. The licensee paid the $4,000 penalty.
Consolidated Edison Company of New York New York, NY (Indian Point Unit 2)	$5,000	Violation relating to exceeding the Technical Specification Limiting Conditions for Operation of the Containment Spray System. Order issued imposing the $5,000 penalty which the licensee paid.
Consumers Power Company Jackson, MI (Midland)	$38,000	Violations involving major deficiencies in the quality assurance program, involving a licensee contractor. Licensee paid the $38,000 penalty.
Nondestructive Inspection Service, Inc. Hurricane, WV (Radiographer)	$5,000	Violations relative to health and safety practices. Order issued imposing mitigated penalty of $4,700 which the licensee paid.
Southern California Edison Co. Rosemead, CA (San Onofre 1)	$150,000	Violations relating to personnel exposures. Licensee paid the imposed penalty of $150,000.
Burnside Steel Foundry Co. Chicago, IL (Radiographer)	$2,650	Violations relating to management of program. Mitigated penalty of $2,150 imposed by Order, penalty was withdrawn due to licensee divesting himself of all material and requesting termination of license.
Public Service Electric and Gas Co. Newark, NJ (Salem Unit 1)	$90,000	Violations relating to deficiencies in radiation protection program. Licensee paid the $90,000 penalty.
Florida Power and Light Co. Miami, FL (Turkey Point 3)	$40,000	Violation relating to operator leaving controls while reactor was at full power. Licensee paid the $40,000 penalty.
Nuclear Metals, Inc. Concord, MA (Materials Licensee)	$5,000	Violation relating to the shipment of low specific activity material. Licensee paid the $5,000 penalty.
Fort Hamilton Hughes Memorial Hospital Center Hamilton, OH (Medical Licensee)	$4,000	Violations relating to the failure of teletherapy equipment and exposure of an individual. Based on additional information the proposed penalty of $4,000 was remitted in its entirety.
Pharmatopes, Inc. Oak Park, MI (Pharmaceutical Supplier)	$1,500	Violations relating to transportation of radioactive materials and other radiation protection problems. The licensee paid the $1,500 penalty.
Tennessee Valley Authority Knoxville, TN (Browns Ferry 1, 2 & 3)	$50,000	Violations relating to a breakdown of control of the fire protection program. Order was issued imposing a mitigated penalty of $45,000 which the licensee paid.
Georgia Power Company Atlanta, GA (Edwin I. Hatch 1 and 2)	$15,000	Violations relating to inadequate sampling procedures of contaminated waste oil. Licensee paid the $15,000 penalty.

Table 3. Civil Penalties Imposed During FY1981

(continued)

Licensee	*Amount*	*Reason*
Mayo Clinic Rochester, MN (Medical Licensee)	$1,500	Violation relating to a misadministration of a radiopharmaceutical. The licensee paid the $1,500 penalty.
Carolina Power and Light Co. Raleigh, NC (H. B. Robinson 2)	$40,000	Violations relating to the whole body exposures of two individuals while performing steam generator maintenance work. The licensee paid the $40,000 penalty.
Isotope Measurements Laboratories, Inc. Northbrook, IL (Materials Licensee)	$5,700 (Pending)	Violation relating to unauthorized distribution of radiopharmaceuticals.
Grandview Hospital Dayton, OH (Medical Licensee)	$1,000	Violations relating to improper administration of radiopharmaceuticals. Licensee paid the $1,000 penalty.
Met Lab, Inc. Hampton, VA (Radiographer)	$4,000 (Pending)	Violations relating to the exposure of an individual. An Order imposing a mitigated penalty of $3,000 has been issued.
Magnaflux Corporation Chicago, IL (Radiographer)	$8,000	Violations relating to the exposure of an individual. The licensee paid the $8,000 penalty.
Pharmaco Nuclear, Inc. Cleveland, OH (Pharmaceutical Supplier)	$2,800	Violation relating to the loss of a case containing radiopharmaceuticals. The licensee paid the $2,800 penalty.
Georgia Power Company Atlanta, GA (Edwin I. Hatch 2)	$40,000 (Pending)	Violations relating to the operation of the plant in excess of a Technical Specification Limiting Condition for Operation.
Power Authority of the State of New York New York, NY (James A. FitzPatrick)	$40,000	Violations relating to a change in Safety/Relief Valves which resulted in a violation of a Technical Specification Limiting Safety System Setting. The licensee paid the $40,000 penalty.
Pharmatopes, Incorporated Oak Park, MI (Radiopharmaceutical Supplier)	$5,000 (Pending)	Violation relating to an extremity exposure of an individual.
Mustang Services Houston, TX (Materials Licensee)	$6,000 (Pending)	Violations relating to radiation protection practices and the loss of a sealed source.
Jersey Central Power and Light Co. Morristown, NJ (Oyster Creek)	$80,000	Violations relating to the obstruction of vacuum breakers by contractor installed scaffolding. Licensee paid penalty.
Commonwealth Edison Co. Chicago, IL (Dresden 2)	$80,000 (Pending)	Violations relating to whole body exposures of two individuals.
Niagara Mohawk Power Corp. Syracuse, NY (Nine Mile Point 1)	$50,000 (Pending)	Violations relating to the bypassing of isolation signals in violation of a technical specification limiting condition for operation.
Tennessee Valley Authority Chattanooga, TN (Sequoyah 2)	$40,000 (Pending)	Violations relating to the failure to return recirculation valves in the Containment Spray System to their normally locked-shut position, in violation of procedures.

Public Service Electric and Gas Co. Newark, NJ	$40,000 (Pending)	Violations relating to inadequacies in the management of the licensee's physical security program.
Union Electric Company St. Louis, MO (Materials Licensee)	$2,000 (Pending)	Violations relating to failure to lock out level gauges before performing maintenance in coal hoppers which resulted in an exposure to an individual.

During fiscal year 1981, NRC personnel conducted 90 investigations. Sixty four were prompted by allegations dealing with reactor construction or operational events. Others dealt with allegations or events involving loss or theft of licensed material, overexposures, sabotage, and other matters of public interest.

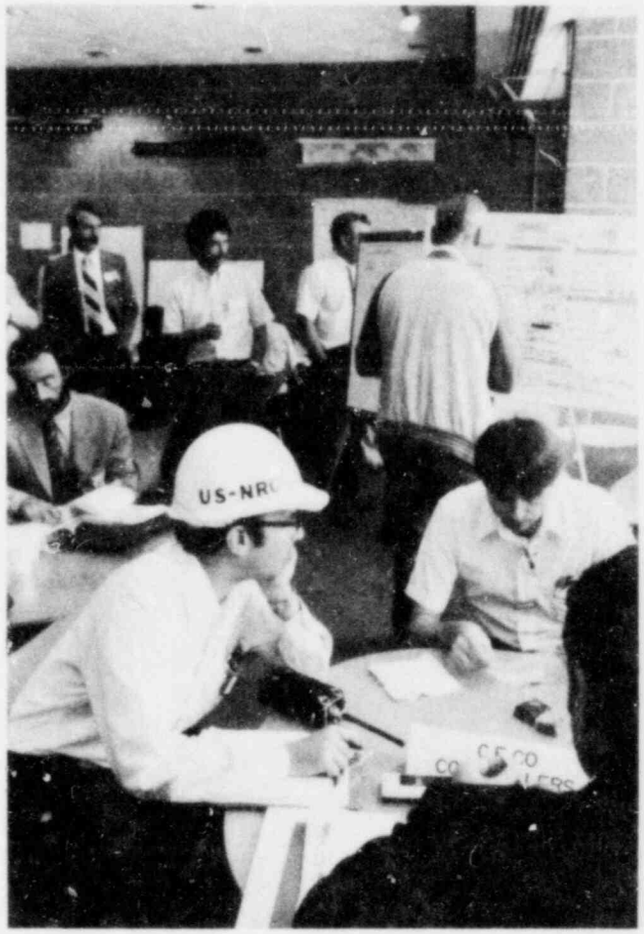
EMERGENCY PREPAREDNESS

In November 1980, the NRC put into effect a decision made during the previous reporting period, to consolidate and upgrade all emergency planning and response functions within the agency, and to provide new impetus and guidance to the operators of nuclear facilities and to government officials at State and local levels in handling a nuclear emergency. The entity created to oversee and implement this decision was the Division of Emergency Preparedness, of the Office of Inspection and Enforcement. The scope of the division's responsibilities included the coordinated oversight of emergency preparedness planning and actions within NRC and the wide ranging emergency response activities required of State and local government agencies and the nuclear facility owners and operators themselves. The NRC Operations Center in Bethesda, Maryland, is operated round the clock by headquarters technical personnel, and five operations centers have been located at the NRC regional offices which are activated in the event of an emergency. This new arrangement is discussed in some detail in the remainder of this chapter.

As noted in Chapter 3 of the *1980 NRC Annual Report*, it was the Three Mile Island accident that made it clear to NRC that the siting and safety design features confirmed for in the licensing process afford effective protection in extreme situations only if licensees are required to take added protective measures once an accident or serious threat of accident occurs. TMI also made it clear that, even without significant off-site radiological consequences, such events can affect the way State and local officials will react to protect the public.

NRC's emergency preparedness program aims at ensuring that operators are ready at all times for radiological emergencies. To do this, the NRC staff reviews emergency plans as they are submitted, appraises their implementation at each site, observes and evaluates tests and exercises, and then certifies that both licensee and official off-site agency emergency preparedness is maintained for a given facility. In reaching the latter decision, NRC considers the findings of the Federal Emergency Management Agency (FEMA) in its evaluations of the preparedness of State and local governments.

Emergency plans as well as overall emergency preparedness at a nuclear power facility are tested in integrated exercises involving major local response organizations. The exercises involving major local response organizations. The exercises, typically, include the simulation of a radioactive release and resulting dose assessment, medical emergencies, site evacuation, radiological monitoring, and other events peculiar to a locality and its emergency response or-



NRC representatives were both observers and participants in the Zion (Ill.) nuclear power plant emergency preparedness exercise. NRC Regional III Director James Keppler led the inspection team at the site while staff members in the regional office and at NRC headquarters charted the course of the "incident."

Table 4. Enforcement Orders Issued by IE in FY 1981

Licensee	*Date*	*Reason*
Tennessee Valley Authority Chattanooga, TN (Browns Ferry Units 1, 2 & 3)	10/02/80	Confirmatory Order **Reason:** To formalize commitments for certain actions in response to IE Bulletin 80-17, which requested additional assurance of ability to scram.
Niagara Mohawk Power Corporation Syracuse, NY (Nine Mile Point Unit 1)	10/02/80	Confirmatory Order **Reason:** Same as above
Philadelphia Electric Company Philadelphia, PA (Peach Bottom Units 2 and 3)	10/02/80	Confirmatory Order **Reason:** Same as above
Boston Edison Company Boston, MA (Pilgrim)	10/02/80	Confirmatory Order **Reason:** Same as above
Vermont Yankee Nuclear Power Company Westboro, MA (Vermont Yankee)	10/02/80	Confirmatory Order **Reason:** Same as above
Jersey Central Power and Light Company New York, NY (Oyster Creek)	10/02/80	Confirmatory Order **Reason:** Same as above
Power Authority of the State of New York New York, NY (James A. FitzPatrick)	10/02/80	Confirmatory Order **Reason:** Same as above
Commonwealth Edison Company Chicago, IL (Dresden Units 2 and 3, Quad Cities Units 1 and 2)	10/02/80	Confirmatory Order **Reason:** Same as above
Nebraska Public Power District Columbus, NB (Cooper Station)	10/02/80	Confirmatory Order. **Reason:** To formalize commitments for certain actions in response to IE Bulletin 80-17, which requested additional assurance of ability to scram.
Northeast Nuclear Energy Company Hartford, CT (Millstone Unit 1)	10/02/80	Confirmatory Order **Reason:** Same as above
Niagara Mohawk Power Corporation Scriba, NY (Nine Mile Point Unit 1)	11/26/80	Order for Modification of License (Effective immediately) and Order to Show Cause. **Reason:** Material False Statement submitted to NRC in response to NRC Order to 01/02/80 relating to Category A items covered in NUREG-0578.
Applied Health Physics, Inc. Bethel Park, PA (Waste Handler)	12/08/80	Order to Modify License and Order to Show Cause why such Modification should not be made permanent. **Reason:** Licensee failed to transfer all material to an authorized burial facility as required by NRC Order, dated 07/02/80.
Automation Industries, Inc. Danbury, CT (Source Encapsulation)	02/17/81	Order suspending license and to Show Cause why suspension of license should not be continued, pending further Order. **Reason:** Exposures of personnel at the licensee's Phoenixville, PA encapsulation facility and failure to report exposures.

Automation Industries, Inc. Danbury, CT	03/06/81	Order (Rescinding Previous Order and Modifying License on a Temporary Basis. Pending submittal of License Amendment Application.) **Reason:** Review of licensee's proposed actions indicated adequate corrections in the licensee's program to comply with Commission requirements.
Consumers Power Company Jackson, MI (Palisades Nuclear Power Facility)	03/09/81	Order confirming licensee actions to upgrade facility performance. **Reason:** Failure to control safety related components in accordance with facility procedures and below average performance over past several years as pointed out during SALP appraisal.
Applied Health Physics Bethel Park, PA (Waste Handler)	03/09/81	Order to Modify License and Terminate Show Cause Order, dated December 8, 1980. **Reason:** Review of licensee's proposed actions indicated that future activities could be conducted in compliance with Commission requirements.
Isotope Measurements Laboratories, Inc. Northbrook, IL (Materials Licensee)	05/26/81	Order to Show Cause why activities under license should not be suspended. **Reason:** Unauthorized distribution of radiopharmaceuticals.
John C. Haynes Co. Heath, Ohio (Materials Licensee)	08/28/81	Order to Modify License. **Reason:** Failure on part of licensee to make required payments to the Commission and to conduct radiation surveys and decontamination incident to the conversion of the license to a "storage only" license.

ganizations. NRC evaluates a licensee's performance in an exercise, while FEMA evaluates the performance of State and local authorities. Twenty-three emergency exercises involving State and local participation were conducted between October 1980 and September 1981.

On April 1, 1981, nuclear power reactor licensees were required to have upgraded emergency plans and procedures in effect, and to test them once a year. NRC technical teams monitor such exercises for 72 nuclear power plants at 49 different sites. The staff is scheduled to complete the evaluation of the emergency plans for all operating plants by April 1, 1982, and also to observe at least one full scale exercise at each site by the same date. In the case of the 12 plants seeking license, no operation above 5% of rated power will be allowed until emergency preparedness is deemed acceptable by both NRC and FEMA.

During 1981, the NRC teams reviewed and evaluated about 80 percent of the nuclear power plant sites and observed exercises at about 40 percent of the nuclear power plants. When these initial site visits are finished in April 1982, the second phase of the program—to assess the upgraded emergency response facilities and communications systems—will run for another two years. Subsequent exercises will concentrate on the use of these sophisticated emergency response facilities, equipment and systems, and the program will shift largely into a maintenance mode in which the on-site preparedness capabilities of one third of the facilities will be inspected and all exercises evaluated each year.

Emergency Preparedness Appraisals

Each appraisal team consists of at least four professionals—from NRC headquaters, NRC Regions and consultants from Battelle Pacific Northwest Laboratories. About two weeks of preparation preceeds each visit which normally lasts about two weeks. Appraisals involve reviews of records, discussions with personnel, observation of work practices and independent tests and measurements by team members, and must result in a finding of reasonable assurance that appropriate protective measures will be taken in the event of a radiological emergency. To receive such a positive finding, the licensee must demonstrate that the equipment, personnel and procedures are in place to detect and assess an accident, that appropriate authorities and the public will be notified promptly, and that adequate protective actions will be taken.

If an appraisal reveals significant deficiencies, the licensee concerned has up to 4 months from the date of the appraisal to make corrections. He also must respond in writing to the NRC letter which identifies major weaknesses and problems. In some cases, the licensee must take immediate corrective actions proposed by the appraisal team and agreed to by the licensee.

Worker with simulated injuries is removed to health physics area for simulated decontamination during emergency drill at the V. C. Summer (S.C.) nuclear power plant.

Prompt Notification Rule

A new NRC rule on emergency planning calls for a licensee to notify State and local government agencies within 15 minutes after declaring an emergency, and to demonstrate that State and local officials can notify the public within a 10-mile Emergency Planning Zone (EPZ) in about 15 minutes after that. The rule called for the administrative and physical means to notify organizations and the public to be established by July 1, 1981; however, only six of 48 sites met the rule on that date. After reviewing the reason for noncompliance, the commission extended the requirement to February 1, 1982, after a public comment period.

In addition to its work on emergency planning for power reactors, the staff began to review emergency planning for research and test reactors. This review resulted in the development of upgraded guidance criteria for use by research and test reactor licensees in preparing emergency plans and upgrading emergency preparedness for these facilities.

Additionally, the Commission proposed amendments to its regulations to change the power level threshold governing the dates to submit emergency plans from 500 KW to 1MW thermal and to extend for four months after the effective date of the rule the present November 3, 1981 date by which affected licensees are required to submit emergency plans.

NRC Operations Center And Nuclear Data Link

In the event of an emergency, NRC response activities will be directed from the NRC Operations Center in Bethesda while personnel from the affected Regional Office are enroute to the incident site. A program is planned to improve the availability of timely and accurate emergency-related information in the Operations Center if an emergency should occur at a commercial power reactor. Another program is already underway to upgrade the training of response personnel and the facilities they will use during an emergency involving an NRC licensee.

Reactor, radiological and meteorological data are now telephoned to the Operations Center during emergencies. Automatic transmission at such times would provide more timely and accurate data. Installation of prototype Nuclear Data Link (NDL) equipment is planned to begin in 1982 to evaluate the use and value of such a system, both to the NRC and to licensee and State personnel with whom the NRC would cooperate in an emergency. Results of the prototype evaluation will ultimately be used by the Commission and the Congress to decide if NDL installation is justified at all commercial power reactors.

NRC response personnel will provide recommendations to State and local officials during emergencies. Along with better training and physical facilities, better techniques for the handling of information are being developed to assure that any advice the response teams provide is based on accurate and complete analyses of available data.

During the early phase of the program, an outside contractor will develop a test and evaluation plan by whihc certain commercially available data and display systems also will be evaluated in 1982.

Emergency Response Centers

In February 1981, NRC published a "Functional Criteria for Emergency Response Facilities" (NUREG-0696), identifying the facilities and systems required at nuclear power plants to provide assurance of effective response to emergency situations. In addition to the control room which is, of course, the key facility from which the plant is operated, each facility must also have the following:

A Technical Support Center (TSC)—an emergency response facility near the control room which has work areas, communications, displays and data for use by senior plant management and technical personnel to monitor and support control room operations during an emergency.

An Operations Support Center (OSC)—a personnel assembly and deployment area, separate from the control room and the TSC, where plant emergency personnel can report during an accident.

NRC Region III's Incident Response Center in Glen Ellyn, Ill., was activated in July 29, 1981, as the NRC joined with other Federal, State and local agencies in a day-long exercise of the radiological emergency response plan for the Zion nuclear power plant. The exercise was the largest of its kind involving Federal agencies. Region III Deputy Director A. Bert Davis, at left, headed the NRC team.

An Emergency Operations Facility (EOF)—located near the plant where overall emergency response to accidents and the management of recovery is coordinated. This facility, which has work areas, communications, displays and data for corporate management, offsite officials and technical personnel, is designed to provide decisionmaking assistance on matters affecting public health and safety, dose assessment, offsite coordination, and deployment of radiological monitoring teams.

A Safety Parameter Display System (SPDS)—provides a display of the plant parameters from which the safety status of operation may be assessed in the control room, the technical support center and the emergency operations facility. Its primary function is to help operating personnel in the control room quickly assess the plant safety status.

Potassium Iodide

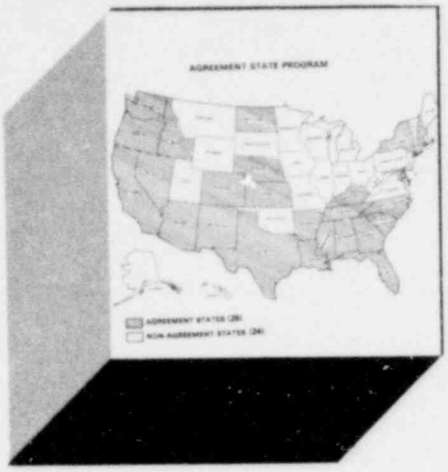
The use of orally administered potassium iodide (KI) in protecting the public from radioiodine released in an accident was discussed in detail the *1980 NRC Annual Report*. (See p. 33.)

These risks were being evaluated in 1981, and the use of KI was encouraged only for limited groups of personnel under controlled conditions. The drug is being stockpiled at operating nuclear power plants for use by site personnel and offsite emergency personnel. Its use has been suggested in institutions such as hospitals, prisons, etc., within a radius of approximately 10 miles of a nuclear power plant where immediate evacuation would be extremely difficult and the administration of the drug can be controlled. The NRC has asked FEMA to study the feasibility of establishing a national stockpile and distribution plan for KI for use by the general public living within this 10-mile radius and also the feasibility of distributing, as an alternative, surgical masks. In addition, the Food and Drug Administration is developing guidance on when KI should be administered to the general public and the medical support that should be provided to the public when it is administered.

NRC, in turn, has initiated studies to determine if the radioactive iodine released in a power reactor accident has been overestimated, and to determine the effectiveness of certain "ad hoc" procedures—breathingthrough damp cloths, types of shelter, etc.—in prevent the inhalation of airborne radioactivity including radioiodine.

Additional Guidance

In April 1981, the staff published a temporary instruction on emergency preparedness which describes the scope of the NRC "Emergency Preparedness Implementation Appraisal Program" and provides guidance to the NRC staff for its implementation. It modifies earlier inspection techniques by accommodating the team inspection efforts to be conducted during 1982.



8

Cooperation With the States

Nuclear Regulatory Commission activities involving contacts with regional, State and local agencies involve many parts of the NRC staff, as well as the Commission itself. The principal focus of such contacts within the staff is the Office of State Programs. Key activities in this field during 1981 included:

(1) Initiation of a pilot regionalization program for the State Agreements function (see below),

(2) Intensified work with officials of six states in their pursuit of amendments to the agreements on regulation of mill tailings to conform to the Uranium Mill Tailings Radiation Control Act of 1978,

(3) Continued to conduct a uranium licensing and inspection course, as well as several radiation safety courses, for State personnel,

(4) Published guidelines for NRC review of Agreement State radiation control programs,

(5) Completed updating of the 1961 Model Radiation Control Act, submitting it through the Office of Management and Budget to the Council of State Governments, and

(6) Continued the important cooperative effort with the states in implementing the new Low Level Waste Policy Act of 1980.

These and other activities are discussed in some detail below.

STATE AGREEMENTS PROGRAM

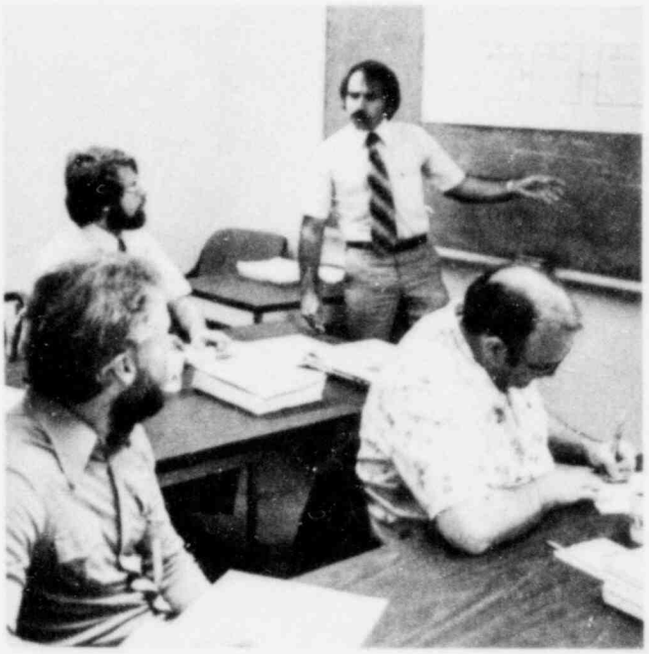
The Nuclear Regulatory Commission has agreements with 26 states which provide for them to assume regulatory responsibility over byproduct and source material and small quantities of special nuclear material. At the end of 1981, those States regulated more than 12,500 radioactive material licenses. They are Alabama, Arizona, Arkansas, California, Colorado, Florida, Georgia, Idaho, Kansas, Kentucky, Louisiana, Maryland, Mississippi, Nebraska, Nevada, New Hampshire, New Mexico, New York, North Carolina, North Dakota, Oregon, Rhode Island, South Carolina, Tennessee, Texas and Washington.

Review of State Regulatory Programs

The NRC is required by the Atomic Energy Act of 1954 to periodically review Agreement State radiation control programs to determine that they are adequate to protect public health and safety and are compatible with NRC programs. Seventeen program reviews and one follow-up review were conducted in 1981. As part of the program review, the NRC technical staff accompanies State inspectors to licensed facilities to evaluate inspector performance. The visits in 1981 included a State-licensed low-level waste site and several uranium mills. The one follow-up review in 1981 addressed earlier NRC findings of deficiencies in the Alabama program relating to a high inspection backlog and staff shortages. The review revealed that the deficiencies had been corrected. On December 4, 1981, the NRC published in the *Federal Register* a revised and updated policy statement containing guidelines for the review of Agreement State radiation control programs.

NRC Technical Assistance to States

NRC technical assistance to the Agreement States during 1981 was provided in the areas of licensing, environmental analyses, reviews of proposed statutes and regulations, and guidance for inspection and enforcement actions. Special assistance was provided to



State officials attend Uranium Mill Licensing and Inspection Training Course in Bethesda, Md. Training is also offered State personnel in a variety of radiation control programs. (See below.)

New Mexico, Texas, Colorado and Washington on their regulation of uranium mills and mill tailings. Maryland received NRC assistance on a contamination incident investigation and a cobalt 60 irradiation facility.

Training Offered by NRC

State radiation control personnel regularly attend NRC-sponsored courses to upgrade their technical and administrative skills so as to maintain high quality regulatory programs. Both Agreement State and non-Agreement-State personnel attend these courses at no cost. Courses sponsored by NRC during 1981 included: "Industrial Radiography", Gamma Industries Inc. Baton Rouge, Louisiana; "Medical Uses of Radionuclides", Memorial Sloan-Kettering Cancer Center, New York City; "Health Physics and Radiation Protection", Oak Ridge Associated Universities; "Inspection Procedures", NRC Regional Offices; "Teletherapy Calibration", M.D. Anderson Hospital, Houston, Texas; "Orientation in Regulatory Practices", NRC headquarters; and "Gas and Oil Well-Logging for Regulatory Personnel", Schlumberger, Inc. Houston, Texas. In addition, training was offered in radiochemistry, radiation protection engineering, uranium mill licensing and inspection procedures, and environmental radiation doses from uranium recovery. A total of 195 state regulatory persons received 429 student-weeks of training during the year.

Annual Agreement States Meeting

The annual meeting of Agreement State radiation control program directors, held in October 1981 in Arlington Texas, covered a wide range of topics, including uranium mill regulation, waste management, transportation, environmental issues, emergency preparedness, occupational radiation exposure, and problems involved in regulating radioactive materials. NRC personnel at the meeting discussed enforcement policy, revisions to NRC regulations, and the NRC's recently developed medical misadministration rule.

Agreement States and Uranium Mill Tailings

During 1981, NRC has been reviewing the regulatory programs of those States which have indicated an interest in entering into amended agreements by November 1981. Criteria for these States were adopted by the Commission on December 17, 1980, and were published in the *Federal Register* on January 23, 1981. NRC furnished preliminary assessments of the States' abilities to meet these criteria to the States in the summer of 1980, and provided updated assessments in early 1981. These evaluations covered areas such as the adequacy of authorizing legislation, implementing regulations, and staff resources. NRC staff has participated in hearings in New Mexico and Colorado concerning the adoption of mill tailings regulations and has also met with the States to review the amended agreement packages.

On December 4, 1981, President Reagan signed the NRC Appropriation Bill (PL 97-88) which provided, among other things, that NRC's accession to jurisdiction in Agreement States over uranium mill tailings without amended agreements is deferred for FY 82. The law precludes NRC from implementing or enforcing its mill tailings standards published on October 3, 1980 but does not prohibit NRC from entering into amended agreements permitting Agreement States to continue regulating mill tailings. Washington, Colorado and Texas, which have active milling operations, voluntarily applied for an amended agreement and submitted the documentation necessary to such an agreement. New Mexico, which also has active milling operations, submitted a draft proposal for NRC comment. The NRC was working with the States to complete agreements as the year closed.

LIAISON AND COOPERATIVE ACTIVITIES

Model State Radiation Control Act

The Council of State Governments' "Suggested State Legislation—Program for 1961" included a

model State Radiation Control Act which has been used by many States as a framework for developing comprehensive radiation control programs. In the 20 years since the model was published, many changes in Federal and State radiation control programs, have necessitated changes in the model act itself.

The NRC in cooperation with the Food and Drug Administration and the Conference of Radiation Control Program Directors (CRCPD), has prepared an updated model State Radiation Control Act which has been reviewed and forwarded by the Office of Management and Budget to the Council of State Governments.

The key additions relate to provisions of the Uranium Mill Tailings Radiation Control Act of 1978 (UMTRCA) for source material processing and tailings management; low-level radioactive waste disposal; user fees; civil penalties; surety requirements; and the authority to regulate sources of non-ionizing radiation in addition to radioactive materials and machines which generate ionizing radiation. The section on sureties combines the provisions of UMTRCA, recommendations of the CRCPD's task force on bonding and perpetual care and provisions of the Commission's proposed regulation 10 CFR Part 61 on low-level waste disposal.

Deleted were provisions for administrative organizations which combine regulatory and promotional activities in State radiation agencies, and for a radiation advisory board which vested policy and decision making responsibilities in members who are not public employees.

Transportation Surveillance

During 1981, six states (Illinois, Maryland, Michigan, Nevada, South Carolina and Washington) were participants in a joint NRC/Department of Transportation program to monitor the transport of radioactive materials through their borders. Results of such surveillance in 1980 were published, in NRC documents as follows: Florida, NUREG/CR-2036; Washington, NUREG/CR-2037; South Carolina, NUREG/CR-2195; and Georgia, NUREG/CR-2280. In October 1981, this program which began in 1973 was enlarged to include all hazardous materials, and State standards enforcement activities became the major emphasis with the Department of Transportation assuming primary funding and administrative responsibility. NRC plays a supporting role.

Memoranda of Understanding

Since 1976 the NRC has been implementing a program of entering into Memoranda of Understanding with States in which the parties pledge their cooperation in areas of mutual interest. A total of 14 such agreements have been developed, some dealing with the quality of water discharged from NRC-licensed facilities, for example, but most more general in coverage. In 1981, the NRC entered into two specific subagreements with the State of Washington. One established procedures for a joint hearing to be held on the Skagit Nuclear Power Plant application. The other established a management committee to supervise the development of a joint Washington-NRC environmental impact statement (EIS) on the amended Skagit application.

State Liaison Officers

As noted in the 1980 Annual Report, governors of all states and the Commonwealth of Puerto Rico have now appointed liaison officers to maintain direct communication with NRC. In a December 1980 meeting of State liaison officers held in Washington, and a September 1981 regional meeting in Chicago, conferees addressed the subjects of radioactive wastes, and emergency planning.

With regional State liaison officers now assigned to all five of its regional offices, NRC has in place the

Mr. B. Paul Cotter, Jr., Chairman of the NRC's Atomic Safety and Licensing Board Panel, at left, and Mr. Nicholas B. Lewis, Chairman of the Washington State Energy Facility Site Evaluation Council, sign a Memorandum of Understanding to establish procedures for joint hearings in Bethesda, Md.

Executive Board of the Conference of Radiation Control Program Directors meet with Chairman Palladino (center) and other NRC officials in November 1981, in Bethesda, Md.

capability to respond more quickly to local needs and to maintain regular contact with the key officials responsible for State or local regulatory and policy decisions. Under this program NRC personnel played active roles in State low-level waste compact activities, off-site emergency planning, and the transportation of radioactive materials in 1981.

Conference of Radiation Control Program Directors

The NRC continued its financial and technical support of the Conference of Radiation Control Program Directors, Inc., which is composed of the heads of State and major municipal radiation protection programs. (See page 180, 1979 Annual Report.) Federal co-sponsorship of the Conference was extended in 1981 to include the Department of Energy and the Federal Emergency Management Agency. Early in the year, the Conference established a central office in Frankfort, Kentucky, to enhance cooperation with and among the governments, and agencies concerned with safety.

Low-Level Waste Compacts

The Low-Level Radioactive Waste Policy Act, enacted in December 1980, stated that each State is responsible for the disposal of low-level radioactive waste generated within its borders, and authorized regional interstate compacts to establish and operate regional disposal sites. It also provided that after January 1, 1986, member States of a compact can exclude wastes from outside their regions. NRC has been working with the States in implementing the policy and in developing compacts.

Reporting State Legislation

The Office of State Programs, continued into its seventh year the periodic publication, *Information Report on State Legislation*. The report summarizes both introduced and enacted legislation in 17 nuclear-related categories, such as, agreements, emergency preparedness initiatives, power plant siting, transportation, uranium milling, waste management, etc. A new computer now permits NRC to track State legislation more effectively than before, and it was possible to issue special editions of the *Report* summarizing State legislation on emergency preparedness and radioactive waste. States and other Federal agencies use the *Report* as a source of up-to-date information, and on January 1, 1982, non-government users will be able to purchase the *Report* through the NRC/GPO Sales Program as NUREG/BR-0025.

INDEMNITY AND FINANCIAL PROTECTION

The Price-Anderson System

NRC's regulations implementing the Price-Anderson Act provide a three-layered system to pay public liability claims in the event of a nuclear incident causing personal injury or property damage. The first layer of this system requires all licensees of commercial nuclear power plants rated at 100 electrical megawatts or more to provide proof of financial protection in an amount equal to the maximum liability insurance available from private sources. Currently, this amount is $160 million.

The second layer provides a mechanism - payment of a retrospective premium - whereby the utility industry would share liability for any damages exceeding $160 million that result from a nuclear incident. In the event of such an incident, each licensee of a commercial reactor rated at 100 electrical megawatts or more would be assessed a prorated share of damages up to the statutory maximum of $5 million per reactor per incident. Presently, the secondary financial protection layer is $375 million (i.e., 75 power re-

actors rated in excess of 100 MW(e) licensed to operate X $5 million/reactor).

The third layer - Government indemnity - equals the difference between the $560 million limit of liability and the sum of the first and second layers. Currently, the third layer is $25 million. Government indemnity for reactors will be phased out when the sum of the first and second layers provides liability coverage of $560 million. Under the current level of primary financial protection required by the Commission, this will occur when 80 commercial reactors have been licensed. After that point, the limit of liability for a single nuclear incident would increase without limit in increments of $5 million for each new commercial reactor licensed.

Office of State Programs staff meet with Dr. Phillip Gustafson, Director of the Illinois Department of Nuclear Safety in Bethesda, Md.

Financial Protection for Three Mile Island Units 1 and 2

On May 1, 1979, the two nuclear energy liability insurance pools, American Nuclear Insurers (ANI) and Mutual Atomic Energy Liability Underwriters (MAELU), informed the Commission and Metropolitan Edison Company, Jersey Central Power and Light Company and Pennsylvania Electric Company — the holders of licenses authorizing operation of the Three Mile Island (TMI) Nuclear Station, Units 1 and 2 — that because of the March 28, 1979 accident at TMI, the pools were unwilling at that time to make $160 million in nuclear liability insurance available for the TMI site, despite the licensee's request for such increased coverage. The pools' principal reason for not increasing the primary insurance available (from $140 million to $160 million) for TMI was their desire to limit clearly to $140 million their potential liability for claims and claims expenses arising out of the accident. The pools were opposed to increasing the primary insurance layer to $160 million because they would not be assured that the additional $20 million would not be used to satisfy public liability claims associated with the accident which might arise either prior to or subsequent to May 1, 1979.

The Commission notified the licensee for TMI that it would have to demonstrate its compliance with NRC regulations by providing to the Commission evidence that $160 million in primary financial protection for both units 1 and 2 was in place as of May 1, 1979. The insurance pools proposed an endorsement that would provide $140 million to primary insurance to Three Mile Island, Units 1 and 2, with an additional $20 million for both units. This additional $20 million would only apply to Unit 2, however, if a new accident at Unit 2 were declared an "extraordinary nuclear occurrence" (ENO), a term defined in subsection 11j. of the Atomic Energy Act of 1954, as amended. The insurance pools insisted on this ENO provision to ensure that the additional $20 million could not be used to satisfy public liability claims associated with the March 28 accident. The Commission in reviewing the pools' proposed endorsement determined that it complied with the required financial protection and notified the licensee of its acceptability.

On a related matter, the indemnity agreement executed by the licensee and the Commission requires that, in the event of payments made by the insurers under an insurance policy used as financial protection which reduce the aggregate limit of the policy, the licensee must apply to its insurers for reinstatement of the amount of these payments. The licensee requested reinstatement of the approximately $1.7 million paid out for claims and claims expenses arising out of the March 28, 1979 accident and the insurance pools have complied with this request.

Three Mile Island Liability Settlement Agreement

In early September 1981, a Settlement Agreement was signed in the TMI class action litigation arising out of the March 28, 1979 accident. Under the terms of the agreement the insurance pools will pay $20 million on behalf of the defendants to establish an Economic Loss Fund to cover economic loss claims from persons and businesses located within 25 miles of TMI. In addition, a Public Health Fund of $5 million will be established for various public health activities in the TMI area, including improvements in radiation monitoring, studies in possible health-related effects on the population around TMI, public education programs concerning early detection of cancer, assistance in development of emergency evacuation plans in the area and general research into health effects of low level radiation.

Indemnification of Storage of Spent Fuel At Distant Reactor Locations

On January 8, 1979, the Commission published a notice in the *Federal Register* (44 FR 1751) requesting public comment on specific requests by two utilities, Duke Power Company and Commonwealth Edison Company, to indemnify spent fuel at a reactor site different from the one where it was generated. Commonwealth has since requested that the Commission defer action on its application. Duke proposed to store fuel irradiated at Oconee at the McGuire reactor site under its McGuire Operation license. The Commission extended indemnity coverage under the McGuire indemnity agreement to the Oconee irradiated fuel stored at the McGuire reactor.

Indemnity Operations

As of September 30, 1981, 132 indemnity agreements with NRC licensees were in effect. Indemnity fees collected by the NRC from October 1, 1980, through September 30, 1981, totaled $847,084. Total fees collected since the inception of the program are $21,874,442. Future collection of indemnity fees will continue to decrease as the indemnity program is phased out for commercial reactor licensees. No payments have been made under the NRC's indemnity agreement with licensees during the 24 years of the program's existence.

Insurance Premium Refund

The two private nuclear energy liability insurance pools, American Nuclear Insurers and the Mutual Atomic Energy Liability Underwriters, paid to policyholders the fifteenth annual refund of premium reserves under their Industry Credit Rating Plan. Under the plan, a portion of the annual premiums is set aside as a reserve for either payment of losses or ultimate return to policyholders. The amount of the reserve available for refund is determined on the basis of loss experience of all policy holders over the preceding 10-year period. Refunds paid in 1981 totaled $1,653,042; which is approximately 28.8 percent of all premiums paid on the nuclear liability insurance policies issued in 1971 and covers the period 1971-1981. The refunds represent 39.6 percent of the premiums placed in reserve in 1971.

Financial Qualifications

On August 18, 1981, a notice of proposed rulemaking was published in the *Federal Register* that would amend the NRC's regulations to (1) eliminate the present financial qualifications review of electric utilities that are applying for reactor construction permits; and (2) either eliminate also the present financial qualifications review of electric utilities that are applying for reactor operating licenses, or retain that part of the financial qualifications review relating to decommissioning costs.

The Commission's reasons for the proposed rule are that (a) the link between public health and safety and financial qualifications are tenuous and (b) electric utility applicants have the ability to recover construction and operation costs either through the economic regulatory process or through their ability to set their own rates.

A possible exception to the proposed elimination of financial-qualification requirements is that portion of the operating license review of financial qualifications relating to permanent shutdown and maintenance of the facility in a safe condition — that is, decommissioning. Safety and financial aspects of decommissioning nuclear facilities are being studied by the Commission. Upon completion of rulemaking on the decommissioning issue, the Commission will reexamine the financial qualifications regulations and will, if necessary, further amend them to conform to the final rule on decommissioning.

As part of the proposed rulemaking on financial qualifications, the Commission is also proposing to require power reactor licensees to maintain the maximum amount of commercially available on-site property damage insurance. Such a requriement would act to provide additional assurance that licensees would be better able to cope financially with any future TMI-type accidents.

Need for Power

On August 3, 1981 the Commission proposed rulemaking providing that, for National Environmental Policy Act (NEPA) purposes, need for power and alternative energy source issues will not be considered in operating license proceedings for nuclear power plants and need not be addressed by operating license applicants in environmental reports submitted at the operating license stage. The Commission believes that the construction permit proceeding is the appropriate forum in the NRC's two-step licensing process for resolving need for power issues. Before construction begins, there has been little environmental disruption at the proposed site and only a relatively small capital investment has been made by the license applicant. Hence, real alternatives to the construction and operation of the proposed facility exist, including no additional generating capacity at all if no "need" exists or generation of the needed electricity by some non-nuclear energy source.

By contrast, the operating license stage is reached only after a finding at the construction permit stage that there was need for the power and that, on balance, no superior alternative energy sources existed. The Commission believes that at the time of the operating license decision, construction-related environ-

mental impacts have already occurred and almost all construction costs have been incurred by the licensee. Operation of a nuclear power plant entails some environmental costs which should be justified, under NEPA, by some benefit from plant operation. For all cases to date, and in all foreseeable cases, there will be some benefit in terms of either meeting increased energy needs or replacing less economical generating capacity.

Reports available to the Commission show that the economic costs of operating completed nuclear power plants have been below the operating costs of available methods of baseload fossil generation. Further, past experience suggests that rarely will an alternative energy source, including use of an existing fossil-fired unit as substitute for the nuclear plant, be found environmentally superior.

Given the apparent economic advantages of operating existing nuclear plants, the Commission believes that even an alternative shown to be marginally environmentally superior in comparison to operation of a nuclear facility is unlikely to tip the NEPA cost-benefit balance against issuance of the operating license.

In addition, as a matter of policy the Commission endorses placing substantial reliance on State assessments of need for power, energy conservation, and alternative energy source analyses to fulfill NRC's NEPA responsibilities at the construction permit stage. The Commission has requested its staff to develop procedures to solicit input from the States and the Federal Energy Regulatory Commission for use in the environmental impact statement and for testimony before licensing boards in construction permit proceedings. The staff is holding meetings and workshops with State agencies to provide technical assistance to them and to become familiar with State activities in need for power assessment.

9 International Cooperation

The NRC's international activities continued to expand in 1981 under the impetus of international concern over issues of health and safety, and nonproliferation. During the year, the NRC:

- Signed arrangements with Egypt and the People's Rebublic of China that brought to 21 the number of active international bilateral arrangements for the exchange of reactor safety information and cooperation.
- Arranged meetings for vistors from 22 foreign countries and two international organizations to consult with the NRC staff.
- Arranged for 19 foreign regulatory officials from 10 countries to work with the NRC staff on one-year assignments to gain experience in the areas of reactor licensing, human factors safety and systems evaluation.
- Sponsored a course in radiological emergency response operations training attended by nineteen foreign nationals from nine countries.
- Taught courses on reactor safety technology in Korea and Mexico in co-sponsorship with the technical assistance program of the International Atomic Energy Agency (IAEA).
- Provided safety experts on short-term assignments to the Philippines, Yugoslavia, Korea, Brazil, Mexico, and Egypt.
- Carefully reviewed and issued 421 export licenses and 140 amendments to existing licenses.
- Issued several export licenses for reduced-enrichment fuel to be installed as test elements in foreign reactors to help reduce the amount of potential nuclear explosive material in international commerce.
- Assisted in the implementation of the voluntary application of international safeguards at civil nuclear facilities in the United States.

INFORMATION EXCHANGES

Bilateral Arrangements

Since mid-1974, the NRC has engaged in a program of nuclear safety information exchanges and cooperation arrangements with other countries. Originally designed to assure that the experience of countries with major commitments to light water reactor technology was made available to the NRC staff, the program has since been expanded to make such information available to countries with small nuclear power programs or with plans to enter the nuclear power field. These arrangements are designed to establish official communications channels on reactor safety problems, a network for bilateral cooperation, and a vehicle for U.S. assistance in improving health and safety practices, particulary in countries importing U.S. reactors and other equipment.

Bilateral arrangements have been concluded with 21 countries: Belgium, Brazil, the People's Republic of China, Denmark, Egypt, Finland, France, the Federal Republic of Germany, Greece, Israel, Italy, Japan, Korea, Mexico, the Netherlands, the Philippines, Spain, Sweden, Switzerland, Taiwan, and the United Kingdom. During 1981, the NRC also conducted arrangement negotiations with regulatory authorities in Argentina, Austria, Canada, Romania, Turkey, and Yugoslavia.

These arrangements typically call for a reciprocal exchange of regulatory information—technical reports, correspondence, newsletters, meetings, training courses—and, in some cases, for cooperation in reac-

The signing of the NRC-Mexico Regulatory and Safety Research Arrangement took place on April 8, 1981. Seated at left are Sergio Ruiz and Roberto Trevino of the National Nuclear Safety and Safeguards Commission of Mexico. Standing is James Shea, NRC Director of International Programs. Seated at right are Joseph D. Lafleur (signing agreement) of the NRC and William J. Dircks, NRC Executive Director for Operations.

tor safety research or for temporary exchange assignments of personnel to agencies and joint laboratory programs. They are written to cover a five-year period, and may be extended by mutual written agreement. In 1981, the NRC signed arrangements for the first time with the People's Republic of China and with Egypt. The NRC also implemented its letters of agreement with Mexico and renewed its arrangements with the Federal Republic of Germany, Italy, the Republic of Korea and the United Kingdom for anther five years. The renewal of arrangements with Brazil and Switzerland, was in process at year-end.

Foreign Visitors

In 1981, the NRC received delegations and individuals from 22 countries and two international organizations for technical or policy discussions that ranged from one-day sessions to week-long series of meetings. These frequently included visits to nuclear facilities and national laboratories.

Foreign National Assignees

As in past years, a number of foreign regulatory agencies nominated members of their organizations for placement with NRC program offices as part of a program of on-the-job training of foreign regulatory employees. Nineteen engineers from 10 countries (Czechoslovakia, Finland, France, Italy, Korea, Mexico, the Philippines, Spain, Taiwan and Turkey, were accepted for assignment to branches of the NRC's Offices of Nuclear Reactor Regulation and Inspection and Enforcement.

Radiological Emergency Response Operations Training

In September 1981, nineteen foreign nationals from nine countries attended a two-week course on Radiological Emergency Response Operations Training held in Las Vegas, Nevada. This course, sponsored by NRC and conducted by a Department of Energy contractor, featured field exercises involving various simulated nuclear accidents. It was modeled after the courses NRC sponsors several times each year for American state and local officials.

COOPERATION WITH INTERNATIONAL ORGANIZATIONS

IAEA Nuclear Safety Program

As part of its support of the IAEA's expanded nuclear safety program, which was established in 1979, NRC staff members in 1981 participated in meetings on such subjects as material transportation regulations and package test standards, quality assurance in nuclear power plant construction and operations, fission product releases from accidents involving severe core damage, and the safety of certain research reactors. The NRC also continued its lead role in the IAEA nuclear power plant safety standards program. Five codes and more than 30 safety guides have been completed. Another 15 guides should be completed in 1982.

Technical Assistance through IAEA

The NRC's cooperation with the IAEA Technical Assistance Program is aimed at providing safety advice and assistance to regulatory authorities of countries embarking on nuclear power programs. In July 1981, for example, NRC staff members presented a course on "Pressurized Water Reactor Technology" at the Korean Advanced Energy Research Institute in Seoul, Korea, and a similar course on "Boiling Water Reactor Technology" at the Mexican National Nuclear Safety and Safeguards Commission (CNSNS) in Mexico City, Mexico. The exchange is continuing under revised rules.

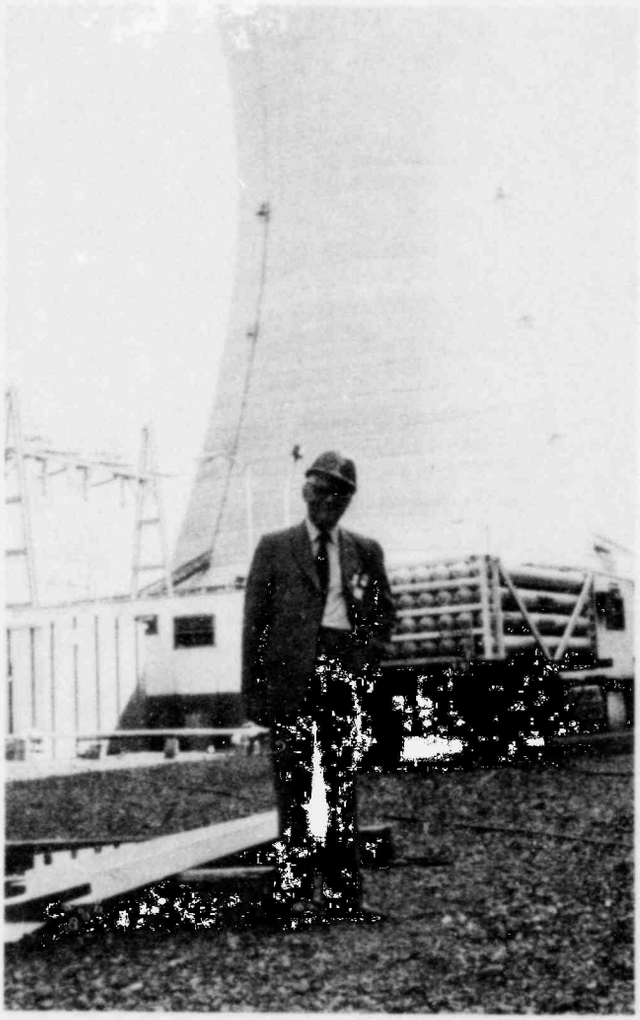
NRC staff experts traveled to Yugoslavia to assist the Josef Stefan Institute in its review of technical specifications for the Krsko power reactor; to the Philippines to help its Atomic Energy Commission in reviewing welding inspection techniques; to Brazil assisting that country's National Nuclear Energy Commission in reviewing electrical safety inspection techniques; and to Seoul to advise the Korean Nuclear Regulatory Bureau on reactor safety techniques. Arrangements also were made for Mexican safety engineers to visit various NRC regional offices and nuclear power plant sites for practical, on-site inspection training. One NRC staff member was assigned to a one-year IAEA advisory position in Mexico. NRC specialists were called on to lecture in IAEA courses at the Argonne National Laboratory on the evaluation of safety analysis reports and the siting of nuclear power plants.

In addition, NRC staff members lectured at the Third IAEA International Training Course on Physical Protection, sponsored by Sandia Laboratories in November 1980. This course is intended primarily for representatives of countries where the development and use of nuclear power is either under way or planned for the near future and whose responsibilities include the preparation of regulations and the design and evaluation of physical protection systems.

Cooperation wi[illegible]he OECD

NRC serves on several committees of the Organization for Economic Cooperation and Development's (OECD) 24-country Nuclear Energy Agency (NEA), with primary focus on the Committee on the Safety of Nuclear Installations (CSNI). CSNI activities involve exchanges of safety research and regulatory information, and a two-year trial exchange of safety information on reactor incidents was concluded in 1981. This exchange is continuing under revised rules.

NRC staff members also worked with NEA committees on radiation protection and public health waste management and with an ad hoc group on the legal, administrative and financial aspects of long-term management of radioactive waste.



During his last visit to the United States as Director General of the International Atomic Energy Agency (IAEA) of the United Nations, Dr. Sigvard Eklund of Sweden visited the Three Mile Island (Pa.) nuclear power plant.

EXPORT-IMPORT ACTIONS

Export License Actions

During the fiscal year ending September 30, 1981, the NRC issued 421 export licenses and 140 amendments to existing licensees. Of the licenses issued, 127 were major licenses in three categories: special nuclear material, source material, and reactors. The 294 export licenses considered to be minor included 64 for small quantities of special nuclear material, 19 for source material, 31 for by-product material, and 180 for section 109 components and materials. Thirteen different nations received U.S. shipments of special nuclear material under major export licenses during the year. In addition, four nations received major quantities of source material, and two nations re-

ceived a reactor facility. No licenses were issued during the period for the export of large quantities of plutonium.

Philippines Reactor Project

Several environmental groups sued to set aside two Commission orders, dated May 6, 1980. The first of these orders directed issuance of export licenses to the Westinghouse Electric Corporation because the Commission had determined that the export of a nuclear reactor and certain components to the Philippines met all applicable licensing criteria in the Atomic Energy Act of 1954, as amended by the Nuclear Non-Proliferation Act of 1978. In the second order, the Commission declared it would adhere to the policy reflected in its earlier licensing decisions and consider only those health, safety, and environmental impacts arising from exports of nuclear reactors that could affect the territory of the United States or the global commons. The Court of Appeals for the District of Columbia Circuit upheld the Commission's decision on March 30, 1981 (647 F. 2d 1345).

NON-PROLIFERATION EFFORTS

During the year ending September 30, 1981, the NRC was consulted on numerous transactions with non-proliferation implications—including five agreements for cooperation, nine nuclear technology transfers, and 11 reprocessing retransfer requests, and 305 Department of Commerce-licensed nuclear-related exports. In consulting on these items, NRC gives primary attention to reviewing whether or not the proposed action would be in conformance with applicable statutory criteria and U.S. nonproliferation policy guidelines. For example, the Commission has been especially concerned about the provisions for spent fuel disposition in new agreements for cooperation. Several DOE technology transfer cases have involved the proposed export of items with significant laser-isotope separation applications, and the Commission has been concerned about the establishment of an export control policy in this area. With respect to Commerce Department-licensed nuclear-related exports, the Commission ensures that approvals of these cases do not conflict with approval policies for related NRC-licensed cases.

Agreements for Cooperation

The renegotiation of Agreements for Cooperation, as required by the Nuclear Non-Proliferation Act, continued in 1981. Executive Branch agencies consulted with the NRC on Agreements for Cooperation with Egypt, Finland, Norway, Sweden and Venezuela.

The renewal of the NRC-United Kingdom Arrangement for the Exchange of Nuclear Reactor Safety Information was signed on May 15, 1981. At left is Ronald Gausden of the UK Health and Safety Executive and at right Chairman Joseph Hendrie of the NRC.

Out of these negotiations, an agreeement was concluded with Egypt.

U.S.-Australian Agreement. The U.S. and Australia began discussions during 1980 regarding the administrative arrangements for implementing the agreement between the United States and Australia concerning peaceful uses of nuclear energy. These administrative arrangements may result in additional requirements being placed upon NRC licensees who receive Australian-origin materials and equipment, either through NRC license conditions or new rule changes. The administrative arrangements will require that the U.S. and Australia each establish and maintain records for the timely accounting for, and control of, designated nuclear technology, equipment and devices, major critical components, compounds and materials, as defined in the agreement. These records would reflect transactions involving authorized persons under their respective jurisdictions. Safeguards and reporting related to safeguards also would be required.

Retransfers for Reprocessing

NRC reviewed 11 requests to retransfer U. S.-supplied nuclear material for reprocessing from Japan, Spain, Sweden and Switzerland. Significant among these were the two Swiss requests—the first approved under the new Administration policy. The NRC also provided views on the proposed new Executive Branch policy on the use of separate plutonium, and reviewed two extensions of the Tokai-Mura Agreements. A third extension was under review at the close of fiscal year 1981. This extension was subsequently approved after Congressional hearings and will remain in effect until December 31, 1984.

NRC Role in Non-Proliferation Policy: Reduced Enrichment Fuel

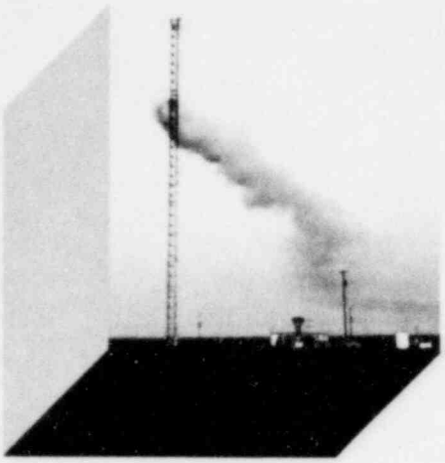
The NRC monitors and supports the goals of the Department of Energy's Reduced Enrichment in Research and Test Reactor (RERTR) program, which seeks to achieve a significant reduction in U.S.-supplied high-enriched uranium inventories overseas at (which could be used directly in nuclear explosives) research and test reactor sites. The program examines ways in which research reactors can be operated efficiently with fuels of significantly reduced levels of enrichment, and helps the reactor operators establish procurement specifications for alternate fuels. In the past year, NRC issued 11 export licenses for reduced-enrichment fuel to be installed as test elements in foreign research reactors. NRC also has written several Congressional committees and the head of DOE urging funding support of the RERTR program.

INTERNATIONAL SAFEGUARDS

NRC's functions in the field of international safeguards were discussed in past annual reports, notably on pages 175 and 176 of the 1980 report. Activities in 1981 centered on continuing cooperation with the Department of State toward providing on an orderly basis the information needed by the Commission in its export licensing and safeguards evaluation work. Two hearings held by the Senate Foreign Relations Committee held significant interest for NRC. The first, in June, included testimony by former IAEA inspector R. Richter, and the second, in December, by another inspector, E.R. Morgan. Prior to the second hearing, NRC expressed concern to the Congress over the effectiveness of IAEA safeguards.

In addition to licensing nuclear exports in 1981, NRC was involved in 1981 with the application of international safeguards at nuclear facilities in the U.S.

In December 1980, the Commission had published notice of the U.S.-IAEA Safeguards Agreement and the new regulations (Part 75) required to implement that treaty. In February 1981, the IAEA selected the Trojan and Rancho Seco power reactors in Oregon and California, respectively, and the Exxon fuel fabrication plant in Richmond, Washington for the first application of the safeguards under Agreement, and routine reporting of accounting data for all three facilities by NRC was initiated a month later. The first IAEA inspections were conducted at the Exxon facility in March and at the two power reactors in May.



10

Nuclear Regulatory Research

The Office of Nuclear Regulatory Research and the Office of Standards Development were consolidated in April 1981 into a newly structured Office of Nuclear Regulatory Research. The new organization is designed to make the NRC research program more responsive to regulatory needs, provide for more effective application of research results in regulations and regulatory guides, and improve the use of staff resources.

This chapter is organized to follow the reorganized office structure. Research and standards development work are combined under five categories: engineering technology, accident evaluation, risk analysis, facility operations, and health, siting, and waste management. Safeguards research is discussed in Chapter 5.

Engineering Technology

MECHANICAL/STRUCTURAL ENGINEERING

NRC's mechanical/structural engineering research program provides technical information to support licensing decisions in the safety review of nuclear power plants and fuel cycle facilities. The program also develops the bases for NRC positions reflected in national standards and NRC regulatory guides and regulations. The program addresses such areas of performance as piping, pumps, valves, snubbers, vessels, containment buildings, concrete structures, and soil media in a wide range of conditions. Sub-programs are discussed below.

Seismic Research and Standards

The *Seismic Safety Margins Research Program* is a multiphase, long-range program to develop improved methods for seismic safety assessments of nuclear power plants, using a probabilistic computation procedure. Phase I of the program was completed in 1981 with the development and demonstration of a methodology using three computer programs: HAZARD, which assesses the seismic hazard at a given site; SMACS, which computes in-structure and subsystem seismic responses; and SEISIM, which calculates the probabilities of structural, component, and system failure and radioactive releases. This methodology will be used to assess the effect of seismic events on nuclear power plant safety and to identify key areas of possible improvement to decrease risks from them.

Response Prediction for Soil-Structure Interactions. NRC's investigations of methods to calculate the modifications in earthquake motion caused by heavy, rigid power plant structures led to the development of a simplified computer code, "Structure in Media" (SIM), for licensing use in checking license applications. The code was being verified at the end of the year.

Reinforced Concrete Panels and Seismic Cost Assessments. During the year, NRC issued NUREG/CR-2049, which examines the strength and stiffness degradation of containment wall panels subjected to seismic cyclic loading, and NUREG/CR-1508, which presents incremental costs of 1100-to-1300 MWe nuclear power plants as a function of a range of seismic design requirements.

Seismic Response and Instrumentation. Two other achievements in the seismic research area included initiation of a study, due for completion in 1982, to evaluate the potential benefit of a seismic

REGULATIONS AND GUIDES

NRC standards are primarily of two types:

- Regulations, setting forth in Title 10, Chapter I, of the Code of Federal Regulations requirements that must be met.

- Regulatory Guides, describing, primarily, methods acceptable to the NRC staff for implementing specific parts of the NRC's regulations.

When NRC proposes new or amended regulations, they are normally published in the *Federal Register* to allow interested citizens time for comment before they are adopted. This is required by the Administrative Procedure Act. Following the public comment period, the regulations are revised, as appropriate, to reflect the comments received. Once adopted by the NRC, they are published in the *Federal Register* in final form with the date they become effective. After that publication, rules are codified and included annually in the Code of Federal Regulations.

Some regulatory guides describe techniques used by the staff to evaluate specific situations. Others provide guidance to applicants concerning the information needed by the staff in its review of applications for permits and licenses. Many NRC guides refer to or endorse national standards (also called "consensus standards" or voluntary standards) that are developed by recognized national organizations, often with NRC participation. NRC makes use of a national standard in the regulatory process only after an independent review by the NRC staff and after public comment on NRC's planned use of the standard has been reviewed.

The NRC encourages comments and suggestions for improvements in regulatory guides and, before staff review is completed, issues them for comment to many individuals and organizations along with the value/impact statements which indicate the objectives of each guide, along with its expected effectiveness and impact.

To reduce the burden on the taxpayer, the NRC has an arrangement with the U.S. Government Printing Office to act as a consigned sales agent for certain of its publications, including regulatory guides. Draft guides issued for public comment continue to receive free distribution, but the active guides are sold. NRC licensees receive pertinent draft and active guides at no cost.

Regulations published during fiscal year 1981 are summarized in Appendix 4. Regulatory guides issued, revised, or withdrawn are listed in Appendix 5.

scram system that would automatically trip the reactor upon sensing high-level seismic activity, and the issuance for public comment of a proposed Revision 2 to Guide 1.12 on instrumentation for earthquakes. The guide describes the instrumentation acceptable to the NRC for promptly determining the seismic response of plant safety features.

Fluid Systems and Components Research and Standards

Load Combinations Program. Results in 1981 indicate that fatigue crack growth leading to double-ended guillotine breaks in the primary system piping of a PWR is extremely unlikely. This information affects licensing decisions and may lead to a relaxation of the requirement to design for simultaneous occurrence of an earthquake and a large loss-of-coolant accident. A panel of national experts has stated that reasons exist for concluding that further study will not change the findings already brought to light.

Kuosheng Research. NRC entered into a cooperative research venture with Taipower at Taiwan's Kuosheng Nuclear Power Station, scheduled to be the world's first operating BWR/6 plant using an advanced design pressure-suppression containment (Mark III). Emphasis was given to low-level vibration testing of equipment near the suppression pool and to predictions of equipment and piping response to safety/relief valve discharge loads.

Research at Heissdampfreaktor (HDR). At the decommissioned HDR in West Germany (see *1980 NRC Annual Report*, p. 214) investigations continued into computer code capabilities to estimate piping behavior under simulated seismic and thermal-hydraulic transients. These have shown, in general, that even under controlled or ideal situations, large differences may occur between predictions and observations. Efforts continue to explain these differences and to develop more accurate methodologies.

Loose Parts Detection. In May 1981, NRC issued Revision 1 to Guide 1.133 on the loose-parts detection program for the primary system of light-water-cooled reactors. This guide contains guidance for programs intended to provide early detection of loose metallic parts and thus to provide the time required to avoid or mitigate damage to primary system components.

Construction and Inservice Inspection Standards. Section 50.55a, "Codes and Standards," of 10 CFR Part 50 has been amended to incorporate, by reference, certain sections and addenda of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code concerning nuclear power plant components and inservice inspection. This makes the quality assurance requirements consistent for Classes

1, 2, and 3 components, and clarifies both acceptance standards for flaws and the examinations for component supports.

NRC also has issued for public comment a proposed amendment to update Section 50.55a by incorporating further recent addenda through 1980 as well as the 1980 Edition of the ASME Boiler and Pressure Vessel Code.

Containment Research and Standards

Containment Integrity. A new program was begun to compare analytical predictions of containment behavior beyond the normal design loads with results from scale-model tests. The order of test loadings was determined — static pressure, dynamic (unsymmetrical) pressure, and lateral (simulated seismic) pressure. The first containment type to be tested will be steel, to be followed by concrete. The results from 1981 studies will enable construction to begin on the first small-scale models in 1982. The test results should permit predictions about the ultimate capacities of containments and provide data against which analyses can be checked. Other work on containment response to dynamic loads addressed the sensitivity of response to a uniform hydrogen burn pressure.

Containment Construction. NRC took another step toward endorsement of the ASME Boiler and Pressure Vessel Code's Section III, Division 2, "Code for Concrete Reactor Vessels and Containments," with the issuance in June 1981 of Revision 2 to Guide 1.136 on materials, construction, and testing of concrete containments. Acceptance of this national standard made it possible to withdraw six regulatory guides: Guides 1.10, 1.15, 1.18, 1.19, 1.55, and 1.103 (see Appendix 5 for guide titles).

Structural Research and Standards

Probability-Based Load Criteria. NUREG/CR-1979, issued in fiscal year 1981, provides an in-depth review of the current use of probabilistic concepts and procedures used to determine the load combinations for the design of Category I structures, which are those structures designed to remain functional if an earthquake producing the maximum vibratory ground motion should occur. Work also was started on a data base for various loads and resistances.

Safety Margins for Category I Structures. The buildings (other than containment) that house safety-related equipment at nuclear power plants are massive concrete shear-wall structures, which, because of their safety function, are subjected to loads and load combinations that differ from framed structures. The program will supply experimental information needed to assess the capability of such structural systems when loaded beyond their design limits. Structures considered in this program include fuel buildings, diesel generator buildings, and auxiliary buildings. The NRC published a plan for assessing the capability of Category I structural systems and began the first phase of the program with the fabrication and testing of small-scale models.

Other Concrete Structures Standards. Guide 1.142, on safety-related concrete power plant structures (other than reactor vessels and containments), was issued in October 1981. It endorsed an American Concrete Institute Standard (ACI 349-76, "Code Requirements for Safety-Related Concrete Structures") and its 1979 supplement.

Equipment Qualification Research and Standards

Snubbers. As part of the NRC effort to improve the reliability of snubbers, a draft guide on qualification and acceptance tests was issued for public comment in February 1981. It provides guidance for functional specifications, for prototype snubber qualification testing, and for acceptance tests of those that will actually be installed.

Active Valve Assemblies. "Active valves" must, during or following a postulated accident, perform a mechanical function to shut down the plant, maintain the plant in safe-shutdown condition, or mitigate the consequences of a postulated event. In March 1981, NRC issued Guide 1.148 on the functional specifications for such valve assemblies, supplementing the ANSI standard which provides guidance for their minimum function and operability specifications.

Safety and Relief Valves. A TMI-related industry test program to demonstrate the capability of safety and relief valves to operate satisfactorily under all anticipated fluid conditions neared completion in 1981. The program includes testing of safety and relief valves, block valves, and associated piping. It is being monitored by NRC which will review and evaluate utility submittals on plant-specific valve and piping systems, identify codes and modeling techniques to confirm the adequacy of valves and piping, and verify hydraulic load calculations in valve and associated piping and supports. New test programs will be identified if required.

MATERIALS ENGINEERING

NRC's metallurgy and materials research program deals with the safety and serviceability of reactor pressure vessels, major piping, and steam generator tubing - components of a reactor's primary system. The program includes the development of guides and regulations on, as well as studies of, fracture me-

chanics, environmental operating effects, and nondestructive inspection techniques. These are discussed below.

Fracture Mechanics

Fracture mechanics studies are directed at developing and validating methods for evaluating and ensuring reactor vessel and primary piping integrity. Areas of concern include thermal shock and pressurized thermal shock to reactor pressure vessels, irradiation-induced loss of toughness in pressure vessels, and the capacity of degraded piping to withstand earthquake and dynamic loadings.

Thermal Shock. The seventh in a series of thermal shock tests (see *1980 NRC Annual Report*, p. 211) was completed at Oak Ridge National Laboratory (ORNL) in 1981 to validate that thermal stresses alone will not drive a crack through a reactor pressure vessel wall. The test used a wall-thickness-to-vessel radius more representative of actual operating vessels. The tests have been aimed at validating linear-elastic fracture mechanics concepts and evaluating the effects of loss-of-coolant-accident (LOCA) and thermal transients on pressure vessels. Recent developments suggest the need for further tests to evaluate the effects of reactor vessel cladding on cracks and on the propensity for short flaws to "run long" under thermal shock conditions. Planning for these tests was begun.

Pressurized Thermal Shock. Researchers at ORNL designed a pressurized thermal shock facility to use an externally flawed test vessel. The external surface of the vessel will be thermally shocked while pressure is applied internally, a test configuration that should permit duplication of a wide range of transient and postulated accident conditions at little cost. Construction is scheduled for completion in 1982, and the first test of a series is tentatively scheduled for 1983. Under this program, researchers also produced special computer codes for use by license reviewers in heat transfer, thermal stress, and fracture mechanics calculations for reactor pressure vessels and for probabilistic evaluations of reactor pressure vessel failure.

Elastic-Plastic Fracture Mechanics. Fracture of steel used in reactor pressure vessels and piping can occur brittlely, ductilely, or in combination. Brittle failure has long been analyzed by linear-elastic fracture mechanics. Elastic-plastic techniques for analyzing ductile and mixed mode fractures are a more recent and rapidly developing area of research, important for evaluating high-temperature conditions where the materials remain in the ductile failure range. In 1981, work at ORNL, the Naval Research Laboratory (NRL), David Taylor Naval Ship Research and Development Center, and the U.S. Naval Academy was designed to develop and validate test techniques and data bases. Benefits are applied directly to NRC licensing activities in fields such as reactor pressure vessel toughness (Generic Issue A-11), pressurized thermal shock, and leak-before-break in piping.

Fracture Toughness Requirements. On November 14, 1980, NRC issued for public comment general revisions of Appendix G, "Fracture Toughness Requirements," and Appendix H, "Reactor Vessel Material Surveillance Program Requirements," to 10 CFR Part 50, clarifying the applicability of some requirements, modifying others, and expanding the references to national standards. In 1981, the public comments were resolved and the final rule prepared for management review.

Degraded Piping and Probability of Failure. The 1981 programs addressing piping reliability used both deterministic and probabilistic approaches. The deterministic approach concentrated on elastic-plastic fracture mechanics analyses techniques, fracture toughness data base development, and degraded pipe tests. Intermediate-sized pipes were tested at David Taylor, and a degraded-piping program was begun at Battelle Columbus Laboratory to demonstrate the capacity of degraded piping to withstand postulated accident and transient loadings and to evaluate the elastic-plastic techniques in predicting load capacities and failure modes.

In the probabilistic approach, a computer code for determining the probability of failure or leak before break was expanded by Lawrence Livermore National Laboratory to include additional variables such as stress corrosion cracking and residual stresses. The code has been used to generate input for the load combinations program and will be used for reevaluating the current criteria for postulating pipe-break locations.

Operating Environmental Effects

Studies in the area of environmental effects include radiation effects on materials, steam generator tube degradation, and stress corrosion cracking in primary piping.

Irradiated Fracture Toughness, Dosimetry, and Fatigue Crack Growth. Research in 1981 on the effects of radiation on reactor vessel steels included irradiation and testing of fracture mechanics specimens to define the relationship between fluence and reduction in fracture toughness, with emphasis on developing elastic-plastic fracture toughness data for irradiated specimens. This information is needed to demonstrate whether operating pressure vessels can maintain their integrity in both normal and accident conditions. Work also continued under the irradiation-anneal-reirradiation program at NRL on

the effectiveness of annealing in restoring fracture toughness to irradiated steels. NRC sponsored dosimetry work at ORNL and the Hanford Engineering Development Laboratory to establish benchmarks for validating and improving fluence calculation techniques. Work also continued at NRL on fatigue crack-growth rate for reactor vessel steels under various cyclic loading forms. Data from this program will be used to revise Section XI fatigue crack-growth-rate curves of the ASME Code.

Environmentally Assisted Pipe Cracking. Metallurgy, stresses and environmental conditions from both normal and accident conditions can contribute to cracking of reactor pipes in combination with the other conditions of metallurgy and loads. In 1981, the NRC published the Argonne National Laboratory's review of pipe-cracking literature (see *1980 NRC Annual Report*, p. 212) and began new research on these problems.

System and Component Criteria. In December 1980 and in August 1981, Revisions 17 and 18 to Guides 1.84 and 1.85, which list acceptable ASME Boiler and Pressure Vessel Code, Section III, Division 1 Code Cases as well as those Code Cases annulled, revised, or reaffirmed since inception of these guides, were issued. Guide 1.147, listing acceptable ASME Boiler and Pressure Code, Section XI, Division 1 Code Cases, was issued in February 1981.

Nondestructive Examination

This program includes studies of inservice inspection techniques to find and characterize flaws more easily and reliably and studies of methods for continuous monitoring for that purpose.

Flaw Inspection by Ultrasonic Test. The improved ultrasonic testing (UT) method developed at the University of Michigan (see *1978 NRC Annual Report*, p. 196, *1980 NRC Annual Report*, pp. 212-213) called SAFT (Synthetic Aperture Focusing Technique), has proved much better than earlier UT methods. The Southwest Research Institute, which has constructed a SAFT-UT inspection system for the NRC, was preparing to take the system into the field for trials at year-end. However, until the new UT developments become standard, it is still necessary to determine the reliability of current methods. Battelle Pacific Northwest Laboratory (PNL) continued its efforts to define current inspection reliability and to deduce the best inspection methods. In 1981, PNL recommendations were being incorporated into the ASME Code for improving the reliability of inservice inspection. In June 1981, NRC issued Guide 1.150, which describes acceptable ultrasonic testing of reactor vessel welds during preservice and inservice examinations.

CHEMICAL ENGINEERING

NRC's chemical engineering research program addresses areas such as decommissioning, fuel storage, waste treatment and storage, criticality, ventilation, effluent treatment systems, hydrogen control, and fission product control. These and others are described in the summary that follows.

Decommissioning

Technical studies for the NRC continue to develop a decommissioning information base for light-water reactors and other nuclear facilities. Five reports dealing with decommissioning were published in 1981 covering: (1) non-fuel-cycle nuclear facilities (NUREG/CR-1754), (2) uranium fuel fabrication plants (NUREG/CR-1266), (3) monitoring for compliance with decommissioning termination survey criteria (NUREG/CR-2082), (4) an addendum to NUREG/CR-0570 on environmental surveillance programs for low-level-waste burial grounds, and (5) NUREG/CR-2370 on design, costs and acceptability of an electric utility self-insurance pool for decommissioning funding assurance. Four other reports were nearing completion at year-end as part of NRC's continuing reevaluation of decommissioning policy. Another report, on fund availability, and a draft generic environmental statement also were published. Regulations concerning decommissioning and terminating licenses are under development.

Ongoing research projects to help develop decommissioning standards and guides deal with long-lived activation products in reactor materials; decontamination methods to reduce occupational exposures, offsite releases, and radioactive waste volumes; and radioactive contamination around typical LWR plants. A literature review on decontamination processes that are precursors to decommissioning (NUREG/CR-1915) was published during 1981. Measurements of radioactive contamination at the Pathfinder reactor were completed. Those at other LWR facilities were still under way at year's end.

Spent Fuel Storage

In November 1980, the NRC issued 10 CFR Part 72, "Licensing Requirements for the Storage of Spent Fuel in an Independent Spent Fuel Storage Installation," as an effective rule. Revision 1 to Guide 3.44, providing the standard format and content for a safety analysis report for a water-basin-type independent spent fuel storage installation (ISFSI), was issued in December 1980. Four draft guides were issued during fiscal year 1981. One provides the standard format and content for a safety analysis report for an ISFSI (dry storage), one deals with license applications for ISFSI storage, another on the

design of a water-basin-type ISFSI, and the other addressing spent fuel heat generation.

Research to determine nuclide inventories and afterheats of LWR spent fuel was undertaken in order to provide standardized information to applicants concerning long-term heat generation rates of power reactor spent fuel as a function of burnup and decay time. The project data basis and SCALE system codes being used were compared to experimental measurements during 1981, and results will be reflected in the appropriate active guide.

Nuclear Criticality Safety

Guide 3.45, on nuclear criticality safety for pipe intersections containing aqueous solutions of enriched uranyl nitrate, and a proposed Revision 1 to Guide 3.1, on use of borosilicate-glass raschig rings as neutron absorbers in solutions of fissile material, were issued in November 1980 and May 1981, respectively. Also Guide 3.47, on nuclear criticality control and safety of homogeneous plutonium-uranium fuel mixtures outside reactors, was issued in July 1981.

Experiments to provide benchmark data on spent fuel storage, shipping configurations, and process geometries using low-enriched uranium oxide continued to provide data used to validate NRC methods of analyzing licensee criticality safety programs.

Effluent Treatment Systems

Measurements continued at the Prairie Island plant to obtain radionuclide source term data for use with gaseous and liquid effluent models for LWR licensing. A report (NUREG/CR-1992), evaluating the effluent treatment systems at four operating LWRs, was issued during fiscal year 1981.

Hydrogen Control

A program was being developed in 1981 to evaluate equipment concepts and operating schemes proposed to prevent sudden flareups and/or detonations, and schemes to mitigate the effects of hydrogen burns in light-water reactor plants.

Fission Product Control

A report (NUREG-0771) on the regulatory impact of nuclear reactor accident source term assumptions was issued for public comment during fiscal year 1981. Another program was under development to facilitate review and evaluation of fission product control systems. It will examine 1.) the effectiveness of engineered-safety-feature systems under various accident conditions; 2.) existing designs, taking into account expected aerosol concentrations; and 3.) fission product chemistry and the behavior of iodine in chemical environments experienced in past incidents.

ELECTRICAL ENGINEERING

Qualification of Electric Equipment

Research at Sandia in 1981 improved NRC's understanding of equipment qualification testing methodologies and aging techniques, as the Sandia facility was upgraded to accommodate larger equipment. Verification tests of connector and electrical penetration assemblies and certain cables were conducted in an 88-inch-high by 20-1/2-inch-diameter pressure vessel. Accelerated aging tests identified strong synergistic effects in certain insulation materials and demonstrated the influence of the test sequence on material degradation. In addition, tests were conducted in France as part of a joint U.S./French test series to judge the relative degradation of elastometric materials with varying oxygen concentrations under LOCA conditions.

A proposed rule, "Environmental Qualification of Electric Equipment for Nuclear Power Plants," was developed, and work on three regulatory guides dealing with the qualification of lead storage batteries, motor control centers, and battery chargers and inverters was begun.

Fire Protection

Fire protection research continued at Sandia as a full-scale replication fire test was completed, and new programs were initiated to test the validity of a 20-foot separation distance between redundant cable trays.

On February 17, 1981, new fire protection regulations became effective for nuclear power plants licensed prior to January 1, 1979. Work on a comprehensive fire protection regulation for new nuclear power plants also was begun during the year.

Accident Evaluation

EXPERIMENTAL PROGRAMS

Experimental programs research covers the integral systems and separate effects tests needed to support the reactor licensing effort. The following sections describe these efforts.

Integral Systems Tests

The NRC is the major source of support for both the Loss-of-Fluid-Test (LOFT) and Semiscale PWR test facilities, although LOFT receives approximately ten percent of its support from foreign countries. A

third facility — the Full Integral Simulation Test (FIST) BWR test facility — is supported almost equally by the NRC, the Electric Power Research Institute (EPRI), and the General Electric Company (GE). Test plans for the three facilities have been modified to include small-break-LOCA and operational-transient experiments as well as those for large-break LOCAs.

LOFT Program. During 1981 the LOFT program:

- Issued Research Information Letters on small-break LOCA experiments, the Augmented Operator Capability Program, the Technical Support Center established after the TMI-2 accident, operational transient experiments, and an in-depth study comparing nuclear and electric heater rod performance.
- Conducted experiments involving an open pressurizer power-operated relief valve (PORV) in conjunction with a loss of all feedwater, a simulation of the Arkansas Nuclear One - Unit 2 turbine trip transient and associated effects, an intermediate-size-break LOCA equivalent to the rupture of an accumulator pipe, and a core uncovery accident at high decay heat level.
- Conducted a modeling workshop in conjunction with Semiscale to explain the experience gained in modeling the two facilities to those analysts involved in code development, assessment, and standard problem calculations.

Finally, 1981 saw the initiation of plans to close, decontaminate, and decommission the LOFT facility following the test program in 1983, as directed by the Commission.

Semiscale. During 1981, several test series were completed on the Semiscale test facility. (For a description of the facility see p. 198, *1980 NRC Annual Report*.) These included:

- Characterization analyses and tests that provided a component-by-component understanding of system heat loss in PWR's.
- Seven tests covering cold leg break configurations, with and without operation of upper head injection (UHI) subsystems. Break sizes tested were 2.5, 5, and 10 percent, for which no significant core heating was found in any test. The 5 percent break caused the greatest core uncovery, as had been predicted. Three accumulator configurations were evaluated: the standard non-UHI Westinghouse PWR setting (600 psi), the standard UHI PWR setting (400 psi), and 400 psi without UHI. Although the results do not apply directly to a PWR because of some nontypical items, the test data can be extrapolated to PWR conditions.
- Natural convection tests provided valuable information on the effects of noncondensible gas and two-phase flow over a wide range of quality. Several tests were also conducted to obtain data under transient conditions and to study the influence of emergency core coolant injection on natural convection behavior.

The 1982 Semiscale program calls for further improvements in hardware and a program including tests of 25, 50, and 100 percent breaks, evaluation of loss of station power and recovery methods, and study of events such as steam generator tube breakage and loss of main circulation pump seals.

BWR FIST Facility. The FIST facility in San Jose, Calif., is an upgrade of the two-loop test apparatus (see *1980 NRC Annual Report*, p. 199) to improve the simulation of various BWR transients. FIST, sponsored jointly by NRC, EPRI, and GE, will use a single, full-sized electrically heated fuel bundle operating at typical BWR pressures and temperatures. During 1981, plans were completed for 1982 and 1983 tests.

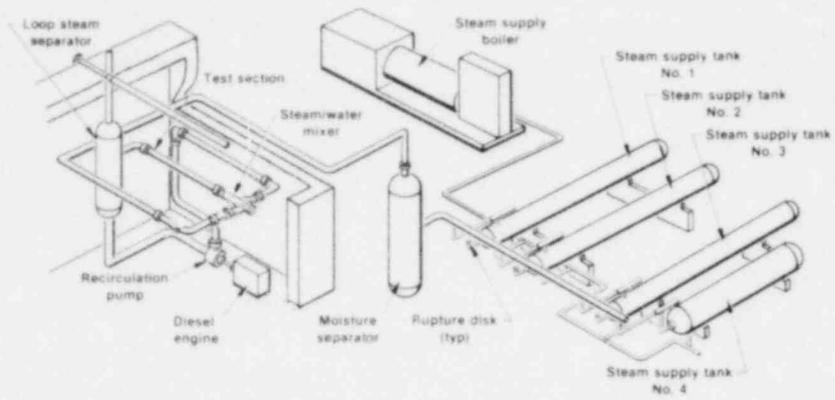
BWR Counter Current Flow Limit Refill/Reflood Program. Plans for this facility (described in the *1980 NRC Annual Report*, see p. 199) were carried out in 1981. Simulations of the late phases of a BWR LOCA transient were conducted, and the code models were produced for the BWR version of the TRAC code. (See the section on "Analytical Models.")

Separate Effects Experiments

NRC separate effects research involves experiments in the FLECHT-SEASET facility shared with Westinghouse and EPRI, acquisition of model development data for use in computer codes, instrument development for use in experimental facilities, and the international 2D/3D program.

FLECHT-SEASET. In 1981 this program was expanded to include three major investigations: heat transfer effects of blockage in fuel bundles; separate effects of key components during reflood; and primary system behavior under different modes of natural circulation for long-term PWR cooling. The flow blockage test, addressing the requirement of Appendix K to 10 CFR Part 50 to provide data to assess vendor licensing computer models for reflood, has been largely completed. Thus far, both the 17 x 17 unblocked bundle and 21-rod blocked bundle tests have been completed. The 17 x 17 blocked bundle facility required to complete this series is under construction. The separate effects test data for the steam generator tests have been analyzed. The natural circu-

Two Phase Flow Loop



The two-phase flow loop at INEL was designed to test instrumentation over the full range of two-phase flow conditions expected in LOFT. In addition, it has been used to calibrate an instrumented spool piece for the 2D/3D program. The loop consists of four large stream-supply vessels that produce steam by controlled flashing, a moisture separator, a diesel-drive centrifugal pump, a water-metering section, a steam-metering section, a two-phase mixing section, a steam separator, and associated pressure and flow control valves.

lation system effects test facility has been constructed, and tests were under way at year-end to investigate the system behavior of single-phase, two-phase, and reflux natural circulation.

PWR Blowdown Heat Transfer Program. A variety of film boiling and bundle uncovery/recovery tests were conducted in the Thermal Hydraulics Test Facility at ORNL to obtain bundle heat transfer data for small-break LOCA conditions in a PWR. The final test series, completed in November 1980, produced data which have been stored at the data bank at Idaho National Engineering Laboratory. An initial analysis of the data indicates that steam cooling of an uncovered bundle can be adequately predicted, using a modified DITTUS-BOELTER correlation and that radioactive absorption is significant at high steam pressures.

Model Development. Most NRC model development research is funded at universities. These programs are aimed at supplementing separate effects experiments, helping to interpret data from larger test programs, and developing correlations based on a phenomenological understanding. Some current efforts sponsored by NRC include (1) a program at Lehigh University, including development of the necessary instrumentation, collection of data on post-critical heat flux boiling, and formulation of models and correlations; and (2) a program on phenomenological modeling of two-phase flow at Argonne National Laboratory. These models provide a basis for developing multichannel computer codes. Other experimental studies at Northwestern University are providing information that is serving as the basis for verifying models of containment flooding, emergency core cooling penetration, and pressure drop. Also, the State University of New York at Stony Brook started research to describe the heat transfer enhancement caused by flow blockages such as grid spacers.

Advanced Instrument Development. Some of the research instrumentation expertise and facilities described in the *1980 NRC Annual Report* have been used to develop and evaluate new power plant instruments, and the transfer of this technology to the industry was emphasized in 1981. For example, during fiscal year 1981, heated thermocouple and ultrasonic ribbon liquid-level indicators were developed and tested by industry. The NRC arranged for NSSS vendors to test and evaluate certain of their devices in conjunction with scheduled NRC tests. Combustion Engineering tested a heated thermocouple sensor at ORNL, and the Westinghouse differential pressure system was installed at Semiscale, where it has been evaluated for various LOCAs and transients.

The pulsed neutron generator was delivered by Sandia for in situ instrument calibration and slow flow measurements at 2D/3D and other test facilities. (See below.)

2D/3D Program. The NRC has been participating in a joint research program with Germany and Japan since 1978 to study various aspects of PWR operation. Two integral systems test facilities are located in each country. NRC furnishes advanced instrumentation and analyses for the testing programs. (See *1980 NRC Annual Report*, p. 201.)

The Japanese Atomic Energy Research Institute (JAERI), as part of the 2D/3D program, completed the first series of tests at the Cylindrical Core Test Facility with results essentially identical to those reported in 1980. The Japanese have also begun initial tests at the newly constructed JAERI Slab Core Test Facility to study full-scale flow behavior in the radial and axial directions. Results will be reported in 1982.

The Federal Republic of Germany completed the design of the Upper Plenum Test Facility with a full-

scale reactor vessel and internals using a core simulated by a steam and water injection device. This facility offers a unique feature of studying, in full scale, de-entrainment in the upper plenum in the reflood phase, the ECC water bypass in the refill phase, and the phase separation in hot legs during a small-break LOCA.

A large number of two-phase instruments developed in the U.S. under the 2D/3D program, and described in the 1980 report, performed satisfactorily at the JAERI test facilities.

FUEL BEHAVIOR RESEARCH

A major redirection of NRC's fuel behavior research program occurred in 1981 when the emphasis of the program was shifted from design basis and LOCAs to accidents involving severe core damage such as the event at TMI-2.

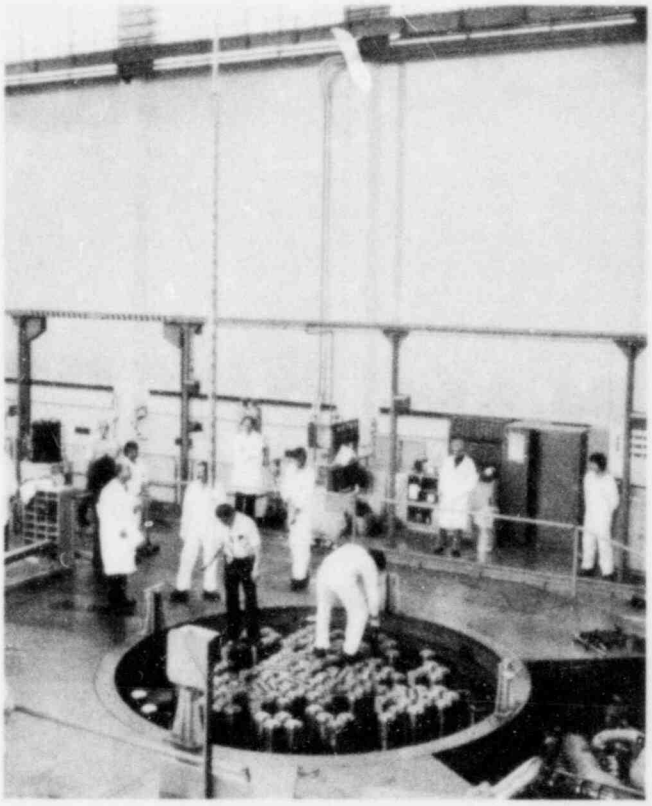
LOCA and Operational Transient Programs

Multirod Burst Test (MRBT) Program. The MRBT program at ORNL to investigate the behavior of Zircaloy cladding under accident conditions (see *1980 NRC Annual Report*, p. 202) featured continuation of the single-rod tests described in 1980, conduct of a multirod burst test with a 6 x 6-rod bundle, and examination of the 8 x 8-rod bundle that was burst-tested in 1980. Final analyses of blockage data of both multirod bundle tests were under way at year's end, and a final report on the MRBT program is expected in 1982.

Power Burst Facility (PBF) Program. At the PBF in Idaho (see *1977 NRC Annual Report*, p. 154 and *1980 NRC Annual Report*, p. 203), tests conducted in 1981 included two simulating accident conditions expected in a large-break LOCA, and two tests to observe the influence of thermocouples used for measuring surface temperatures on the quenching behavior of the fuel rods during a LOCA. These latter two tests were conducted specifically to aid in the interpretation of data obtained from earlier LOFT facility tests. Plans and designs were developed for severe fuel damage tests in the PBF in 1982-1983.

The two LOCA tests support previous observations on circumferential strains during ballooning that the strains in irradiated fuel rods were only slightly greater than the strains in unirradiated rods, though there are too few data points available to lead to a reliable conclusion. The tests on the influence of surface thermocouples on quenching behavior showed that, while the thermocouples mounted on the exterior surface of the fuel rod cladding did cause the rods to be quenched slightly earlier and to produce somewhat lower temperatures than for fuel rods without them, the errors produced were not sufficient to cause the effects ascribed to them during the LOFT tests previously conducted.

NRU Program. Three joint NRC/Canadian tests were performed this year in the NRU reactor, Chalk River, Canada. They gave the first in-reactor evaluation with a full-length PWR fuel bundle of thermal-hydraulic behavior and mechanical ballooning and rupture of the cladding. Current commercial enrichments and fuel designs of a 17 x 17 PWR fuel bundle were used in the tests. The results of these tests indicate that nuclear-heated fuel rods quench faster than anticipated. This can be attributed to the effect of a full-length fuel bundle, the effect of nuclear heating vs. electrical heating, and ballooned vs. undeformed rods. The tests have also shown that circumferential temperature gradients of 25 degrees F to 30 degrees F are common. This is important because it means reduced cladding deformation during ballooning.



The top of the NRU reactor in Canada, where fuel rods are being tested under LOCA conditions, is shown above. The test train containing 32 rods, each 12 feet long, is being lowered into the in-pile test loop.

Halden Reactor Tests. Comprehensive data for the verification of fuel performance computer codes were obtained in 1981 from instrumented 6-rod test assemblies designed and constructed at Pacific Northwest Laboratories (PNL) and irradiated in the Halden reactor in Norway. One of the three assemblies removed from the reactor had reached an average burnup of 30,000 MWd/MTM. Two other assemblies designed by INEL continued under irradiation.

Fuel Rod Analysis Program (FRAP) Codes. The development and assessment of NRC fuel behavior computer codes, FRAP-T, used for the analysis of fuel rod response during off-normal reactor conditions, and FRAPCON, used for the steady-state analysis of fuel rod response during normal conditions, have been completed. Both codes were available for distribution at the National Energy Software Center at year's end.

Severe Fuel Damage (SFD) Program

In response to the recommendations of the Presidential Commission that investigated the TMI accident, a special NRC task force was organized in 1981 to examine the needs and test facilities for research on severe fuel damage. The task force report (NUREG-0840) concluded that such research is needed to contribute to the technical basis for licensing and rulemaking actions, accident management planning, and probabilistic risk assessment for accident conditions beyond the design basis.

The task force recommended an integrated four-part program: The first part consists of in-pile tests in the PBF to provide early scoping data on governing phenomena and for later proof tests of the models and codes developed in the program. The second part consists of separate effects experiments on the governing phenomena, both in the ACRR test reactor and in the laboratory, to furnish a data base for model development. Third is a Severe Core Damage Analysis Package (SCDAP), which includes the development of severe fuel damage models from the experimental data base and their integration. There will be continuous interaction and feedback between the analysis and experimental programs. The fourth part of the integrated program addresses the information to be obtained from the TMI-2 core examination.

Steam Explosions. The objective of the steam explosion research program at Sandia is to develop information for assessing the probability and consequences of a steam explosion during a postulated core meltdown accident with emphasis on failure of the containment. In 1981, continued experiments with 20-kg-scale drops of core melt materials into water substantially broadened the data base on the conditions under which steam explosions occur and on their severity. Analysis showed that the only significant risk of containment failure from steam explosions is from missiles generated by the explosion of the reactor vessel. Probabilistic analysis of this process showed that this probability is less than the 1 percent used in the Reactor Safety Study (WASH-1400) by a factor of 10.

Severe Core Damage Analysis Package (SCDAP). Since success of the SFD program (above) is dependent on the development of analytical models of governing phenomena, a comprehensive code, SCDAP, is being developed at INEL to predict the following in an LWR fuel-rod bundle under severe accident conditions: fuel rod temperatures as a function of time and axial position; the total quantity and types of fission products released from the fuel; fuel rod deformation, the amount of hydrogen generated and released and its axial distribution; amounts of liquefied and resolidified cladding and fuel material; the amount of oxidation of the cladding; the total mass of rubble debris and its distribution; an estimate of the flow blockage expected; and the severely damaged fuel by reflooding.

Fission Product Release And Transport Programs

NRC's research on the release and transport of fission products from overheated and melting fuel is designed to provide the data and codes needed to estimate the potential consequences of severe accidents. (See *1980 NRC Annual Report*, pp. 204-5.)

A new facility has been constructed at Oak Ridge to measure the release of fission products from irradiated commercial fuel rods to temperatures exceeding 2000 degrees Centigrade. In a related program, short fuel rod bundles with simulated fission products were heated to melting to determine aerosol formation rates. Other ORNL tests will try to measure the effect of steam condensation on the behavior of aerosol materials within the containment for use in aerosol models being developed at Battelle Columbus Laboratory (BCL). ORNL also is investigating the chemistry of iodine and tellurium fission product species in aqueous reactor solutions under the temperature and pH conditions expected during severe accidents. The chemistry of fission product species in the high-temperature steam/hydrogen and steam/air environments of coolant systems and containments expected in such accidents is under study at Sandia. Other research is under way or planned on the performance of engineered-safety-feature fission product removal systems in severe accident conditions.

NUREG-0772, issued in June 1981, describes the best technical information available for estimating the release of radioactive material during postulated reactor accidents and for identifying gaps in our knowledge. It focuses on low-probability high-consequence accidents involving severe damage to the reactor core and core meltdown that dominate the risk to the public. Particular emphasis is placed on the accident behavior of radioiodine, which is predicted to be a major contributor to public exposure, because regulatory accident analysis procedures focus on iodine, and several technical issues have been raised re-

cently about the magnitude of iodine release. Aerosols in general also were assessed for their effect on fission product release estimates and to determine the performance of engineered safety features under accident conditions exceeding their design bases. (See Appendix 7 for a complete listing of NUREGs.)

SEVERE ACCIDENT ASSESSMENT

Severe Accident Sequence Analysis (SASA) Program

The SASA research program focuses on possible sequences of events beyond design basis accidents to calculate how power reactors and operators can function in order to prevent or mitigate adverse consequences to both the plant and the public. Four major laboratories are involved in the SASA program—Idaho, Los Alamos, Sandia, and Oak Ridge national laboratories.

Three labs are investigating PWR accident sequences, with Los Alamos and Idaho analyzing the "front-end" (up to core damage) and Sandia the "back-end" (core damage through containment damage). Oak Ridge is focusing on BWR severe accident analyses, both front and back ends.

The Los Alamos program involves calculations for "hands-off" accident scenarios (LOCAs) involving failure of the power-operated relief valve to reclose and the rupture of U-tubes in a steam generator. The studies in Idaho address a matrix of four small breaks with and without high-pressure-injection failure, and the results have been analyzed regarding options available to an operator.

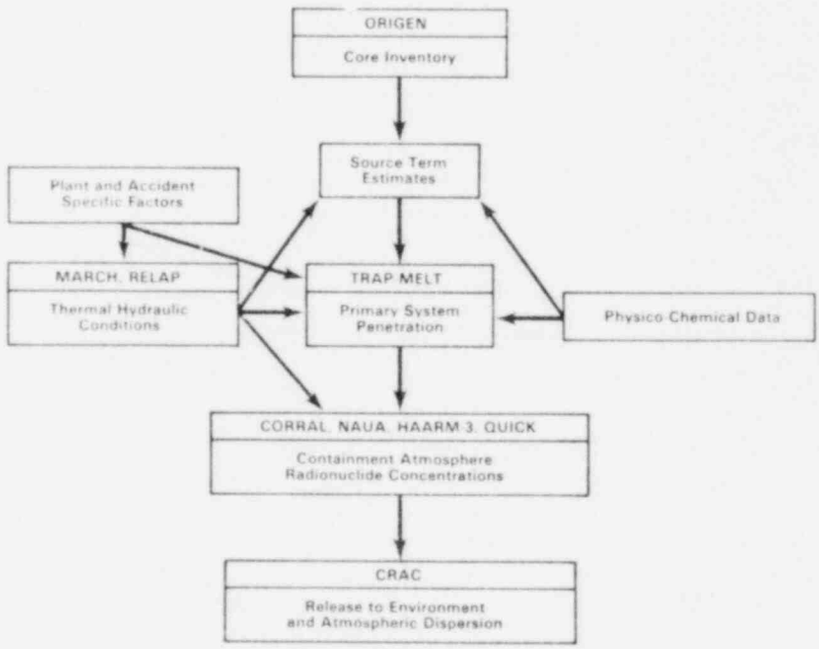
A study at Sandia analyzes a hypothetical core meltdown initiated by loss of off-site power and failure of auxiliary feedwater at Zion Unit 1. Some key findings include: (1) relatively brief operation of containment sprays before vessel breach significantly reduces radiological consequences; (2) containment pressure reductions following vessel breach should be carefully controlled (preferably with sprays to avoid H^2 burns); and (3) following core uncovering, safety features should be operable before restoring reactor coolant makeup.

Another study dealing with small-break LOCAs for Zion Unit 1 revealed that: (1) fan coolers can prevent gross containment failure caused by overpressurization or H^2 burning; (2) partial injection failures do not necessarily lead to core melt; and (3) with three or more fan coolers operating, containment sprays are not required.

A study at Oak Ridge analyzes station blackout for Browns Ferry Unit 1. The blackout is assumed to persist beyond the point of battery exhaustion to core meltdown and subsequent containment failure. The analysis of fission product transport makes up a major part of the study.

Hydrogen Program

The NRC research program on hydrogen is aimed at a better understanding of the phenomena associated with hydrogen burns, the methods to prevent/



This diagram shows the relationship of various computer codes used to predict fission product releases during postulated accidents. The TRAP-MELT code is being developed and assessed as part of the fuel behavior research program.

mitigate severe accidents and effects of burns on equipment. In 1981 experiments were conducted to quantify the H^2 air limits on combustion using igniters similar to those proposed for use in nuclear power plants to control hydrogen. Work was begun to assess the effects of mitigating measures (water fogs and foam) in controlling the pressure and temperature of hydrogen burns. This research in 1982 will be expanded to include examination of preinerting and oxygen depletion as well as such mitigating schemes as post-accident CO^2 inerting and use of hydrogen getters.

The program has been useful in licensing work in assessing the hydrogen control systems for the Sequoyah and Grand Gulf power stations. As part of the regular hydrogen program, analyses have been done for Zion (large dry PWR) and Sequoyah (ice condenser) and are currently planned for Grand Gulf (BWR Mark III) and Surry (subatmospheric PWR). The analytical part of the program will improve understanding of the entire role of hydrogen in a potential accident.

Core Melt Technology

The core melt technology program at Sandia aims to develop the technology to quantitatively analyze severe core melts, using a large-capacity melt facility (200 to 500 kg of fuel and structural material). The structure features a complete redesign of the melt crucible and furnace geometry coupled with new temperature sensors to provide reliable spatial temperature distributions within the melt.

Ultrasonic thermometry provides several axial temperature measurements within the melt, and a rugged fluid thermometer backs up the ultrasonic measurement. Other features of the melt facility include a pressing capability, which enhances melting, spinning, welding, and flame spraying with tungsten for the melt crucibles; and a crack-detecting technique for ceramic bricks, which are used for core retention designs. At the end of 1981, crucibles and charges were being assembled.

The computer program, CORCON, which is being developed and verified at Sandia, will model phenomena governing molten-core/concrete interaction after an accident. The first version is operational, although its application is limited to early stages of an accident since only pure molten materials are considered. The behavior of solid or partially solid debris will be included in a later version. The users' manual (NUREG/CR-2142) has been published.

TMI-2 Post-Accident Examinations

The cooperative NRC/DOE/Electric Power Research Institute/General Public Utilities effort to conduct post-accident examinations of TMI-2 resulted in cost-significant efforts outside the reactor in 1981, and in the planning for examinations of primary system internals and fuel which will occur in subsequent years. (See *1980 NRC Annual Report*, p. 210.)

About 15 research reports have been prepared on results from some of the six technical tasks, and a seminar was scheduled in December 1981 to discuss these reports with industry and utility representatives.

Advanced Safety Technology Research

NRC's advanced safety technology research program (see *1980 NRC Annual Report*, pp. 207-210) focuses on liquid metal fast breeder reactors (LMFBRs) and high temperature gas-cooled reactors (HTGRs).

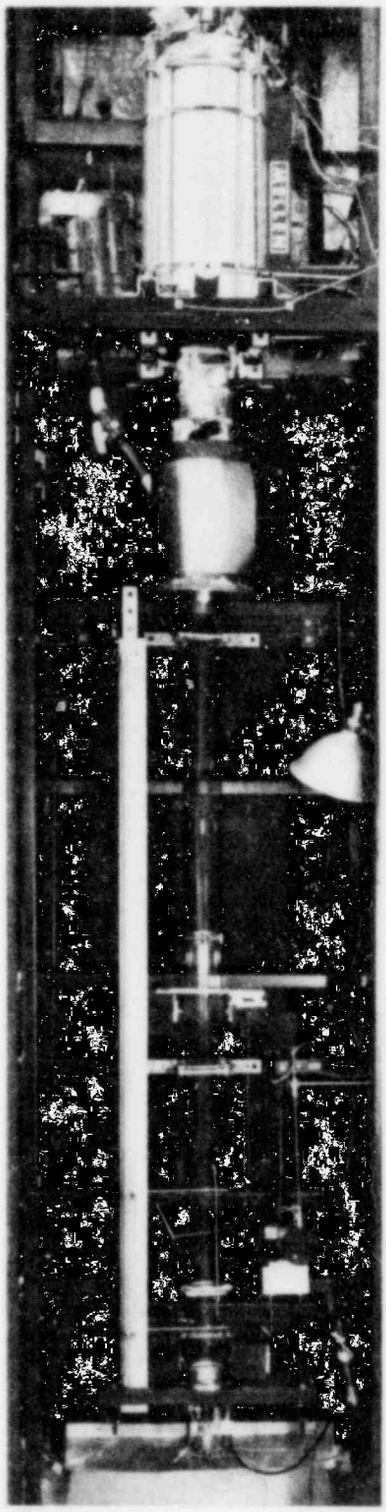
Liquid Metal Fast Breeder Reactors. Work in 1981 under the LMFBR program consisted mainly of projects in (1) analysis, (2) accident threats to the primary system and containment, and (3) aerosol release and transport. Much of this effort continued as described in the 1980 report. Newer developments included:

(1) *Analysis.* The code COMMIX-1A was successfully applied to an analysis of the United Kingdom Prototype Fast Reactor in-vessel flow anomalies and to in-vessel analysis of the Fast Flux Test Facility (FFTF) natural circulation tests.

Brookhaven National Laboratory's Super System Code (SSC) simulates the hydraulic behavior of an entire nuclear plant. It has been available in various forms including the SSC-L code for loop-type LMFBRs. Another version, the SSC-P code, for pool-type LMFBRs, was completed and will soon be documented and ready for general use. Plant modeling for use with SSC-L was completed for the Clinch River Breeder and other reactors. Validation of SSC-L in 1981 focused on the comparison of calculations of the FFTF tests with the experimental data. The comparisons are good. Plant modeling also was extended in 1981 to a generic steam turbine electrical system model, applicable to LWRs and HTGRs as well as LMFBRs.

Los Alamos continued work on the SIMMER code in 1981 (see *1979 NRC Annual Report*, p. 234) with emphasis on verification experiments.

(2) *Accident Threat to Primary System.* The purpose of this research is to develop the data and codes for assessing the impact of core-disassembly accidents on the integrity of the LMFBR primary system (the reactor vessel and piping)—notably the threats from energy released in the accident and the heat from post-accident core debris.



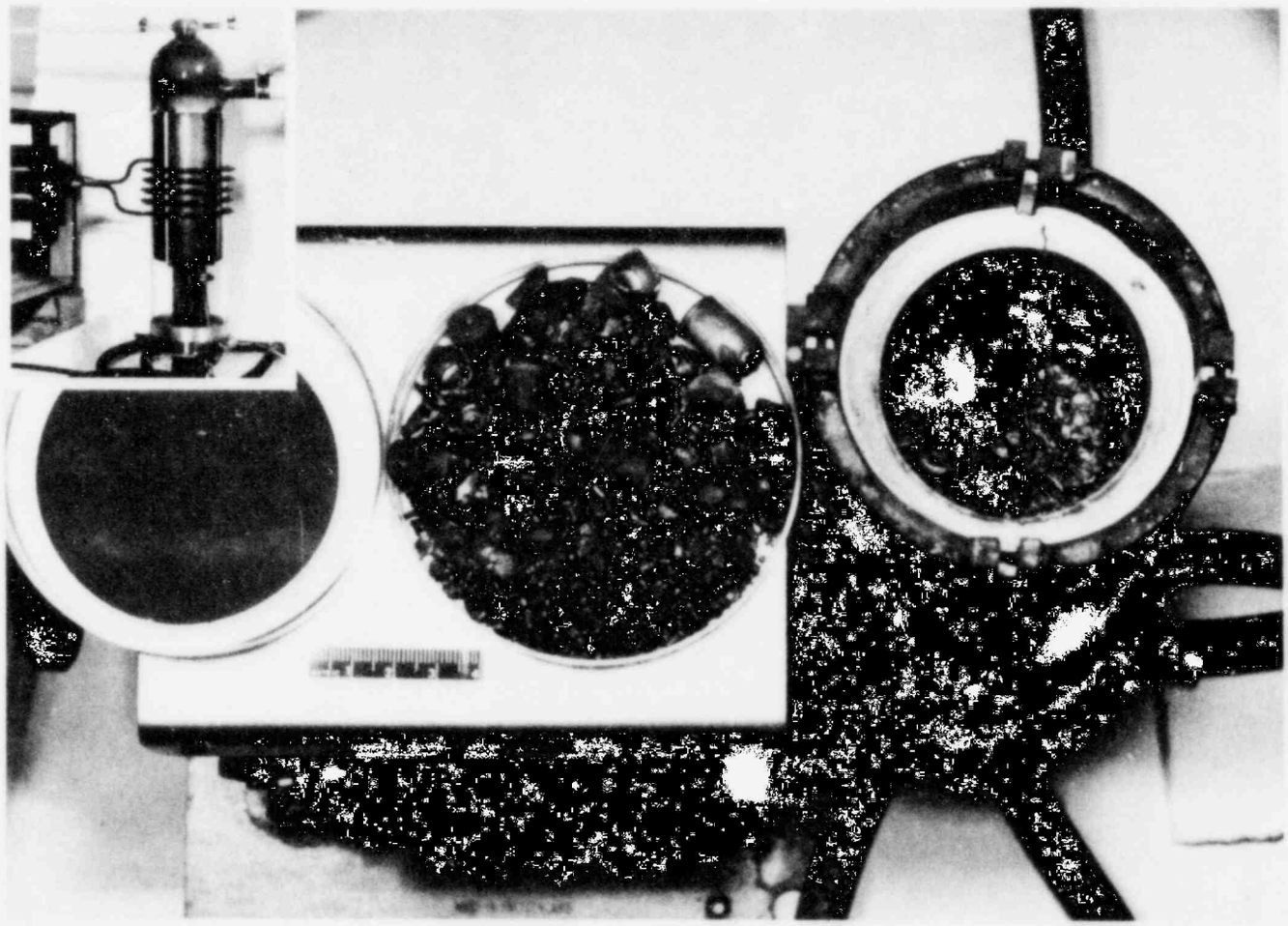
Additional heat transfer experiments at Brookhaven National Laboratory have been conducted to measure the transient rate of heat transfer resulting from the thermal interaction of simulated hot core debris with cold water. A glass pipe serves as the test vessel. The spherical particles are heated in a furnace over the test vessel. Water in the test vessel is preheated to the desired temperature. A release mechanism is actuated, and the particles are dropped into the water.

Most accident energetics experiments are performed with test reactor fuel irradiated in the Annular Core Research Reactor (ACRR) at Sandia. In 1981, a series of experiments was started in the ACRR on the streaming and freezing of molten fuel during the transition phase of a core disassembly accident—fuel motion which determines the energy release associated with that phase. Preparations also were completed for new experiments to determine whether a propagating thermal explosion can occur with molten reactor fuel and liquid-sodium coolant. If such explosions can occur, they may significantly increase the damage potential of postulated severe accidents. The ACRR coded-aperture-imaging diagnostics system (see *1978 NRC Annual Report*, p. 202) was significantly improved in 1981. This unique diagnostics system produces images of the displaced test fuel from gamma rays emitted by fission in the test fuel and is used in some of the experiments in ACRR.

A series of unique experiments in ACRR on core-debris coolability became a joint international program with EURATOM and Japan, in 1981, with the foreign participants carrying most of the program costs. The fifth experiment of the series showed that a stratified debris bed with the finer debris at the top (as would naturally occur in an accident) has considerably lower coolability limits than the unstratified beds previously studied. An analytical model of debris bed coolability limits that best fits available data is now in general use. It has been used in safety analyses of LWRs for the TMI-2 accident and in the Zion/Indian Point studies.

(3) *Accident Threat to Containment.* This research addresses the threat to a containment from sodium and post-accident core debris that have penetrated the reactor primary system. In both cases, the primary threat is from gas pressure generated by interaction with basemat concrete and not from penetration of the basemat per se. In 1981, tests on these chemical interactions between liquid sodium and different concretes showed that in some circumstances the reaction can be quite rapid. Although considerable understanding of the complicated chemistry involved in these interactions has been developed, they are not yet sufficiently understood for reliable prediction.

In 1981, work on the Large-Melt Facility (LMF) at Sandia was finished. This facility can produce pours of up to 500 kg (1100 lbs) of molten reactor fuel onto concrete or simi-



Above is a typical core-melt test for Zircaloy clad UO^2 in a split crucible assembly. At the right is an after-melt view of the quartz furnace chimney, within which the crucible is mounted. It shows a heavy black coating from aerosol plateout. The crucible and offgas filter show the same black coating that was identified by x-ray fluorescense as mainly metallic tin.

Inset shows quartz chimney with external coil which provides energy for radiofrequency induction melting.

lar materials or into reactor coolant. Experiments to expand the data base on core-melt interactions are now possible with the LMF.

Development also continued on improved models of the CORCON code for the analysis of core-melt/concrete interactions. During 1981, experiments at Brookhaven National Laboratory provided important data on heat transfer between liquid layers subject to bubbling gas flow, about which little has been known. An improved model developed from these results was added to CORCON.

In general, NRC concludes that the program of research on sodium/concrete interactions produced major results in 1981. In addition to the items mentioned above, a new model of concrete attack and ablation (SCAM) was developed, a large-scale test showed that the energetic reaction with limestone concrete could be prolonged by sodium additions, and energetic reactions were initiated in small-scale (1-ft dia.) tests by carefully balancing heat loss, interface velocity, constraint, and pressure.

(4) *Aerosol Release and Transport.* During 1981, tests were conducted at Oak Ridge with uranium oxide aerosols and steam. (For other details of this program, see *1980 NRC Annual Report*, p. 209.)

High Temperature Gas-Cooled Reactors. For two years, the budgets did not contain the funds requested by NRC for gas-cooled reactor research; however, the present Administration has forecast $2 million annually for the next several years. As reported in 1980, plans had been made to curtail or discontinue some projects, but Congress identified certain funds and specified certain programs that were not to be terminated. At NRC's request, in the event of project terminations, the national laboratories prepared summaries of all the research work up

to and including 1980, and these will be available early in 1982. Some programs of importance to the Fort Saint Vrain reactor in Colorado were continued in skeletal form at several national laboratories.

ANALYTICAL MODELS

Computer codes, as defined on page 205, *1980 NRC Annual Report*, are designed to assist in the resolution of licensing issues. In 1981, the following codes were completed and released: (1) TRAC-PF1, used primarily in the analysis of small-break LOCAs in PWRs and certain non-LOCA transients and accidents; (2) TRAC-BD1, for analysis of a variety of both LOCA and non-LOCA transients and accidents in BWRs; (3) COBRA/TRAC, used to analyze LOCAs in Westinghouse PWRs that feature the upper-head-injection form of the emergency cooling system; and (4) RELAP-5/MOD1, for one-dimensional analysis of LWR accidents and transients. Plans for 1982 include completion of the PWR version of the code.

Other work in 1981 included efforts (estimated for completion in 1982) toward adaptation of the COBRA-TF subchannel code to LWR containment subcompartment load analysis, and the initiation of work to adapt an existing multidimensional code (SOLA-3D) to analysis of hydrogen transport and distribution in LWR containments.

Independent code assessments of the TRAC-PD2 and RELAP-5/MOD1 codes indicated that TRAC-PD2 is much more accurate and reliable than its predecessor, TRAC-P1A. The RELAP-5/MOD1 code is so new that not enough information concerning its predictive capabilities could be assembled.

TRAC and RELAP codes were used extensively in severe accident sequence analyses and studies of pumps on/off consequences in small-break PWR LOCAs. TRAC-BD1 and RELAP-5/MOD1 were used increasingly to resolve licensing issues, such as overcooling transients and station blackout.

Risk Analysis

RISK METHODOLOGY DEVELOPMENT

The NRC's development of methodology for probabilistic risk analysis in 1981 placed special emphasis on safety goals for nuclear power plants. Priority continued on the development of formalized decision-making approaches (using risk analysis) in licensing and inspections. Methods (and some software) were produced for evaluating time-dependent reliability modeling, determining common-cause failure probabilities, and estimating flood probabilities and risks, as well as for analyzing component reliability data. Eleven risk assessment methodology documents were published in 1981.

REACTOR RISK

Anticipated Transients Without Scram

The Commission voted on June 16, 1981, to issue two proposed alternative rules on Anticipated Transients Without Scram (ATWS) for public comment. One would establish design requirements to reduce the likelihood and mitigate the consequences of ATWS events. The other would require licensee reliability assurance programs and less extensive design changes. A third alternative, proposed by certain utilities, and the two NRC alternatives were published for public comment on November 24, 1981, in the *Federal Register*. Comments were requested by April 23, 1982.

Reactor Accident Consequence Analysis

In 1981, NRC released the Calculations of Reactor Accident Consequence-2 (CRAC-2) model, featuring significant improvements over the original CRAC model in emergency response modeling capabilities and meteorological dispersion modeling techniques (see *1980 NRC Annual Report*, p. 219). Studies were initiated to review and revise, as necessary, the health effects models used in the 1974 AEC Reactor Safety Study (WASH-1400). NRC directed some 30 organizations representing 16 countries in an international comparison of consequence models sponsored by the Organization for Economic Cooperation and Development/Nuclear Energy Agency Committee on the Safety of Nuclear Installations.

Emergency Planning

At the request of the Federal Emergency Management Agency, NRC undertook studies in 1981 to (1) quantify the potential benefits of household items such as towels, sheets, shirts, and handkerchiefs as filters to protect the respiratory system and (2) assess the relative worth of various protective actions in different reactor accidents.

Alternative Decay Heat Removal Concepts

Preliminary results of NRC research on alternative decay heat removal concepts for light-water reactors were published (NUREG/CR-1556) in April 1981. The research includes studies of current decay heat removal systems and the design criteria used in both U.S. and non-U.S. light-water reactors. The report sets forth various concepts to increase the reliability

of the decay heat removal function for further consideration by industry and licensing authorities. A report on risk-reduction benefits from and costs of such systems is due for publication in 1982.

Alternative Containment Concepts

In addition to the investigation of alternative decay heat removal concepts, studies also continued to examine the merits of alternative containment concepts, especially filter-vent containment systems (FVCS) and molten core retention devices. Final reports on the risk-reduction benefit and costs of the former are expected in the latter half of fiscal year 1982. A report on the risk-reduction potential of the latter was issued in 1981 (NUREG/CR-2155). In 1981, work was begun to merge these two programs with the alternative decay heat removal concepts program. The single resulting program is systematically investigating the risk-reduction benefits and costs of these concepts (and combinations of them) along with other concepts. The report of the first semiquantitative analysis of these concepts is expected in the summer of 1982.

Reactor Systems Analysis And Licensing Support

Work continued on the Reactor Safety Study Methodology Applications Program (see p. 219, *1980 NRC Annual Report*). Three of the four volumes of NUREG/CR-1659, which discuss the four plants studied, were published in 1981; the fourth will be published in 1982.

Work on Phase I of the Interim Reliability Evaluation Program will be completed by early 1982 when NRC expects to publish results for each of the four plants studied. (See *1980 NRC Annual Report*, p. 219 for program description.)

The NRC provided financial assistance to the Institute of Electrical and Electronics Engineers and the American Nuclear Society to coordinate development of a procedures guide for probabilistic analysis of safety of nuclear power plants. The first edition (NUREG/CR-2300) was published in September 1981. After peer comment a revised version will be available in mid-1982.

Development was completed on two computer codes to model the physical processes of core meltdown accidents. The MARCH code (see *1980 NRC Annual Report*, p. 219) was released in late 1980; the CORRAL code, used in concert with MARCH, was undergoing final checkout, with public release expected in 1982.

Research to support the activities of the Office for Analysis and Evaluation of Operational Data resulted in a screening of some 22,000 Licensee Event Reports (LERs) dating from 1969 through 1980 to identify precursors of significance to core damage. Analysis of significant trends of safety system reliability vs. plant age is one aspect of this program. The precursor program may provide improved quantitative accuracy for forecasting the likelihood and the topology of core damage accidents. The program is also indicating the nature of various multiple failure scenarios that could be used for better operator training, plant design, and licensing safety review.

TRANSPORTATION AND MATERIALS RISK

Transportation Safety Research

The transportation safety research program focused on two main issues: (1) to determine if mode-dependent transportation regulations to improve the technical basis for protecting public health and safety can be developed and (2) to establish a data base for assessing the potential consequences of explosive attacks on irradiated fuel shipping containers.

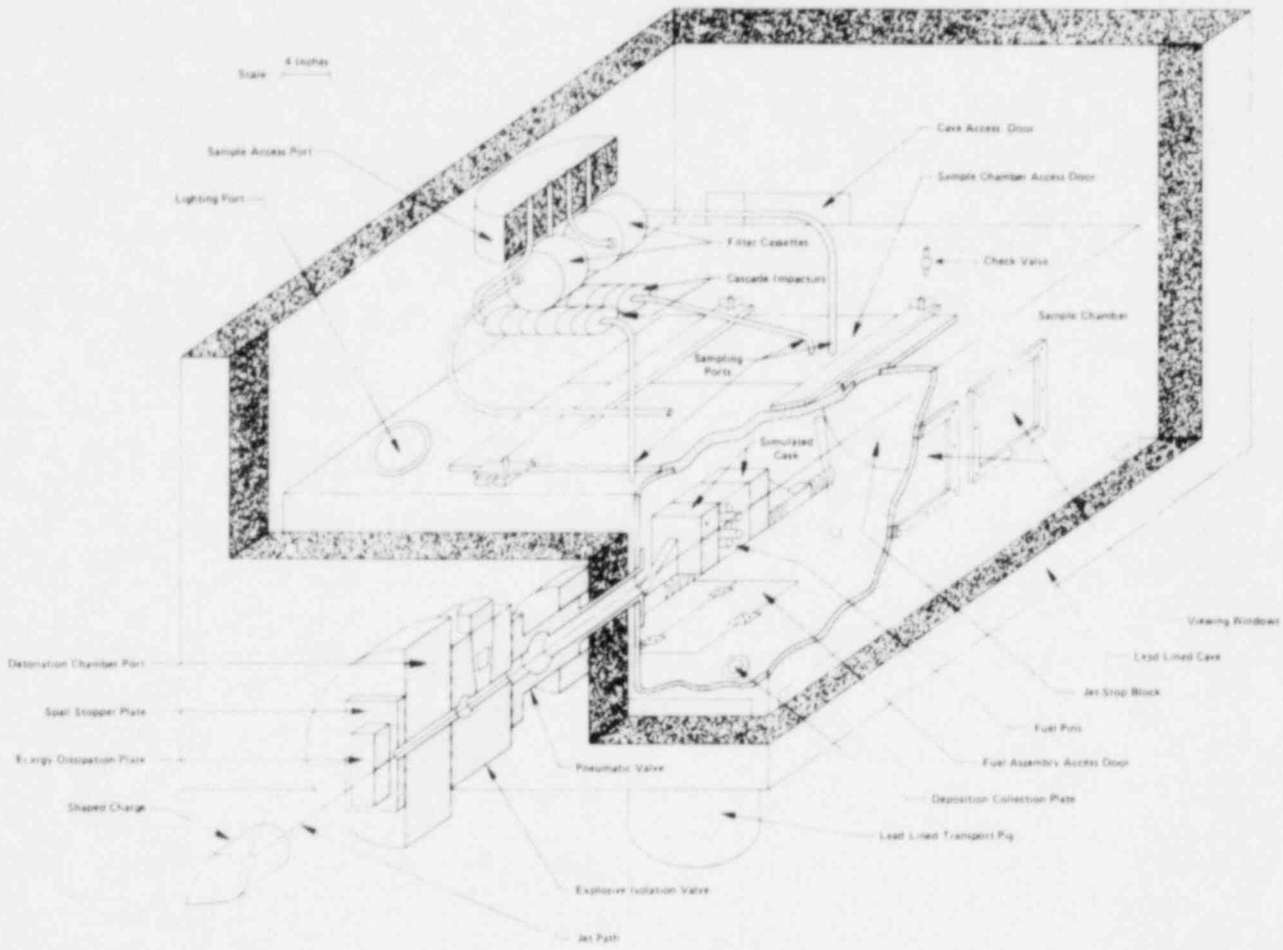
The intent of the first program is to establish package performance tests for severe accidents and to combine these requirements with an appropriate set of post-test acceptance standards. Testing of road and rail transport packages to these new standards is planned for early 1983. A similar process to assess air and marine transport modes began late in the year.

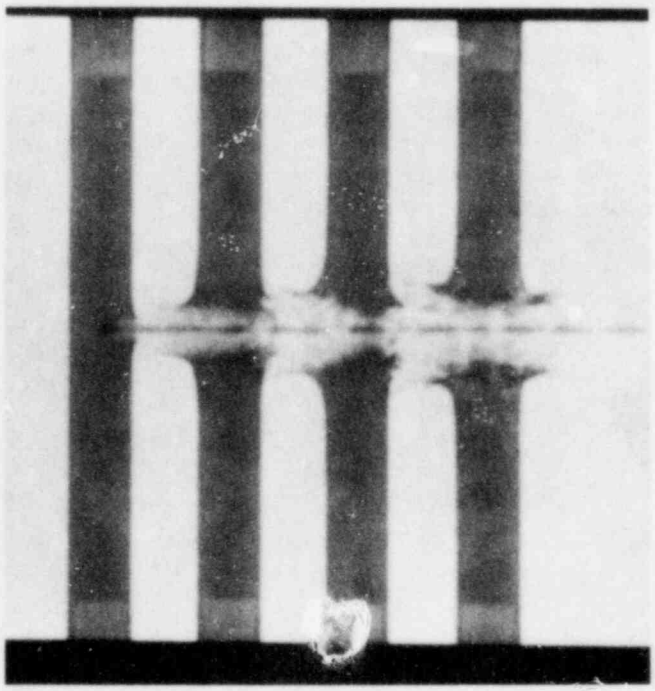
The second program, which characterized the radiological releases resulting from specific kinds of explosives directed against irradiated fuel shipping casks, has been completed. This program included several "first of a kind" experiments, some of which were carried out in the experimental configuration shown on the next page. Using this configuration, the effects of a shaped charge attack on irradiated fuel were assessed. A flash x-ray showing passage of the explosively formed "jet" through a row of fuel pins is shown. The results from this program have indicated that the effects of explosives on irradiated fuel are less than had been previously assumed. NRC decisions on safeguards measures required for irradiated fuel shipments are being reviewed in light of these results. (A comprehensive discussion of transportation regulation, including regulatory standards and guides, appears in Chapter 4.)

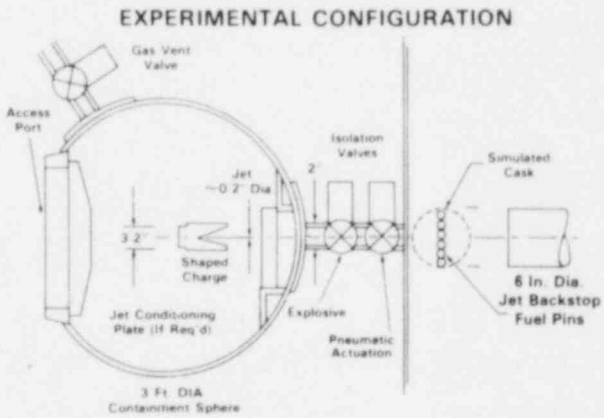
Radioisotope Applications

NRC activities in radioisotope applications included work in the following areas:

Incandescent Gas Mantles. Investigation of the potential radiation dose to the public from incandescent gas mantles impregnated with thorium com-







Under an NRC program to explore the nature of radiological releases produced when irradiated fuel casks are involved in explosions, Battelle Columbus Laboratories in Ohio employed the configuration shown here to study the effects of a shaped-charge detonation. At top is a cross section of the test apparatus; above, a schematic of the experimental configuration; and at lower left, a flash x-ray photo showing the "jet" from the shaped-charge explosion passing through the fuel pins.

pounds continued through 1981. This study is part of several dealing with radiation doses associated with consumer products.

Instrument Calibration Sources. For many years Commission regulations have exempted use of a small source in a radiation-measuring instrument. In 1981, that exemption was expanded to permit users to obtain instruments with several sources of different radionuclides as well as multiple detectors on a single instrument. The changes permit faster and more reliable measurements.

Contaminated Smelted Alloys. In 1981, NRC continued to accept public comments on proposed amendments to regulations dealing with scrap metals contaminated with technetium 99 and enriched uranium (see p. 195, *1980 NRC Annual Report*). More than 3600 letters, postcards, and telegrams had been received at year's end.

Well-Logging Sources. In 1981 NRC completed its assessment of risks in reopening wells containing irretrievable well-logging sources (see *1980 NRC Annual Report*, p. 195) and concluded that the expected reduction in radiological risks does not warrant the use of proposed procedures to previously abandoned well-logging sources. Thus, no regulatory action will be required for these sources.

Fuel Cycle Risk Assessment

NRC's development of methodologies to assess risks from nuclear fuel cycle activities, other than reactors, continued in 1981. The development and demonstration of the high-level waste (HLW) risk assessment methodology continued on the bedded salt reference repository site. Similar methodology is being developed for preclosure and spent fuel isolation. Work was initiated to expand the HLW risk assessment methodology to other geologic media including basalt, welded tuff, domed salts, and granite. The Interoffice Waste Management Modeling Group (IWMG) (see *1979* and *1980 NRC Annual Reports*) continued gaining experience in applying the HLW risk assessment methodology by exercising problems on the geosphere transport, biosphere transport, dosimetry and health effects, and statistical codes. An IWMG Program Plan was formulated outlining the steps for developing expertise on the application of the HLW risk assessment methodology. More than 20 NUREG/CR reports and technical articles have been published since the program began in 1976. An independent technical review group continued its review of the published products. The Fuel Cycle Risk Assessment program was initiated to scope the risks from all elements of the nuclear fuel cycle and to develop risk assessment methodologies for the high risk elements or elements for which the license reviewers need immediate risk tools.

REGULATORY ANALYSIS

Regulatory analysis is designed to ensure that NRC's regulatory actions are coherent, understandable and cost effective. Toward this end, a number of activities are being pursued, including the development of procedures and methodologies to identify the costs and benefits of proposed regulatory actions, the periodic review of existing regulations, and the implementation of procedures to comply with statutory requirements in this area such as the Paperwork Reduction Act (P.L. 96-511) and the Regulatory Flexibility Act (P.L. 96-354).

Severe Accident Rulemaking

As an outgrowth of TMI-2 accident studies, the NRC is initiating rulemaking to consider to what extent, if any, nuclear power plants should be designed to deal effectively with degraded core and core melt accidents and to mitigate the consequences thereof. An advance notice of proposed rulemaking was published in the *Federal Register* in October 1980 to solicit public comments on several questions related to the development of the rule.

In a related action, the NRC has developed an interim rule to improve hydrogen management in some light-water reactors and to provide specific design and other requirements to mitigate the consequences of accidents resulting in a degraded core. A notice of proposed rulemaking on this interim rule was published in October 1980. The sections of this interim rule relating to design considerations to mitigate degraded core accidents were later incorporated into a proposed rule for operator license applicants published in May 1981.

A final rule on hydrogen control in Mark I and II boiling water reactors (BWRs) was published in October 1981. This rule requires the inerting of these reactors and also requires hydrogen recombiner capability for plants that previously relied on venting. Currently under development is a proposed rule to require hydrogen control systems for BWRs with Mark-III-type containments and for pressurized water reactors (PWRs) with ice-condenser-type containments and to establish specific criteria for equipment survivability during a hydrogen burn.

RESEARCH TO IMPROVE REACTOR SAFETY

A plan for research to improve reactor safety was described in April 1978 in NUREG-0438, a report to Congress. The report called for $14.9 million of effort spread over a 3-year period to begin NRC research on improved safety.

This work had just begun when the Three Mile Island accident gave far greater emphasis to this area

of improved reactor safety. In 1981, this research included projects in the areas of alternative decay heat removal concepts, alternative containment concepts, human factors, and instrumentation and control. These areas are described in other parts of this chapter on research.

In the future we plan to drop the designation "Research to Improve Reactor Safety" because in a broad sense, much of NRC's work since the TMI accident, particularly the research program, has been directed toward improving reactor safety. The improved safety systems research program has served its purpose of starting work in this direction.

Facility Operations

HUMAN FACTORS

Human Engineering

NRC's human factors research activities were consolidated in 1981 into a single program addressing human factors systems engineering, human reliability, plant procedures, and licensee qualifications. The objective of this research is to provide a technical basis to support regulatory needs in applying human factors engineering to nuclear facilities. Products include human performance data, analytical methods, assessment of new concepts, and design and evaluation criteria. Data to support improvements in the operator/machine interface are especially needed, as are improved quantitative estimates of human reliability to help reduce large uncertainties in risk analyses.

Human factors publications issued during the year included: a summary of human performance data gathered from experiments on training simulators (NUREG/CR-1908) which provided insights into the automation of safety features; a review of industry methods and practices for specifying and verifying performance characteristics of simulators (NUREG/CR-2353); human-factors review of nuclear power plant alarm systems (NUREG/CR-2147); a series of analyses of human errors affecting pump and valve operability, using Licensee Event Report (LER) data and human error prediction models (NUREG/CR-1879 and 1880); two models for quantifying failure probability in multiple sequential failure events in man-machine systems (NUREG/CR-2211); and a survey of the requirements and practices of 18 foreign nations related to operator selection, training, and utilization (NUREG-0863). More than 150 nuclear engineers and human factors specialists attended an NRC-sponsored workshop to exchange ideas on human factors standards and safety.

A proposed Revision 2 to Guide 1.8, which endorses American Nuclear Society Standard ANS 3.1, on personnel qualification and training, was issued for public comment in October 1980. Guide 1.149, which endorses American Nuclear Society Standard ANSI/ANS 3.5-1981, on nuclear power plant simulators for use in operator training, was issued in April 1981.

Quality Assurance

In this fiscal year 1981, NRC developed proposed regulations and regulatory guides addressing quality assurance (QA) criteria for the disposal of high-level radioactive wastes in geologic repositories; reporting changes to QA programs for nuclear power plants; and updating QA guidance for the design, construction, and operation of nuclear power plants, with completion scheduled for fiscal year 1982. Preliminary plans are under way to begin research in fiscal year 1982 to better determine those nuclear power plant structures, systems, and components considered important to safety and to develop a methodology for applying the QA program requirements in a graded manner. It is expected that a proposed rule will be published in mid-1982 to clarify the relationship between Appendices A and B to 10 CFR Part 50 for the application of QA requirements to nuclear power plant structures, systems, and components with the effective rule scheduled for late that year. Additionally, efforts are under way to endorse the Institute of Electrical and Electronics Engineers program for accreditation of laboratories conducting qualification testing.

A proposed Revision 3 to Guide 1.28, on QA program requirements during design and construction, was issued for comment in March 1981.

Proposed rulemaking concerning reporting changes to QA programs for nuclear power plants was published in the *Federal Register* on July 2, 1981. Quality assurance criteria were developed for proposed Part 60, on the technical criteria for the disposal of high-level radioactive wastes in geologic repositories, which was also published for comment in July 1981.

Emergency Preparedness

NRC research and standards activities within the emergency preparedness area have concentrated on the following projects: (1) the upgrading or clarification of appropriate emergency preparedness regulatory guides and regulations, and (2) upgrading of emergency preparedness regulations for certain fuel cycle and material licensees.

NRC is now assessing warning system capabilities to help establish detailed criteria for implementing emergency preparedness regulations. In September 1981, the Commission published in the *Federal Regis-*

ter a proposed rule change that would delay for one year the date for providing the capability for prompt public notification. This delay was warranted by difficulties and uncertainties regarding designing, procuring, and installing appropriate warning systems.

The Commission published in the *Federal Register* on June 3, 1981, an advance notice of proposed rulemaking (46 FR 29712) announcing that consideration is being given to specifying strengthened emergency preparedness requirements for those fuel cycle and materials licensees having the potential for accidents that could threaten public health and safety. Publication of a proposed rule is expected in 1982.

In parallel with upgrading the regulations on emergency preparedness, the staff is upgrading appropriate regulatory guides to correspond to revised regulations. Guide 1.101, on emergency planning for nuclear power plants, was published in September 1981.

INSTRUMENTATION AND CONTROL

The objective of the NRC research and standards development program on instrumentation and control is to provide the technical bases to support the regulatory program in this area for operating plants as well as those under licensing review. The research effort primarily consists of developing surveillance and diagnostic techniques, including noise analysis methods, evaluating instruments for following the course of an accident; assessing instrument components under severe environmental conditions; and initiating a program on control system safety implications. The standards development effort consisted primarily of issuing a revision to Regulatory Guide 1.97 and continuing work on standards and a regulatory guide for the qualification of electrical equipment in nuclear power plants.

As part of the NRC research program at the Oak Ridge National Laboratory (ORNL) on noise surveillance and diagnostic techniques, the study on use of noise analysis methods for detecting, locating, and characterizing loose parts in nuclear power plants was completed. This study assisted in developing Guide 1.133 on the loose part detection program for the primary system of LWRs. An on-line neutron noise surveillance and diagnostic demonstration system with continuous measurement capability was installed at the Sequoyah Unit 1 reactor and has been gathering signature data since April 1981. Abnormal operating conditions noise data were obtained as part of LOFT and Semiscale tests and are being used in assessing the feasibility of using pressure, neutron, and temperature noise to detect anomalies at power plants.

Nuclear power plant instrumentation performance will be evaluated in a new program by the Idaho National Engineering Laboratories, using criteria in Guide 1.97 that defines the instrumentation recommendations for following the course of an accident.

Sandia will conduct a series of instrument component assessments focused on identifying degradation and failure modes of instruments and electrical equipment important to safety under design basis accident conditions. This research is intended to improve quality assurance guidelines for the design, installation, and maintenance of instrumentation and other electric equipment important to safety.

In another study started at Sandia, nuclear plant alarm and annunciator systems will be evaluated to confirm their adequacy and to assess the feasibility of setting priorities for the required operator responses.

A new program at ORNL has begun to study the safety implications of control systems and related plant dynamics. Accident sequences that may be outside the design basis envelope assumed for all plants will be identified and studied. A methodology for assessing the failure modes and effects of control systems on the basis of common cause, common mode, and other multiple failures such as cascade failures will be developed.

A related program at Sandia was also initiated in fiscal year 1981 to develop methods for assessing the adequacy of nuclear power plant electrical systems with regard to system interactions (particularly with control systems) and cascaded failures.

Revision 2 of Guide 1.97, on instrumentation for light-water-cooled nuclear power plants to assess plant and environs conditions during and following an accident, was issued as an active guide in December 1980. ANSI/ANS-4.5-1980, "Criteria For Accident Monitoring Functions in Light-Water-Cooled Reactors," is endorsed by Guide 1.97. Work is continuing on evaluating the adequacy and effectiveness of this guide and standard, and revisions to the guide will be issued when considered necessary.

Work continued on standards and guides for the qualification of electrical equipment in nuclear power plants. A draft guide on qualification testing of cable penetration fire stops is under review by user groups before being issued as an active guide. Proposed Revision 1 to Guide 1.131 on qualification testing of electric cables and splices is also undergoing final review. (See *1980 NRC Annual Report*, p. 184.)

OCCUPATIONAL RADIATION PROTECTION

Health Physics Measurements

During 1981, research and standards development in improving health physics measurements required to protect workers from radiation centered on upgrading personnel dosimetry programs, developing and testing a health physics survey instrument performance standard, and developing and testing performance

standards for bioassay laboratories. The Health Physics Society Standards Committee and the American National Standards Institute developed draft standards, with NRC staff participation, for the performance of health physics survey instruments and bioassay laboratories. A technical assistance contract, jointly funded and managed by NRC and DOE, was established to test the standards for applicability to the radiation protection programs of both agencies.

Work continued on a program for the accreditation of personnel dosimetry processors who provide devices used to measure the radiation doses received by workers in NRC-licensed activities. Plans were made for additional testing of processors against a revised ANSI performance standard, and site visits to 36 dosimetry processors were conducted to determine reasons for earlier poor performance. (See *1979 and 1980 NRC Annual Reports* for results of earlier tests.) A final round of tests will provide assurance that the standard, as revised, is an appropriate basis for accreditation.

Guide 8.28, on the selection and use of audible alarm dosimeters, was published in September 1981. It provides information on acceptable uses of warning dosimeters and limitations on their use.

Radiation Protection Training

Guide 8.27, on radiation protection training of workers at light-water-cooled reactors, was issued in April 1981, and Guide 8.29, providing instruction on risks from occupational radiation exposure, was issued in July 1981. The latter guide, written in a question-and-answer format, presents material acceptable to the NRC staff to satisfy requirements for biological risk training.

A safety training manual for radiographers entitled "Working Safely in Gamma Radiography" has been prepared for use in training industrial radiographers.

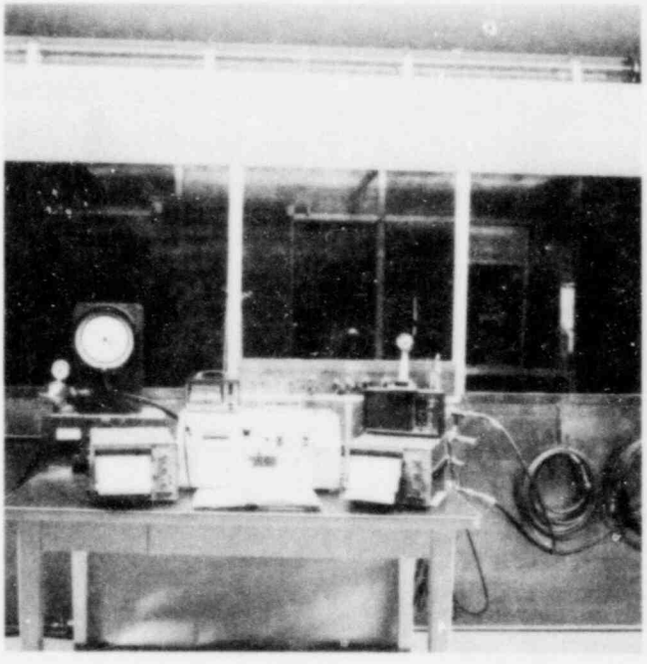
Respiratory Protection

In 1981, the NRC completed two videotape/training manual units on the proper use of air-purifying respirators and atmosphere-supplying respirators, and released a third unit on cleaning, maintenance, and storage of respirators. Work on a manual relating respiratory protection to emergency preparedness was initiated.

Health Physics Surveys

Revision 1 to Guide 8.23, on radiation safety surveys at medical institutions, was issued in January 1981. The guide describes acceptable methods for implementing and conducting radiation survey programs for medical licensees.

Shown above is a respiratory protective device provided by an airline. This type of device was discussed in an NRC training videotape produced by the Los Alamos National Laboratory. Below is the quantitative fit-testing instrument which gives quantitative estimates of the protection provided by various types of respiratory protective devices and is also used for routine checks of the face-to-facepiece fit of a respirator to a given individual.



Licensing Guidance

The NRC staff provides guidance on requirements for applications for various types of licenses for the use of radioactive materials. Two additional guides in this series were issued: Revision 1 to Guide 10.8, a guide for the preparation of applications for medical programs, in October 1980, and Revision 1 to Guide 10.5, guidance for applicants for type A licenses of broad scope, in January 1981.

Siting, Health And Waste Management

SITING AND ENVIRONMENT

The siting and environmental program covers research and standards regarding the siting of nuclear facilities, the assessment of environmental impacts from the construction and operation of these facilities, and the evaluation of the environmental pathways for the transfer of radioactive material to man. Activities in this area during 1981 included the following:

Site Safety

Technical support work for the rulemaking on Reactor Siting Criteria (see *1980 NRC Annual Report*, p. 186), continued in 1981. A notice of intent to prepare an environmental impact statement was published in December 1980. The new regulations will be designed to establish quantitative demographic criteria for proposed sites for nuclear power plants. Most other provisions of the Commission's present siting regulations (e.g., to consider seismicity near the site) will be retained.

A study of the use of subsurface radar techniques for surveying low-level nuclear waste disposal sites (Geo-Centers, Inc.) demonstrated that the radar techniques can detect objects, anomalies, and trench boundaries to depths of from one to 30 meters.

Environmental Radiation Standards

The NRC issued a final rule amending its radiation protection standards to incorporate the environmental radiation standards of the Environmental Protection Agency (EPA) for the uranium fuel cycle and, in a related action, denied a petition from the American Mining Congress (AMC) to stay the implementation of these standards to uranium milling operations. The AMC has also petitioned EPA for a review of the standards.

On May 22, 1981, the AMC and the Kerr McGee Corporation filed separate suits against the NRC in the United States Court of Appeals for the 10th Circuit for a stay of the implementation date. On July 17, 1981, the court consolidated the cases and held them in abeyance pending further administrative proceedings before the EPA.

Socioeconomic Impact Evaluation

A report (NUREG/CR-2063) was published on the impact of the TMI-2 accident on residential property values in the vicinity of Middletown, Pa. A modeling system to predict the demographic impact of plant construction on the local community was developed and published as NUREG/CR-2002. Other activities in this area included work to revise the CONCEPT/OMCOST code which estimates capital and nonfuel operating costs of nuclear power plants by incorporating the effects of new TMI-related safety regulations. Research was initiated to analyze post-licensing population density and land-use changes around nuclear power plant sites. It will aid in developing methods of forecasting small-area demographic and land-use changes.

Radionuclide Uptake in Agro-Ecosystems

At the Savannah River Ecology Laboratory, agricultural scientists studied radionuclide uptake by plants grown in soil contaminated for 25 years by airborne effluents from a fuel reprocessing facility. The chemical forms of the radionuclides, products of natural weathering processes, present a unique opportunity for investigation of conditions that might be associated with the accidental releases. Preliminary results of analyses of wheat and soybeans indicated that americium and curium are much more readily taken up through plant roots than plutonium. Research continued at year's end on the uptake of other radionuclides and other important edible plant species as well as the effects of normal agricultural practices and soil treatments on radionuclide uptake.

Aquatic Ecological Impact Studies

Seven research reports, published in 1981 by the College of Fisheries of the University of Washington, provide measurements of radionuclide distribution coefficients in aquatic ecosystems. One five-volume report (NUREG/CR-1852) covers the methodology, measurement and partitioning of cesium-137, strontium-85, plutonium, americium, and curium-244 between water and sediments in marine and fresh-water environments. The other two volumes (NUREG/CR-1853) deal with the effects of organic compounds on radionuclide uptake by sediments and with the distribution of radionuclides among suspended sediments, phytoplankton, organic detritus, and filtered seawater.

A study by the Woods Hole Oceanographic Institution of the behavior in a marine environment of transuranic radionuclides released from nuclear power plants was published as NUREG/CR-1658. The behavior and release of iron-55, cobalt-60, cesium-134, and cesium-137 also were studied.

Battelle Pacific Northwest Laboratory published a critical review of sediment and radionuclide transport models, water-quality mathematical modeling, and radionuclide adsorption/desorption mechanisms (NUREG/CR-1322).

NRC's aquatic ecological impact research program covered a wide variety of activities in 1981, including the following:

Results of copper toxicity tests at the Lawrence Livermore National Laboratory with various life stages of the Pacific oyster and carp (NUREG/CR-0747, -1088, -1089) indicate that little, if any, effect would result from the levels of copper measured during operation of a power station, but that higher pulsed releases (e.g., during a startup) may cause more significant impacts.

Oak Ridge National Laboratory (ORNL) efforts to provide better tools for assessing the impacts of cooling system operations on fisheries produced two reports, on statistical methods for analyzing stock-recruitment relationships (NUREG/CR-1836), and on estimates of entrainment mortality of ichthyoplankton (NUREG/CR-1984). Related work at ORNL provided information for analyzing impacts on the threadfin shad when nuclear generating facilities are sited on reservoirs (NUREG/CR-1043).

Other studies on the ecological impacts of nuclear reactors done under NRC contract dealt with (1) the entrainment of zooplankton at operating nuclear power stations (New York University—NUREG/CR-2091); (2) the usefulness and validity of fisheries models for impact assessment (University of Washington—NUREG/CR-2016); and (3) the impact of chemical releases in nuclear generating station effluents (Pacific Northwest Laboratory—NUREG/CR-0892 on chronic chlorine toxicity tests with rainbow trout, NUREG/CR-1297 on bromoform toxicity tests with various marine organisms, and NUREG/CR-1299 on halogenated byproducts). A study was made of the impact of nuclear power station operation on the occurrence of pathogenic amoeba in cooling tower water (ORNL—NUREG/CR-1761). Although the impact varied from site to site, at particular sites some enhancement of these organisms from thermal additions was noted.

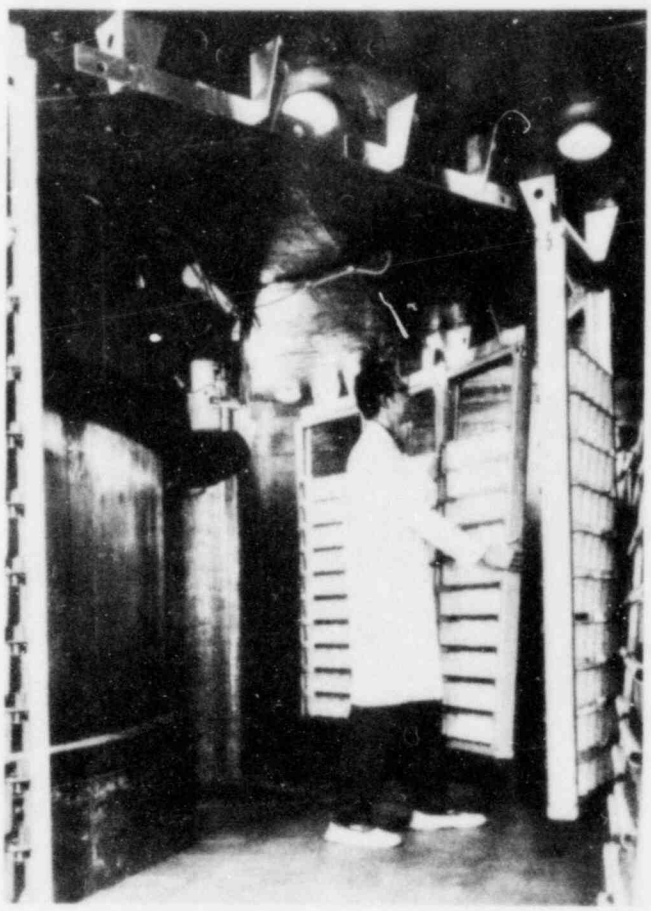
HEALTH EFFECTS RESEARCH

Projects and results of NRC activity in health effects research included in 1981:

Thorium Workers. A report on the health status of former thorium workers (NUREG/CR-1420) revealing that the cause of death of 511 workers showed little association with thorium exposure and that thorium deposition was detected in 131 of the 194 living persons examined. The workers with highest exposures are receiving follow-up medical examinations.

Neutron Exposures. A new research program to improve estimates of risk from neutron exposures at occupational dose level, in which large populations of mice were exposed to pure fission neutrons or pure gamma rays at doses comparable to the permissible occupational limits. Both somatic and genetic effects were being evaluated at the end of the year.

Leukemia Survey. A reanalysis of the adult portion of the Tri-State Leukemia Survey Data (NUREG/CR-2234) at Argonne National Laboratory indicating that the x-ray-related excess leukemia risk is smaller than previously suggested and that it is limited to cases of males with acute and chronic myeloid leukemia and more than 40 trunk x-rays. The chil-



The JENUS reactor at Argonne National Laboratory was designed to produce essentially pure neutron spectrum for radiobiological studies. Mice are loaded into individual exposure holders (shown above) for an experiment to determine the dose-response curve at doses near the occupational exposure limits.

dren's portion of the reanalysis was under way at year's end.

Radiation Protection Standards

NRC has undertaken a major revision of its basic radiation protection standards (10 CFR Part 20) in order to implement certain recommendations of the International Commission on Radiological Protection.

An NRC pamphlet explaining misadministration reporting requirements that became effective November 10, 1980, was sent to medical licensees. The reports received up to the end of 1981 from NRC licensees show that about 500 of the 5 million annual administrations of radioactive material are mishandled. This rate of .01 percent compares favorably to an estimated 15 percent misadministration rate for all drugs administered in hospitals. Also published was a proposed rule that would require medical licensees to measure radiopharmaceutical dosages before administration to patients.

NRC amended its regulations to permit local disposal as nonradioactive waste of certain biomedical wastes containing tracer amounts of hydrogen-3 and carbon-14 instead of sending them to licensed waste burial grounds. This change will save medical and academic institutions an estimated $13 million annually.

The effort initiated in 1979 to establish a TMI Radiation Worker Registry continued as members of the health effects staff monitored the exposure data on the TMI work force and provided it to the National Institutes of Health TMI Follow-up Subcommittee. Work on an industry-wide registry also progressed. A questionnaire was developed to elicit the nature and accessibility of existing data on nuclear power plant workers.

WASTE MANAGEMENT RESEARCH

NRC's waste management research assesses, tests and improves measurement and prediction methods; confirms data bases; and develops regulatory standards to support the licensing of high-level-waste repositories, shallow-land burial sites, and uranium mill tailing operations.

High-Level Waste

The emphasis of NRC's high-level-waste research is on establishing confidence that such wastes can be isolated from the bioenvironment for long periods in geologic repositories. The program investigates waste forms, container materials, geological and hydrological factors, repository engineering and design, and development of the mathematical models and statistical methods that form the bases of a risk methodology for assessing repository safety.

Activities in the materials science program in 1981 assess experimentally the durability of matrices and packages for wastes and examine the relationship between potential storage environments and the rates at which solidified wastes could leach into ground water.

Other 1981 activities included: Research into the corrosion of metal canisters, radionuclide containment by both backfills and host rock, and other characteristics of proposed sites; the publication of technical criteria for the disposal of high-level radioactive waste in geological repositories (10 CFR Part 60) for public comment in July 1981; adoption of the procedural requirements by the Commission in February 1981; and the issuance for public comment of the draft standard format and content guide to be used in the DOE site characterization of the geologic repository in April 1981.

Low-Level Waste

This program identifies better ways to predict and monitor migration of radionuclides from disposal facilities and to find alternatives to shallow-land burial of low-level wastes.

In 1981, the NRC continued studies of a shallow-land burial site to acquire soil retention and transport data toward improving decommissioning and siting criteria. In another study, liquid low-level wastes that have been solidified prior to burial are tested for stability and retention of radionuclides when immersed in water.

Surface-water station at West Valley, N.Y., site boundary monitors sediment and stream discharges

The staff continued its development of regulatory guides to support proposed rule 10 CFR Part 61 published in the *Federal Register* on July 24, 1981. Other guides were being developed to address such areas as format and content for license applications and environmental reports, site selection, site suitability and characterization, waste classification, and monitoring.

Uranium Recovery

Uranium recovery research in 1981 included laboratory and field tests of methods for determining the radon attenuation properties of natural cover materials and the development of attenuation models based on simple physical tests; evaluations of clay liners and unlined sites for limiting seepage over long periods of time; and the assessment of the long-term stabilization of tailings by rock covers.

New projects in 1981 included assessments of in situ mining to minimize ground-water contamination; interim stabilization of tailings to reduce airborne contamination; chemical neutralization to limit contaminant mobility below the water table; tailing dewatering techniques; and monitoring methods and instrumentation for detecting contamination.

The plume is shown dispersing from a tracer release during atmospheric dispersion field tests conducted in Idaho in July 1981.

EARTH SCIENCES

Hydrology

A generic study undertaken in 1981 deals with unsaturated flow and transport through fractured rock related to high-level-waste (HLW) repositories. In reactor siting research, monitoring of hurricane surges along the Florida coast was continued. NRC also continued its field studies of hydrologic/geologic phenomena affecting radionuclide transport at West Valley, N.Y.

Four draft International Atomic Energy Agency safety guides dealing with hydrology were reviewed. Significant contributions were also provided in the development of proposed rule 10 CFR Part 60 on HLW geologic repositories; proposed rule 10 CFR Part 61 on land disposal of low-level radioactive waste; and a draft guide providing standard format and content for site characterization reports for HLW geologic repositories.

Geology and Seismology

In situ testing needed for high-level waste repositories was evaluated, and a list of underground openings that could be used for test facilities has been compiled. The types of tests that may be used to evaluate coupled thermomechanical and hydrological effects in repository rocks and backfill materials were outlined.

Continuing studies of geophysical methods used to minimize borehole intrusion have produced the outline of a new method for processing geotomography data. Since the May 21, 1980 Mount St. Helens' volcanic eruption, a volcanic hazards study program has been started as an attempt to estimate potential volcanic hazards to nuclear power plant sites in the northwestern United States. Additional study of geology and faults in north central Oregon also has been initiated.

Methodologies are being studied for use in determining recurrence intervals between earthquakes at nuclear power plant sites and to rank these techniques.

Meteorology

Information developed by the atmospheric sciences research program is used to develop more realistic atmospheric models for emergency preparedness and facility siting. Based on this program, NUREG/CR-2260 on atmospheric dispersion models for accident consequence assessments and Revision 1 to Guide 1.23, on meteorological research programs for nuclear power plants, were published or being revised at year end.

To provide information for the model evaluation program, the Idaho field experiment consisting of

nine tests was conducted between July 15 and July 31, 1981. Each test involved an eight-hour release of tracer materials, with plume trajectories determined by oil fog tracers and radar-tracked tetroons.

The NRC meteorology research program on severe weather produced a report, NUREG/CR-2252, on national thunderstorm frequencies for the contiguous United States, which was issued in September 1981. It has proved useful in the siting of the nuclear facilities and to architects/engineers.

IAEA REACTOR SAFETY STANDARDS

See page 196 of the NRC 1980 Annual Report for a description of this program. In 1981, eight safety guides were forwarded through the Senior Advisory Group and Technical Review Committees to the Director General of the IAEA. Working groups prepared three draft guides. Some 53 of the 56 planned IAEA safety guides are undergoing review, with the NRC research staff coordinating the reviews within the U. S.

NATIONAL STANDARDS PROGRAM

The national standards program is conducted under the aegis of the American National Standards Institute (ANSI). ANSI acts as a clearinghouse to coordinate the work of standards development in the private sector.

The NRC staff is active in the national standards program, particularly with respect to setting priorities so that regulatory views are known regarding the standards that can be most useful in protecting the public health and safety. NRC participation is based on the need for national standards to define acceptable ways of implementing the NRC's basic safety regulations.

The actual drafting of standards is done by experts, most of whom are members of the pertinent technical and professional societies. Approximately 250 NRC staff members serve on working groups organized by technical and professional societies. National standards are used in the regulatory process only after independent review for suitabilitiy by the NRC staff and after public comments on their intended use have been solicited and considered.

11

Proceedings and Litigation

The highlights of NRC adjudicatory activity during 1981 presented below cover activities of the Atomic Safety and Licensing Boards, the Atomic Safety and Licensing Appeal Boards, and significant decisions of the Commissioners. Brief accounts also are given of Federal court actions in which the NRC was a party or had an interest.

The Commission revised its policies and rules governing licensing adjudications in several significant respects during 1981. On May 20, the Commission issued a policy statement calling for the balanced and efficient conduct of all phases of the hearing process. The Commission encouraged the licensing boards to expedite the hearing process by using management methods already contained in the Commission's regulations and provided them with guidance on how these methods could be used. The Commission directed the boards to: set and adhere to reasonable schedules for proceedings; require the consolidation of intervenors, where this would not be prejudicial to the parties; encourage the parties to negotiate differences; manage and supervise all discovery; hold settlement conferences; issue timely rulings; and encourage the parties to file motions for summary disposition.

The policy statement was followed by several rule changes seeking to expedite the licensing process. On May 28, the Commission announced that alternate site issues would no longer be addressed at the operating license review stage because, by this time in the licensing process, the option of siting the nuclear power plant elsewhere is no longer likely to be a reasonable alternative for the purposes of the National Environmental Policy Act (NEPA).

Also on May 28, the Commission modified the so-called "immediate effectiveness" rule, eliminating the Appeal Board effectiveness review of Licensing Board decisions which authorized the issuance of operating licenses for nuclear power plants while retaining the Commission's own review of whether to allow such decisions to become effective. The Commission further modified the rule on September 30, declaring that, because of the reduced risks inherent to low-power operations, licensing decisions authorizing low-power operations would henceforth become effective without the necessity of Commission review. Commission review of full-power operating license decisions continues to be required, as are Commission and appeal board review of licensing board decisions otherwise authorizing issuance of construction permits. The rule, as modified, is Section 2.764 of Title 10, *Code of Federal Regulations* (1982, published at 46 Fed. Reg. 47764, Sept. 30, 1981).

Additional rule changes intended to expedite the licensing process were adopted on June 8, 1981. Those changes authorize the licensing boards to make oral rulings on written motions during the course of a prehearing conference or a hearing; preclude parties from filing responses to objections to a prehearing order, unless the licensing board so directs; revise the schedule for filing proposed findings of fact and conclusions of law; and permit summary disposition motions to be filed at any time during the course of the proceeding.

Numerous other rule changes were under consideration at the close of the report period. Finally, Commission pronouncements in individual adjudications also serve as generic guidelines for the conduct of the licensing process, as described below.

ATOMIC SAFETY AND LICENSING BOARD PANEL

The Atomic Energy Act of 1954 requires that a public hearing be held on every application for a

An Atomic Safety and Licensing Board is shown during a prehearing conference June 2-3, 1981, in Painesville, Ohio, on the operating license hearing for the Perry nuclear power plant under construction in Lake County, Ohio.

construction permit for a nuclear power plant or related facility. Boards composed of three administrative judges drawn from the Atomic Safety and Licensing Board Panel perform the Commission's hearing function and render initial decisions on a variety of licensing and enforcement matters. The boards constitute the Commission's principal public forum where individuals and organizations may voice their interest in a particular licensing or enforcement issue before an independent tribunal that will consider and adjudicate their concerns before rendering a decision. (Members of the panel are listed in Appendix 2.)

The Atomic Energy Act also requires that, prior to the issuance of a construction permit for a nuclear power plant or related facility, NRC must determine whether the activities licensed by it would create or maintain a situation inconsistent with the antitrust laws. While the procedures for this review are more complex than those for other reviews, an opportunity to request a hearing is provided to those whose interests may be affected.

The Atomic Safety and Licensing Board Panel is a body of legal, technical, environmental, and other experts appointed by the Commission. On September 30, 1981, the panel included 24 permanent and 40 part-time administrative judges drawn from the following professions: 23 lawyers, 17 environmental scientists, 10 engineers, 7 physicists, 1 medical doctor, 1 economist and 1 chemist. (See Appendix 2 for names of members.) The Commission appoints administrative judges to the panel based upon recognized experience, achievement and independence in the appointee's field. Assignment of administrative judges to a licensing board depends on the kinds of issues involved in the proceeding before that board. Generally, a board consists of a lawyer-chairman, a nuclear engineer or reactor physicist and an environmental scientist.

The hearing on a particular application for a nuclear facility license may be divided into two phases—one concerning the health, safety, common defense and security aspects of the application, as required by the Atomic Energy Act, the other concerned with the environmental considerations required by the National Environmental Policy Act (NEPA). Separate initial decisions covering these matters may be issued.

Administration

Following Commission action on TMI related issues, licensing boards, previously forestalled from completing most hearings during 1980, were faced with an unprecedented workload, although panel membership was at its lowest level in six years. A variety of administrative actions were taken in 1981 to meet the demand. The panel increased the number of authorized permanent members from 18 to 24, expanded the technical and clerical staff by ten, including five law clerks (three of whom were on duty September 30, 1981), reorganized panel management and facilities and installed modern word processing and other information management systems.

The Commission conducted some 40 hours of public hearings on improving the hearing process, and sought public comment on discovery, board authority,

immediate effectiveness of board decisions and issues proper for adjudication. On May 20, 1981, the Commission issued a statement of policy on the conduct of licensing proceedings which reaffirmed the boards' authority to manage hearings to assure both expeditious completion and fairness. At Commission direction, boards will try to issue initial decisions within 10 months of issuance of the last document needed for hearing. More than a third of the boards have now been reconstituted to eliminate scheduling conflicts.

The Caseload

An unprecedented number of operating license proceedings dominated the ASLBP docket. Of some 39 nuclear power plant units scheduled for completion from 1981 to 1985, 31 are or will be the subject of hearings, and another 25 units may become the subject of hearings in the future. Some 25 operating license proceedings were active in 1981. In addition, the docket included 14 construction permit proceedings, 13 license amendments, 5 antitrust cases and 20 other proceedings. The boards issued some 600 memoranda and orders and closed 23 proceedings. They held 431 days of hearings, almost four times as many hearing days as in 1980.

Three Mile Island Hearings

Following the accident at TMI Unit 2 on March 28, 1979, the Commission directed that Unit 1 remain in cold shutdown until futher notice and ordered a hearing by an Atomic Safety and Licensing Board to determine whether and under what conditions to permit restart of TMI-1. The evidentiary hearing began in Harrisburg, Pennsylvania, in October 1980. In addition to the NRC staff and the licensee, Metropolitan Edison Co., there were 10 private intervening parties and three State and local government entities, including the Commonwealth of Pennsylvania. Over 100 major contentions and a number of subcontentions were litigated in the proceeding.

On March 23, 1981, the Commission ordered that TMI-1 be considered by the standards applicable to an operating reactor, unless the evidentiary record required a different result, and removed the financial qualifications of the utility from the issues to be heard. The hearing closed in July after more than 120 days of hearings. On August 27, 1981, the board issued a partial initial decision on management issues, such as the competence of the licensee's managers, the quality of its training, the adequacy of safety related maintenance and quality assurance, and control room staffing. However, because of reports that two TMI-1 senior reactor operators had admitted cheating in the NRC senior reactor operator examination, in October 1981 the Board reopened evidentiary hearings to inquire into those allegations, and a special master, one of the panel's administrative judges, was appointed to preside. At year's end, the Board awaited the report of the special master, and the effect of the cheating episodes upon the restart of TMI-1 remained an unresolved issue.

A second partial initial decision was issued in December 1981 on issues concerning plant design and procedures, the separation of TMI Unit 1 from Unit 2 and emergency planning. Noteworthy among the sub-issues decided in the first category were methods of detecting inadequate core cooling, safety system overrides, human factors engineering in control room design, methods of evaluating design basis accidents and the environmental qualification of equipment. Also considered were the waste handling capacity dedicated to TMI Unit 1, as separate from Unit 2, fuel handling between the units, and state local and licensee emergency response capabilities.

OTHER HIGHLIGHTS

The following cases were addressed in decisions by licensing boards during the period:

Operating Licenses

The first board decision authorizing a new operating license since Three Mile Island was issued in the *McGuire* (North Carolina) proceeding. An initial decision issued in 1979 had authorized operating licenses for McGuire but stayed the effectiveness of that decision to await issuance by the NRC staff of a safety evaluation report supplement addressing unresolved safety issues. Following an evidentiary hearing on hydrogen generation and control following a TMI-type accident, the board held that premature termination of emergency cooling actions by the control room staff was too unlikely to be credible, and that, in the unlikely event of premature cooling termination, emergency procedures at McGuire provide reasonable assurance that ECCS will be safely reinstated. The decision has been appealed.

In *Diablo Canyon* (Cal.), a partial initial decision granting fuel loading and low power testing was issued on July 17, 1981, following approval by the Appeal Board of a security plan for the plant. The Commission subsequently issued the license and then suspended it pending resolution of newly discovered seismic design problems.

In the wake of the TMI accident, the Commission issued orders requiring modifications to other power reactors manufactured by the vendor of the TMI reactor. Following a hearing requested by the owners of the *Rancho Seco* (California) plant, the board authorized its continued operation contingent upon several TMI-related conditions.

Construction Permits

In the *Blue Hills* (Tex.) construction permit proceeding, the board issued a partial initial decision granting early site review following an uncontested evidentiary hearing. Evidence was introduced on site suitability, including regional demography, land and water use, meteorology, hydrology, seismology, geology and environmental impacts and alternatives under NEPA. No work can be performed under this partial decision, and when the actual design of the plant is developed the applicant will have to submit a detailed evaluation to the staff and honor 26 commitments or conditions during construction. The decision will remain in effect for five years, and can be extended by the Commission for a period not to exceed one year.

In *Pilgrim* (Mass.), the board issued a lengthy partial initial decision favorable to the construction of Pilgrim Unit 2. Some time thereafter the applicant decided to withdraw the application.

Antitrust

In the *St. Lucie 2* (Fla.) antitrust proceeding, the board approved a settlement agreement among the applicant, the NRC staff and the Department of Justice. Inventervening Florida cities did not oppose the settlement outright but they did request the board to approve the settlement on condition that further relief be granted them. The cities did not request that the settlement be rejected absent such further relief. The board denied the request for conditions because the settlement appeared to further antitrust policy by providing some relief to the cities. Whether they should be afforded additional relief will be the subject of further hearings.

Operating License Amendments

In the *Dresden* (Ill.) spent fuel pool proceeding, the licensee sought approval of a "five storage rack" project on an emergency basis. Operative facts such as criticality, quality assurance, corrosion and accident analysis, among others, were examined on the record. The board in its partial initial decision concluded that the operating license should be modified to permit the carrying out of the "five storage rack project."

In a memorandum and order in *Humboldt Bay* (Cal.), the licensing board notified the licensee that the board is considering an order requiring licensee to show cause: (1) why the operating authority provided in its facility operating license should not be revoked; and (2) why the licensee should not submit a plan to decommission the plant which has been shut down since 1976. The board ordered that the licensee file a statement of intentions regarding the plant modifications required to comply with NRC requirements, together with a schedule for completing such modifications.

In the *Turkey Point* (Fla.) steam generator repair proceeding, the board issued a preliminary order granting summary disposition of all contentions and vacating the evidentiary hearing as unnecessary. However, one intervenor affidavit raised, for the first time, some question about storage and transportation of solid low-level waste, and all parties were directed to supply information, and the licensee was directed to give detailed data and commitments regarding such wastes. The board analyzed the extensive data received and concluded that there would be no significant radiological hazard to the public from such low level wastes, even if a hurricane or tornado were to occur. A final order was entered authorizing the NRC Director of Nuclear Reactor Regulation to issue appropriate license amendments for the steam generator repairs in accordance with the commitments of the licensee.

Procedure

In the *Comanche Peak* (Tex.) operating license proceeding, the board established nine principles to govern discovery in accordance with the Commission Statement of Policy on the Conduct of Licensing Proceedings. These principles included: (1) requiring parties to negotiate directly before filing discovery motions, (2) reducing the number and complexity of interrogatories, (3) establishing the showing required where a party claimed to be waiting for information, and (4) simplifying the procedure for boards to rule upon objections to interrogatories or motions to compel more responsive answers.

In *UCLA Argonaut* (Cal.), the board held that an intervenor's proposed expert interrogator need not have the same qualifications as an expert witness. The test set forth in 10 CFR 2.733(a) asks if the examination will contribute to the development of an adequate record. The board found in the affirmative with the caveat that the authorization would be revoked if it were determined the expert interrogator was not proceeding properly.

Civil Penalty

In the *Palisades* (Mich.) civil penalty case, an administrative law judge terminated the proceeding after approving the parties' settlement agreement which provided for payment of a penalty in the amount of $225,000.00.

ATOMIC SAFETY AND LICENSING APPEAL BOARDS

Atomic Safety and Licensing Appeal Boards, consisting of three members each, perform the Commis-

sion's review functions in facility licensing proceedings and in such others as the Commission may specify. Board membership for each proceeding is selected from among the members of the Atomic Safety and Licensing Appeal Panel by the chairman of the panel. (See Appendix 2 for membership of the panel. For a statement of appeal board functions see *1980 NRC Annual Report*, pp. 235-236.)

During 1981, the appeal boards issued close to 40 published decisions and orders (in addition to numerous unpublished ones) in the *Nuclear Regulatory Commission Issuances*, the permanent compilation of NRC adjudicatory decisions used by the bar and others involved in the licensing of nuclear reactors.

As in the years before, the appeal boards were called upon to rule on a wide variety of matters involving the public health and safety and the environment. In addition, they were confronted with numerous procedural questions whose resolution are important to the fair and efficient conduct of licensing proceedings. And for only the third time in its history, an antitrust proceeding reached the appeal board on the merits. This and some of the other more significant decisions rendered by the appeal boards are highlighted below.

Public Health, Safety And Security Questions

Two of the most significant decisions of the appeal boards involved the *Diablo Canyon* (Cal.) plant. In that proceeding, the licensing board's authorization of the issuance of an operating license for the plant had been appealed to the appeal board by a group of intervenors. Because new information subsequent to the licensing board's decision had developed concerning the seismic conditions in the area, the appeal board reopened the proceeding and conducted additional evidentiary hearings, in which the Governor of California participated. In a lengthy decision in which the evidence was analyzed in detail, the appeal board found that the plant was adequately designed to withstand any earthquake that could reasonably be expected in the plant area.

The adequacy of the security plan for the Diablo Canyon plant was the subject of evidentiary hearings before a second appeal board. In another exhaustive analysis of the evidence adduced at the hearings, the appeal board found that the security plan for the plant was adequate to protect the public health and safety from the threat of radiological sabotage. Under the revised procedures which followed the *Three Mile Island* accident, licensing board decisions authorizing the construction or operation of a nuclear reactor become effective only upon Commission approval. Resolution of the seismic and security plan issues by the appeal board paved the way for Commission review of the application for operating licenses for the Diablo Canyon plant.

A long-standing question concerning the health effects of radon resulting from the mining and milling of uranium which may be attributed to the licensing of nuclear reactors came nearer to resolution. Following evidentiary hearings on the question, the appeal board issued a detailed decision on the amount of radon release which can be expected as a result of using uranium to fuel the reactors involved. That decision resulted from a consolidated proceeding involving the *Peach Bottom* (Pa.), *Three Mile Island* (Pa.), and *Hope Creek* (N.J.) plants and directly affects only those plants. Its findings, however, can be expected to be of precedential significance in other reactor licensing proceedings in which the question of health effects of radon is in issue. (For additional details on the radon hearings, see Chapter 4.)

Environmental Matters

A number of proceedings involved the proposed expansion of facility spent fuel pools. A key question in several of these proceedings was whether the National Environmental Policy Act (NEPA) required the preparation of an Environmental Impact Statement (EIS) in connection with their expansion. In *Salem* (N.J.), the appeal board reversed a licensing board decision holding that an EIS was required. The appeal board found that NRC approval of the proposed expansion of the spent fuel pool did not constitute a major federal action with significant environmental impact and, consequently, that no such statement was required. In *Big Rock Point* (Mich.), the appeal board ruled that the fact that the facility (a pre-NEPA licensed plant) had never undergone environmental review was not determinative of whether an EIS was required on the planned spent fuel pool expansion for that plant. And in a case involving the proposed transportation of spent fuel between two facilities of a single utility (*Oconee* (S.C.) and *McGuire* (N.C.)), for storage at the latter, the appeal board found that an environmental appraisal prepared by the staff on the transportation plan was adequate and that a full environmental impact statement was not required.

Antitrust

The past year also saw an important appeal board decision in the antitrust area. Following appeals by the parties in the proceeding, the appeal board decided in *Farley* (Ala.), on its own review of the extensive record (consisting of some 30,000 hearing transcript pages), that the licensing board's finding of anti-competitive activity by the applicant did not go far enough. On the basis of its conclusion that there were other instances of anti-competitive activity beyond those found by the licensing board, the appeal board ordered more extensive relief generally in the form of ownership access to the plant and greater ac-

cess to the applicant's transmission facilities. In doing so, the appeal board ruled that the NRC's remedial authority under the Atomic Energy Act was a broad one; that it extended to actions which ran counter to the policies underlying the antitrust laws, as well as to violations of those laws; and that it was not limited to activities under the NRC license but included the authority to impose any license conditions found necessary to rectify anti-competitive situations.

Hearing Procedure

Consideration of procedural questions consumed a large amount of the time of the appeal boards. The question of when interlocutory review of licensing board rulings and orders may be permitted was the subject of several appeal board decisions. In normal adjudicatory practice, including that of the NRC, a licensing board ruling made in the course of a proceeding is not usually appealable immediately; appeal must await the issuance of the licensing board's final decision. In *Allens Creek* (Tex.), the appeal board dismissed as interlocutory an intervenor's appeal of a licensing board order rescinding prior orders which had granted it free transcripts, pursuant to NRC regulations then in effect. The licensing board order under appeal had followed a Comptroller General's ruling that procedural assistance afforded by the regulations was precluded by NRC's fiscal year 1981 Appropriations Act. In two other decisions in that same proceeding, the appeal board declined to consider complaints against licensing boards—in one instance objections to the composition of the licensing board itself and, the other, the objections of one intervenor to the licensing board's refusal to allow another intervenor to pose certain questions on cross-examination by the second intervenor. Other examples of interlocutory rulings which the appeal board declined to review included a ruling by the licensing board compelling a named NRC staff member to submit to a deposition (*Midland* (Mich.)); rejection by the licensing board of one (of several) of an intervenor's contentions (*Zimmer* (Ohio)); and refusal of the licensing board to a 90-day postponement of a scheduled hearing (*South Texas* (Tex.)). On another occasion in that same proceeding, however, the appeal board accepted review of a licensing board's order, though possibly interlocutory in character, requiring the staff (subject to a protective order) to give the names of confidential informants who reported questionable construction practices at the facility. The appeal board undertook review of the ruling because of its importance in the scheme of Commission operations.

In *Summer* (S.C.), the appeal board reversed a licensing board's grant of an untimely petition for intervention in that proceeding. Under NRC rules, an order wholly denying an intervention petition is immediately appealable.

In other decisions worthy of note, the appeal board in *Bailly* (Ind.) affirmed a licensing board's decision denying two petitions for intervention in the proceeding to extend the construction permit expiration date for the plant, noting that the intervenors' concerns could be litigated in a then-pending "show-cause" proceeding; in *Monticello* (Minn.), explained the circumstances in which it would review uncontested matters in operating license proceedings; and in *Susquehanna* (Pa.), denied a staff's request for review of a licensing board's ruling denying summary disposition of a portion of a contention dealing with chlorine discharges from the facility. The request was denied on the grounds that granting would change the standard for discretionary review involving a denial of summary disposition to a simple determination of whether the licensing board erred.

COMMISSION DECISIONS

Some of the Commission's more significant decisions during fiscal year 1981 are discussed below. The Commission's actions on export licensing cases are discussed in Chapter 9.

Three Mile Island Unit 1

On December 5, 1980, the Commission effectively denied by a vote of 2-2 a question certified by the licensing board: whether the issue of psychological stress should be considered in the TMI-1 restart proceeding. Four separate opinions addressed the need to consider psychological stress under the Atomic Energy Act and the National Environmental Policy Act. Although three Commissioners agreed that the NRC should consider psychological stress and community fears, a majority did not believe that the licensing board proceeding was the appropriate forum for doing so. On September 17, 1981, the Commission announced that a majority of the full five-member Commission had voted to affirm the result previously reached. (This decision was reversed by the D. C. Circuit Court of Appeals on January 7, 1982.)

On March 23, 1981, the Commission issued an order authorizing Metropolitan Edison to commence hot functional testing. In the same order the Commission denied General Public Utility's request that the facility be permitted to resume operation prior to the completion of the NRC hearings on the restart of the facility. The Commission also decided that the licensee's financial qualifications should not be litigated in the restart proceeding, stating that litigation of the issue would not be productive. The NRC staff was directed to monitor subsequent financial developments and report any health and safety implications to the Commission.

On August 14, 1981, the Commission issued an Order transferring the authority to possess, use and op-

erate the Unit from Metropolitan Edison to GPU Nuclear Corporation.

Indian Point — No Shutdown Ordered

On January 8, 1981, the Commission issued a Memorandum and Order in which it declined to order an interim shutdown of the Indian Point Unit 2 and Unit 3 facilities while awaiting the outcome of an adjudicatory proceeding to address issues related to the safety of the two plants. The January 8 Order was a follow-up to an Order dated May 30, 1980, in which the Commission announced that it would conduct an adjudicatory proceeding on safety issues raised by a Union of Concerned Scientists petition regarding Indian Point and by the decision of the NRC Director of Nuclear Reactor Regulation, granting in part and denying in part that petition. The May 30, 1980 Order had also directed the Commission's General Counsel and the Director of the NRC's Office of Policy Evaluation to establish a task force to address the question of the status of the reactors pending the outcome of the planned adjudication.

The January 8, 1981 Order reaffirmed the Commission's decision, made in a public meeting during July 1980, to allow interim operation of Indian Point Unit 3 before and during the adjudicatory proceeding. With respect to Unit 2, which was shut down at the time because of water leaking into the containment vessel cavity, the Commission stated that it would determine, prior to the resumption of operations, whether the earlier determination to allow interim operation remained valid.

The Order also denied the motion of the two Indian Point licensees—Consolidated Edison of New York and the Power Authority of the State of New York—for reconsideration of the decision to conduct an adjudicatory proceeding.

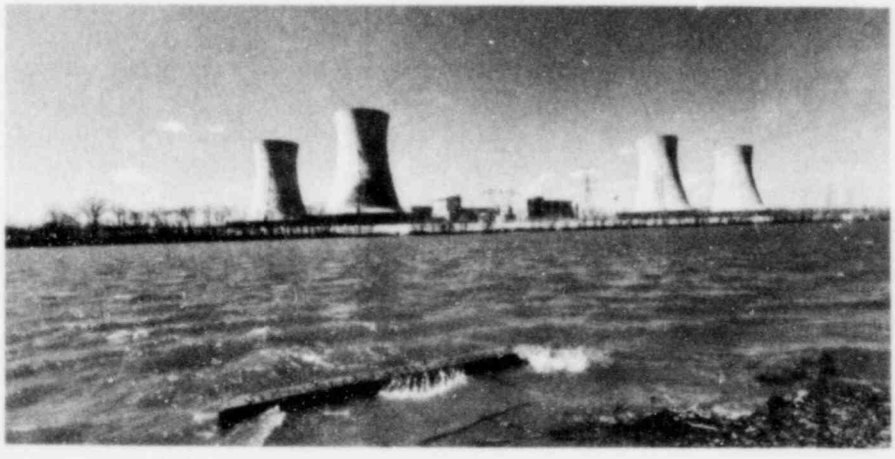
The Order stated that its primary concern was the extent to which the population around Indian Point affected the risk posed by Indian Point as compared with the risks posed by other nuclear power plants. The Commission expressed interest in the current and future state of emergency planning in the vicinity of the Indian Point site. In a series of questions, the Commission spelled out its particular concerns, and the issues it wished to have addressed by the board. These focused on the safety of the plant; emergency planning considerations; and the energy, environmental, economic or other consequences of a shutdown of one or both units.

On September 18, 1981, the Commission issued a brief Memorandum and Order clarifying certain aspects of the January 8, 1981 Order and designating the three members of the licensing board which will conduct the proceeding.

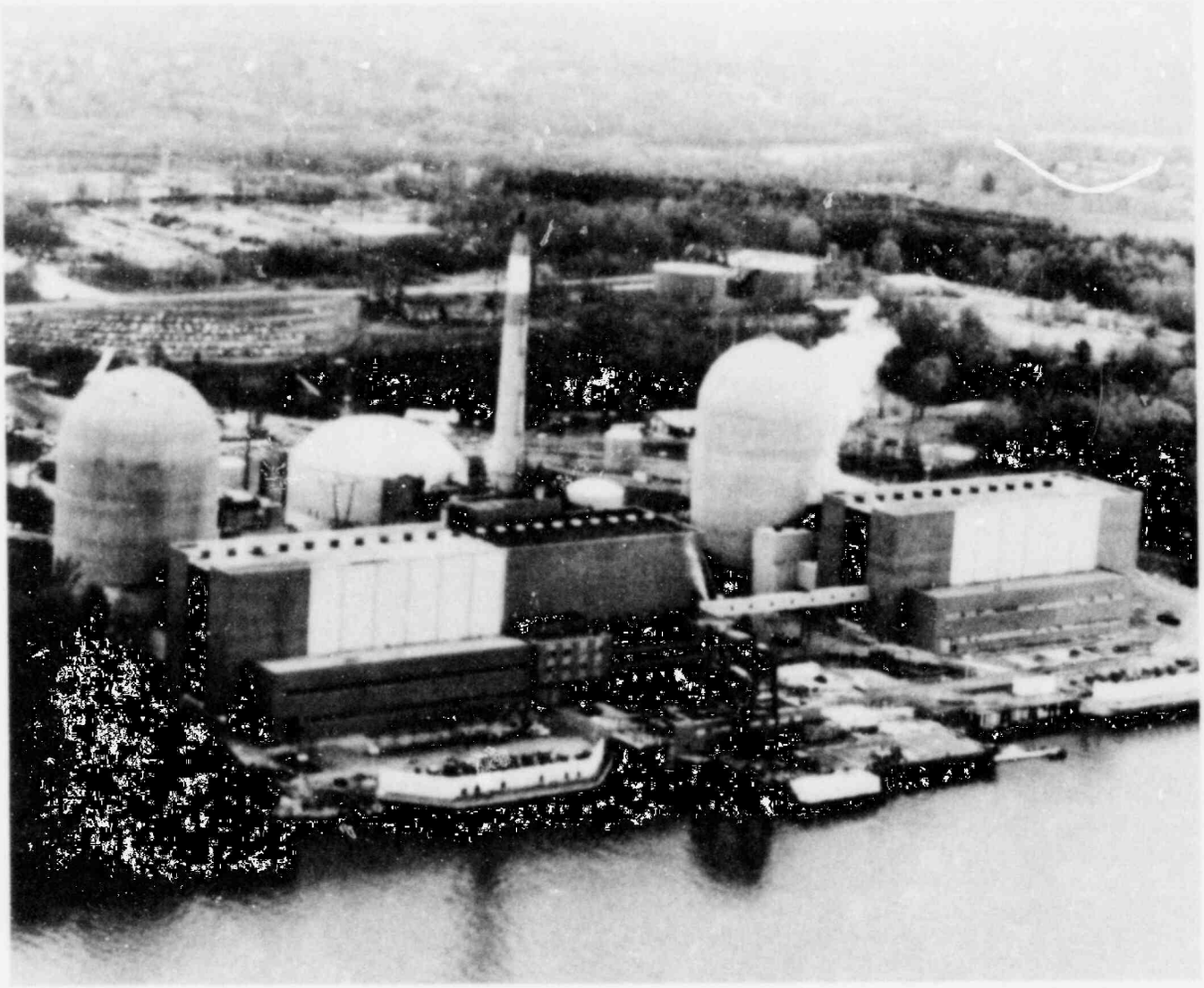
Diablo Canyon— Further Guidance on TMI Issues

On April 1, 1981, upon review of the licensing board's prehearing conference order in the Diablo Canyon low power operating license proceeding, the Commission provided further guidance on the litigation of TMI-related issues. After setting forth the principle that an application for a fuel loading and low power testing permit does not generally give rise to a proceeding separate and distinct from the full power proceeding, the Commission reaffirmed that, where the evidentiary record has been closed in the full power proceeding, the record should not be reopened in either the full or low power proceedings absent a showing of new evidence which would materially affect the decision.

The Commission then set out general methods by which new evidence or issues could be introduced into a proceeding. The new evidence or issues could address either violations of present NRC regulations or the sufficiency of TMI-related requirements contained in NUREG-0694 or NUREG-0737. A challenge to the sufficiency of a TMI-related item in the NUREG documents must be based upon the same safety concern that formed the basis for the NUREG



The Commission held 120 days of hearings on the proposed restart of Three Mile Island (Pa.) Unit 1 nuclear power plant. (Unit 2 was the plant damaged in the 1979 accident.) Decisions were issued in July and December of 1981 on plant design and procedures issues.



Adjudicatory hearings were ordered on safety issues related to operation of the Indian Point (N.Y.) Unit 2 and Unit 3 nuclear power plants. The Commission declined to order an interim shutdown of the facilities while the hearings were being conducted.

requirement. Where the issue or evidence cannot be associated with either a violation of present regulations or a safety concern identified by NUREG-0694 or NUREG-0737, a party may bring the matter to the Commission's attention either directly or through the licensing board upon a motion to waive a Commission regulation pursuant to 10 CFR 2.758. The latter option is available only where the application of a given rule in a particular proceeding would not serve the purpose for which the rule was adopted.

McGuire Unit 1

In its supplemental initial decision dated May 26, 1981, the Atomic Safety and Licensing Board authorized the Director of Nuclear Reactor Regulation (NRR) to issue full term, full power operating licenses to Duke Power Company for the McGuire Nuclear Station Units 1 and 2. The Commission completed its "effectiveness review" of the licensing board decision with respect to Unit 1 on June 29, 1981, and itself authorized the Director of NRR to issue a full power, full term license, but only for Unit 1. The Commission's order also required Duke Power to install and use an igniter hydrogen mitigation system. The Commission order stated that a hydrogen control system is required in this case for adequate protection of the public health and safety.

GPU Federal Tort Claim

On June 8, 1981, the Commission denied a claim filed by General Public Utilities (GPU) and its operating subsidiaries under the Federal Tort Claims Act

for over $4 billion in property damages alleged as a result of the March 28, 1979 accident at Three Mile Island Unit 2. The GPU claim asserted that the NRC negligently failed to warn its subsidiary of generic defects in TMI's equipment, procedures and operator training, the correction of which would have prevented the accident. GPU claimed that the NRC should have been aware of these generic problems because of a similar accident at the Davis-Besse nuclear plant in Ohio 18 months before that at TMI. In addition, the GPU claim alleged that the NRC negligently performed its regulatory safety review of TMI-2 when it was licensed for operation, in that NRC had approved the equipment and procedures which caused the accident. The Commission found the claim without merit and at odds with the regulatory framework and philosophy of the Atomic Energy Act, wherein the nuclear industry bears the primary responsibility for the proper construction and safe operation of licensed nuclear facilities. In prescribing standards for protection of the public health and safety, the Commission does not certify to the industry that the standards are adequate to protect its equipment or operations.

Sunflower Coalition

In this case the Commission dealt for the first time with a petition seeking the termination or suspension of an Agreement State's authority to regulate materials, pursuant to section 274 of the Atomic Energy Act. The petition of the Sunflower Coalition asks the Commission to terminate or suspend Colorado's radiation control program and its uranium mill licensing procedures.

In denying Sunflower Coalition's petition, the Commission concluded that the petitioner incorrectly interpreted a 1979 clarifying amendment to the Uranium Mill Tailings Radiation Control Act (UMTRCA, P.L. 95-604). The Commission stated that the amendment does not require the NRC to make a formal finding that Colorado has complied with UMTRCA to the maximum extent practicable during the three year period between November 8, 1978, and November 8, 1981 (when NRC was given authority to regulate mill tailings unless a State has entered into an amended agreement with NRC to regulate those materials). Rather, Congress intended that the NRC work with Colorado during the interim period to encourage and aid the States, in a relatively informal manner, to comply. The Commission also concluded that petitioner's allegations of deficiencies in Colorado's radiation control program were not sufficient to justify permanently terminating or suspending Colorado's agreement state status.

Honicker Petition Denial

In an order dated July 28, 1981 (46 *Fed. Reg.* 39573 (August 4, 1981)), the Commission denied Mrs. Jeannine Honicker's petition for a shutdown of the entire nuclear industry on the grounds that unavoidable releases of radioactive materials were causing deaths among the general population. The petition contended that the nuclear power program violated constitutional, statutory and international law. In denying the petition, the Commission noted that cancer fatality estimates based on the linear "no-threshold" hypothesis of radiological risk could not be regarded as predictions of deaths that would actually occur, since there has been no confirmation of the hypothesis that very low doses of radiation are harmful. Nevertheless, the Commission concluded that, even if the NRC health effects estimates are regarded as predictions that the nuclear power program will cause cancer deaths, the program would not thereby be shown illegal. The Commission pointed out that Mrs. Honicker has cited no judicial authority to support her view that the constitutional protection of life applied to a program in which the purposeful taking of life had no part and in which there was no significant risk of harm to particular individuals. The Commission also noted that the realistic alternatives to nuclear power, including the alternative of cutting back on the generation of electricity, would also carry a cost in lives "comparable to and in all probability greater than the impacts estimated for the nuclear plants."

Diablo Canyon—Low Power License Decision

On September 21, 1981, the Commission completed its "effectiveness" review of the Diablo Canyon low power proceeding, authorizing the Director of Nuclear Reactor Regulation to issue the fuel loading and low power testing license for Unit 1. As part of its decision, the Commission directed the staff to make certain findings regarding physical security prior to issuing the license, and directed the licensing board to include in the full power proceeding certain contentions which had been rejected in the low power proceeding. The Commission also addressed numerous procedural motions and requests, concluding that there was no need to depart from normal review procedures in this case. The decision emphasized the reduced risk associated with fuel loading and low power testing, noting that difficult issues remained to be resolved prior to granting the full power operating license.

On November 19, after the utility seeking the license discovered errors in portions of the seismic design of its facility, the Commission suspended the low power license pending satisfactory completion of an independent design verification program.

JUDICIAL REVIEW

Pending Cases

Sholly v. NRC, 651 F.2d 780 (D.C. Cir. 1980), *on denial of reconsideration en banc*, 651 F.2d 792 (D.C. Cir. 1981), *cert. granted*, 451 U.S. 1016, 69 L.Ed.2d 387 (May 26, 1981).

This lawsuit sought an injunction against the venting of krypton-85 from the TMI-2 reactor building. In orders dated June 26, June 27 and June 28, 1980, the D.C. Circuit denied requests for a stay of venting. In a companion case seeking essentially the same relief, *PANE v. NRC* (3d Cir. Nos. 80-1994 and 80-1995), the Third Circuit on July 10, 1980, transferred the cases to the D.C. Circuit for disposition. The cases were argued on the merits in September 1980.

On November 19, the D.C. Circuit declared illegal the Commission's refusal to hold hearings in connection with its approval of venting the Three Mile Island containment. The D.C. Circuit held that, even where a license amendment involves no "significant hazards" consideration, any interested person who requests a hearing is entitled by Section 189a of the Atomic Energy Act to that hearing before the amendment becomes effective. The court also held that the TMI-2 accident had essentially negated any authority in the TMI-2 operating license, so that any action not authorized by the Commission's February 11, 1980 Order establishing post-accident conditions for TMI-2 is a license amendment subject to Section 189a hearing requirements.

The utility sought rehearing *en banc*. Four members of the court would have granted rehearing *en banc*. They filed a dissenting statement urging reconsideration of the panel's holding that the Commission may not dispense with an opportunity for a hearing prior to granting an amendment to a nuclear power plant operating license, even though it has determined that the contemplated amendment entails no significant hazards consideration. The Supreme Court granted *certiorari* on May 26, 1981. The case has been briefed and awaits argument.

Susquehanna Valley Alliance v. Three MIle Island, 485 F. Supp. 81 (M.D. Pa. 1979), *rev'd in part*, 619 F.2d 231 (3d Cir. 1980), *cert. denied sub nom. General Public Utilities Corp. v. Susquehanna Valley Alliance*, 449 U.S. 1096, 1981)

The Susquehanna Valley Alliance (SVA) brought this lawsuit on May 25, 1979, alleging that the Commission had approved the construction and operation of EPICOR-II, a demineralizing and filtration system designed to decontaminate intermediate-level radioactive waste water resulting from the TMI accident, and intended to allow discharge of the treated water into the Susquehanna River in violation of the Atomic Energy Act, the National Environmental Policy Act, the Clean Water Act and various provisions of the United States Constitution. On that same day (and in response to a lawsuit raising virtually the same issues, *City of Lancaster v. NRC* (D.D.C. No. 79-1368)), the Commission issued a statement prohibiting the treatment or discharge of contaminated water, except for certain routine operational releases, until completion of an environmental assessment. On October 12, 1979, while the Commission was still considering EPICOR-II operation, the district court dismissed the complaint for lack of subject matter jurisdiction based on SVA's failure to exhaust its administrative remedies. Thereafter, the Third Circuit reversed the dismissal of SVA's claims under NEPA, the Clean Water Act and the Constitution, but affirmed the dismissal of the claim under the Atomic Energy Act. A petition for writ of certiorari, filed by the utility, was denied January 12, 1981, three justices dissenting. The case is awaiting further action before the district court.

People Against Nuclear Energy v. NRC (D.C. Cir. No. 81-1131)

On February 3, 1981, petitioners sought review of the Commission's decision not to consider contentions regarding psychological distress in an adjudicatory proceeding on the proposed restart of the Three Mile Island Unit 1. Their contention is that the Commission violated the Atomic Energy Act and NEPA in not hearing evidence on the issue and in not supplementing the pre-accident environmental impact statement for the reactor. Oral argument was held on November 17, 1981. (On January 7, 1982, the Commission decision not to consider psychological stress under NEPA was struck down.)

Kerr-McGee Nuclear Corp. v. NRC (10th Cir. No. 80-2043) *Uranium Mining and Milling Council, et al. v. NRC* (10th Cir. No. 80-2271) *Western Nuclear Corp. v. NRC* (10th Cir. No. 80-2269) *United Nuclear Corp. v. NRC* (10th Cir. No. 80-2043)

On October 3, 1980, Kerr-McGee (later joined by a number of other uranium milling companies) petitioned the Tenth Circuit to review the Commission's Uranium Mill Licensing Requirements which were issued that day (45 *Fed. Reg.* 65521-38). The Commission's regulations have been challenged on a number of grounds, including the claimed insignificance of the radon risk, the claimed excessive cost of complying with the regulations and NRC's failure to await promulgation of EPA standards. A request for a stay was denied June 17, 1981. Oral argument was held on November 17.

Kerr-McGee Nuclear Corporation, et al. v. NRC, et al. (10th Cir. 81-1569) *American Mining Congress v. U.S.A.* (10th Cir. No. 81-1566)

On May 22, 1981 Kerr-McGee Nuclear Corporation, Homestake Mining Company and the American

Mining Congress filed with the U.S. Court of Appeals for the Tenth Circuit a petition for review of the Commission's final rule which amended 10 CFR Part 20 to explicitly incorporate the Environmental Protection Agency's (EPA) generally applicable environmental standards for uranium fuel cycle facilities, including uranium mills (46 *Federal Regulation* 18525 (March 25, 1980;). They also seek review of the Commission's Memorandum and Order of March 26, 1981 which denied their motion to reconsider or defer implementation of 40 CFR Part 190 at uranium mills pending EPA's final decision on their motion to reconsider that standard.

The lawsuits are being held in abeyance, pursuant to the court's July 17, 1981 order pending the Environmental Protection Agency's resolution of AMC's petition to reopen the record and reconsider the generally applicable environmental standards (40 CFR Part 190) for uranium fuel cycle facilities including uranium mills.

Common Cause v. NRC (D.D.C. No. 80-2347, *appeal pending* D.C. Cir. Nos. 81-1975 and 81-2002)

On September 15, 1980, Common Cause filed a Sunshine Act lawsuit against the NRC claiming that the Commission's July 18, 1980 budget meeting was improperly closed to the public. Common Cause sought a copy of the transcript of the meeting and an injunction requiring that like meetings in the future be held in open session.

On July 2, 1981, Judge Curran ruled that the Commission had violated the Sunshine Act in closing its July 18, 1980 budget meeting (517 F. Supp 608). In reviewing the transcript of the meeting, the court found that the discussion at the meeting was general in nature and that the Commission failed to carry its Exemption 9(b) burden of showing that premature disclosure of the matters discussed would be likely to significantly frustrate implementation of a proposed agency action. In subsequent action, the court construed its order as prohibiting the closure of any budget meeting under any exemption in any circumstances (522 F. Supp. 457, Sept. 9, 1981). The case was on expedited appeal at the close of the report period. (On February 26, 1982, the Circuit Court substantially affirmed the District Court decision.)

Riley v. NRC (D.C. Cir. No. 81-1326)

This lawsuit, filed March 23, 1981, raises the question whether, under the Price-Anderson Act, the Nuclear Regulatory Commission is required to consider the existence of other forms of insurance maintained by licensees in determining the maximum amount of liability insurance available at reasonable cost and on reasonable terms from private sources. Petitioner sued when the Commission turned down his request that the Commission amend its regulations to increase the amount of liability insurance required of operators of nuclear power plants by requiring the conversion of outstanding property insurance policies to liability insurance. Briefing has been completed but oral argument has not yet been scheduled.

Citizens Action for Safe Energy v. NRC (D.C. Cir. No. 80-1566)

This lawsuit, filed May 27, 1980, challenges the appeal board's decision in ALAB-587 which deferred for the present further consideration of Class 9 accidents at Black Fox Station (Okla.). Petitioners contend that NEPA requires the Commission to prepare a supplemental environmental impact statement to consider the consequences of Class 9 accidents. The case has been briefed, but has not yet been set for oral argument.

Coalition for the Environment v. NRC (D.C. Cir. No. 77-1905) (Callaway) *Lloyd Harbor Study Group v. NRC* (D.C. Cir. No. 73-226) (Shoreham) *Nelson Aeschliman v. NRC* (D.C. Cir. Nos. 73-1776 and 73-1867) (Midland) *Natural Resources Defense Council v. NRC* (D.C. Cir. No. 74-1385) (Vermont Yankee)

These lawsuits challenge, on uranium fuel cycle grounds ("Table S-3"), the construction permits for Callaway (Mo.), Shoreham (N.Y.), and Midland (Mich.), and the Vermont Yankee (Vt.), operating license. Briefing in these cases is being held in abeyance pending the D.C. Circuit's decision in the fuel cycle rulemaking cases where the court heard argument in September, 1980. See *Natural Resources Defense Council v. NRC* (D.C. Cir. Nos. 74-1586, 77-1448 and 79-2131) and *State of New York v. NRC* (D.C. Cir. No. 79-2110).

Natural Resources Defense Council v. NRC (D.C. Cir. Nos. 74-1586, 77-1448 and 79-2131) and *State of New York v. NRC* (D.C. Cir. No. 79-2110)

These consolidated cases challenge three related versions of the Commission's uranium fuel cycle rule. The rule speaks to the fact that the environmental impact of operating a nuclear power reactor necessarily includes the impacts of off-site fuel cycle activities which support the plant. The rule sets out a table of values ("Table S-3") to be used in individual licensing proceedings as a starting point for evaluating the contribution of fuel cycle activities to the environmental impact of light water power reactors. The D.C. Circuit's consideration of these cases follows the Supreme Court's remand in *Vermont Yankee Nuclear Power Corp. v. NRDC*, 435 U.S. 519 (1978). Oral argument was heard in September 1980. The D.C. Circuit has held in abeyance a series of cases involving application of the S-3 rule to individual facilities pending its decision in the rulemaking cases. See *Lloyd Harbor Study Group v. NRC* (D.C. Cir. No. 73-2266) (Shoreham); *Nelson Aeschliman v. NRC* (D.C. Cir. No. 73-1776 and 73-1867) (Midland); *Nat-*

ural Resources Defense Council v. NRC (D.C. Cir. No. 74-1385) (Vermont Yankee); *Coalition for the Environment v. NRC* (D.C. Cir. No. 77-1905) (Callaway).

Connecticut Light and Power Co. v. NRC (D.C. Cir. No. 81-1050)

On January 16, 1981, a number of utilities sought review of Appendix R to Part 50, 45 *Fed. Reg.* 76602 (Nov. 19, 1980), the Commission's final rule on fire protection. In particular the utilities challenge as without technical basis those portions of the rule requiring licensees to install specific features that would protect redundant equipment necessary for safe shutdown from being simultaneously disabled by a single fire, and the requirement of an oil collection system for reactor coolant pumps. Petitioners request for a stay was denied July 1981. Briefing has been completed.

The Township of Lower Alloways Creek v. Public Service Electric & Gas Co. and NRC (3rd Cir. No. 81-2335)

On August 20, 1981, petitioner sought review in the Third Circuit of the Appeal Board's July 17, 1981 decision authorizing an amendment to expand the spent fuel storage capacity of the Salem Nuclear Generating Station Unit 1 (N.J.) from 264 to 1,170 spent fuel assemblies, on the grounds that an environmental impact statement is required for the NRC's policy of permitting long term storage at reactor sites through spent fuel pool expansion.

United States v. Consolidated Edison Co. of New York (S.D.N.Y. 81 Civ. 4347)

On July 13, 1981, the United States and the Nuclear Regulatory Commission filed suit against Consolidated Edison of New York to collect $210,000 in civil penalties assessed by the Commission in March 1981. The penalty assessment against Consolidated Edison followed the Commission's investigation of an incident of flooding, on October 17, 1980, of the containment at the Indian Point 2 Nuclear Power Plant in Buchanan, N.Y. The Commission's $210,000 penalty assessment was based upon a finding that the utility had failed to comply with certain conditions of its license and other requirements of the Commission. The case was in discovery at the close of the report period.

Brown v. NRC, et al. (D.C. Cir. No. 81-2034) *San Luis Obispo Mothers for Peace, et al. v. NRC, et al.* (D.C. Cir. No. 81-2035)

On September 21, 1981, these cases were filed by the public participants in the Diablo Canyon proceeding to challenge the Commission's determination which allowed various licensing board and appeal board decisions to become effective so as to authorize a low power operating license. On October 8, the court consolidated these cases on the Commission's motion. The Certified Index was filed November 2. On November 4, NRC moved to hold further consideration in abeyance pending completion of the administrative appeals. That motion and a similar one filed by petitioner Brown were granted on December 8.

Jaffer v. Brown and NRC (C.D. Cal. CV-81-4958-R(G), 9th Cir. No. 81-5878)

On September 22, 1981, Joel Jaffer sued the Governor of California to enjoin arrests at the Diablo Canyon site and the NRC to enjoin low power testing. The essence of his claim against the NRC is that the NEPA analysis is defective because it relies on inadequate or incomplete analysis of the effects of water discharge from the plant. On September 23, the court denied a request for a temporary restraining order and a request for class certification. An October 22 hearing on a preliminary injunction was cancelled and not reset. The government was served in this action on October 21, and the Commission's motion to dismiss was filed in December.

On September 23, the plaintiff also filed an interlocutory appeal with the Ninth Circuit concerning the denial of class certification. On November 4, plaintiff moved for a stay of the low power license pending his appeal. The NRC opposed and cross-moved to dismiss. On November 12, the Ninth Circuit *sua sponte* dismissed the case on the ground that the order was not appealable and therefore the court was without jurisdiction.

City of West Chicago v. NRC (N.D. Ill. No. 81-C-5743)

The plaintiff, the City of West Chicago, instituted this litigation on October 14, 1981, to challenge a September 28, 1981, license amendment issued to Kerr-McGee Corporation for amendments to its license for the now inactive thorium ore milling facility in West Chicago, Ill. The license amendment allowed Kerr-McGee to disassemble several of the buildings on the site and to receive on to the facility a quantity of material that evidently had been removed from the site by local citizens for landfill prior to the time the AEC was given licensing authority over such milling facilities. Among its claims, the city asserts that NRC erred by failing to give it prior notice and a prior hearing and that preparation of an Environmental Impact Statement was necessary prior to issuance of the amendment. On October 21, the court granted the plaintiff's motion for a temporary restraining order and enjoined Kerr-McGee from further activities under the license amendment until NRC afforded the plaintiff a hearing. On November 4, 1981, NRC filed a motion to dismiss for lack of subject matter jurisdiction.

Kepford v. NRC (D.C. Cir. No. 81-2111)

Chauncey Kepford, an intervenor in the TMI-2 licensing proceeding, petitioned for review of ALAB-640, one of a series of preliminary decisions in a continuing Commission proceeding which addresses the environmental significance, if any, of radon-222 emissions from nuclear fuel cycle operations supporting commercial nuclear power plants. This proceeding is part of the appeal board's review of several individual plant licensing decisions—including TMI-2—by lower boards. Because the appeal board has not yet reached a final determination, petitioner surmised that ALAB-640 was not a final decision reviewable by the Court of Appeals. Accordingly, he also moved the court to hold this case in abeyance pending a final decision in the radon proceeding. NRC responded to the motion by not objecting to holding the case in abeyance and by noting that because ALAB-640 is not a final order reviewable under 28 U.S.C. 2342(4), the Commission may move to dismiss the petition for lack of jurisdiction.

NFS v. NRC D.C. Cir. No. 81-2114)

On October 20, 1981, Nuclear Fuel Services, Inc., petitioned the Court of Appeals for the District of Columbia Circuit for a temporary restraining order staying the NRC's amendment to NFS's license for the Western New York Nuclear Service Center at West Valley, N.Y., and petitioned for review of that license amendment. Subsequently, NFS withdrew its request for a stay because the Court of Appeals for the Second Circuit, in a different lawsuit, stayed a decision by the United States District Court for the Western District of New York evicting NFS from the West Valley site.

Central Electric Power Cooperative, Inc. v. NRC (4th Cir. No. 81-1785)

On August 21, 1981, Central Electric Power Cooperative, Inc., petitioned the United States Court of Appeals for the Fourth Circuit for review of the Commission's June 26, 1981 decision (CLI-81-14) which declined to institute a Section 105c antitrust proceeding in connection with the operating license proceedings for the Virgil C. Summer (S.C.) nuclear power facility. Applicants South Carolina Electric and Gas Company and South Carolina Public Service Authority have intervened in the lawsuit. The certified index has been filed and petitioner's brief was due on December 1, 1981.

Alabama Power Company v. NRC (11th Cir. Nos. 81-7547, 81-7580, 81-7846, 81-7847, 81-7848)

On July 8, 1981, the Alabama Power Company sought review of ALAB-646, the appeal board's June 30, 1981 decision, which held in part that the grant of an unconditioned license to petitioner to construct and/or operate the Joseph M. Farley Nuclear Plant, Units 1 and 2 (Ala.), would create or maintain a situation inconsistent with the antitrust laws. All of these cases seek review of the same Appeal Board decision and have been consolidated.

Natural Resources Defense Council v. NRC (D.C. Cir. Nos. 80-1863 and 80-1864)

These lawsuits, filed July 28, 1980, seek review of two Commission orders involving the NFS Erwin facility. In No. 80-1863, NRDC challenges an interlocutory Commission order that granted NRDC a hearing on a proposed license amendment for the NFS Erwin facility which was less adversary than petitioners sought. In No. 80-1864, NRDC challenges an immediately effective rule issued June 26, 1980, which amended the Commission's rules of practice to incorporate the military function exception of the Administrative Procedure Act, and applied that adjudicatory exception to the ongoing license amendment proceeding for NFS Erwin. On September 29, 1980, the D.C. Circuit denied the Commission's motion to dismiss the rule challenge, stayed the rule pending appeal, and held the hearing case in abeyance. Oral argument was cancelled and the court on its own motion consolidated these cases and is holding them in abeyance pending the Commission's decision on reconsideration of its "military functions" rule. (The comment period in the rulemaking ended November 16.) The court stated that it will hear the matter expeditiously once the Commission determines whether to readopt the rule and apply it to pending proceedings.

Prairie Alliance v. NRC (D.C. Ill. No. 80-2095)
General Electric Co. v. NRC (D.D.C. No. 80-2659)
General Electric v. NRC (D.C. Cir. No. 80-2496)

On May 7, 1980, the Prairie Alliance sued the NRC under the Freedom of Information Act to compel disclosure of the General Electric Nuclear Reactor Study known as the Reed Report. While that lawsuit was pending, on October 9, 1980, the Commission, on a 2-2 vote, could not claim any FOIA exemption for the report, and hence ordered its release. The General Electric Company (GE), on October 17, 1980, thereupon filed a complaint and a request for a temporary restraining order to enjoin release of the report and require its return to General Electric. On October 31, 1980, GE's case was transferred to the District Court for the Central District of Illinois where the Prairie Alliance case had been filed. The Commission was enjoined from releasing the Reed Report pending disposition of the case by that court. Motions for summary judgment have since been filed by GE and NRC. In addition, GE is seeking discovery prior to a court ruling on NRC's summary judgment motion, and NRC has moved to dismiss the Prairie Alliance case as moot. The lawsuit in the D.C. Circuit has been held in abeyance pending the district court's decision.

Ft. Pierce Utilities Authority v. NRC (D.C. Cir. No. 80-1099)

On January 21, 1980, the Ft. Pierce Utilities Authority filed a lawsuit challenging the Commission's decision not to initiate at this time a Section 105a antitrust proceeding against the Florida Power and Light Company. The request had been prompted by a Fifth Circuit ruling that Florida Power and Light had conspired with Florida Power Company to divide the wholesale power market in Florida. The Commission reasoned that Section 105a was designed to supplement court ordered relief and that until the district court issued its decision it was unclear what supplementary relief from the Commission might be necessary. The case was argued January 9, 1981. On August 3, 1981, the district court lawsuit was settled. The Commission's motion to hold the lawsuit in abeyance, pending its determination of the implications of the settlement, was unopposed by petitioners and was granted on September 29, 1981.

Potomac Alliance v. NRC (D.C. Cir. No. 80-1862)

On August 28, 1980, the Potomac Alliance sought review of the appeal board's decision granting VEPCO an operating license amendment to expand the capacity of its North Anna Unit 1 spent fuel pool. Petitioner claims that the Commission illegally failed to consider the environmental effects of storing spent fuel at the site after the plant's operating license has expired. The lawsuit was argued June 17, 1981, and is awaiting decision.

Frisby, Kaiser and Clary v. IRS, NRC and MSPB (D.C. Cir. No. 80-1442)

This lawsuit was brought on April 18, 1980, by employees of two Federal agencies who had been dismissed from government service. The Merit Systems Protection Board re-opened the cases, in light of the Board's decision in *Wells v. Harris* (MSPB No. RR-80-3), for hearing officers to determine whether dismissal would have been proper under the standards for adverse actions of 5 U.S.C. Chapter 75, rather than under the Civil Service Reform Act of 1978, where an OPM-approved performance system had not yet been properly implemented. On reconsideration, the hearing officer upheld the removal of the NRC employee. Court proceedings have been held in abeyance pending completion of the administrative proceedings for the other two former employees.

International Verbatim Reporters v. United States (Ct. Cl. No. 458-80)

On August 27, 1980, International Verbatim Reporters sued the United States claiming that the NRC illegally breached plaintiff's contract to provide stenographic reporting services. The Commission has counterclaimed for excess reprocurement costs on the grounds that the reporting company failed to provide adequate reporting services. The case was in the discovery stage at the close of the report period.

Friends of the Earth v. NRC (9th Cir. No. 79-7311)

This lawsuit sought review of the Commission's June 22, 1979 decision to re-start the Rancho Seco plant (Cal.) after it had completed various TMI-related modifications. On July 5, 1979, the Ninth Circuit denied emergency relief, and on September 10, 1980, entered an order deferring action on the merits until completion of the then ongoing licensing board hearing. The licensing board issued its decision May 15, 1981. No exceptions were filed. The Appeal Board, conducting a sua sponte review, has directed that specified updated information be submitted to it. The Ninth Circuit has been informed of the administrative decisions but has taken no further action, presumably awaiting completion of NRC review.

State of New York and People of the State of Illinois v. NRC (S.D.N.Y. 79 Civ. 4568)

This lawsuit follows similar suits by the State of New York which sought to stop the air shipment of plutonium pending preparation of an environmental impact statement. Those earlier requests for injunctive relief were rejected. See State of New York v. NRC, 550 F.2d 745 (2d Cir. 1977). The current lawsuit challenges the adequacy of the NRC's environmental impact statement on the transportation of radioactive material (NUREG-0170) and is still in the early stages.

John Abbotts v. NRC (D.D.C. No. 77-624)

On April 11, 1977, John Abbotts, the Public Interest Research Group, and the Natural Resources Defense Council brought a Freedom of Information Act suit challenging the NRC decision to withhold certain safeguard documents. The dispute has since been narrowed to two small portions of two documents specifically contesting the proper classification of "baseline threat level" information. The court must now decide whether to review the documents *in camera* and whether there is a valid "exemption 1" claim by NRC.

United States v. New York City (S.D.N.Y. No. 76 Civ. 273)

On January 15, 1976, the NRC, DOE and DOT sought a judgment declaring a New York City Health Code provision dealing with the transportation of nuclear materials through the city to be inconsistent with the Federal statutory scheme governing the transportation of hazardous materials. The government's request for a preliminary injunction against enforcement of the Health Code provision was denied on January 30, 1976, in view of the absence of DOT regulations under the Hazardous Materials Transportation Act prohibiting such local ordinances. On April 4, 1978, DOT ruled that the New York City or-

dinance was not inconsistent with DOT's then existing statutory scheme and regulatory policy, but that a rulemaking would be held to consider what restrictions should be placed on local regulation of the routing of nuclear materials. The rulemaking was completed January 19, 1981, 46 *Federal Regulation* 5298, and the City has gone to court to challenge the rule. *City of New York v. DOT*, No. 81 Civ. 1778 (S.D.N.Y.) (April, 1981). See also State of Ohio v. DOT, No. 81-1394 (N.D. Ohio) (Aug., 1981). The lawsuit originally brought by the United States is still pending.

State of New York v. NRC (2d Cir. No. 75-4278) *Natural Resources Defense Council v. NRC* (2d Cir. No. 75-4276) *Allied General Nuclear Services v. NRDC* (S.Ct. No. 76-653) *Commonwealth Edison Co. v. NRDC* (S.Ct. No. 76-762) *Baltimore Gas & Electric Co. v. NRDC* (S.Ct. No. 76-774) *Westinghouse Electric Corp. v. NRDC* (S.Ct. No. 76-769)

These "GESMO" lawsuits have been pending before the Second Circuit ever since the Supreme Court on January 16, 1978, vacated the court of appeals decision in *Natural Resources Defense Council v. NRC*, 539 F.2d 824 (1976) and remanded the case to the Second Circuit "to consider the question of mootness." The court of appeals has not yet acted on our request to dismiss the cases as moot.

West Michigan Environmental Action Council v. AEC (W.D. Mich. No. G-58-53)

Plaintiffs sought an injunction against the increased use of mixed-oxide fuel in Consumer Power's Big Rock Point power reactor. In June 1974, the court placed the case in abeyance pending the outcome of the GESMO proceeding. The utility has not pressed its application nor prepared the environmental report preliminary to pressing its application. Settlement attempts to have the lawsuit voluntarily dismissed without prejudice to bringing a new lawsuit should the utility activate its application have thus far been unsuccessful. In December, the court set a briefing schedule to consider motions to dismiss the lawsuit in April 1982.

Rosanna Kelly v. Hendrie, et al. (D.D.C. No. 79-1550)

On June 14, 1979, plaintiff filed a lawsuit alleging that she has suffered age and sex discrimination in her efforts to be promoted and has been retaliated against as a result of initiating EEO proceedings. Plaintiff seeks retroactive promotion and an injunction against discrimination. NRC's answer, filed in September 1979, denies the substantive allegations of her complaint. The court has deferred consideration of this case pending resolution at the administrative level. An EEOC hearing examiner found that the NRC discriminated on the basis of age, but did not find sex discrimination. In May 1981 the EDO rejected the hearing examiner's finding of age discrimination, and that issue is on appeal to the EEOC. The sex discrimination claim is being pursued independently in district court.

Thot-Thompson v. McVeagh (D. Md. No. B-1703)

On August 16, 1979, plaintiff sued for damages alleged to be the result of certain statements defendant made. The NRC position is that the defendant was acting within the scope of his employment with NRC when he made the statements. The lawsuit was removed to district court on September 13, 1979, and on August 18, 1980, the government's motion to dismiss was denied. The case is being handled through the Department of Justice and is at the discovery stage. In a related administrative claim on August 7, 1981, the EDO rejected a hearing examiner's finding that the agency had retaliated against Thot-Thompson. A notice of administrative appeal to EEOC has been filed by the complainant and is currently pending before that agency.

Broudy v. United States (C.D. Calif. No. 79-02626 LEW (GX)) *Punnett v. Carter* (E.D. Pa. No. 79-29) *Skinner v. United States* (N.D. Calif. No. CA-79-1231-WAI) *Hinkie v. United States* (E.D. Pa. No. 79-2340) *Runnels v. United States* (D. Hawaii No. 79-0385) *Fountain v. United States* (W.D. Ark. No. 80-5092) *Ridgway v. United States* (D. Nev. No. 80-348 RDF)

These are a series of cases seeking money damages for injuries suffered as a result of the atomic weapons testing program. The principal defendant in the suits is the United States and the cases are being defended by the Department of Justice. In *Skinner, Hinkie and Runnels*, the government has motions to dismiss pending. *Broudy* was dismissed on January 3, 1980, on the grounds that no action will lie under the Federal Tort Claims Act for an injury which arises out of activity incident to military service. The case is now on appeal. In *Punnett*, plaintiff's motion for a preliminary injunction to compel the government to notify all soldiers formerly involved in the atomic testing program of potential risks of genetic damage was denied on March 30, 1979; the denial was later upheld by the Third Circuit.

Won-Door Corp. v. United States (Ct. Claims No. 109-79L)

Won-Door sued the United States on March 20, 1979, for compensation for an alleged taking of its property by virtue of radon contamination from the adjoining Vitro uranium mill tailing site. The government answered denying a taking on June 11, 1979. On August 20, 1979, Judge Harkens stayed the proceeding at the request of the Department of Justice which is handling the defense of this action to allow for settlement negotiations. DOE has proposed a settlement that is now being reviewed by Won-Door and the NRC.

Kepford v. NRC (D.C. Cir. Nos. 78-1160 and 78-2170)

In No. 78-1160, petitioner brought suit on February 27, 1978, to stay operation of the Three Mile Island Unit 2 facility, primarily because of claimed unacceptable health impacts from radon-222 releases attributable to the mining and milling of uranium to fuel the plant. On March 8, 1978, the D.C. Circuit denied the motion for a stay, and on March 22, the court held further review in abeyance pending completion of administrative proceedings. In No. 78-2170, petitioner brought suit on November 13, 1978, to review a September 15, 1978 Commission order affirming the appeal board's decision, ALAB-486, which authorized an operating license for TMI-2, but called for further hearings on the probability of a very heavy aircraft crash into the TMI-2 containment building. On May 11, 1979, the D.C. Circuit ordered the case held in abeyance pending completion of administrative proceedings.

United States of America v. State of Washington, et al., No. C-81-190, (E.D. Wash.) *Washington State Building and Construction Trades Council, AFL-CIO, et al. v. Spellman, et al.*, No. C-81-154, appeal pending No. 81-3454 (E.D. Wash.) (9th Cir.)

Two lawsuits, one by the Department of Justice filed April 13, 1981, on behalf of executive branch agencies, the other filed March 27, 1981, by private interests, have been brought against the State of Washington challenging the constitutionality of Washington's Radioactive Waste Storage and Transportation Act of 1980. Effective July 1, 1981, that Act prohibits the new storage, disposal and transportation of non-medical radioactive waste within the State of Washington if such waste is generated or produced outside the State of Washington.

On June 26, 1981, Judge McNichols, U.S. District Court, Eastern District of Washington, granted summary judgment for the United States and the other plaintiffs holding the Washington State Radioactive Waste Storage and Transportation Act of 1980 unconstitutional and therefore unenforceable. Thus, the State's attempt to ban the storage, disposal and transportation of non-medical, out-of-state radioactive waste as of July 1, 1981, was stopped. The State of Washington has filed an appeal.

Sunflower Coalition v. NRC, State of Colorado, et al. (D. Colo., Civil Action 81-66)

On January 19, 1981, Sunflower Coalition sued the NRC and the State of Colorado to (1) enforce the Uranium Mill Tailings Radiation Control Act (UMTRCA) requirement that a state must comply with the Act to the extent practicable prior to November, 8, 1981, and (2) terminate Colorado's Agreement State status.

The NRC and the State of Colorado filed with the District Court on April 3, 1981, motions to dismiss this action. NRC's motion was based on three theories: (1) that the plaintiff had not exhausted administrative remedies, (2) that primary jurisdiction over plaintiff's complaint is in the NRC, and (3) that review of any final agency action would properly be in the courts of appeals rather than in district court. At oral argument in Denver on May 15, the judge ruled that primary jurisdiction is in the NRC and that plaintiff must file a petition with this agency within 20 days of May 15 or its action will be dismissed. This plaintiff did. The NRC decided that Colorado was in compliance with UMTRCA and the Agreement State programs, and decided not to hold a hearing pursuant to section 274j of the Atomic Energy Act. The lawsuit was pending before the district court on renewed motions to dismiss at the close of the report period.

Rockford League of Women Voters v. NRC (7th Cir. No. 81-1772) 81-1772)

The Rockford League has sought review of the Commission's refusal, by way of a Director's denial of their petition under 10 CFR 2.206, to initiate a proceeding to modify, suspend or revoke the construction permit issued to Commonwealth Edison Company to build the Byron Station pending resolution of all outstanding generic safety issues. The Petition for Review was filed May 15, 1981. The case is now being briefed.

Honicker v. Palladino (M.D. Tenn. No. 81-3568-M) *Honicker v. NRC* (D.C. Cir. No. 81-2006)

Mrs. Honicker has sought judicial review of the Commission's denial of her petition to close down the nuclear industry (46 *Federal Rego39573 (Aug. 4, 1981)). In Honicker v. Palladino*, Mrs. Honicker filed suit in district court on August 17, 1981. The Commission moved for dismissal of the complaint on jurisdictional grounds. Judge Morton agreed, holding in a memorandum opinion, issued August 27, that the courts of appeals have exclusive jurisdiction to review the denial of her petition. Judge Morton relied on his analysis in an earlier case brought by Mrs. Honicker (*Honicker v. Hendrie*, 465 F. Supp. 414 (M.D. Tenn.), *aff'd* 605 f.2d 556 (6th Cir. 1979), *cert. denied* 444 U.S. 1072 (1980)). After Judge Morton's August 27 decision, Mrs. Honicker properly filed suit in the D.C. Circuit on September 14, 1981, seeking the same relief. She also moved for an extraordinary writ providing preliminary relief. The court denied this motion on October 28, 1981. The case has been briefed.

Riden v. NRC (7th Cir. No. 80-2793)

Mr. Riden brought this lawsuit to review an order of the Merit Systems Protection Board (MSPB) sus-

taining the NRC's decision to remove Mr. Riden, a reactor inspector who was a candidate for assignment as a resident inspector. NRC dismissed Mr. Riden after determining that he had falsified the results of an examination in order to obtain a passing grade in the PWR Technology Training Course required for all reactor inspectors. After a formal hearing, the MSPB upheld NRC's action, finding that a preponderance of the evidence supported the charge that Mr. Riden had falsified his training examination. The case was briefed and oral argument took place on October 29, 1981.

U.S. Nuclear Regulatory Commission v. Radiation Technology, Inc., 519 F. Supp. 1266 (D.N.J. 1981), *appeal docketed* No. 81-2975 (3d Cir. December 12, 1981).

On July 15, 1980, the Commission sued Radiation Technology, Inc. to collect civil penalties imposed by the NRC under Section 234 of the Atomic Energy Act for a series of infractions and deficiencies at defendant's Rockaway, N.J. facility.

In an opinion issued August 6, 1981, the district court granted summary judgment in favor of NRC and sustained the amount of penalty assessed by the Commission on all but one item of noncompliance. Based on a detailed review of the legislative history of Section 234 of the Atomic Energy Act and an analysis of similar statutory penalty provisions, the court concluded that a licensee was entitled to a trial *de novo* on the fact of violation. Thus the findings of prior administrative hearings were not binding on the court and a licensee may litigate anew whether he violated regulatory or statutory requirements. However, the court held that the administrative record could and in this case did support entry of summary judgment in the agency's favor on most items of noncompliance.

Notwithstanding a licensee's right to a trial *de novo* on the fact of violation, the court abjured any authority to independently determine the amount of penalty. Finding that the imposition of sanctions involved the exercise of agency discretion, the court held that the Commission's assessment would be overturned only if unwarranted in law or without justification in fact.

Finally, the court upheld the constitutionality of "warrantless" NRC inspections; found NRC inspections to be reasonable at any time licensed material is in use; and read a licensee's "walk-around" rights under 10 CFR 19.14(b) as an accommodation to the licensee that in no way conditions the Commission's right to inspect (519 F. Supp. 1266). An appeal has been docketed in the Third Circuit.

Closed Cases

NRDC v. NRC, 666 F.2d 595 (D.C. Cir. 1981)

In 1978, the Commission adopted amendments to 10 CFR Part 21 which exempted manufacturers of commercial grade items from the reporting requirements of that Part. Several months later, the Natural Resources Defense Council asked the Commission to reconsider the matter, arguing that the amendments violated Section 206 of the Energy Reorganization Act which requires manufacturers to report defects in basic components that could create a substantial safety hazard. The NRC denied the request and petitioner sought judicial review. The D.C. Circuit issued an opinion on October 1, 1981, affirming the Commission's decision. The court found that the 1978 amendments did not contravene the language of the statute or its legislative history.

Union of Concerned Scientists v. NRC (D.C. Cir. No. 80-1962)

On August 14, 1980, the Union of Concerned Scientists and five other organizations sought review in the D.C. Circuit of the Commission's Statement of Policy entitled "Further Commission Guidance for Power Reactor Operating License," 45 *Federal Regulation* 41738 (June 20, 1980). Petitioners contended that the policy statement unlawfully discriminates between parties to NRC adjudications by permitting applicants for operating licenses to challenge in each adjudication the necessity for the additional licensing requirements contained in NUREG-0694, while prohibiting intervenors from challenging their sufficiency. The case was dismissed as moot by stipulation of the parties on February 19, 1981, after the Commission issued a revised policy statement.

Natural Resources Defense Council v. NRC, 647 F.2d 1345 (D.C. Cir. 1981)

On May 6, 1980, a number of environmental groups sued to set aside two Commission Orders, the first of which had found that the export of a nuclear reactor and certain components to the Republic of the Philippines met all the applicable licensing criteria in the Atomic Energy Act of 1954, as amended by the Nuclear Non-Proliferation Act of 1978, and directed issuance of export licenses to the Westinghouse Electric Corporation. In the second Order, the Commission declared that it would adhere to the policy reflected in its earlier licensing decisions and only consider those health, safety, and environmental impacts arising from exports of nuclear reactors that affect the territory of the United States or the global commons.

On March 30, 1981, the D.C. Circuit, two judges participating, unanimously upheld the Commission's position on somewhat divergent rationales: Judge Wilkey in the main concluding that the Commission was correct in its rulings, while Judge Robinson,

more doubtful, nevertheless deferred to the agency's decision (647 F.2d 1345).

Three Mile Island Litigation (M.D. Pa. No. 79-0432)

This is a consolidated complaint seeking money damages for personal injuries, property losses, and business losses alleged to have resulted from the Three Mile Island accident. On July 10, 1980, Judge Rambo ruled that the federal district court properly had jurisdiction over the TMI litigation, despite the fact that the Commission had determined that the accident did not constitute an "extraordinary nuclear occurrence," because the lawsuit in any event arises under Federal law; second, that the lawsuit could properly proceed as a class action as to the "economic harm" classes; and third, that insofar as personal injury claims were involved, class action treatment was proper only as to the alleged need for medical monitoring services. Judge Rambo specifically decided that claims of emotional distress flowing from the TMI accident were too diverse and personal to be adjudicated by the vehicle of a class action. The Commission is participating as a friend of the court in this lawsuit.

On September 9, 1981, Judge Rambo approved settlement of the class action aspects of the Three Mile Island damage lawsuit for $25 million. The settlement provides that $20 million of that amount shall be allocated to those businesses and individuals residing within 25 miles of TMI who suffered economic harm as a result of the accident. The remaining $5 million is to be used as a public health fund to monitor and study possible health related effects resulting from the Three Mile Island accident.

Three Mile Island Alert, Inc. v. NRC (D.C. Cir. No. 81-1557)

On May 22, 1981, Three Mile Island Alert, Inc., filed a petition for review challenging the Commission's March 23 decision to remove the financial qualification issue from the TMI Unit 1 restart proceeding.

The NRC filed a motion to dismiss the case on the ground that the Commission's decision was interlocutory and should not be subject to judicial review until the Commission issues its final decision on the restart of Unit 1. The D.C. Circuit agreed and on August 19, 1981, dismissed the case.

People of the State of Illinois v. NRC 661 F.2d 250 (Table) (D.C. Cir. 1981)

On February 7, 1980, the State of Illinois filed a lawsuit challenging the Commission's determination that the plan of the Northern Indiana Public Service Company for installing foundation piles for the Bailly nuclear facility (Ind.) was not a design change requiring a construction permit amendment and a hearing as of right, and was not of such safety significance as to warrant a discretionary hearing. The Commission's decision noted that pilings issues had appropriately been left for later resolution, and that the Advisory Committee on Reactor Safeguards had advised that the use of shorter pilings was not a significant design change from the standpoint of engineering. On July 1, 1981, the D.C. Circuit ruled that the Commission was in error when it held that the proposed shorter pilings plan did not require a construction permit amendment. It did so on the narrowest of grounds, finding the reaction of the NRC's staff most telling when confronted with NIPSCO's proposed change—immediate suspension of all construction activity on the Bailly plant, and extensive study of the short pilings issue.

San Luis Obispo Mothers for Peace, et al. v. Hendrie, 502 F. Supp. 405 (D.D.C. 1980).

Plaintiffs filed this lawsuit on September 16, 1980, seeking the disqualification of Commissioner Joseph M. Hendrie from any further participation in the proceedings on the pending operating license application for the Diablo Canyon Nuclear Plant. The basis for their claim was both allegedly improper *ex parte* contacts between the Commissioner and utility company officials and his purported involvement in the review of the Diablo Canyon license application during his tenure as a staff employee of the Atomic Energy Commission.

On November 26, 1980, federal district court Judge Oberdorfer dismissed the lawsuit. The court ruled that judicial intervention to review a petition for disqualification before an agency has reached a final decision on the merits is proper only in those few cases where plaintiffs have made a showing of patent violation of agency authority or manifest infringement of substantial rights irremediable by the statutorily prescribed method of review, a showing not made here. The court noted that the issue of Commissioner Hendrie's participation would be fully reviewable upon completion of the agency licensing proceedings, should plaintiffs seek review in the court of appeals, the only appropriate forum to hear their case (502 F. Supp. 408).

Simmons v. Arkansas Power and Light Company and NRC (E.D. Ark. LR-80-C-263, *aff'd*, 655 F.2nd 131 (8th Cir. 1981).

On May 30, 1980, plaintiffs Simmons, *et al.* sued Arkansas Power and Light Company, the NRC, the State of Arkansas and various State agencies seeking an injunction against operation of Arkansas Nuclear One Unit 1, alleging that the emergency planning and preparedness program for the facility is inadequate. A hearing on the motion for preliminary injunction was held on June 17-18. At the conclusion of plaintiff's testimony and after argument on the motions to dismiss the lawsuit, Circuit Judge Arnold, sitting by designation, ruled from the bench that the constitu-

tional claims were insubstantial, that there was no subject matter jurisdiction over the federal statutory claims for plaintiffs' admitted failure to exhaust remedies under 10 CFR 2.206 and because exclusive judicial review over NRC actions is in the U.S. Courts of Appeals, and that the court lacked pendant jurisdiction over the State law claims. The Eigth Circuit affirmed. As to claims premised on the Atomic Energy Act, the court held that the only avenue for private enforcement of the Act is through agency 2.206 proceedings followed by court of appeals review, and not through an original action in district court. The court also held that operation of the power plant did not amount to a taking of property without just compensation, and that Federal displacement of State law in the regulation of nuclear power does not violate the Fifth Amendment or Tenth Amendment of the Constitution (655 F.2d 131).

Duke Power Co. v. NRC (D.C. Cir. No. 80-2253)
On October 10, 1980, Duke Power Co. filed a lawsuit challenging the Commission's final rule on radiological emergency planning. Duke claimed that the Commission's 15-minute notification requirement was invalid (45 *Federal Regulation* 55402). The case was argued September 15, 1981. At oral argument, petitioner's counsel significantly narrowed the issue to whether the formulation of the rule and the implementing criteria were consistent. Based on NRC's explanation to interpret the rule, there appeared to be no disagreement. On September 29, the court dismissed the case on that basis.

People of the State of Illinois v. General Electric (N.D. Ill. No. 79-C-1427, *aff'd* 7th Cir. No. 80-1962)
On April 11, 1979, the State of Illinois sued General Electric, the Commission, and the Department of Energy (DOE) over the G.E. Morris spent fuel storage facility. Illinois claimed that its own Radioactive Waste Act violates the Illinois Constitution, is preempted by the Atomic Energy Act, and hence voids its perpetual care contract with General Electric (GE), and that the Department of Energy violated NEPA in not preparing an environmental impact statement (EIS) to accompany proposed legislation on the use of G.E. Morris as an away-from-reactor storage site. On December 18, 1979, Judge Will dismissed all but the EIS claim involving the Department of Energy; that latter claim was dismissed as moot on May 8, 1980, based on DOE's expressed intention to prepare a site-specific EIS before acquistion of Morris or any other facility once Congressional authorization was obtained. On June 27, 1980, Illinois appealed.

On March 5, 1981, the Seventh Circuit affirmed the district court decision. On appeal, Illinois had only pressed a NEPA claim against DOE.

Illinois claimed that DOE had reached some unarticulated decision to acquire G.E. Morris, which would unduly influence DOE's preparation and evaluation of any EIS it prepares prior to actually acquiring the site. In a brief order, the Seventh Circuit noted that that kind of conjecture was an improper basis for employment of the judicial process. Illinois would have full opportunity to challenge DOE's EIS after it had been prepared and to challenge DOE's subsequent acquisition decision as well, when those events occur.

Potomac Alliance v. NRC (D.C. Cir. No. 80-2122)
On September 18, 1980, the Potomac Alliance filed this lawsuit seeking to enjoin the repair of the Surry Nuclear Power Station Unit 1 (Va.) steam generators, pending a more complete environmental impact statement. On October 3, 1980, the D.C. Circuit denied petitioner's request for an injunction. Repairs on the steam generators were begun on October 5, and the lawsuit was thereafter voluntarily dismissed.

Eason v. NRC (D.C. Cir. No. 80-1382)
This is an appeal from the February 6, 1980 decision of Judge Penn, which dismissed plaintiff's Freedom of Information Act (FOIA) request for a subscription to Media Monitor. Judge Penn ruled that the FOIA did not encompass documents not yet in existence and that the Commission had not withheld any copies of the publicaton. The D.C. Circuit affirmed the district court on January 14, 1981.

Woliver v. NRC (D.D.C. No. 80-2627)
On October 15, 1980, this Freedom of Information Act lawsuit was filed seeking a copy of a 1969 Sargent & Lundy Engineers' report to the Cincinnati Gas & Electric Company, "An Economic Evaluation of Alternatives." The Commission had denied the request for the report under Exemption 4 as proprietary, but re-evaluated the request and released the report, deciding that the passage of time had eliminated any likely competitive injury. The lawsuit was dismissed as moot in March 1981.

Upper Skagit Indian Tribe, Suak-Suiattle Indian Tribe and Swinomish Tribal Community v. NRC (D.C. Cir. No. 79-2277)
On October 26, 1979, three American Indian tribes petitioned the D.C. Circuit to review an appeal board decision denying their 3-1/2 year late petition to intervene in the Skagit construction permit proceeding (Wash.). The lawsuit was voluntarily dismissed on January 19, 1981, when the utility withdrew its application to construct the power plant at the Skagit site.

Gentry v. United States (N.D. Ala. No. CA 79-L-5181-NE)
This is a Federal Tort Claims Act lawsuit brought on September 14, 1979, by a former employee of Thiokol Corporation seeking money damages for exposure to radiation while working as a radiographer

on government projects. On March 5, 1980, the court dismissed all defendents except the United States. A motion for summary judgment based on statute of limitations grounds was granted December 29, 1980.

Lorenz v. NRC 516 F. Supp. 1151 (D. Colo. 1981)
In a lawsuit brought December 31, 1980, to compel the NRC to release the complete text of a document which evaluated a prospective employee's suitability for employment with the Commission, Judge Kane, on June 19, 1981, granted summary judgment for the Commission. The withheld portion of the document would have identified a person who gave his evaluation of Mr. Lorenz under a pledge of confidentiality. Judge Kane ruled that the Privacy Act entitled the NRC to withhold information which would reveal the identity of a confidential source, and that the Commission's implementing regulations adequately stated that purpose (516 F. Supp. 151).

City of Gary, et al. v. NRC (D.C. Cir. No. 81-1429)
On February 18, 1981, the NRC Commission secretary informed the City of Gary, et al., that the Commission had declined to review ALAB-619. In that decision, the appeal board ruled that issues of emergency planning and site suitability were not properly within the scope of the proceeding under way to consider the licensee's request for a construction amendment extending the date by which construction must be completed. The appeal board held that under the circumstances of this case, the appropriate forum for the petitioners is a 2.206 petition. Since the only contentions raised by the City of Gary in the extension proceeding were those relating to emergency planning and site suitability, the effect of ALAB-619 was to exclude petitioners altogether from the extensions proceeding.
On April 16, 1981, the City of Gary filed a petition for review of ALAB-619 in the U.S. Court of Appeals for the D.C. Circuit. The City sought a court order remanding the case to the Commission with instructions to allow litigation of the excluded issues in the extension proceeding. The lawsuit was voluntarily dismissed on September 16, 1981, after the utility cancelled the Bailly plant (Ind.).

Friends of the Earth, et al. v. NRC, et al. (9th Cir. No. 80-4564)
This lawsuit was an appeal, filed November 26, 1980, of the district court's dismissal of the Friends of the Earth's (FOE) complaint to compel the NRC to supplement the Diablo Canyon (Cal.) final environmental statement with regard to Class 9 accidents. At FOE's request, the parties on May 11, 1981, stipulated to dismiss the lawsuit. The same substantive issue is pending in the D.C. Circuit in *Citizens Action for Safe Energy v. NRC*, D.C. Cir. No. 80-1566.

Municipal Electric Utility Association of Alabama v. NRC (D.D.C. No. 81-0105)
On January 15, 1981, the Municipal Electric Utility Association of Alabama sued the Commission seeking to compel the Appeal Board to decide the *Farley* antitrust case. On June 30, 1981, the Appeal Board decided *Farley*, ALAB-646, and this lawsuit was dismissed on July 21.

Niagra Mohawk Power Corp. and Thomas J. Perkins v. NRC (2d Cir. No. 81-4009)
On January 23, 1981, Niagra Mohawk and Mr. Perkins petitioned the Second Circuit to review the November 26, 1980 order of the Director, NRC Office of Inspection and Enforcement, insofar as it directed that, effective immediately, Mr. Perkins not be involved with nuclear matters for Niagra Mohawk. A settlement was thereafter reached and on March 31, 1981 the lawsuit was dismissed upon stipulation of the parties.

Gilbert Larry Font v. United States of America, et al. (M.D. Ala. No. 81-0019-S)
On February 5, 1981, Mr. Font sued the United States and the NRC for injuries allegedly received as a result of a December 10, 1969 accident when two 40-foot trailers he had purchased from Long Island Nuclear Services Corp. (LINSCO) spilled nuclear waste on him. NRC argued that, in view of the Section 274 agreement with New York State, LINSCO was a New York State licensee and the Commission was not responsible for allegedly negligent actions of State licensees. To the extent the lawsuit seeks damages for the Federal Government's allegedly misinforming Mr. Font about the consequences of the accident, the Commission urged that the lawsuit be dismissed without prejudice to enable Mr. Font to file a more detailed administrative claim. In June 1981, plaintiff voluntarily dismissed his complaint.

Citizens Against Nuclear Power, Inc. & James Runyon v. United States Nuclear Regulatory Commission (7th Cir. No. 81-1016)
On January 5, 1981, Citizens Against Nuclear Power, Inc., and Mr. Runyon filed in the 7th Circuit a petition for review of ALAB-601, an appeal board decision which denied petitioner's request to intervene in the Commonwealth Edison Company (Carroll County Site) early site review proceeding on the grounds that none of their 15 contentions were litigable at that stage of the proceeding. By letter of November 5, 1980, petitioners were informed that the appeal board decision had become final agency action on November 4, 1980, when the Commission declined to review ALAB-601.
The lawsuit was dismissed for failure to file the petition for review within 60 days, as required by 28 U.S.C. 2344.

The Nuclear Regulatory Commission v. NRC, et al. (D.C. Cir. No. 81-1026)

On January 9, 1981, an affiliate of the group that brought the various *Honicker* cases, which now calls itself "The Nuclear Regulatory Commission," appealed to the D.C. Circuit the Director of Nuclear Reactor Regulation's denial of its 2.206 request, which sought revocation of the Sequoyah (Tenn.) full power operating license on the grounds that adequate measures had not been taken to deal with hydrogen generation in the event of a TMI-2 type accident. On April 1, 1981, petitioners voluntarily dismissed the lawsuit.

Christa Maria v. NRC (D.C. Cir. No. 81-1920)

On August 14, 1981, petitioner sought review of the appeal board's March 31, 1981 decision that an environmental impact statement was not required to consider the impacts of continued operation of the Big Rock Point (Mich.) facility in connection with an application to expand the facility's spent fuel pool. On September 3, 1981, NRC moved to dismiss on the grounds that the appeal board's decision was not a final order; if it were to be construed as a final order, dismissal was sought for failure to meet the 60-day filing time specified by 28 U.S.C. 2344. After NRC's motion to dismiss was filed, petitioner, on September 11, 1981, stipulated to voluntarily dismiss its petition for review on non-final-order grounds. On October 27, 1981, the Court granted the motion.

Peshlakai v. Edwards (D.D.C. No. 78-2416) (formerly *Peshlakai v. Duncan)*

This lawsuit was brought December 22, 1978, against a number of Federal agencies—primarily the Department of the Interior but also including NRC—claiming that government actions affecting the mining and milling of uranium violated NEPA because national, regional, and individual environmental impact statements (EIS) had not been prepared on a multitude of actions. The case is essentially the nuclear analogue of the *Kleppe* case which dealt with similar claims regarding coal exploration. The court saw it as such in a September 5, 1979 opinion which denied plaintiff's motion for a preliminary injunction to halt work at Mobil's pilot *in situ* uranium extraction project at Crown Point, N.M. 476 F. Supp. 1247. Thereafter, on August 29, 1980, the court denied plaintiff's motion for partial summary judgment, ruling that the regional EIS issue presented disputed material issues of fact and hence was inappropriate for summary disposition. Subsequently each claim was dismissed until on September 9, 1981, the parties voluntarily dismissed the fifth and sole remaining claim of the complaint challenging the adequacy of the Dalton Pass EIS, thus concluding the lawsuit.

Jaffer v. NRC (D.C. Cir. No. 81-8035)

On August 19, 1981, petitioner sought leave to proceed in *forma pauperis* to enjoin a licensing board opinion authorizing the issuance of two license amendments for the Turkey Point nuclear power plant (Fla.) steam generator repairs. The Commission opposed the motion on the grounds that his lawsuit had no chance to succeed because petitioner is not a party to the proceeding for which review was sought. On October 2, the court denied the motion based on a finding that petitioner had no standing to sue. On December 7, the court denied an untimely suggestion for rehearing *en banc*

Union of Concerned Scientists v. NRC (2d Cir. No. 81-4188)

On October 9, 1981, the Union of Concerned Scientists and the New York Public Interest Research Group filed suit, charging that a letter from the NRC staff to the licensees of the Indian Point Units 2 and 3 facilities constituted a final agency decision that emergency preparedness at the two plants was acceptable. The petitioners asserted that the agency's action violated the terms of the Commission's Final Emergency Planning Rule, and that once the agency has started the "120-day clock" for the correction of deficiencies in emergency preparedness, it cannot terminate that clock without a systematic review of the deficiencies which have been corrected and of those which remain uncorrected. NRC moved to dismiss the case as "non-final" agency action and the second Circuit dismissed the case on December 15.

Virginia Sunshine Alliance v. NRC (509 F. Supp 863 D.D.C. 1981, aff'd F. 2nd , D.C. Cir. December 8, 1981)

On August 18, 1980, three groups brought suit to compel the Commission to release agency records concerning the details about routes for spent fuel shipments. The administrative request predated enactment, on June 30, 1980, of a new Section 147 to the Atomic Energy Act. Consequently, the request was re-evaluated in light of the new criteria when the lawsuit was brought. On October 24, the Commission disclosed a number of documents to plaintiffs and filed an affidavit in court supporting the continued withholding of information covering communication dead zones, safe havens and law enforcement response capabilities.

On February 26, 1981, Judge June Green upheld the Commission's position that the newly enacted amendments to Section 147 of the Atomic Energy Act authorized the FOIA withholding of local law enforcement agency response capabilities and mobile telephone limitations for spent fuel shipments. Judge Green reasoned that although the FOIA requests preceded the June 30, 1980 amendments to Section 147, she was obliged to apply the law now if effect, and the withheld information could be of considerable value to a potential saboteur by revealing specific vulnerabilities in spent fuel routes. The information

thus qualified as safeguards information, the disclosure of which could reasonably be expected to have a significant adverse effect on public health and safety or common defense and security, and was protectable under Section 147 and Exemption 3 of the FOIA. On April 13, 1981, plaintiff appealed the District Court's decision. On December 8, the D.C. Circuit affirmed based on Judge Green's opinion. The court also noted that the NRC should report to Congress, as required by Section 147, whenever that section is involved.

12

Management and Communication

This chapter covers the personnel, funding, and other essential management functions of the NRC, as well as the activities the agency engaged in during the year to provide the public with information about regulation. The latter communications functions have been treated in a separate chapter in past reports.

STRENGTH AND STRUCTURE

Personnel Strength Increases

Congress authorized 3,300 full-time permanent positions for the NRC in 1981, an increase of more than 9 percent above the 1980 authorized level of 3,066. Almost 69 percent of NRC employees work in the major program offices. About 24 percent are in program direction and administration. The remainder are Commission staff and the independent advisory and adjudicatory bodies.

Sixty-eight percent of NRC employees hold college degrees. More than 23 percent of these have masters degrees, some 3 percent professional (mostly law) degrees, and over 9 percent hold doctorates. Employees trained as scientists or engineers comprise more than half of the NRC's work force.

Commission and Director Changes

From June 30, 1980, to July 1, 1981, there were only four instead of the authorized five Commission members. Dr. Joseph M. Hendrie reassumed the chairmanship on March 31, 1981, from John F. Ahearne, who continued to serve as a commissioner. Dr. Hendrie completed his term and left the NRC on June 30, 1981. On July 1, 1981, Dr. Nunzio Palladino began his term of office as chairman. The Commission reached its full strength on August 3, 1981, when Thomas M. Roberts was appointed.

The following changes took place in the principal staff:

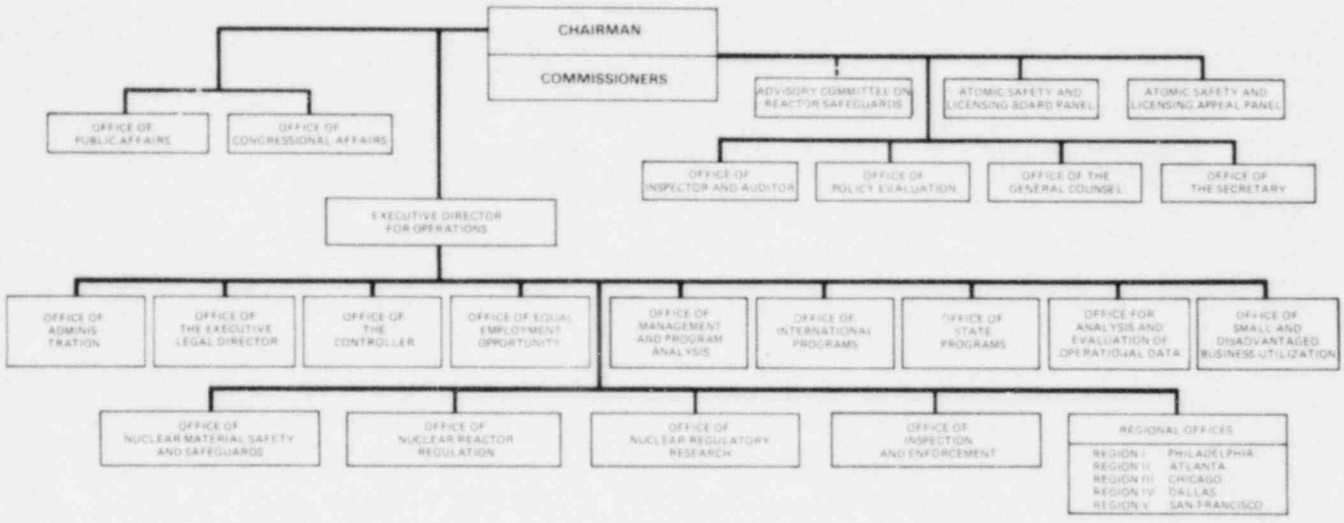
- In November 1980, B. Paul Cotter was appointed Chairman of the Atomic Safety and Licensing Board Panel.
- In April 1981, Edward Hanrahan, director of the Office of Policy Evaluation, left the NRC, and Dennis K. Rathbun was appointed acting director.
- In July 1981, Norman H. Haller, director, Office of Management and Program Analysis, was appointed executive assistant to the chairman. Harold S. Bassett was designated acting director of MPA.
- Ronald C. Haynes, formerly deputy director of the NRC Region V office, was appointed director, Region I in August 1981. He succeeded Boyce H. Grier, who retired.

The Advisory Committee on Reactor Safeguards designated J. Carson Mark as its chairman for calendar year 1981.

Recruitment

The temporary hiring freeze and budgetary restrictions imposed by the new Administration hampered the NRC's recruitment program. Although the need for highly qualified professionals to staff technical positions and the competitive labor market in the nuclear industry continued to demand a high-level of recruitment effort, the number of NRC campus recruitment visits was reduced to 26 colleges and universities. These included ten schools where significant numbers of women and minority persons were enrolled, and involved NRC representation at a number of job fairs and/or career days sponsored by university or student technical associations.

U.S. NUCLEAR REGULATORY COMMISSION ORGANIZATION CHART



Staff Reorganizations

The consolidation of the functions and positions of the Office of Standards Development with those of the Office of Nuclear Regulatory Research was the major organizational change of 1981. The new organization retained the latter name. This change makes the research function more responsive to the regulatory needs of the agency by permitting more direct application of research programs to rules, regulations, and guides and through more effective use of staff resources.

In other changes, the NRC:

- Standardized the regional office structures to conform more closely with the 1980 realignment of the headquarters Office of Inspection and Enforcement.

- Moved from the Office of Nuclear Reactor Regulation to the Office of State Programs responsibility for: (1) functions involving need for power determinations, (2) applicant financial responsibility, (3) licensee indemnity matters and (4) decommissioning cost analysis and recommendations to facilitate coordination between Federal and State levels.

- Transferred the NRC's automatic data processing support unit from the Office of Administration to the Office of Management and Program Analysis to group similar functions and better utilize staff capabilities.

EMPLOYEE-MANAGEMENT RELATIONS

Incentive Awards Program

NRC managers recognized the high quality of work performed by their staff members during the year by presenting some 205 Special Achievement Awards for performance exceeding job requirements. In addition, 149 NRC personnel were awarded High Quality Performance Increases, and 31 received Certificates of Appreciation.

Union Activity

Negotiations on Bargaining Agreement. In March the NRC management negotiating team and the National Treasury Employees Union (NTEU) bargaining team completed negotiations on a comprehensive agreement. The agreement became effective July 14, 1981 and will be in effect for three years. It provides for a limited re-opener at the end of the 18 months, at which time each party has the right to propose one new article and the amendment of not more than two articles of the agreement.

General Labor Relations Activities. Approximately 100 grievances and 27 unfair labor practice cases were handled during the year. In addition, NTEU pursued its representational rights in mid-contract bargaining. Approximately 100 negotiating sessions were held regarding the procedures by which management decisions would be implemented and the impact those decisions would have on bargaining unit employees.

Performance Appraisal

A new performance appraisal system for non-bargaining-unit employees not in the Senior Executive Service (SES) was developed to conform with requirements of the Civil Service Reform Act. Negotiations were conducted with the NTEU for a performance appraisal system for bargaining unit employees. All supervisors were trained in identifying critical and non-critical elements and performance standards. Supervisory efforts focused on writing elements and standards, in consultation with employees, for every covered position. The appraisal system for SES employees also was revised in accordance with experience gained during its first year of implementation.

Training and Development

A broad spectrum of NRC employees received training in both "technical/scientific" and "nontechnical" areas under four general categories. The objectives were to (1) enable new employees to orient themselves rapidly to NRC operations; (2) help on-board professional employees stay current with technological and policy developments, and changing NRC regulations and requirements; (3) help all employees maintain and improve their job skills and performance, and (4) provide present and prospective supervisory and executive personnel with development and training of management.

In addition, retraining was provided for employees affected by reassignments and organizational or mission changes. The NRC executive and management development program was designed to meet all requirements of the civil service reform act of 1978 and was implemented to provide relatively brief on-site training of immediate impact in the work place.

NRC EMPLOYMENT PROFILE

	SEPTEMBER 30, 1980				SEPTEMBER 30, 1981			
	MEN		WOMEN		MEN		WOMEN	
	NON-MINORITY	MINORITY	NON-MINORITY	MINORITY	NON-MINORITY	MINORITY	NON-MINORITY	MINORITY
EXECUTIVE	4	0	0	0	5	0	0	0
SES	180	3	2	0	187	3	3	0
GS-18	0	0	0	0	1	1	0	0
GS-17	4	0	1	0	3	0	1	0
GS-16	18	0	1	0	13	1	2	0
GS-15	505	24	10	0	535	32	13	0
GS-14	575	63	22	4	599	79	25	5
GS-13	310	36	33	9	308	40	42	14
GS-12	139	16	54	10	130	21	63	6
GS-11	54	9	57	12	52	9	61	17
GS-1-10	68	22	461	144	118	34	560	172
OTHER*	22	10	3	0	25	8	0	0

*Employees whose salaries are set by wage board, scientific & technical schd, or admin determination.

Equal Employment Opportunity

Staff resources committed to the Equal Employment Opportunity (EEO) Program in 1981 included six full-time permanent employees: a director, two EEO specialists, a program analyst, a secretary, and a Federal Women's Program manager assigned to the Office of Administration. An Upward Mobility Coordinator, occupying a part-time position in the Division of Organization and Personnel, administers that program under which "bridge" positions are coupled with formal training, to provide avenues into the para-professional and professional ranks for employees in lower level positions.

Twelve trained EEO counselors, including one in each of the five NRC regional offices, establish open, sympathetic channels through which employees may raise questions and discuss grievances or problems associated with equal opportunity. Five officers and five attorneys assist in adjudicating discrimination complaints. The agency also contracts with private firms to investigate complaints of discrimination filed by NRC employees and applicants for employment.

The Federal Women's Program (FWP). The FWP initiated a special system of monitoring the hiring process at NRC to keep key supervisors and personnel staffers aware of the percentages of women in the NRC workforce. In addition, a talent bank of women applicants was developed to encourage consideration of women in each job category. On August 4, 1981, a special conference of women employees and representatives of the offices of personnel and EEO was held to discuss career and promotion opportunities for women and by year's end, some steps had been taken to improve the picture. However, note also was taken that hires of women at NRC increased substantially in the last quarter of 1980 — to 54.6% —, but decreased sharply in the following quarter to 40.7%, a 14% drop. By contrast, promotions of women rose from 40.5% of total promotions to 44.5% and 44.2%, respectively for those same periods.

INSPECTION AND AUDIT

The NRC's Office of Inspector and Auditor (OIA) serves as the agency's inspector general, although it is not statutorily structured as such. OIA's functions are geared toward assuring effectiveness, efficiency, and integrity in NRC operations.

As in the past, OIA concentrated its efforts in 1981 on eliminating fraud, waste, and inefficiency, and on evaluating ways to improve its efforts in these areas. The office issued 13 audit reports in 1981 and made 81 recommendations to improve the operations of various NRC programs and activities. Also issued were 13 reports of investigation. Some 13 matters were referred to the Department of Justice for review and possible criminal prosecution.

Some of the more important reports issued during 1981 are summarized below.

Short Term Lessons Learned

In July 1979 NRC issued NUREG-0578, titled "TMI-2 Lessons Learned Task Force Status Report and Short Term Recommendations" (short term lessons learned). NUREG-0578 identified a number of actions that should be taken to reduce the likelihood of a nuclear accident and to improve emergency preparedness in responding to such events. In early 1980, NRR formed review teams to visit reactor sites to review licensees' documentation and implementation of the short term lessons learned. OIA's November 12, 1980, report discussed the functions performed by the NRR review teams and the role played by the Office of Inspection and Enforcement in verifying licensee implementation of the short term lessons learned.

Policy, Planning and Program Guidance

At the request of the Commission, OIA performed an audit of NRC's Policy, Planning and Program Guidance (PPPG) covering fiscal year 1982-1986. A report, issued December 12, 1980, discloses that the PPPG was used during the 1982 budget process and identified areas where improvements were needed

Members of the National Treasury Employees Union, Chapter 208, are shown at a meeting concerning NRC overtime work policy. James D. Thomas, Chapter President, reported on the negotiations which led to a new Memorandum of Understanding on the subject, effective March 16, 1981.

NRC representatives were among the officers of the Suburban Maryland Chapter, Federally Employed Women (FEW), who presented Senator Edward M. Kennedy with the 1981 FEW Distinguished Service Award. Left to right are Carol Peabody, NRC; Ruth Anderson, NRC; Senator Kennedy; Elaine Lazaroff, Department of Health and Human Services; and Ina Alterman, NRC.

with the agency's implementation of the policy guidance and perceptions of the PPPG overall. OIA made recommendations geared primarily toward assuring that NRC's daily operations support the broad Commission policy, clarifying questionable areas related to the PPPG, and formalizing the program manager system. The new Commission guidance reflects most of OIA's recommendations.

Resident Inspector Training

A report issued by OIA on December 17, 1980, deals with the recruitment and training programs for resident inspectors, especially "new-hire" inspectors. OIA described the training programs that were in place for these individuals and the qualifications for newly hired resident inspectors.

While there was a training program in place for "new-hire" resident inspectors, OIA concluded more attention should be given to developing a uniform, comprehensive training program for resident inspectors.

Document Control System Review

A review of the contract for the NRC Document Control System (DCS) resulted in a March 9, 1981, report stating that the contract was improperly monitored, that questionable costs were charged to it, that it was poorly negotiated in its third year, and that the cumbersome system rarely was used as intended. It was recommended that NRC re-examine the technical aspects of the DCS, ensure that it met NRC's needs, and then encourage broader use of the DCS.

Three Mile Island Action Plan

An OIA report of June 4, 1981, focused on NRC's implementation of the TMI Action Plan items relating to utility personnel licensing and training. It also

addressed the larger issue of the overall management of the Action Plan's implementation. OIA concluded that although portions of the Action Plan were being implemented, progress had been slow in many areas because of the lack of management attention and inadequate coordination, control and follow-up by the NRC staff. A follow-up OIA review in 1982 will assess the remedial actions which have been taken.

Operating Reactors Licensing Action Program

OIA's July 31, 1981, report identified factors which contributed to the backlog of unreviewed operating reactor licensing acitons and addressed efforts taken by NRR to reduce this backlog. OIA found that corrective actions had not been effectively implemented, and that no one had developed an overall plan for identifying and solving the underlying problems contributing to the backlog.

The report makes recommendations to improve the: (1) monitoring of the backlog; (2) assignment and review of actions; (3) use of contractor resources in reviewing licensing actions; and (4) use of computer capability to improve data reporting and task tracking.

Integrated Safeguards Information System

A review of a staff proposal for an Integrated Safeguards Information System (ISIS) resulted in a report issued on August 12, 1981, which concluded that the Commission should reconsider the project. The report noted among other things, that NRC had not fully complied with procurement regulations, and that the ISIS proposal was based on changes to regulations which have not been adopted.

FUNDING AND BUDGET MATTERS

NRC resource charts and financial statements appear at the end of this chapter. These charts show allocations of personnel and funds to the various NRC activities for fiscal year 1981 and those projected fiscal year 1982.

Staffing increases in fiscal 1982 are required to provide for inspection and enforcement capabilities at the growing number of operating nuclear reactors and at reactor construction sites, increased operating license reviews for reactor plants, and developing NRC requirements for licensing a DOE high-level waste repository.

Funding increases for fiscal 1982 are required to obtain contractor technical assistance, largely at Department of Energy (DOE) national laboratories, for operating licensing reviews for reactor plants and the Clinch River Breeder Reactor; and to develope NRC requirements for licensing the DOE high-level waste repository. Increased regulatory research in the area of reactor accident evaluation and mitigation also is being conducted by contractors as part of efforts that were expanded following the TMI-2 accident. These efforts are geared toward understanding the behavior of damaged fuel and studying primary reactor systems integrity. These increases are partially offset by the reduced funding that continues in an area such as the loss-of-coolant accident (LOCA) and transient research program, as work is focused on small-break LOCAs as a result of TMI-2 lessons and as major studies of separate effects are completed.

Consistent with Federal policy, NRC will begin using the full-time equivalent method of accounting for staff years in fiscal 1982. NRC resources for fiscal 1981 have been adjusted from end-of-year full time permanent staff previously reported to full time equivalent staff for comparability with fiscal 1982 data.

Project Management

The EDO further streamlined the project management process within the agency during the year. Close, formal coordination among all program offices was emphasized, along with standardized, routine project management procedures. Technical staff skills were increased through greater attendance at the procurement training course and the more generalized project management emphasis which was added to the syllabus developed by the Management Development and Training Staff.

The Safeguards Technical Assistance and Research Review Group, the Waste Management Review Group, and the Senior Contract Review Board (SCRB) all continued to function. Each group reviewed an increased number of projects during the year. Each of these groups reviews brief Project Descriptive Summaries and Statements of Work to assure that each project is well planned, supprots NRC objectives, is not duplicative of other work, and has fiscal integrity. All projects larger than $500,000 annually must be approved by the SCRB. This matrix management approach, using talent from several disciplines, has benefited the overall contractual program. The Commission was able to decrease the number of projects they personnally review based on the increased use of these coordination and review processes at the EDO level. In the future, the Commission will review only commercial contracts at the $1 million threshold level and projects where their personal review is mandated by law.

The EDO also initiated efforts to revise the research coordination procedures in order to implement simplified, standardized practices for endorsing regulatory research projects by the licensing and other staff offices. More emphasis will be placed on early review in the planning and budget formulation process.

During a break in an NRC News Media Workshop, sponsored by NRC Region III's Public Affairs Office, Carl Paperiello, chief of the Region's Emergency Preparedness and Program Support Branch, explains the use of radiation survey instruments to two newsmen. The one-day workshop, held in Chicago, provided newsmen with fundamental information on radiation and on nuclear power plant operations.

The program offices were directed to consolidate their project files into single locations, standardize the contents of each file, and initiate the use of standard terminology described in NRC Bulletin 1401-3. NRC Bulletin 1401-2 continued this theme by standardizing the responsibilities of Project Managers obtaining support from DOE or other outside sources. Both NRC and DOE reviewed NRC Manual Chapter 1102, and minor changes were suggested to this basic "contract" between the two agencies. NRC Form 189 was produced to replace the eleven different versions of the forms 189 which DOE used in the past. Again, standardized terminology will further enhance the coordination between the agencies. Increased cost detail and schedule reporting will be provided by the laboratory contractors.

The Agency's ADP functions were consolidated to increase efficiency, provide a central point of control, and better serve NRC project managers. Long range planning was increased in serveral areas such as ADP support. Overall long range program estimates were coordinated with the national laboratories to ensure the availability to resources to perform accepted NRC work.

Contracting and Reimbursable Work

Most of NRC's operating funds were expended in reimbursable arrangements with other agencies and in contracts for confirmatory research and technical assistance.

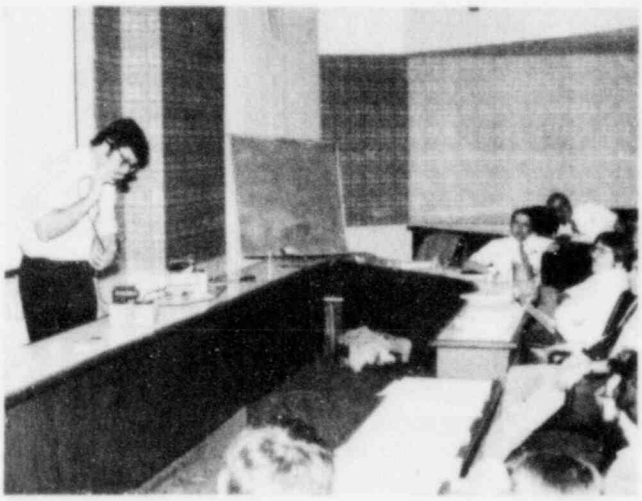
Some $265 million was allocated to program support during fiscal 1981. The Department of Energy's share was approximately $215 million for work performed in DOE's national laboratories and other facilities. This work included major regulatory research projects such as the Integrated Reliability Evaluation Program, and experiments at the Loss-of-Fluid Test (LOFT) Facility, the Power Burst Facility, and the Semiscale Facility. (Specific research programs are described in Chapter 10.)

Contracts with commercial firms for technical assistance and research work (except work performed through DOE), as well as general purchases, are administered through the Division of Contracts, Office of Administration, in support of the responsible program offices. Such contracts totaled approximately $50 million during fiscal 1981.

BUSINESS DEVELOPMENT

NRC's Office of Small and Disadvantaged Business Utilization (OSDBU), working with the Division of Contracts, committed the agency in 1981 to goals set forth in P.L. 95-507, which amended the Small Business Act and Small Business Investment Act of 1958. Among the commitments were $16,293,000 for prime contract awards to small businesses, $200,000 for subcontracts to small businesses and $50,000 for subcontracts to small businesses controlled by disadvantaged individuals. The agency received more than 400 corporate capability statements from small, disadvantaged and woman-owned businesses, and participated in many meetings with such firms.

NRC staffers also made presentations at the Department of Labor's "How to do Business with Fed-



Reporters in the Region III area are taken through the intricacies of radiation detection by Rick Hasselberg, instructor with the NRC Management Development and Training staff. The session was part of the News Media Workshop held in Chicago in May of 1981.

Table 1. FY 1981 License Fee Collections

Fees	*Materials*	*Facilities*	*Total*
Applications	$ 337,000	—	$ 337,000
Construction Permit	—	—	—
Operating License	—	$ 2,654,000	2,654,000
Amendments	471,000	2,168,000	2,639,000
Renewals	534,000	—	534,000
Inspection Fees	1,343,000	5,964,000	7,307,000
Special Projects	5,000	108,000	113,000
Totals	$ 2,690,000	$ 10,894,000	$ 13,584,000

eral and Local Governments" seminar, and spoke to representatives of some 40 businesses at the Mid-Atlantic Technology and Business Opportunities Conference, detailing the kinds of goods and services NRC has sought in the past and for which future requirements might arise. A number of NRC financial assistance grants were awarded to historically black colleges, as encouraged by a presidential memorandum on that subject dated January 17, 1979.

DOCUMENT CONTROL SYSTEM

As a result of several management reviews during 1980 (see OIA discussion, above), the NRC's computerized Document Control system was redirected and simplified early in 1981. User needs were sharpened and annual operating costs reduced from $11 million to about $6 million a year. The figure will be further reduced in 1982 and 83 to about $3 million annually. A comprehensive study of user requirements and technology assessment initiated by the staff will be submitted to the commission in 1982.

NRC LICENSE FEES

In accordance with the provision of the Independent Offices Appropriation Act of 1952 and Administration policy on collection of user fees, the Commission continued to collect fees for processing applications, permits, licenses and approvals and routine health and safety and safeguards inspections.

Fees collected in fiscal year 1981 totaled $13.6 million. All license and inspection fees are sent to the Treasury as miscellaneous receipts. Table I provides a breakdown of these collections.

The total collected since fees first were imposed in 1968 is $119.2 million. This figure excludes $6.5 million which was refunded to licensees because of the Supreme Court 1974 decision against annual fees, and $1.8 million in application fees made in the prior fiscal year where actual cost of the review did not equal the application fee.

The current schedule of fees, adopted March 23, 1978, provides that fees assessed for construction permits and operating licenses for power reactors will be based on the actual costs (manpower and contractual) expended to complete the review but not exceed certain upper limits established by the Commission. During 1981, the Commission did not issue any construction permits. Three operating licenses were issued which were subject to the actual costs requirement.

Clarification of Regulation. On November 10, 1980 the NRC published a proposed rule to clarify its intent in promulgating a regulation which said that charges would be assessed whenever any review is brought to an end. It noted that several electric utilities had withdrawn applications for construction permits on which the NRC staff had spent considerable time and effort. The interpretive amendments to 10

Table 2. Cost of OL Issuances in FY 1981

Operating Licenses	*Issue Date*	*Licensing Cost*	*Inspection Cost*	*Total Cost*	*Fees Paid*
Farley 2	10/23/80	$ 528,648	$ 333,248	$ 861,896	$ 302,800
McGuire 1	01/23/81	1,630,492	561,974	2,192,466	1,024,500
Sequoyah 2	06/25/81	343,891	368,010	711,901	302,800

(No construction permits were issued in fiscal year 1981.)

The Region II News Media Workshop took place in Atlanta in August 1981. Shown clockwise from above are: a briefing conducted by Victor Stello, Director of the NRC Office of Inspection and Enforcement; a discussion with reporters of the TLD radiation monitoring device and high-frequency radio for emergency use, led by Greg Gibson, the regional emergency officer; and a visit to the Region II mobile laboratory.

CFR 170.12 were intended to remove any misunderstanding about the Commission's intent and to charge fees on withdrawal, denial, suspension or postponement of action on an application. The Commission will consider billing an applicant for processing and review costs when it receives a statement of intent by the applicant to postpone further review or is informed of a construction schedule delay which forces the staff to postpone further review. If such an application is reinstated without significant changes, or if the review effort is resumed, charges will accrue only from the time of reinstatement or recommencement. The final rule was published effective November 6, 1981. On November 25, 1981, 17 electric utilities petitioned for review of the rule in the U.S. Court of Appeals for the first circuit.

PUBLIC COMMUNICATION

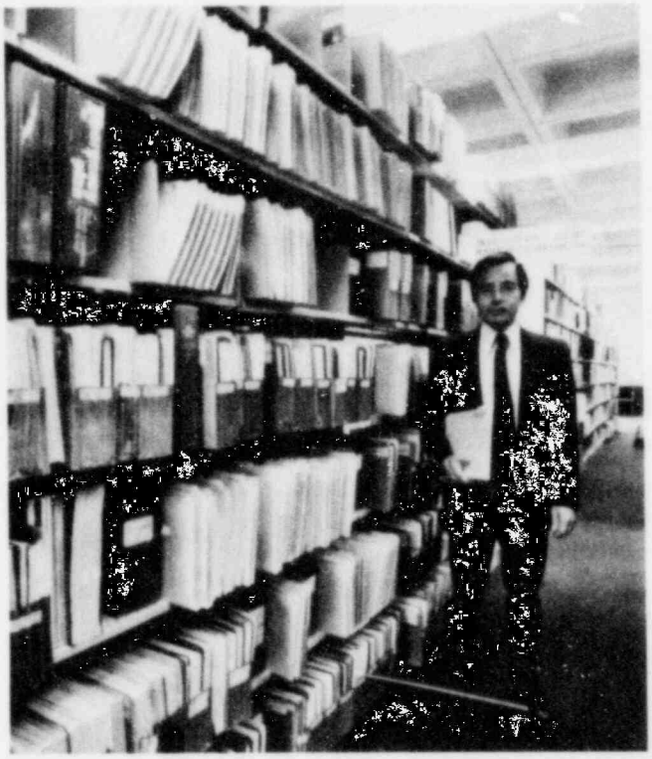
Public Information

The Nuclear Regulatory Commission's program for providing information to the public and the news media continued to expand in 1981 in a number of ways. The agency Office of Public Affairs initiated a pilot program of educational seminars for reporters from wire services, broadcast networks, news magazines and daily newspapers on the fundamentals of nuclear reactors and radiation.

The NRC's year-old Consumer Affairs Program. To increase public awareness and involvement in agency activities included a number of meetings between Commissioners and representatives of organizations with wide and varied views on nuclear regulation as well as regional public meetings where a broad cross-section of comment was sought.

Headquarters Public Document Room

NRC's headquarters Public Document Room (PDR) at 1717 H Street, N.W., Washington, D.C., contains a large collection of technical, legal and administrative documents that NRC receives or generates. The majority relate to the licensing and inspection of nuclear facilities and to the management of nuclear materials. Also included are Commission cor-



NRC Public Document Rooms are located near the sites of proposed or operating nuclear facilities across the country. Above, the university library at the California Polytechnic State University in San Luis Obispo, Cal., houses documents related to the Diablo Canyon nuclear power plant. Below, the White Plains, N.Y., Public Library contains the documentation on the Indian Point nuclear power plant.

respondence, contracts, export and import licenses, rules and regulations, transcripts of Commission meetings, regulatory guides, agency generated reports and contractor technical reports.

The PDR responds to requests from any member of the public. Staff librarians assist users in defining search strategies, explaining reference tools and locating and retrieving documents in specific files. A daily accession listing and other indexes are available. In cases where indexes are not appropriate or where documentation cannot be easily drawn together, librarians can perform on-line computer searches of the PDR's machine-readable data base which contains descriptive citations of all records submitted to the facility after October 1978 and for principal licensing documents dated earlier.

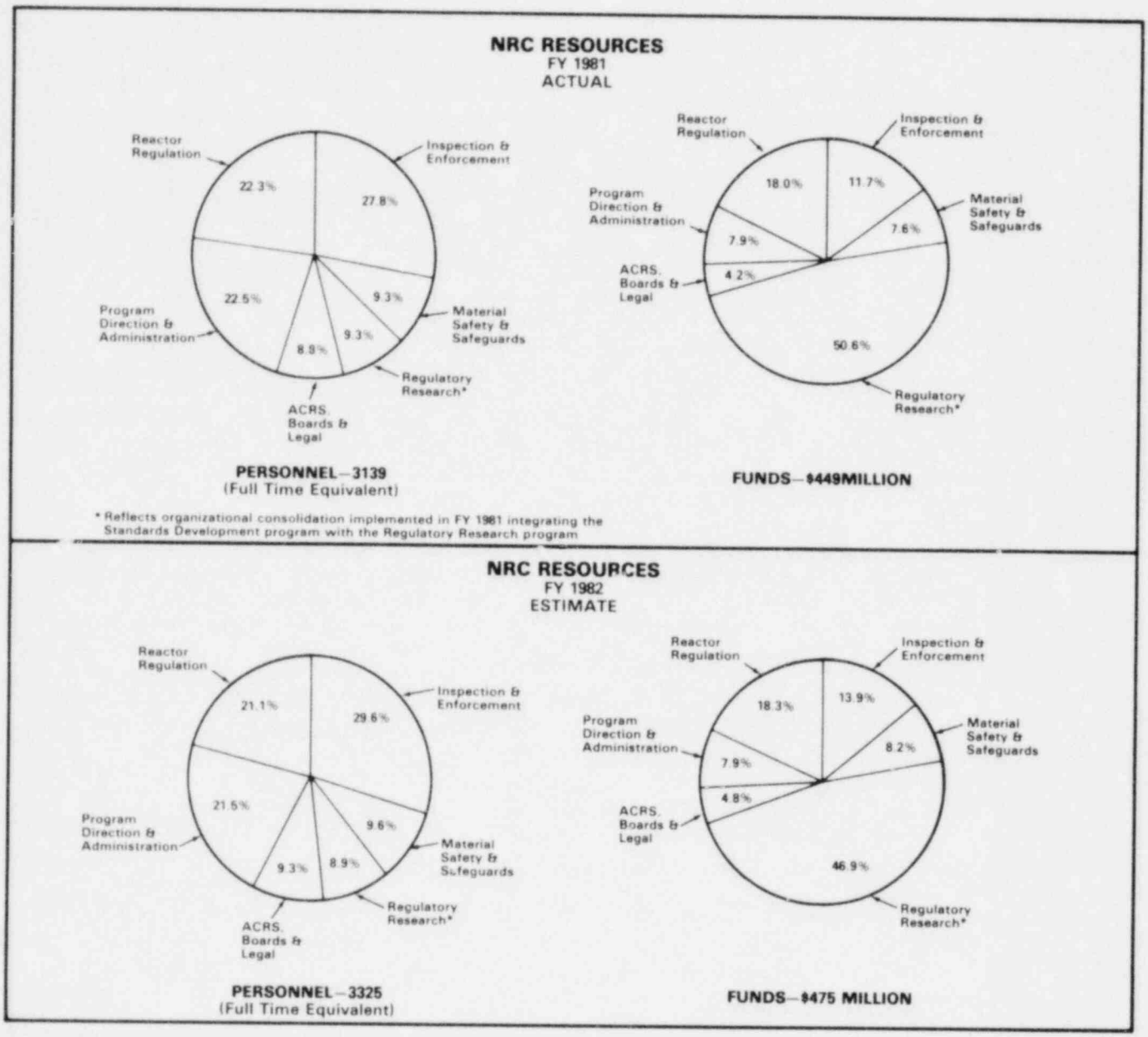
During fiscal year 1981, the PDR collection included about 1,060,000 documents, with an average of 356 new documents each day. During an average month, the PDR retrieved 6,350 files on microfiche in response to public requests, located 2,400 documents requested in letters from the public, and serviced 900 users. More than 2.5 million pages and 32,400 microfiche cards were reproduced for the public during the year.

Persons wishing to use or obtain additional information regarding the holdings, file organization, reference services and request procedures of the PDR may call (202) 634-3274 or write to the U.S. Nuclear Regulatory Commission, Public Document Room, Washington, DC 20555. A "Public Document Room User's Guide" is available upon request. In addition, guided tours of the facility and orientation/training for individuals or groups interested in using the facility can be arranged on an appointment basis.

Local Public Document Rooms

The NRC's local public document collections near the sites of proposed or operating nuclear power plants make available to the public documents considered during the licensing for the plant, and current data on the plant after it begins operation. The document rooms are sources of information to the public during licensing and other hearings involving the nuclear power plants. The collections are usually located in university or public libraries, largely because they are open during the evening and on weekends. Currently more than 150 Local Public Document Rooms (LPDRs) are in operation in the United States. (See Appendix 3 for a listing of LPDR's.)

During 1981, NRC installed a toll-free telephone number (1-800-638-8081) to permit library staffs and members of the public more rapid and convenient communication with the public document room staff in Washington. Using this 800 number, people outside Washington can not only ask questions about documents, or NRC procedures, but can obtain special



services such as computer assisted bibliographic searches of the document collections, as well.

Last year, the NRC also began providing financial assistance and micrographic support to libraries containing the NRC document collections — financial to help defray the costs of the maintenance and reference services provided for the NRC, and micrographics support to provide microfiche reader/printers and storage cabinets, as well as selected NRC documents on microfiche. This program enhances the document collections without unnecessarily adding to the libraries limited shelf space. In the future, the NRC plans to provide many licensing documents on both paper copy and on microfiche.

Document Sales Program

After two years of operation, the NRC/Government Printing Office (GPO) sales program was established in 1979 to make After two years of operation the NRC/Government Printing Office (GPO) sales program staff is processing approximately 600 requests a month for single copies of NRC publications. Revenue from single copy sales was averaging $10,000 a month at the end of 1981. The NRC/GPO subscription service for 34 NRC publications brought 18,000 new customers in 1981, and approximately $800,000 in annual revenues.

Technical Information Brochure and Services

NRC released a brochure during the year entitled "Citizen's Guide to U.S. Nuclear Regulatory Commission Information," which explains how to obtain information from NRC. The booklet is free. (Write to: U.S. Nuclear Regulatory Commission, ATTN: Technical Information and Document Control, Washington, D.C. 20555.) With the release of the booklet, the NRC established a Technical Information Clearinghouse and a toll-free phone number to respond to inquiries about the availability of information on licensing and regulation and inquiries regarding Commission meeting schedules, licensing hearings and the location of local public document-rooms. The clearinghouse can also provide telephone numbers of those persons or agencies that may be able to respond to technical questions. (The toll-free number is 1-800-638-8282. Persons living in Maryland should dial 800-492-8106.)

Freedom of Information Act Releases

Under the Freedom of Information Act (FOIA) during 1981, more than 500 requests were received. Generic health and safety issues concerning the construction and operation of nuclear power plants continued to attract the greatest public interest. Other issues of interest were the transport of spent nuclear fuels and the pending litigation concerning the Three Mile Island accident.

Privacy Act Releases

Any personal record that NRC maintains and retrieves under the name of an individual, or by some identification number or symbol assigned to the individual, is maintained in NRC systems of records in accordance with the Privacy Act of 1974. NRC presently maintains 38 systems of records containing information about individuals. The purpose of each system of records and its use is published annually in the *Federal Register.* A listing of the systems may be obtained by writing to the NRC. Most systems of records contain information regarding NRC employees, and pertain to employment matters such as recruitment, payroll, travel, and training. No systems of records are maintained on individuals or groups that support or oppose nuclear power, or how persons may exercise their first amendment rights.

The Privacy Act provides individuals the right to learn what records NRC maintains about them, to gain access to those records, to correct or amend records which are inaccurate, and to obtain an accounting of disclosures of those records. During fiscal year 1981, NRC received 28 requests from individuals wishing to exercise these rights. Of these 26 sought access to records, one sought a record correction, and one sought both access and an accounting of disclosures. Twenty-two of the individuals were present or former NRC employees or their legal representatives. The other six were private citizens who sought general access to any records the NRC may have had about them.

FY 1980/1981 NRC Financial Statements

Balance Sheet (in thousands)

Assets	*September 30, 1981*	*September 30, 1980*
Cash:		
Appropriated Funds in U.S. Treasury	$ 191,503	$ 168,468
Other (Notes 1 & 3)	10,613	4,414
	202,116	172,882
Accounts Receivable:		
Federal Agencies	95	81
Miscellaneous Receipts (Note 2)	5,687	4,092
Other	56	248
	5,838	4,421
Plant:		
Completed Plant and Equipment	14,105	9,446
Less — Accumulated Depreciation	2,442	1,978
	11,663	7,468
Advances and Prepayments:		
Federal Agencies	60	160
Other	2,477	1,300
	2,537	1,460
Total Assets	$ 222,154	$ 186,231

Liabilities and NRC Equity	*September 30, 1981*	*September 30, 1980*
Liabilities		
Funds held for Others (Notes 1 & 3)	$ 10,613	$ 4,414
Accounts Payable and Accrued Expenses:		
Federal Agencies	64,329	57,623
Other	19,111	17,889
Accrued annual leave of NRC Employees	8,590	7,327
Deferred revenue (Note 3)	4,294	2,892
Total Liabilities	106,937	90,145
NRC Equity: Balance at October 1	96,086	89,538
Additions:		
Funds Appropriated-Net	439,901	400,100
	535,987	489,638
Deductions:		
Net Cost of Operations	407,084	372,032
Funds returned to U.S. Treasury (Note 2)	13,686	21,520
	420,770	393,552
Total NRC Equity	115,217	96,086
Total Liabilities and NRC Equity	$ 222,154	$ 186,231

Note 1. As of September 30, 1981, includes $5,697,309.66 of funds received under cooperative research agreements involving NRC, DOE, Euratom, France, Federal Republic of Germany, Japan, Austria, the Netherlands, Belgium, and the United Kingdom. Also included is $4,405,239.00 of funds received from deferred revenue billings. These funds will be refunded and/or recorded as earned revenue after the cost of processing the applications has been finalized and accordingly, are not available for NRC use. (See Note 3.)

Note 2. These funds are not available for NRC use.

Note 3. On March 24, 1978, 10 CFR 1 was revised. Contained therein by category of license are maximum fee amounts to be paid by applicants at the time a facility or material license is issued. Also, after the review of the license application is complete, the expenditures for professional manpower and appropriate support services are to be determined and the resultant fee assessed. In no event will the fee exceed the maximum fee for that license category, which generally has been paid. This could involve the refunding of a significant portion of the initial amount paid. Therefore, the revenue is recorded in a deferred revenue account at the time of billing and is removed from this account and recorded in Funds Held for Others when the bill is paid. The balance in the Deferred Revenue account consists of deferred revenue on billings issued but not collected. (See Note 1.)

Note 4. Represents current year cost of plant and equipment acquisitions for use at DOE facilities.

FY 1980/1981 Statement of Operations (in thousands)

	Fiscal Year 1981 (October 1, 1980, thru September 30, 1981)	*Fiscal Year 1980 (October 1, 1979, thru September 30, 1980)*
Personnel Compensation	$ 112,832	$ 97,630
Personnel Benefits	10,352	8,991
Program Support	242,105	229,216
Administrative Support	39,498	36,660
Travel of Persons	6,908	7,088
Equipment (Technical) — Note 4	7,383	8,558
Construction — Note 4	-0-	-0-
Taxes and Indemnities	16	28
Refunds to Licensees	-0-	1
Representational Funds	2	13
Reimbursable Work	249	169
Increase in Annual Leave Accrual	1,263	1,042
Depreciation Expense	952	696
Equipment Write-offs and Adjustments	(357)	169
Total Cost of Operations	421,203	390,261
Less Revenues:		
Reimbursable Work for Other Federal Agencies	240	165
Fees (deposited in U.S. Treasury as Miscellaneous Receipts (Note 2):		
Indemnity	1,108	1,059
Material Licenses	2,075	2,803
Facility Licenses	9,556	12,854
Other	1,140	1,348
Total Revenue	14,119	18,229
Net Cost of Operations before prior Year Adjustmentjs	407,084	372,032
Prior Year Adjustment	-0-	-0-
Net Cost of Operations	$ 407,084	$ 372,032

U.S. Government Investment in the Nuclear Regulatory Commission (From January 19, 1975 through September 30, 1981 — in thousands)

Appropriation Expenditures:	
Fiscal Year 1975 (January 19, 1975 through June 30, 1975)	$ 52,792
Fiscal Year 1976 (July 1, 1975 through September 30, 1976)	226,248
Fiscal Year 1977 (October 1, 1976 through September 30, 1977)	230,559
Fiscal Year 1978 (October 1, 1977 through September 30, 1978)	270,877
Fiscal Year 1979 (October 1, 1978 through September 30, 1979)	309,493
Fiscal Year 1980 (October 1, 1979 through September 30, 1980)	377,889
Fiscal Year 1981 (October 1, 1980 through September 30, 1981)	416,867
Total Appropriation Expenditures	$1,884,725
Unexpended Balance of Appropriated Funds in U.S. Treasury, September 30, 1981	191,502
Transfer of Refunds Receivable from Atomic Energy Commission, January 19, 1975	429
Funds Appropriated-Net	$2,076,656
Less:	
Funds returned to U.S. Treasury — Note 2	85,948
Assets and Liabilities transferred from other Federal Agencies without Reimbursement	2,018
Net Cost of Operations from January 19, 1975 through September 30, 1981	1,873,473
Total Deductions	1,961,439
NRC Equity at September 30, 1981, as shown on Balance Sheet	$ 115,217

Appendix 1

NRC ORGANIZATION

(As of January 31, 1982)

COMMISSIONERS

Nunzio J. Palladino, Chairman
Victor Gilinsky
Peter A. Bradford
John F. Ahearne
Thomas M. Roberts

The Commission Staff

General Counsel, Leonard Bickwit
Office of Policy Evaluation, Forrest J. Remick, Director
Office of Public Affairs, Joseph J. Fouchard, Director
Office of Congressional Affairs, Carlton C. Kammerer, Director
Office of Inspector and Auditor, James J. Cummings, Director
Secretary of the Commission, Samuel J. Chilk

Other Offices

Advisory Committee on Reactor Safeguards, Paul G. Shewmon, Chairman
Atomic Safety & Licensing Board Panel, B. Paul Cotter, Jr., Acting Chairman
Atomic Safety & Licensing Appeal Panel, Alan S. Rosenthal, Chairman

EXECUTIVE DIRECTOR FOR OPERATIONS

Executive Director for Operations, William J. Dircks
Deputy Executive Director for Operations, E. Kevin Cornell
Deputy Executive Director for Regional Operations and
Generic Requirements, Victor Stello, Jr.
Assistant for Operations, Thomas A. Rehm

Program Offices

Office of Nuclear Reactor Regulation, Harold R. Denton, Director
Office of Nuclear Material Safety and Safeguards, John G. Davis, Director
Office of Nuclear Regulatory Research, Robert B. Minogue, Director
Office of Inspection and Enforcement, Richard C. DeYoung, Director

Staff Offices

Office of Administration, Daniel J. Donoghue, Director
Executive Legal Director, Guy H. Cunningham
Controller, Learned W. Barry
Office of Equal Employment Opportunity, Edward E. Tucker, Director
Office of Management and Program Analysis, Harold S. Bassett, Acting Director
Office of International Programs, James R. Shea, Director
Office of State Programs, G. Wayne Kerr, Director
Office for Analysis and Evaluation of Operational Data, Carlyle Michelson, Director
Office of Small and Disadvantaged Business Utilization, William B. Kerr, Director

Regional Offices

Region I Philadelphia, Pa., Ronald C. Haynes, Director
Region II Atlanta, Ga., James P. O'Reilly, Director
Region III Chicago, Ill., James G. Keppler, Director
Region IV Dallas, Texas, John T. Collins, Director
Region V San Francisco, Calif., Robert H. Engelken, Director

The NRC is responsible for licensing and regulating nuclear facilities and materials and for conducting research in support of the licensing and regulatory process, as mandated by the Atomic Energy Act of 1954, as amended, the Energy Reorganization Act of 1974, as amended, and the Nuclear Nonproliferation Act of 1978; and in accordance with the National Environmental Policy Act of 1969, as amended, and other applicable statutes. These responsibilities include protecting public health and safety, protecting the environment, protecting and safeguarding materials and plants in the interest of national security; and assuring conformity with antitrust laws. Agency functions are performed through: standards-setting and rulemaking; technical reviews and studies; conduct of public hearings; issuance of authorizations, permits and licenses; inspection, investigation and enforcement; evaluation of operating experience, and confirmatory research. The Commission itself is composed of five members, appointed by the President and confirmed by the Senate, one of whom is designated by the President as Chairman. The Chairman is the principal executive officer and the official spokesman of the Commission.

The Executive Director for Operations directs and coordinates the Commission's operational and administrative activities among the program and support staff offices described below, and also coordinates the development of policy options for Commission consideration. The EDO reports directly to the Chairman.

The Office of Nuclear Reactor Regulation licenses nuclear power, test and research reactors under a two-phase process. A construction permit is granted before facility construction can begin and an operating license is issued before fuel can be loaded. NRR reviews license applications to assure that each proposed facility can be built and operated without undue risk to the health and safety of the public and with minimal impact on the environment. NRR monitors operating reactor facilities during their lifetime through decommissioning.

The Office of Nuclear Material Safety and Safeguards. The Office of Nuclear Material Safety and Safeguards is responsible for the licensing and regulation of facilities and materials associated with the processing, transport, and handling of nuclear materials, and the disposal of nuclear waste as well as the regulation of uranium recovery facilities. NMSS reviews and assesses safeguards against potential threats, thefts, and sabotage for licensed facilities, including reactors, working closely with other NRC offices in coordinating safety and safeguards programs and in recommending research, standards and policy options necessary for their successful operation.

The Office of Nuclear Regulatory Research plans and conducts a comprehensive research and standards program that is deemed necessary for the performance of the Commission's licensing and regulatory functions and that is responsive to current and future NRC needs. The program covers areas such as facility operation, engineering technology, accident evaluation, probabilistic risk analysis, and siting, health, and waste management.

The Office of Inspection and Enforcement develops and oversees programs of inspection of nuclear facilities and materials licensees to determine whether facilities are constructed and operations are conducted in compliance with license provisions and Commission regulations; to identify conditions that may adversely affect the protection of nuclear materials and facilities, the environment, or the health and safety of the public; and to provide a basis for recommending issuance or denial of licenses. It develops and oversees a program of investigation of accidents, incidents, and allegations of improper actions that involve nuclear material and facilities; enforces NRC regulations and license provisions; and manages and directs all NRC actions related to emergency preparedness, including evaluation of State and local emergency plans performed by the Federal Emergency Management Agency (FEMA). It performs audits of its programs as carried out by NRC regional offices.

THE COMMISSION STAFF

The Office of Secretary provides secretariat services for the conduct of Commission business and implementation of decisions, including planning meetings and recording deliberations, manages the staff paper system, monitors the status of actions, and maintains the Commission's official records. The office also processes institutional correspondence, controls the service of documents in adjudicatory and public proceedings, supervises the Washington, D.C. Public Document Room, administers the NRC historical program, and provides administrative support for the Commission.

The Office of General Counsel serves the Commission in a variety of legal capacities. The Office assists the Commission in the review of Appeal Board decisions, petitions seeking direct Commission relief, and rulemaking proceedings, and drafts legal documents necessary to carry out the Commission's decisions. The General Counsel provides a legal analysis of proposed legislation affecting the Commission's functions and assists in drafting legislation and preparing testimony. The General Counsel also represents the Commission in court proceedings, frequently in conjunction with the Department of Justice.

The Office of Policy Evaluation plans and manages activities involved in performance of an independent review of positions developed by the NRC staff which require policy determinations by the Commission. The Office also conducts analyses and projects which are either self-generated or requested by the Commission.

The Office of Inspector and Auditor investigates to ascertain the integrity of all NRC operations; investigates allegations of NRC employee misconduct, equal employment and civil rights complaints, and claims for personal property loss or damage; conducts the NRC's internal audit activities; and hears individual employee concerns regarding Commission activities under the agency's "Open Door" policy. The office develops policies governing the Commission's financial and management audit program and is the agency contact with the General Accounting Office on this function. Refers criminal matters to the Department of Justice and maintains liaison with law enforcement agencies.

The Office of Public Affairs plans and administers NRC's program to inform the public of Commission policies, programs and activities and keeps NRC management

informed of public affairs activities of interest to the Commission. OPA reports directly to the Chairman.

The Office of Congressional Affairs provides advice and assistance to the Commission and senior staff on congressional matters, coordinates NRC's congressional relations activities, and maintains liaison for the Commission with congressional committees and members of Congress. OCA reports directly to the Chairman.

SUPPORT STAFF

The Office of Administration directs the agency's programs for organization and personnel management; security and classification; technical information and document control; facilities and materials license fees; contracting and procurement; rules, proceedings and document services, administration of Freedom of Information Act and Privacy Act requests; management development and training; telecommunications, transportation services, management of space and other administrative housekeeping services.

The Office of Controller develops and maintains the Commission's financial management program, including accounting, budgeting, pricing, contract finance, automatic data processing equipment acquisition, and accounting for capitalized property. Prepares reports necessary to the management of NRC funds. Maintains liaison with the General Accounting Office, Office of Management and Budget, Congressional committees, other agencies, and industry. The Controller also performs resource evaluation studies.

The Office of the Executive Legal Director provides legal advice and services to the Executive Director for Operations and staff, including representation in administrative proceedings involving the licensing of nuclear facilities and materials, and the enforcement of license conditions and regulations; counseling with respect to safeguards matters, contracts, security, patents, administation, research, personnel, and the development of regulations to implement applicable Federal statutes.

The Office of Equal Employment Opportunity develops and recommends overall policy providing for equal employment opportunity, recommends improvements or corrections to achieve this goal, and monitors the agency's affirmative action program.

The Office of International Programs plans and implements programs of international nuclear safety cooperation, creating and maintaining relationships with foreign regulatory agencies and international organizations; coordinates NRC export-import and international safeguards policies; issues export and import licenses; and coordinates responses by NRC to other agencies related to export-import actions and issues.

The Office of Management and Program Analysis provides NRC staff with management information and program analyses; identifies and analyzes major NRC policy, program and management issues and conducts long- and short-range planning to assist NRC operating officials; develops and implements management information and control systems and recommends policy on use of such systems for agency-wide applications; develops and implements application of sound statistical practices within NRC; and coordinates special information projects on overall NRC policies and programs.

The Office of State Programs directs programs relating to regulatory relationships with State governments and organizations and interstate bodies, manages the NRC State Agreements program, administers the indemnification program and performs financial qualification reviews of applicants and licensees. The office also verifies that applicants are not in violation of the antitrust laws.

The Office for Analysis and Evaluation of Operational Data provides agency coordination for the collection, storage, and retrieval of operational data associated with licensed activities, analyzes and evaluates such operational experience and feeds back the lessons of that experience to NRC licensing, standards and inspection activities. The office oversees action taken in response to the feedback and assesses the overall effectiveness of the agency-wide operational safety data program, serving as a focal point for interaction with the ACRS and industry groups involved in operational safety data analysis and evaluation.

The Office of Small and Disadvantaged Business Utilization develops and implements, in cooperation with the Director, Division of Contracts and Directors of other affected offices, specific policies and procedures to carry out the functions and duties of Sections 8 and 15 of the Small Business Act and Executive Order 12138, as they relate to the NRC. Provides focus for NRC efforts to assist small business, small businesses owned by socially or economically disadvantaged individuals, women-owned businesses, and firms in labor surplus areas.

OTHER OFFICES

Advisory Committee on Reactor Safeguards. A statutory committee of 15 scientists and engineers advises the Commission on the safety aspects of proposed and existing nuclear facilities and the adequacy of proposed reactor safety standards, and performs such other duties as the Commission may request. The Committee conducts a continuing study of reactor safety research and submits an annual report to the Congress. The Committee also administers the ACRS Fellowship Program.

Atomic Safety and Licensing Board Panel. Three-member licensing boards drawn from the Panel--made up of lawyers and others with expertise in various technical fields--conduct public hearings and make such intermediate or final decisions as the Commission may authorize in proceedings to grant, suspend, revoke or amend NRC licenses.

Atomic Safety and Licensing Appeal Panel. Three-member appeal boards selected from the Panel exercise the authority and perform the review functions which would otherwise be carried out by the Commission in licensing proceedings. ASLB decisions are reviewable by an appeal board, either in response to an appeal or on its own initiative. The appeal board's decision also is subject to review by the Commission on its initiative or in response to a petition for discretionary review.

Appendix 2

NRC Committees and Boards

Advisory Committee on Reactor Safeguards

The Advisory Committee on Reactor Safeguards (ACRS) is a statutory committee established to advise the Commission on the safety aspects of proposed and existing nuclear facilities and the adequacy of proposed reactor safety standards, and to perform such other duties as the Commission may request. The Committee conducts a continuing study of reactor safety research and submits an annual report to Congress. It also administers the ACRS Fellowship Program. As of January 31, 1982, the members were:

DR. PAUL G. SHEWMON, *Chairman*, Professor and Chairman of Metallurgical Engineering Department, Ohio State University, Columbus, Ohio

JEREMIAH J. RAY, *Vice Chairman*, Chief Electrical Engineer, Philadelphia Electric Company, Philadelphia, Pa. (retired)

DR. ROBERT C. AXTMANN, Professor of Chemical Engineering, Princeton University, Princeton, N.J.

MYER BENDER, Director of Engineering Division, Oak Ridge National Laboratory, Oak Ridge, Tenn. (retired)

DR. MAX W. CARBON, Professor and Chairman of Nuclear Engineering Department, University of Wisconsin, Madison, Wis.

JESSE EBERSOLE, Head Nuclear Engineer, Division of Engineering Design, Tennessee Valley Authority, Knoxville, Tenn. (retired)

DR. WILLIAM KERR, Professor of Nuclear Engineering and Director of the Office of Energy Research, University of Michigan, Ann Arbor, Mich.

DR. HAROLD W. LEWIS, Professor of Physics, Department of Physics, University of California, Santa Barbara, Cal.

DR. CARSON MARK, Division Leader, Los Alamos Scientific Laboratory, Los Alamos, N.M. (retired)

WILLIAM M. MATHIS, Director, Planning, United Nuclear Industries, Inc., Richland, Wash. (retired)

DR. DADE W. MOELLER, Chairman, Department of Environmental Health Sciences, School of Public Health, Harvard University, Boston, Mass.

DR. DAVID OKRENT, Professor, School of Engineering and Applied Science, University of California, Los Angeles, Cal.

DR. MILTON S. PLESSET, Professor of Engineering Science — Emeritus, California Institute of Technology, Pasadena, Cal.

DR. CHESTER P. SIESS, Professor Emeritus of Civil Engineering, University of Illinois, Urbana, Ill.

DAVID A. WARD, Research Manager of Nuclear Engineering, E.I. du Pont de Nemours & Company, Savannah River Laboratory, Aiken, S.C.

Atomic Safety and Licensing Board Panel

Section 191 of the Atomic Energy Act of 1954 authorizes the Commission to establish one or more atomic safety and licensing boards, each comprised of three members, one of whom is to be qualified in the conduct of administrative proceedings and two of whom will have such technical or other qualifications as the Commission deems appropriate to the issues to be decided. The boards conduct such hearings as the Commission may direct and make such intermediate or final decisions as it may authorize in proceedings with respect to granting, suspending, revoking, or amending licenses or authorizations. The Atomic Safety and Licensing Board Panel (ASLBP) Office—with a permanent chairman who coordinates and supervises the ASLBP activities—serves as spokesman for the panel, and makes policy recommendations to the Commission concerning conduct of hearings and hearing procedures. Pursuant to subsection 201 (g)(1) of the Energy Reorganization Act of 1974, the functions performed by the licensing boards were specifically transferred to the Nuclear Regulatory Commission. As of January 31, 1982, the ASLBP was composed of the following members and professional staff ("*" denotes full-time ASLBP members and staff):

B. PAUL COTTER, *Chairman*, ASLBP Attorney, U.S. Nuclear Regulatory Commission, Bethesda, Md.*

ROBERT M. LAZO, *Vice Chairman (Executive)*, ASLBP Attorney, U.S. Nuclear Regulatory Commission, Bethesda, Md.*

DR. GEORGE C. ANDERSON, Department of Oceanography, University of Washington, Seattle, Wash.

CHARLES BECHHOEFER, ASLBP Attorney, Bethesda, Md.*

PETER B. BLOCH, ASLBP Attorney, Bethesda, Md.*

LAWRENCE BRENNER, ASLBP Attorney, Bethesda, Md.*

GLENN O. BRIGHT, ASLBP Engineer, Bethesda, Md.*

DANIEL BROWN, ASLBP Law Clerk, Bethesda, Md.*

DR. A. DIXON CALLIHAN, Retired Physicist, Union Carbide Corporation, Oak Ridge, Tenn.

DR. JAMES H. CARPENTER, ASLBP Environmental Scientist, Bethesda, Md.*

LOUIS J. CARTER, Law Offices of Louis J. Carter, Philadelphia, Pa.

DR. E. LEONARD CHEATUM, Retired Director of Institute of Natural Resources, University of Georgia, Watkinsville, Ga.

HUGH K. CLARK, Retired Attorney, E. I. duPoint deNemours & Company, Kennedyville, Md.

DR. RICHARD F. COLE, ASLBP Environmental Scientist, Bethesda, Md.*

DR. FREDERICK P. COWAN, Retired Physicist, Brookhaven National Laboratory, Boca Raton, Fla.

VALENTINE B. DEALE, Attorney at Law, Washington, D.C.

RALPH S. DECKER, Retired Engineer, U.S. Atomic Energy Commission, Cambridge, Md.
DR. DONALD P. DE SYLVA, Professor, Biology and Living Resources, School of Marine and Atmospheric Science, University of Miami, Miami, Fla.
MICHAEL A. DUGGAN, College of Business Administration, University of Texas, Austin, Tex.
DR. GEORGE A. FERGUSON, Professor of Nuclear Engineering, Howard University, Washington, D.C.
DR. HARRY FOREMEN, Director, Center of Population Studies, University of Minnesota, Minneapolis, Minn.
DR. RICHARD F. FOSTER, Environmental Scientist, Bethesda, Md.
JOHN H. FRYE, III, ASLBP Attorney, Bethesda, Md.*
JAMES P. GLEASON, ASLBP Attorney, Bethesda, Md.
ANDREW C. GOODHOPE, Retired Administrative Law Judge, Federal Trade Commission, Wheaton, Md.
HERBERT GROSSMAN, ASLBP Attorney, Bethesda, Md.*
DR. CADET H. HAND, JR., Director, Bodega Marine Laboratory, University of California, Bodega Bay, Cal.
DR. JERRY HARBOUR, ASLBP Environmental Scientist, Bethesda, Md.*
JAMES E. HARD, ASLBP Technical Advisor for Engineering, Bethesda, Md.*
DR. DAVID L. HETRICK, Professor, Nuclear Engineering Department, University of Arizona, Tucson, Ariz.
ERNEST E. HILL, Engineer, Lawrence Livermore Laboratory, University of California, Livermore, Cal.
DR. ROBERT L. HOLTON, School of Oceanography, Oregon State University, Corvallis, Ore.
DR. FRANK F. HOOPER, Chairman, Resource Ecology Program, School of Natural Resources, University of Michigan, Ann Arbor, Mich.
HELEN HOYT, ASLBP Attorney, Bethesda, Md.*
ELIZABETH B. JOHNSON, Engineer, Oak Ridge National Laboratory, Oak Ridge, Tenn.
DR. WALTER H. JORDAN, Retired Senior Research Advisor & Physicist, Oak Ridge National Laboratory, Oak Ridge, Tenn.
CAROLE F. KAGAN, ASLBP Law Clerk, Bethesda, Md.*
JAMES L. KELLEY, ASLBP Attorney, Bethesda, Md.*
DR. JERRY R. KLINE, ASLBP Environmental Scientist, Bethesda, Md.*
DR. JAMES C. LAMB, III, Department of Environmental Sciences & Engineering, University of North Carolina, Chapel Hill, N.C.
DR. J.V. LEEDS, JR., Professor, Environmental and Electrical Engineering, Rice University, Houston, Tex.
GUSTAVE A. LINENBERGER, ASLBP Physicist, Bethesda, Md.*
DR. LINDA W. LITTLE, Research Triangle Institute, Research Triangle Park, N.C. Department of Environmental Sciences & Engineering, University of North Carolina, Chapel Hill, N.C.
DR. M. STANLEY LIVINGSTON, Retired Associate Director, Atomic Energy Commission National Accelerator Laboratory, Santa Fe, N.M.
DR. EMMETH A. LUEBKE, ASLBP Physicist, Bethesda, Md.*
DR. KENNETH A. McCOLLOM, Dean, Division of Engineering, Technology and Architecture, Oklahoma State University, Stillwater, Okla.
GARY L. MILHOLLIN, University of Wisconsin Law School, Madison, Wis.
MARSHALL E. MILLER, ASLBP Attorney, Bethesda, Md.*
RUTHANNE MILLER, ASLBP Law Clerk, Bethesda, Md.*
LUCINDA MINTON, ASLBP Law Clerk, Bethesda, Md.*
DR. PETER A. MORRIS, ASLBP Physicist, Bethesda, Md.*
DR. OSCAR H. PARIS, ASLBP Environmental Scientist, Bethesda, Md.*
DR. MICHAEL A. PARSONT, ASLBP Technical Advisor for Environmental Matters, Bethesda, Md.*
DR. HUGH PAXTON, Los Alamos Scientific Laboratory, Los Alamos, N.M.
DAVID PRESTEMON, ASLBP Legal Counsel, Bethesda, Md.*
DR. PAUL W. PURDOM, Director, Environmental Studies Institute, Drexel University, Philadelphia, Pa.
DR. FORREST J. REMICK, Director, Institute of Science and Engineering, Pennsylvania State University, University Park, Pa.
DR. DAVID R. SCHINK, Department of Oceanography, Texas A&M University, College Station, Tex.
FREDERICK H. SHON, ASLBP Physicist, Bethesda, Md.*
IVAN W. SMITH, Administrative Law Judge, U.S. Nuclear Regulatory Commission, Bethesda, Md.*
DR. MARTIN J. STEINDLER, Chemist, Argonne National Laboratory, Argonne, Ill.
DR. QUENTIN J. STOBER, Research Associate Professor, Fisheries Research Institute, University of Washington, Seattle, Wash.
SEYMOUR WENNER, Retired Administrative Law Judge, Postal Rate Commission, Washington, D.C.
JOHN F. WOLF, Attorney, law firm of Lamensdorf, Leonard & Moore, Washington, D.C.
SHELDON J. WOLFE, ASLBP Attorney, Bethesda, Md.*

Atomic Safety and Licensing Appeal Panel

An Atomic Safety and Licensing Appeal Board, established effective September 18, 1969, was delegated the authority to perform the review function which would otherwise be performed by the Commission in proceedings on applications for licenses or authorizations in which the Commission had a direct financial interest, and in such other licensing proceedings as the Commission might specify.

In view of the increase in the number of proceedings subject to administrative appellate review, the Atomic Safety and Licensing Appeal Panel was established on October 25, 1972, from whose membership three-member appeal boards could be designated for each proceeding in which the Commision had delegated its authority to an appeal board. At the same time, the Commission modified its rules to delegate authority to appeal boards in all proceedings involving the licensing of production and utilization facilities (for example, power reactors).

Pursuant to subsection 201 (g)(1) of the Energy Reorganization Act of 1974, the functions performed by appeal boards were specifically transferred to the Nuclear Regula-

tory Commission. The Commission appoints members to the Appeal Panel, and the Chairman of the panel (or, in his absence, the Vice Chairman) designates a three-member appeal board for each proceeding. The Commission retains review authority over decisions and actions of appeal boards. The appeal board panel, on January 31, 1982 was composed of the following full-time members and professional staff:

ALAN S. ROSENTHAL, Appeal Panel *Chairman*, U.S. Nuclear Regulatory Commission, Bethesda, Md.
DR. JOHN H. BUCK, Appeal Panel *Vice Chairman*, U.S. Nuclear Regulatory Commission, Bethesda, Md.
JOHN CHO, Counsel, Appeal Panel, U.S. Nuclear Regulatory Commission, Bethesda, Md.
GARY J. EDLES, Appeal Panel Member, U.S. Nuclear Regulatory Commission, Bethesda, Md.
STEPHEN F. EILPERIN, Appeal Panel Member, U.S. Nuclear Regulatory Commission, Bethesda, Md.
ZORI G. FERKIN, Legal Intern, Appeal Panel, U.S. Nuclear Regulatory Commission, Bethesda, Md.
MARK J. GHOURALAL, Legal Intern, Appeal Panel, U.S. Nuclear Regulatory Commission, Bethesda, Md.
LINDA S. GILBERT, Special Counsel, Appeal Panel, U.S. Nuclear Regulatory Commission, Bethesda, Md.
REGINALD L. GOTCHY, Appeal Panel Member, U.S. Nuclear Regulatory Commission, Bethesda, Md.
CHRISTINE N. KOHL, Appeal Panel Member, U.S. Nuclear Regulatory Commission, Bethesda, Md
THOMAS S. MOORE, Appeal Panel Member, U.S. Nuclear Regulatory Commission, Bethesda, Md.
THOMAS G. SCARBOROUGH, Special Technical Advisor, Appeal Panel, U.S. Nuclear Regulatory Commission, Bethesda, Md.
HOWARD A. WILBER, Technical Advisor, Appeal Panel, U.S. Nuclear Regulatory Commission, Bethesda, Md.

PART-TIME MEMBERS:

MICHAEL C. FARRAR, Vice-President, Environmental & Health Programs, American Paper Institute/National Forest Products Association, Washington, D.C.
DR. W. REED JOHNSON, Professor of Nuclear Engineering, University of Virginia, Charlottesville, Va.
DR. LAWRENCE R. QUARLES, Dean Emeritus, School of Engineering and Applied Science, University of Virginia, Charlottesville, Va.

Advisory Committee on Medical Uses of Isotopes

The Advisory Committee on Medical Uses of Isotopes was established in July 1958. The ACMI, composed of qualified physicians and scientists, considers medical questions referred to it by the NRC staff, and renders expert opinion regarding medical uses of radioisotopes. The ACMI also advises the NRC staff, as requested, on matters of policy. Members are employed under yearly personal services contracts. The Deputy Director, Division of Fuel Cycle and Material Safety, serves as Committee Chairman. As of January 31, 1982, the members were:

RICHARD E. CUNNINGHAM, *Chairman*, ACMI, Deputy Director, Division of Fuel Cycle and Material Safety, U.S. Nuclear Regulatory Commission, Silver Spring, Md.
DR. VINCENT P. COLLINS, Medical Director, Houston Institute for Cancer Research, Diagnosis and Treatment, Houston, Tex.
DR. FRANK H. DE LAND, Chief, Nuclear Medicine Department, Veterans' Administration Hospital, Lexington, Ky.
DR. SALLY J. DE NARDO, Director, Nuclear Hematology-Oncology, Department of Nuclear Medicine, University of California-Davis Medical Center, Sacramento, Cal.
DR. JACK K. GOODRICH, Radiology Associates of Erie, Hamot Medical Center, Erie, Pa.
DR. MELVIN L. GRIEM, Professor and Director, Chicago Tumor Institute, University of Chicago, Chicago, Ill.
DR. B. LEONARD HOLMAN, Chief, Clinical Nuclear Medicine, Department of Radiology, Peter Bent Brigham Hospital, Boston, Mass.
DR. EDWARD W. WEBSTER, Director, Department of Radiation Physics, Massachusetts General Hospital, Boston, Mass.
DR. DAVID H. WOODBURY, Director, Nuclear Medicine, Wayne County General Hospital, Eloise, Mich.
DR. JOSEPH B. WORKMAN, Associate Professor of Radiology, Duke University Medical Center, Durham, N.C.

Advisory Panel for the Decontamination of Three Mile Island Unit 2

JOHN E. MINNICH, *Chairman*, Dauphin County Commissioners, Harrisburg, Pa.
THOMAS B. COCHRAN, Senior Staff Scientist, Natural Resources Defense Council, Washington, D.C.
ELIZABETH MARSHALL, Mayor, City of York, York Pa.
ARTHUR E. MORRIS, Mayor, City of Lancaster, Lancaster, Pa.
ROBERT G. REID, Mayor, Borough of Middletown, Pa., Middletown, Pa.
GORDON ROBINSON, Associate Professor, Pennsylvania State Univ., Department of Nuclear Engineering, University Park, Pa.
JOEL ROTH, Chairman, TMI Alert, Harrisburg, Pa.
DEWITT C. SMITH, JR., Director, Commonwealth of Pennsylvania Emergency Management Agency, Harrisburg, Pa.
THOMAS SMITHGALL, Real Estate Broker, Lancaster, Pa.
ANN TRUNK, Middletown, Pa.
HENRY J. WAGNER, JR., Head, Johns Hopkins Univ., Div. of Nuclear Medicine and Radiation Health, Baltimore, Md.
NEIL WALD, Medical Doctor, University of Pittsburgh, Pittsburgh, Pa.
TRAVERS D. WILLIAM, Technical Assistant/Nuclear Engineer, TMI Program Office, U.S. Nuclear Regulatory Commission, Washington, D.C.

Appendix 3

Public Document Rooms

Most documents originated by NRC, or submitted to it for consideration, are placed in the Commission's Public Document Room at 1717 H Street, N.W., Washington, D.C., for public inspection. In addition, documents relating to licensing proceedings or licensed operation of specific facilities are made available in local public document rooms established in the vicinity of each proposed or existing nuclear facility. The locations of these local PDRs and the name of the facility for which documents are retained, are listed below. (NOTE: Updated listings of local PDRs may be obtained by writing to the Local Public Document Room Branch, Division of Rules and Records, U.S. Nuclear Regulatory Commission, Washington, D.C. 20555.)

ALABAMA

- Mrs. Maude S. Miller
  Athens Public Library
  South and Forrest
  Athens, Ala. 35611
  Browns Ferry Nuclear Plant

- Mr. Wayne Love
  G.S. Houston Memorial Library
  212 W. Burdeshaw Street
  Dothan, Ala. 36303
  Farley Nuclear Plant

- Mrs. Peggy McCutchen
  Scottsboro Public Library
  1002 South Broad Street
  Scottsboro, Ala. 35768
  Bellefonte Nuclear Plant

ARIZONA

- Mrs. Mary Carlson
  Phoenix Public Library
  Science and Industry Section
  12 East McDowell Road
  Phoenix, Ariz. 85004
  Palo Verde Nuclear Plant

ARKANSAS

- Mr. William Vaughn
  Arkansas Tech University
  Russellville, Ark. 72801
  Arkansas Nuclear One

CALIFORNIA

- Mrs. Judy Klapprott
  Humboldt County Library
  636 F Street
  Eureka, Calif. 95501
  Humboldt Bay Nuclear Plant

- West Log Angeles Regional Library
  11360 Santa Monica Boulevard
  Los Angeles, Calif. 94596
  UCLA Research Reactor

- Mrs. Geany Crabb
  Mission Viejo Branch Library
  24851 Chrisanta Drive
  Mission Viejo, Calif. 92676
  San Onofre Nuclear Plant

- Stanislaus County Free Library
  1500 I Street
  Modesto, Calif. 95345
  Stanislaus Nuclear Plant

- Ms. Mary Strohl
  Business & Municipal Department
  Sacramento City-County Library
  828 I Street
  Sacramento, Calif. 95814
  Rancho Seco Nuclear Plant

- Mr. Chi Su Kim
  Documents and Maps Department
  California Polytechnic State
  University Library
  San Luis Obispo, Calif. 93407
  Diablo Canyon Nuclear Plant

- Nuclear Regulatory Commission.
  Region V
  Suite 202
  1990 N. California Boulevard
  Walnut Creek, Calif. 94596
  GETR Vallecitos

COLORADO

- Miss Ester Fromm
  Greeley Public Library
  City Complex Building
  Greeley, Colo. 80631
  Fort St. Vrain Nuclear Plant

CONNECTICUT

- Mrs. Phyllis Nathanson
  Russell Library
  119 Broad Street
  Middletown, Conn. 06457
  Haddam Neck Nuclear Plant

- Mr. Vincent Juliano
  Waterford Public Library
  Rope Ferry Road—Route 156
  Waterford, Conn. 06385
  Millstone Nuclear Plant

FLORIDA

- Mrs. B. Bonsall
  Crystal River Public Library
  668 N.W. First
  Crystal River, Fla. 32629
  Crystal River Nuclear Plant

- Mrs. R. Scott
  Indian River Community College
  Library
  3209 Virginia Avenue
  Ft. Pierce, Fla. 33450
  St. Lucie Nuclear Plant

- Ms. Renee Pierce
  Miami-Dade Public Library
  Holmstead Branch
  700 North Holmstead Blvd.
  Holmstead, Fla. 33030
  Turkey Point Nuclear Plant
  (Emergency Plan Only)

- Ms. Sally Litton
  Jacksonville Public Library
  122 North Ocean Street
  Jacksonville, Fla. 32204
  Offshore Power Systems

- Miss Esther B. Gonzalez
  Environmental and Urban
  Affairs Library
  Florida International University
  Miami, Fla. 33199
  Turkey Point Nuclear Plant

GEORGIA

- Mrs. Wynell Bush
  Appling County Public Library
  301 City Hall Drive
  Baxley, Ga. 31513
  Hatch Nuclear Plant

- Mrs. J.W. Borom
  Burke County Library
  Fourth Street
  Waynesboro, Ga. 30830
  Vogtle Nuclear Plant

ILLINOIS

- Mrs. Penny O'Roarke
  Byron Public Library
  Third and Washington Streets
  Byron, Ill. 61010
  Byron Nuclear Plant
  (Selected Documents Only)

- Ms. Carol Boast, Director
  University of Illinois
  College of Law Library
  504 East Pennsylvania Avenue
  Champaign, Ill. 61820
  Clinton Nuclear Plant
  (Selected Documents Only)

- Mrs. M. Evans
  Vespasian Warner Public Library
  120 West Johnson Street
  Clinton, Ill. 61727
  Clinton Nuclear Plant

- Mr. Earl Shumaker
  Government Publications Department
  Northern Illinois University
  Dekalb, Ill. 60115
  Byron Nuclear Plant
  (Selected Documents Only)

- Mrs. Pam Wilson
  Morris Public Library
  604 Liberty Street
  Morris, Ill. 60451
  Dresden Nuclear Plant

- Mr. Ed Anderson
  Illinois Valley Community College
  Rural Route 1
  Oglesby, Ill. 16348
  LaSalle Nuclear Plant

- Mrs. Marie Hoschied
  Moline Public Library
  504 17th Street
  Moline, Ill. 61255
  Quad Cities Nuclear Plant

- Mr. Richard Gray
  Rockford Public Library
  215 N. Wyman Street
  Rockford, Ill. 61103
  Byron Nuclear Plant

- Savanna Township Public Library
  326 Third Street
  Savanna, Ill. 61074
  Carroll Nuclear Plant

- Mr. Thomas Carter
  Wilmington Township Public Library
  201 S. Kankakee Street
  Wilmington, Ill. 60481
  Braidwood Nuclear Plant

INDIANA

- Mr. Philip Baugher, Director
  West Chester Township Public Library
  200 W. Indiana Avenue
  Chestertown, Ind. 46304
  Bailly Nuclear Plant

- Mr. Ray Gnat, Director
  Marion County Public Library
  Box 211
  Indianapolis, Ind. 46206
  Bailly Nuclear Plant
  Marble Hill Nuclear Plant
  (Selected Documents Only)

- Mrs. Charlene Peters
  Madison-Jefferson County Public Library
  420 West Main Street
  Madison, Ind. 47250
  Marble Hill Nuclear Plant

IOWA

- Mr. Roy Kenagy
  Reference Service
  Cedar Rapids Public Library
  428 Third Avenue, S.E.
  Cedar Rapids, Ia. 52401
  Duane Arnold Nuclear Plant

KANSAS

- Ms. Sue Hatfield,
  Gov. Doc. Librarian
  Emporia State University
  William Allen White Library
  1200 Commercial Street
  Emporia, Ks. 66801
  Wolfcreek Nuclear Plant

KENTUCKY

- Ms. Beverly Bury
  Campbell County Public Library
  Alexandria Branch
  400 West Main Street
  Alexandria, Ky. 41001
  Zimmer Nuclear Plant
  (Selected Documents Only)

- Mr. Clarence R. Graham
  Louisville Free Public Library
  4th and York Streets
  Louisville, Ky. 40203
  Marble Hill Nuclear Plant
  (Selected Documents Only)

LOUISIANA

- Mr. Jimmie H. Hoover
  Government Documents Department
  Louisiana State University
  Baton Rouge, La. 70803
  River Bend Nuclear Plant

- Business and Science Division
  New Orleans Public Library
  219 Loyola Avenue
  New Orleans, La. 70140
  Offshore Nuclear Plant

- Mr. Ken Owen
  University of New Orleans Library
  Louisiana Collection, Lakefront
  New Orleans, La. 70122
  Waterford Nuclear Plant

MAINE

- Mrs. Barbara Shelton
  Wiscasset Public Library
  High Street
  Wiscasset, Me. 04578
  Maine Yankee Nuclear Plant

MARYLAND

- Mrs. Marie Barrett
  Calvert County Library
  Prince Frederick, Md. 20678
  Calvert Cliffs Nuclear Plant

MASSACHUSETTS

- Mrs. Margaret Howland
  Greenfield Community College
  One College Drive
  Greenfield, Mass. 01301
  Yankee Rowe Nuclear Plant

- Ms. Ruth Chamberlain
  Plymouth Public Library
  North Street
  Plymouth, Mass. 02360
  Pilgrim Nuclear Plant

MICHIGAN

- Mrs. M. B. Wallick
  Charlevoix Public Library
  107 Clinton Street
  Charlevoix, Mich. 49720
  Big Rock Point

- Mrs. Margean Gladyz
  Reference Department
  Kalamazoo Public Library
  315 South Rose Street
  Kalamazoo, Mich. 49006
  Palisades Nuclear Plant

- Mrs. Averill Packard
  Grace Dow Memorial Library
  1710 West St. Andrews Road
  Midland, Mich. 48640
  Midland Nuclear Plant

- Mrs. Sarah Peth
  Reference Department
  Monroe County Library System
  3700 South Custer Road
  Monroe, Mich. 48161
  Fermi Nuclear Plant

- Ms. Ann Stobbe
  Maude Preston Palenske Memorial Library
  500 Market Street
  St. Joseph, Mich. 49085
  D.C. Cook Nuclear Plant

MINNESOTA

- Mrs. J. Copeland
  Environmental Conservation Library
  Minneapolis Public Library
  300 Nicollet Mall
  Minneapolis, Minn. 55401
  Monticello Nuclear Plant
  Prairie Island Nuclear Plant

MISSOURI

- Mrs. Ladonna Justice
  Fulton City Library
  709 Market Street
  Fulton, Mo. 65251
  Callaway Nuclear Plant

- Mrs. Ranata Rotkowicz
  Olin Library of Washington University
  Skinker & Lindell Boulevard
  St. Louis, Mo. 63130
  Callaway Nuclear Plant

MISSISSIPPI

- Mr. William McMullin
  Corinth Public Library
  1023 Fillmore Street
  Corinth, Miss. 38834
  Yellow Creek Nuclear Plant

- Ms. Gayle Keefe
  Hinds Junior College
  McLendon Library
  Raymond, Ms. 39154
  Grand Gulf Nuclear Plant

NEBRASKA

- Mrs. Loy Mowery
  Auburn Public Library
  118 15th Street
  Auburn, Neb. 68305
  Cooper Nuclear Plant

- Mr. Frank Gibson
  W. Dale Clark Library
  215 South 15th Street
  Omaha, Neb. 68102
  Ft. Calhoun Nuclear Plant

NEW HAMPSHIRE

- Miss Pamela Gjettum
  Exeter Public Library
  Front Street
  Exeter, N.H. 03883
  Seabrook Nuclear Plant

NEW JERSEY

- Miss Elizabeth Fogg
  Salem Free Public Library
  112 West Broadway
  Salem, N.J. 08097
  Salem Nuclear Plant
  Hope Creek Nuclear Plant

- Ms. Phyllis Haefner
  Ocean County Library
  101 Washington St.
  Toms River, N.J. 08753
  Oyster Creek Nuclear Plant
  Forked River Nuclear Plant

NEW MEXICO

- Ms. Sandra Coleman
  General Library, Reference Department
  University of New Mexico
  Albuquerque, N.M. 87131
  Waste Isolation Pilot Plant

- Ms. Ingrid Vollnhofer
  New Mexico State Library
  Box 1629
  Santa Fe, N.M. 87503
  Waste Isolation Pilot Plant

NEW YORK

- Mr. Sol Becker
  Public Health Library
  New York City Department of Health
  125 Worth Street
  New York, N.Y. 10012
  Columbia University Research Center

- Mr. Peter Allison
  Social Science Center
  New York University
  70 Washington Sq. S.
  New York, N.Y. 10012
  (Selected Documents Only)

- Documents Librarian
  Penfield Library
  State University College at Oswego
  Oswego, N.Y. 13126
  Nine Mile Point Nuclear Plant
  FitzPatrick Nuclear Plant

- Mrs. June Rogoff
  Rochester Public Library
  Business & Social Science Division
  115 South Avenue
  Rochester, N.Y. 14604
  Ginna Nuclear Plant

- Ms. Kathy McGowan
  Shoreham-Wading River Public Library
  Route 25A
  Shoreham, N.Y. 11786
  Shoreham Nuclear Plant

- Mr. Oliver Swift
  White Plains Public Library
  100 Martine Avenue
  White Plains, N.Y. 10601
  Indian Point Nuclear Plant

NORTH CAROLINA

- Miss Ruth Hoyle
  Davie County Public Library
  416 North Main Street
  P.O. Box 158
  Mocksville, N.C. 27028
  Perkins Nuclear Plant

- Mr. Roy Dicks
  Wake County Public Library
  104 Fayetteville Street
  Raleigh, N.C. 27601
  Shearon Harris Nuclear Plant

- Southport-Brunswick County Library
  109 West Moore Street
  Southport, N.C. 28461
  Brunswick Nuclear Plant

- Ms. Dawn Hubbs
  Atkins Library
  University of North Carolina Charlotte
  UNCC Station, N.C. 28223
  McGuire Nuclear Plant

OHIO

- Ms. Vera Ehaus
  Clermont County Library
  Third and Broadway Streets
  Batavia, Ohio 45103
  Zimmer Nuclear Plant

- Ms. Diane Locke
  Perry Public Library
  3753 Main Street
  Perry, Ohio 44081
  Perry Nuclear Plant

- Mrs. Julia Baldwin, Librarian
  Government Document Collection
  William Carlson Library
  University of Toledo
  2801 West Bancroft Avenue
  Toledo, OH 43606
  Davis-Besse Nuclear Plant

OKLAHOMA

- Mr. Craig Buthod
  Tulsa City-County Library
  400 Civic Center
  Tulsa, Okla. 74102
  Black Fox Nuclear Plant

OREGON

- Kay F. West, City Recorder
  City Hall, Records Office
  Arlington, Ore. 97812
  Pebble Springs Nuclear Plant

- Mr. Jim Takita
  Multnomah County Library
  Social Science Dept.
  801 S.W. 10th Ave.
  Portland, Ore. 97205
  Trojan Nuclear Plant

PENNSYLVANIA

- Mrs. Mary Columbo
  B.F. Jones Memorial Library
  663 Franklin Avenue
  Aliquippa, Pa. 15001
  Beaver Valley Nuclear Plant
  Shippingport Light Water Breeder Reactor

- Mr. John Geschwindt
  Government Publications Section
  State Library of Pennsylvania
  Education Building
  Commonwealth and Walnut Street
  Harrisburg, Pa. 17126
  Peach Bottom Nuclear Plant
  Three Mile Island Nuclear Plant
  Fulton Nuclear Plant

- Mr. Phil Hearne
  East Shore Area Branch Library
  4501 Ethel Street
  Harrisburg, Pa. 17109
  Three Mile Island Nuclear Plant
  (Transcripts Only)

- Mr. Clifford Crowers
  Free Library of Philadelphia
  Government Publications Dept.
  19th and Vine
  Philadelphia, Pa. 19103
  Three Mile Island Nuclear Plant
  (Transcripts Only)

- Ms. Kathy Berry, Director
  Pottstown Public Library
  500 High Street
  Pottstown, Pa. 19464
  Limerick Nuclear Plant

- Ms. Elizabeth Harvey
  Schlow Memorial Library
  100 E. Beaver Avenue
  State College, Pa. 16801
  Three Mile Island Nuclear Plant
  (Transcripts Only)

- Pennsylvania State University
  Central Pattee Library
  Room 207
  University Park, Pa. 16802
  Susquehanna Nuclear Plant
  (Transcripts Only)

- Mrs. Gail Frew
  Reference Department
  Osterhout Free Library
  71 South Franklin Street
  Wilkes-Barre, Pa. 18701
  Susquehanna Nuclear Plant

- Mr. David Vanderstreck
  Pennsylvania State University Library
  York Campus
  1031 Edgecomb Avenue
  York, Pa. 17403
  Three Mile Island Nuclear Plant
  (Transcripts Only)

PUERTO RICO

- Mrs. Rosaio Cabrera
  Public Library, City Hall
  Jose de Diego Avenue
  P.O. Box 1086
  Arecibo, P.R. 00612
  North Coast Nuclear Plant

- Mrs. Amalia Ruiz De Porras
  Etien Totti Public Library
  College of Engineers, Architects
  & Surveyors
  Urb Roosevelt Development
  Hato Rey, P.R. 00918
  North Coast Nuclear Plant

SOUTH CAROLINA

- Mrs. Ellen Jenkins
  Barnwell County Library
  Hagood Avenue
  Barnwell, S.C. 29812
  Chem-Nuclear Plant

- Mrs. Peggy Cover
  Clemson University Library
  Science, Technology and
  Agricultural Services
  Clemson, S.C. 29631
  Oconee Nuclear Plant
  (Selected Documents Only)

- Mr. David Eden
  Cherokee County Library
  300 East Rutledge Avenue
  Gaffney, S.C. 29340
  Cherokee Nuclear Plant

- Mrs. Allene Reep
  Hartsville Memorial Library
  Home and Fifth Avenues
  Hartsville, S.C. 29550
  H.B. Robinson Nuclear Plant

- Mrs. Mary Mallaney
  York County Library
  138 E. Black St.
  Rock Hill, S.C. 29730
  Catawba Nuclear Plant

- Mr. Tom Gilson
  Oconee County Library
  502 W. Southbroad
  Walhalla, S.C. 29691
  Oconee Nuclear Plant

- Ms. Sarah McMaster
  Fairfield County Library
  Garden and Washington Streets
  Winnsboro, S.C. 29180
  Summer Nuclear Plant

TENNESSEE

- Ms. Carolyn McManus
  Chatanooga-Hamilton County
  Bicentennial Library
  1001 Broad Street
  Chattanooga, Tenn. 37402
  Sequoyah Nuclear Plant
  Watts Bar Nuclear Plant

- Mr. T. Cal Hendrix
  Kingsport Public Library
  Broad and New Streets
  Kingsport, Tenn. 37660
  Phipps Bend Nuclear Plant

- Mrs. Patricia Rugg
  Lawson McGhee Public Library
  500 West Church Street
  Knoxville, Tenn. 37902
  Clinch River Breeder Plant

- Mr. John Thweatt
  Tennessee State Library and Archives
  403 Seventh Avenue, North
  Nashville, Tenn. 37219
  Hartsville Nuclear Plant

- Ms. Dorothy Dismuke
  Oak Ridge Public Library
  Civic Center
  Oak Ridge, Tenn. 37830
  Clinch River Breeder Plant

TEXAS

- Mr. John Hudson
  University of Texas at Arlington
  Arlington, Tex. 76019
  Comanche Peak Nuclear Plant
  (Selected Documents Only)

- Ms. Nancy Byrd
  Austin-Travis County Collection
  Austin Public Library
  810 Guadalupe Street
  P.O. Box 2287
  Auston, Tex. 78768
  South Texas Nuclear Plant
  (Selected Documents Only)

- Mrs. Frances Parker, Director
  Bay City Library
  1900 5th Street
  Bay City, Tex. 77414
  South Texas Nuclear Plant

- Mrs. Tim Whitworth
  Somervell County Public Lib.
  On The Square
  P.O. Box 1417
  Glen Rose, Tex. 76043
  Comanche Peak Nuclear Plant

- Mrs. Ann Langtroop
  Houston Public Library
  500 McKinney
  Houston, Tex. 77002
  Allens Creek Nuclear Plant
  (Selected Documents Only)

- Newton Public Library
  P.O. Box 657
  Newton, Tex. 77034
  Blue Hills Nuclear Plant

- Mr. James Sosa
  San Antonio Public Library
  Business, Science and Technology
  Department
  203 S. St. Mary Street
  San Antonio, Tex. 78205
  South Texas Nuclear Plant
  (Selected Document Only)

- Mrs. B. Kroesche
  Virgil & Josephine Gordon
  Memorial Library
  917 N. Circle Drive
  Sealy, Tex. 77474
  Allens Creek Nuclear Plant

VERMONT

- Mrs. June Bryant
  Brooks Memorial Library
  224 Main Street
  Brattleboro, Vt. 05301
  Vermont Yankee Nuclear Plant

VIRGINIA

- Mr. Gregory Johnson
  Alderman Library
  Manuscripts Department
  University of Virginia
  Charlottesville, Va. 29901
  North Anna Nuclear Plant

- Mr. Edward Kube
  Board of Supervisors
  Louisa County Courthouse
  P.O. Box 27
  Louisa, Va. 23093
  North Anna Nuclear Plant

- Ms. Sandra Peterson
  Swem Library
  College of William & Mary
  Williamsburg, Va. 23185
  Surry Nuclear Plant

WASHINGTON

- Mrs. Mary Ann Schafer
  W.H. Abel Memorial Library
  125 Main Street South
  Montesano, Wash. 98563
  WPPSS 3 and 5 Nuclear Plants

- Ms. D.E. Roberts
  Richland Public Library
  Swift and Northgate Streets
  Richland, Wash. 99352
  WPPSS 1, 2 and 4 Nuclear Plants
  Skagit Nuclear Plant
  Exxon Fuel Plants

WISCONSIN

- Ms. Sue Grossheuch
  Kewaunee Public Library
  822 Juneau Street
  Kewaunee, Wis. 54216
  Kewaunee Nuclear Plant

- Mrs. Jane Radloff
  LaCrosse Public Library
  800 Main Street
  LaCrosse, Wis. 54601
  LaCrosse BWR Nuclear Plant

- Mrs. Barbara Kelly
  Manitowoc Public Library
  808 Hamilton Street
  Manitowoc, Wis. 54220
  Point Beach Nuclear Plant
  (Selected Documents Only)

- Mr. Arthur M. Fish
  Document Department, Library
  University of Wisconsin
  Stevens Point
  Stevens Point, Wis. 54481
  Point Beach Nuclear Plant
  (Selected Documents Only)
  Wood Nuclear Plant

- Ms. Elsie Heitkemper
  Joseph Mann Library
  1516 Sixteenth Street
  Two Rivers, Wis. 54241
  Point Beach Nuclear Plant

Appendix 4

Regulations and Amendments—Fiscal Year 1981

The regulations of the Nuclear Regulatory Commission are contained in Title 10, Chapter 1, of the Code of Federal Regulations. Effective and proposed regulations concerning licensed activities, and certain policy statements relating thereto, which were published in the Federal Register during fiscal year 1981, are described briefly below.

REGULATIONS AND AMENDMENTS PUT INTO EFFECT

Uranium Mill Licensing Requirements — Parts 30, 40, 70, and 150

On October 3, 1980, amendments to Parts 30, 40, 70, and 150 were published, effective November 17, 1980 which specify licensing requirements for uranium and thorium milling activities, including tailings and wastes generated from these activities.

Changes in Rules of Practice Governing Summary Disposition on Pleadings — Part 2

On October 17, 1980, an amendment to Part 2 was published, effective immediately, to permit the presiding officers of NRC licensing boards to consider motions for summary disposition of certain issues on pleadings under 10 CFR Section 2.749, to permit parties to file answers supporting such motions.

Changes in Rules of Practice Governing Discipline in Adjudicatory Proceedings — Part 2

On October 22, 1980, amendments to Part 2 were published, effective November 21, 1980 to amend regulations governing representation and conduct of attorneys in adjudicatory proceedings.

Revised Costs for the Reproduction of Agency Records — Part 9

On October 22, 1980, amendment to Part 2 were published, effective immediately, to reflect new costs for the reproduction of records made available to the public.

Fire Protection Schedules for Operating Nuclear Power Plants — Part 50

On October 29, 1980, an amendment to Part 50 was published, effective immediately, which temporarily suspended completion schedules for certain fire protection features in operating nuclear plants pending completion of ongoing comprehensive fire protection rulemaking.

Standards for Protection Against Radiation; Burial of Small Quantities of Radionuclides — Part 20

On October 30, 1980, an amendment to Part 20 was published, effective January 28, 1981, which requires NRC licensees to obtain specific approval to bury small quantities of radionuclides. The amendments will provide a greater assurance that varied radioactive material will not present a health hazard.

Access Authorization for Licensee Personnel — Part 25

On October 30, 1980, an amendment to Part 25 was published, effective immediately, to comply with a Commission policy easing security forms requirements for those individuals already possessing a security clearance granted by another Federal agency.

Physical Protection of Plants and Materials Requirements for the Physical Protection of Nuclear Power Plants — Part 73

On October 31, 1980, an amendment to Part 73 was published, effective immediately, which extended from November 1, 1980 to December 1, 1980 relief from pat-down searches of regular employees at nuclear power reactors in order to allow time for the Commission to consider revisions to its rule in Section 73.55, which is intended to finalize requirements for entry searches at such facilities.

Safeguards on Nuclear Material; Implementation of US/IAEA Agreement — Parts 70 and 75

On November 4, 1980, amendments to Part 70 and 75 were published, to be effective upon the US/IAEA Safeguards Agreement's entry into force and publication of notice in the FEDERAL REGISTER. The amendments were intended to clarify that NRC licensees required to submit inventory change reports pursuant to the US/IAEA Agreement are not additionally required to submit nuclear material transfer reports under NRC domestic safeguards regulations.

Rules of Practice for Domestic Licensing Proceedings — Part 2

On November 5, 1980, an amendment to Part 2 was published, effective immediately, to conform the time period permitted in NRC regulations with the Commission's revised internal operating procedures which provide that the Commissioners have ten working days to review the decision of the appropriate Office Director or the Appeal Board and the advice of the General Counsel.

Licensing Requirements for the Storage of Spent Fuel in an Independent Spent Fuel Storage Installation — Part 72

On November 12, 1980, a new Part 72 was published, effective November 28, 1980, along with conforming amendments in Parts 2, 51, 70, 73, and 150. The Commission promulgated the new part after experience with certain licensing actions demonstrated the need for a more definitive regulation to cover spent fuel storage.

Fire Protection Program for Operating Nuclear Power Plants — Part 50

On November 19, 1980, the Commission amended its regulations to require fire protection provisions in operating nuclear power plants, licensed to operate before January 1, 1979. This rule establishes the fire protection policy for the protection of structures, systems, and components important to safety at each plant and the procedures, equipment and personnel required to implement the program at the plant site.

Criteria and Procedures for Determining Eligibility for Access to or Control Over Special Nuclear Material - Parts 11, 50, 70

On November 21, 1980, the Commission amended its regulations to establish criteria and procedures for determining eligibility for access to or control over special nuclear material in fuel cycle facilities and transportation activities that use, process, or store formula quantities of special nuclear material.

Searches of Individuals at Power Reactor Facilities — Part 73

On December 1, 1980, an amendment to Part 73 was published, effective immediately, which extended the current relief from pat-down searches of regular employees at nuclear power reactors in order to accommodate a rulemaking proceeding concerning revisions to rules in Section 73.55 intended to finalize requirements for entry searches at such facilities.

Title Change for Adjudicatory Panel Member — Part 1

On December 4, 1980, an amendment to Part 1 was published, effective immediately, which provided new titles for members of the Atomic Safety and Licensing Board Panel and the Atomic Safety and Licensing Appeal Panel. Instead of being referred to as a panel "Member" those individuals have been given the title "Administrative Judge."

Licensing Requirements for the Storage of Spent Fuel in an Independent Spent Fuel Storage Installation; Correction — Parts 72, 73, and 150

On December 4, 1980, amendments to Parts 72, 73, and 150 were published which corrected typographical errors of an earlier published final rule establishing Licensing Requirements for the Storage of Spent Fuel in an Independent Spent Fuel Storage Installation.

Physical Protection Upgrade Rule; Clarification of Effective Dates — Part 73

On December 18, 1980, the Commission amended its Physical Protection Upgrade Rule to clarify three dates setting deadlines for the development and implementation of plans required of nuclear power reactor licensees for the training and qualification of security personnel.

Physical Protection of Plants and Materials; Reporting of Physical Security Events — Part 73

On January 19, 1981, amendments to Part 73 were published. The amendments, effective April 6, 1981, imposed a requirement upon licensees for reporting or recording physical security events within a range of from one to twenty-four hours, depending upon the severity of the event and compensatory measures taken.

Access Authorization for Licensee Personnel — Part 25

On January 27, 1981, an amendment to Part 25 was published, effective on February 26, 1981, which amended the regulation establishing the scheduling of fees charged NRC licensees for the performance of full field security background investigations. This amendment increases the fee to cover the increased fee charged for NRC by the Office of Personnel Management which performs these investigations and to cover increasing costs NRC incurs in processing the access authorizations that require the investigations.

Licenses for Radiography and Radiation Safety Requirements for Radiographic Operations; Disposal of Records of Pocket Dosimeter Readings — Part 34

On February 11, 1981, an amendment to Part 34 was published, effective March 13, 1981, to provide the pocket dosimeter records of daily radiation dosage need be retained by licensees only for a period of two years.

Transient Shipments of Strategic Special Nuclear Material — Parts 70 and 73

On February 13, 1981, amendments to Parts 70 and 73 were published, effective October 13, 1981. NRC is amending its regulations to withdraw the exemption from strategic special nuclear material in the course of a transient shipment and require them to be responsible for assuring that the strategic special nuclear material is protected against theft and radiological sabotage. These amendments are intended to assure that any transient shipments which may occur are provided physical protection equivalent to that currently required of domestic, import and export shipments.

Rules of Practice for Domestic Licensing Proceedings; Administrative Appellate Briefs — Part 2

On February 13, 1981, amendments to Part 2 were published, effective March 16, 1981, to limit the length of administrative appellate briefs to 70 pages.

Domestic Licensing of Special Nuclear Material; General License Requirements for any Person Who Possesses Irradiated Special Nuclear Material (SNM) in Transit — Part 70

On February 18, 1981, an amendment to Part 70 was published effective April 20, 1981, to issue a general license to any person who possesses irradiated reactor fuel in transit. This action provides the NRC a level of direct control and direct inspection authority over irradiated reactor fuel shipments comparable to that provided over formula quantities of strategic special nuclear material (SSNM) in transit.

Physical Protection of Plants and Materials; Physical Protection of In-Transit Special Nuclear Material of Moderate Strategic Significance — Part 73

On February 18, 1981, an amendment to Part 73 was published, effective March 20, 1981, to allow the NRC to delay the shipment of certain quantities of special nuclear material of moderate strategic significance. The intent of the NRC is to prevent the concurrent shipment of two or more quantities of SNM of moderate strategic significance that, in total, could exceed a formula quantity.

Statutory Increase in Civil Penalty Limits for Violations of Reporting Requirements in Part 21

On February 20, 1981, the Commission amended its regulations effective immediately governing the reporting of defects and noncompliance to reflect the statutory increase in the monetary amount of civil penalties which the Commission may impose pursuant to Section 234 of the Atomic Energy Act of 1954, as amended.

Access by Representatives of the International Atomic Energy Agency — Part 95

On February 20, 1981, the Commission amended its regulations, effective March 23, 1981, to permit NRC licensees to grant International Atomic Energy Agency (IAEA) representatives access to NRC classified information as required by their visits to NRC-licensed facilities under the US/IAEA Safeguards Agreement. The amendments also specify recordkeeping requirements related to this access.

Domestic Licensing Proceedings; Procedural Assistance Program — Part 2

On February 24, 1981, NRC published a final rule, effective immediately, which suspends 10 CFR 2.712(F) and 2.750(c), concerning procedural assistance to non-applicant parties in domestic licensing proceedings.

Change of Effective Date for Application, Recordkeeping, and Reporting Requirements — Parts 11, 50, and 70

On February 24, 1981, NRC published a notice of extending the effective date to March 21, 1981, for the application, recordkeeping, and reporting requirements contained in the final rule establishing "Criteria and Procedures for Determining Eligibility for Access to or Control Over Special Nuclear Material." The effective date for all the other requirements of the rule remains February 4, 1981. The change was made to allow additional time for completion of the review of those requirements by the General Accounting Office.

Disposal of High-Level Radioactive Wastes in Geologic Repositories; Licensing Procedures — Parts 2, 19, 20, 21, 30, 40, 51, 60, and 70

On February 25, 1981, NRC published a rule, effective March 27, 1981, which sets forth requirements applicable to the Department of Energy for submitting an application for a license and specifies the procedures which the Commission will follow in considering such an application.

Group Licensing for Certain Medical Uses — Part 35

On March 6, 1981, NRC published a final rule amending its regulations to add a new reagent kit to its list of authorized radioactive drugs and reagent kits. The amendment, effective immediately, adds to the lists the use of a reagent kit to prepare the radiopharmaceutical technetium-99m, labeled oxidronate sodium.

Biomedical Waste Disposal — Part 20

On March 11, 1981, NRC published a final rule, effective immediately, which permits licensees greater leeway in disposing of liquid scintillation media and animal carcasses containing tracer levels of hydrogen-3 (tritium) or carbon-14. The licensees may now dispose of specified concentrations of these materials without regard to their radioactivity. The new regulations also increase the annual limits for disposal of hydrogen-3 and carbon-14 by release to the sanitary sewerage systems.

Environmental Radiation Protection Standards for Nuclear Power Operations — Part 20

On March 25, 1981, NRC published final amendments to its regulations to incorporate the existing Environmental Protection Agency requirement for certain uranium fuel cycle licensees to comply with the EPA's "Environmental Radiation Protection Standards for Nuclear Power Operations." The effective date for these amendments is June 23, 1981. The effective dates for the existing requirement to comply with EPA's rule are as specified in 40 CFR 190.12. In addition, the amendments require licensees to submit reports to NRC when 40 CFR Part 190 limits have been or may be violated.

Codes and Standards for Nuclear Power Plants — Part 50

On April 3, 1981, NRC published a final rule to incorporate by reference new addenda of the ASME Boiler and Pressure Vessel Code, May 4, 1981, which provide rules for the construction of nuclear power plant components and specify requirements for inservice inspection of these components. The amendment is effective May 4, 1981.

ACRS Participation in NRC Rulemaking — Part 2

On April 17, 1981, NRC published a final rule, immediately effective, which establishes procedures for specific

Commission action on recommendations by the ACRS that the Commission initiate rulemaking in a particular area. The new rule also requires that the NRC staff give the ACRS an opportunity to provide advice and identify issues when the staff develops rules involving nuclear safety matters.

Amendment of Exemption for Ionizing Radiation Measuring Instruments — Part 30

On May 13, 1981, NRC published a rule, immediately effective, to amend its rules of general applicability to domestic licensing of byproduct material so that persons exempt from licensing and regulatory requirements may receive, use, and transfer ionizing radiation measuring instruments containing multiple internal calibration or standardization sources of byproduct material.

Commission Review Procedures for Power Reactor Operating Licenses; Immediate Effectiveness Rule — Part 2

On May 28, 1981, NRC published a final rule, immediately effective, which amends it review procedures for Licensing Board decisions granting nuclear power reactor operating license applications. The amendment requires direct Commission review of those decisions to determine whether their effectiveness should be delayed pending normal agency appelate review.

Alternative Site Issues in Operating License Proceedings — Part 51

On May 28, 1981, NRC published a final rule, effective June 25, 1981, which amends its regulations, "Licensing and Regulatory Policy and Procedures for Environmental Protection," to provide that, for National Environmental Policy Act purposes, alternative sites will not be considered in operating license reviews for nuclear power plants and need not be addressed by operating license applicants in their environmental reports submitted to the NRC at the operating license stage.

Emergency Planning; Correction — Part 50

On May 29, 1981, NRC published a final rule, effective immediately, making two minor corrections to the Part 50 rule that appeared in the *Federal Register* August 19, 1981, to bring the language of the rule into conformity with the Commission's intent.

Rules of Practice for Domestic Licensing Proceedings; Expediting the NRC Hearing Process — Part 2

On June 8, 1981, NRC published a final rule, effective immediately, amending its Rules of Practice to facilitate expedited conduct of its adjudicatory proceedings on applications to construct or operate nuclear power plants. The amendments authorize the Licensing Boards to make oral rulings on written motions during the course of a prehearing conference or a hearing, preclude parties from filing responses to objections to a prehearing order unless the Licensing Board so directs, revise the schedule for filing proposed findings of fact and conclusions of law, and permit summary disposition motions to be filed at any time during the course of the proceeding.

Rules of Practice for Domestic Licensing Proceedings — Part 2

On July 6, 1981, NRC published a final rule, effective immediately, amending its regulation concerning the Secretary's authority to rule on procedural matters. The amendment permits the Secretary to refer pleadings, improperly directed to the Commission's attention, to the appropriate adjudicatory board.

Expedited Procedure for Handling Certain Petitions for Rulemaking — Part 2

On July 9, 1981, NRC published a final rule, effective immediately which amends its rules of practice for processing petitions for rulemaking. The amendment establishes a procedure that begins with publication of a notice of proposed rulemaking, reducing the time required to respond to selected petitions and eliminating the need to publish in every case a notice of receipt of petition for rulemaking.

Reporting Requirements for Spent Fuel Storage Facilities Subject to IAEA Safeguards — Part 72

On July 14, 1981, NRC published a final rule, effective August 13, 1981, to amend its regulations to clarify the Commission's intent that a licensee need not submit duplicative reports. Licensees required to submit inventory change reports and material status reports pursuant to the US/IAEA Safeguards Agreement are not also required to submit material status reports and nuclear material transfer reports under NRC domestic safeguards regulations.

NRC's Jurisdiction Over Persons Using Byproduct, Source or Special Nuclear Materials in Certain Offshore Waters — Parts 31 and 150

On September 3, 1981, NRC published a final rule amending its regulations (1) to clarify that it has jurisdiction vis-a-vis Agreement States over persons using byproduct, source, or special nuclear materials in certain offshore waters bounded by the U.S. Outer Continental Shelf, (2) to recognize Agreement State specific licenses in an NRC general license covering activities in these waters, and (3) to allow Agreement States to perform inspections and other functions for NRC in these waters.

Regional Licensing Program — Parts 30, 40, and 70

On September 4, 1981, NRC published a final rule, immediately effective, amending its regulations on domestic licensing of byproduct material to provide information about its regional licensing program. The amendment informs licensees of the current NRC practices in using regional offices.

Fire Protection Rule; Corrections — Part 50

On September 8, 1981, NRC published the corrected text of affected sections of the Part 50 final rule regarding fire protection. The final rule appearing in the *Federal Register* on November 19, 1980 (45 FR 76602) contained several nonsubstantive errors requiring correction.

Commission Review Procedures for Power Reactor Operating Licenses; Immediate Effectiveness Rule — Part 2

On September 30, 1981, NRC published an amendment, effective immediately, to modify its review procedures for Licensing Board decisions granting power reactor operator license applications. The Commission will retain to itself the decision as to whether or not a plant will be allowed to go into commercial operation. However, the requirement for Commission review at earlier stages has been deleted.

REGULATIONS AND AMENDMENTS PROPOSED

Proposed Licensing Requirements for Pending Construction Permit and Manufacturing License Applications — Part 50

On October 2, 1980, NRC published a notice of proposed rulemaking that would incorporate the lessons learned in connection with the Three Mile Island Unit 2 (TMI-2) accident in its requirements for licensing of nuclear power plants.

Domestic Licensing of Production and Utilization Facilities: Interim Requirements Related to Hydrogen Control and Certain Degraded Core Considerations — Part 50

On October 2, 1980, NRC published a notice of proposed rulemaking that would improve hydrogen management in light-water reactor facilities and provide specific design and other requirements to mitigate the consequences of accidents resulting in a degraded reactor core.

Standards for Protection Against Radiation — Part 20

On October 8, 1980, the NRC published a notice of proposed rulemaking that would permit licensees greater leeway in disposing of liquid scintillation media and animal carcasses containing tracer levels of hydrogen-3 (tritium) and carbon-14. The NRC is also considering amending its regulations to raise the annual limits for disposal of hydrogen-3 and carbon-14 by release to the sanitary sewerage system.

Plan to Require Licensees and Applicants to Document Deviations from the Standard Review Plan — Part 50

On October 9, 1980, the NRC published a notice of proposed rulemaking that would require nuclear power plant licensees and applicants for construction permits and manufacturing licenses to identify and justify deviations from the acceptance criteria of the applicable revision of the standard review plan NUREG-75/087.

Exemption of Technetium-99 and Low-Enriched Uranium as Residual Contamination in Smelted Alloys — Parts 30, 32, 70, and 150

On October 27, 1980, the NRC published a notice of proposed rulemaking that would exempt from licensing and regulatory requirements technetium-99 and low-enriched uranium as residual contamination in any smelted alloy. The Commission also proposed requirements for issuing specific licenses to persons desiring to smelt scrap or to initially transfer smelted alloys containing technetium-99 or low-enriched uranium as a residual contamination.

NRC's Jurisdiction Over Persons Using Byproduct, Source, and Special Nuclear Material in Offshore Waters Beyond Agreement States' Territorial Waters — Parts 31 and 150

On October 30, 1980, the NRC published a notice of proposed rulemaking that would (1) clarify that the NRC has jurisdiction vis-a-vis Agreement States over persons using byproduct, source, and special nuclear materials in offshore waters beyond Agreement States territorial waters and within the area of the Outer Continental Shelf and (2) recognize specific licenses issued by an Agreement State in an NRC general license covering activities in these waters.

Fees for Review of Applications — Part 170

On November 10, 1980, the NRC published a notice of proposed rulemaking that would clarify the requirement that fees for review will be charged, upon completion of the review. The review is complete by issuance of a permit, license, or other approval, or by denial or withdrawal of an application, or by any other event that brings active Commission review of the application to an end.

Domestic Licensing of Production and Utilization Facilities; Fracture Toughness Requirements for Nuclear Power Reactors — Part 50

On November 14, 1980, the NRC published a notice of proposed rulemaking that would specify fracture toughness requirements for nuclear power reactors and the requirements for reactor vessel material surveillance programs.

Searches of Individuals at Power Reactor Facilities — Part 73

On December 1, 1980, NRC published a notice of proposed rulemaking that would clarify requirements for searches of individuals at power reactor facilities, protected area entry portals. The amendment would require searches similar to those used on an interim basis at power reactors prior to November 1, 1980, including mandatory use of search equipment, and the pat-down search of visitors to nuclear power plants.

Advance Notification to States of Transportation of Certain Types of Nuclear Waste — Part 71

On December 9, 1980, NRC published a notice of proposed rulemaking that would implement a Federal statute which requires NRC licensees shipping nuclear waste to provide advance notification of shipments to the governors of States affected, when the Commission determines that the shipment is potentially hazardous to health and safety.

Advance Notification to Governors Concerning Shipments of Irradiated Reactor Fuel — Part 73

On December 9, 1980, NRC published a notice of proposed rulemaking that would require NRC licensees to provide advance notification to the governor of any State affected prior to the transport of irradiated reactor fuel through that State.

Protection of Unclassified Safeguards Information — Parts 2, 50, 70, and 73

On December 29, 1980, NRC published a notice of proposed rulemaking that would prohibit the unauthorized disclosure of safeguards information by NRC licensees and other persons.

Codes and Standards for Nuclear Power Plants — Part 50

On December 31, 1980, NRC published a notice of proposed rulemaking that would incorporate by reference new addenda of the ASME Boiler and Pressure Vessel Code.

Financial Protection Requirements and Indemnity Agreements; Miscellaneous Amendments — Part 140

On February 18, 1981, NRC published a notice of proposed rulemaking seeking comments on whether to continue the publication in its regulations of the entire Facility Form of nuclear liability insurance policy and endorsements to that policy furnished by licensees as evidence of financial protection or just those provisions of the policy related to the NRC responsibilities for protection of the public.

Amendment of Exemption for Ionizing Radiation Measuring Instruments — Part 30

On February 25, 1981, NRC published a notice of proposed rulemaking that would allow persons exempt from licensing and regulatory requirements to receive, use, and transfer ionizing radiation measuring instruments containing multiple internal calibration or standardization sources of byproduct material.

Appendix A, Narrative Explanation of Table S-3, Uranium Fuel Cycle Environmental Data — Part 51

On March 4, 1981, NRC published a notice of proposed rulemaking consisting of amendments and a new Appendix A to Part 51. Appendix A consists of a narrative explanation for Table S-3, "Uranium Fuel Cycle Environmental Data," describing the basis for the values contained in Table S-3 and the conditions which govern the use of the table.

Rules of Practice for Domestic Licensing Proceedings; Expediting the NRC Hearing Process — Part 2

On March 18, 1981, NRC published a notice of proposed rulemaking that would expedite the conduct of adjudicatory proceedings on applications to construct or operate nuclear power plants by providing a number of means relating to the filing of motions, discovery, and the preparation of orders to minimize time lag between NRC adjudicatory decisions and plant completion.

Licensing Requirements for Pending Construction Permit and Manufacturing License Applications — Part 50

On March 23, 1981, NRC published a notice of proposed rulemaking that would add to its power reactor safety regulations a set of licensing requirements applicable only to construction permit and manufacturing license applications pending at the effective date of the rule. The requirements stem from the Commission's ongoing effort to apply the lessons learned from the accident at Three Mile Island to power plant licensing.

Immediate Effectiveness Rule; Commission Review Procedures for Power Reactor Operating Licenses — Part 2

On April 3, 1981, NRC published a notice of proposed rulemaking that would modify Appendix B to Part 2 either by (a) reducing the length of time between a Licensing Board decision permitting fuel loading and low power testing or full power operation and the Commission's decision to permit the Licensing Board's decision to become effective, or (b) allowing a Licensing Board decision permitting fuel loading, low power testing, or full power operations to become immediately effective.

Licensing Requirements for Pending Operating License Applications — Part 50

On May 13, 1981, NRC published a notice of proposed rulemaking that would add to its power reactor safety regulations a set of licensing requirements applicable to operating license applications. The requirements stem from the Commission's ongoing effort to apply the lessons learned from the accident at Three Mile Island to power plant licensing.

Rules of Practice for Domestic Licensing Proceedings; Modifications to the NRC Hearing Process — Part 2

On June 8, 1981, NRC published a notice of proposed rulemaking which would amend its regulations to facilitate expedited conduct of its adjudicatory proceedings. The proposed amendments would require a person seeking intervention to present the facts on which the contentions are based and the sources of documents used to establish those facts, limit the number of interrogatories that a party may file on another party in an NRC proceeding and permit the boards to require oral answers to motions to compel and service of documents by express mail. An increased threshold showing in support of a contention as a prerequisite to admission for hearing might also be required.

Physical Protection of Intransit Special Nuclear Material of Moderate Strategic Significance — Part 73

On June 19, 1981, NRC published a notice of proposed rulemaking which would improve licensee safeguards capabilities for early detection of attempted theft of this material while it is in transit.

Report of Changes to the Quality Assurance Program — Part 50

On July 2, 1981, NRC published a notice of proposed rulemaking which would require holders of nuclear power plant construction permits and holders of operating licenses to implement the approved quality assurance program. The amendment would also require that the Commission be informed in writing of certain quality assurance program changes which affect the description of the quality assurance program.

Disposal of High-Level Radioactive Waste in Geologic Repositories — Part 60

On July 8, 1981, NRC published a notice of proposed rulemaking which would specify technical criteria for dis-

posal of high-level radioactive wastes in geologic repositories.

Amendment of Exemption for Ionizing Radiation Measuring Instruments — Part 30

On July 9, 1981, NRC published a notice of proposed rulemaking which would amend its rules of general applicability to domestic licensing of byproduct material. The amendments would consider a small quantity of americium-241 as an exempt quantity under the list of radionuclides authorized for exempt use in ionizing radiation measuring instruments.

Licensing Requirements for Land Disposal of Radioactive Waste — Parts 2, 19, 20, 21, 30, 40, 51, 70, 73, and 170

On July 24, 1981, NRC published a notice of proposed rulemaking in response to the needs and requests of the public, Congress, industry, the States, the Commission, and other Federal agencies for codification of regulations for the disposal of low-level radioactive waste. The amendments would provide performance objectives for disposal, general requirements for land disposal of radioactive waste, technical requirements for disposal of radioactive waste into near-surface disposal facilities, requirements for submitting applications for licenses authorizing such activities and procedures which the Commission will follow in the issuance of such licenses. The amendments also would provide for consultation and participation in license reviews by State governments and Indian tribes.

Codes and Standards for Nuclear Power Plants — Part 50

On July 27, 1981, NRC published a notice of proposed rulemaking to incorporate by reference new addenda of the ASME Boiler and Pressure Vessel Code. The ASME Code provides rules for the construction of nuclear power plant components and specifies requirements for inservice inspection of those components.

Need for Power and Alternative Energy Issues in Operating License Proceedings — Part 51

On August 3, 1981, NRC published a notice of proposed rulemaking that would provide that need for power and alternative energy source issues will not be considered in operating license proceedings for nuclear power plants and need not be addressed by operating license applicants in environmental reports submitted to the NRC at the operating license stage. These amendments would result in avoidance of unnecessary litigation of issues.

Financial Qualifications; Domestic Licensing of Production and Utilization Facilities — Part 50

On August 18, 1981, NRC published a notice of proposed rulemaking that would amend its requirements for financial qualifications review and findings for electric utility applicants applying for permits or licenses for production or utilization facilities. In the same notice the Commission proposed an amendment that would require power reactor licensees to maintain the maximum amount of commercially available onsite property damage insurance, or an equivalent amount of protection (e.g., letter of credit, bond, or self insurance), from the time that the Commission first permits ownership, possession, and storage of special nuclear material at the site of the reactors.

Measurement of the Activity of Radiopharmaceutical Dosages — Part 35

On September 1, 1981, NRC published a notice of proposed rulemaking that would amend its regulations on human uses of byproduct material. The amendment would require specific medical licensees to (1) measure the total activity of each radiopharmaceutical dosage, except those containing less than 10 microcuries or a pure beta-emitting radionuclide, before it is administered to a patient; (2) verify that smaller dosages contain less than 10 microcuries; and (3) keep a record of the measurements.

Safeguards Requirements for Non-power Reactor Facilities Authorized to Possess Formula Quantities of Strategic Special Nuclear Material — Parts 50, 70, and 73

On September 18, 1981, NRC published a proposed amendment to its physical protection regulations for non-power reactor facilities authorized to possess formula quantities of strategic special nuclear material. The amendment would require that these facilities be protected at the same level as required for special nuclear material of moderate strategic signifiance and also would require additional physical protection measures against theft of special nuclear material.

Nondescrimination on Basis of Age in Federally Assisted Commission Program — Part 4

On September 21, 1981, NRC published a proposed amendment to its regulations which would implement the provisions of the Age Discrimination Act of 1975, as amended. The proposal with certain exceptions, would make it unlawful for any recipient of Federal financial assistance to discriminate on the basis of age in programs or activities receiving Federal financial assistance.

Emergency Planning and Preparedness for Production and Utilization Facilities — Part 50

On September 21, 1981, NRC published a proposed amendment to its regulations on Emergency Planning and Preparedness. The amendment would extend the time by which prompt public notification systems must be operational around all nuclear power plants. The compliance date would be changed from July 1, 1981 to no later than February 1, 1982.

Reconsideration of Rule to Provide Exception from Procedural Rules for Adjudication Involving Conduct of Military or Foreign Affairs Functions — Part 2

On September 30, 1981, NRC published a notice of reconsideration of that part of its "Rules of General Applicability" for the conduct of adjudicatory proceedings which provides an exception from those rules for adjudications involving the conduct of military or foreign affairs functions. The amendment would permit the Commission greater flexibility in established procedures for proceedings involving military or foreign affairs functions.

Appendix 5

REGULATORY GUIDES — FISCAL YEAR 1981

Regulatory guides describe and make available to the public methods acceptable to the NRC staff for implementing specific parts of the Commission's regulations and, in some cases, describe techniques used by the staff in evaluating specific problems or postulated accidents. Guides also may provide applicants with information the NRC staff needs in reviewing applications for permits and licenses.

Comments and suggestions for improvements in guides are encouraged, and guides are revised, as appropriate, to reflect new information or experience. To provide for increased public participation in the regulatory process, the NRC issues guides for public comment in draft form before the guides have received complete staff review and before an official NRC staff position has been established.

Regulatory guides may also be withdrawn when they are superseded by the Commission's regulations, when equivalent recommendations have been incorporated in applicable approved codes and standards, or when changes in methods and techniques have made them obsolete.

When guides are issued, revised, or withdrawn, notices are placed in the *Federal Register*.

To reduce the burden on the taxpayer, the NRC has made arrangements with the U.S. Government Printing Office to become a consigned sales agent for certain NRC publications including regulatory guides. Draft guides, which are issued for public comment, continue to receive free distribution. Active guides are sold on a subscription or individual copy basis. NRC licensees receive, at no cost, pertinent draft and active regulatory guides as they are issued.

The following guides were issued or revised (or withdrawn as noted) during the period October 1, 1980, to September 30, 1981:

Division 1 — Power Reactor Guides

1.10 WITHDRAWN. Mechanical (Cadweld) Splices in Reinforcing Bars of Category I Concrete Structures (Revision 1)

1.15 WITHDRAWN. Testing of Reinforcing Bars for Category I Concrete Structures (Revision 1)

1.18 WITHDRAWN. Structural Acceptance Test for Concrete Primary Reactor Containments (Revision 1)

1.19 WITHDRAWN. Nondestructive Examination of Primary Containment Liner Welds (Safety Guide 19, Revision 1)

1.55 WITHDRAWN. Concrete Placement in Category I Structures

1.84 Design and Fabrication Code Case Acceptability—ASME Section III Division 1 (Revisions 17 and 18)

1.85 Materials Code Case Acceptability—ASME Section III Division 1 (Revisions 17 and 18)

1.97 Instrumentation for Light-Water Cooled Nuclear Power Plants to Assess Plant and Environs Conditions During and Following an Accident (Revision 2)

1.97 (Errata to Revision 2)

1.101 WITHDRAWN. Emergency Planning for Nuclear Power Plants (Revision 1)

1.103 WITHDRAWN. Post-tensioned Prestressing Systems for Concrete Reactor Vessels and Containments (Revision 1)

1.133 Loose-Part Detection Program for the Primary System of Light-Water-Cooled Reactors (Revision 1)

1.136 Materials, Construction, and Testing of Concrete Containments (Articles CC-1000, -2000, and -4000 through -6000 of the "Code for Concrete Reactor Vessels and Containments") (Revision 2)

1.147 Inservice Inspection Code Case Acceptability—ASME Section XI Division 1

1.48 Functional Specification for Active Valve Assemblies in Systems Important to Safety in Nuclear Power Plants

1.149 Nuclear Power Plant Simulators for Use in Operator Training

1.150 Ultrasonic Testing of Reactor Vessel Welds During Preservice and Inservice Examinations

Division 2 — Research and Test Reactor Guides

None

Division 3 — Fuels and Materials Facilities Guides

3.11.1 Operational Inspection and Surveillance of Embankment Retention Systems for Uranium Mill Tailings (Revision 1)

3.23 WITHDRAWN. Stabilization of Uranium-Thorium Milling Waste Retention Systems

3.24 WITHDRAWN. Guidance on the License Applica-

tion, Siting, Design, and Plant Protection for an Independent Spent Fuel Storage Installation

3.44 Standard Format and Content for the Safety Analysis Report for an Independent Spent Fuel Storage Installation (Water-Basin Type) (Revision 1)

3.45 Nuclear Criticality Control and Safety of Homogeneous Plutonium-Uranium Fuel Mixtures Outside Reactors

Division 4 — Environmental and Siting Guides

None

Division 5 — Materials and Plant Protection Guides

5.62 Reporting of Physical Security Events

Division 6 — Product Guides

None

Division 7 — Transportation Guides

None

Division 8 — Occupational Health Guides

8.5 Criticality and Other Interior Evacuation Signals (Revision 1)

8.12 Criticality Accident Alarm Systems (Revision 1)

8.23 Radiation Safety Surveys at Medical Institutions (Revision 1)

8.27 Radiation Protection Training for Personnel at Light-Water-Cooled Nuclear Power Plants

8.28 Audible-Alarm Dosimeters

8.29 Instruction Concerning Risks from Occupational Radiation Exposure

Division 9 — Antitrust and Financial Review Guides

None

Division 10 — General Guides

10.5 Applications for Type A Licenses of Broad Scope (Revision 1)

10.8 Guide for the Preparation of Applications for Medical Programs (Revision 1)

DRAFT GUIDES

Division 1

MS 140-5 Proposed Revision 2 to Guide 1.12, Nuclear Power Plant Instrumentation for Earthquakes

RS 002-5 Proposed Revision 3 to Guide 1.28, Quality Assurance Program Requirements (Design and Construction)

RS 709-4 Proposed Revision to Guide 1.80 (To Be Issued as Guide 1.68.3), Preoperational Testing of Instrument and Control Air Systems

RS 807-5 Second Proposed Reivision 2 to Guide 1.8, Personnel Qualification and Training

RS 902-4 Second Proposed Revision 3 to Guide 1.33, Quality Assurance Program Requirements (Operation)

SC 708-4 Qualification and Acceptance Tests for Snubbers Used in Systems Important to Safety

Division 3

FP 026-5 Nuclear Criticality Control and Safety of Homogeneous Plutonium-Uranium Fuel Mixtures Outside Reactors

FP 027-5 Proposed Revision 1 to Guide 3.1, Use of Borosilicate-Glass Raschig Rings as a Neutron Absorber in Solutions of Fissile Material

FP 029-4 Standard Format and Content for the Safety Analysis Report for an Independent Spent Fuel Storage Installation (Dry Storage)

FP 034-4 Spent Fuel Heat Generation in an Independent Spent Fuel Storage Installation

FP 716-4 Standard Format and Content for the Health and Safety Sections of Renewal Applications for Uranium Fuel Fabrication Plants

FP 806-6 Design of an Independent Spent Fuel Storage Installation (Water Basin Type)

FP 907-4 Guidance on Preparing a License Application to Store Spent Fuel in an Independent Spent Fuel Storage Installation

WM 039-4 Proposed Revision 2 to Guide 3.5, Standard Format and Content of License Applications for Uranium Mills

Division 4

GS 027-4 Standard Format and Content of Site Characterization Reports for High-Level-Waste Geologic Repositories

Division 6

TP 102-5 Safety Features of Gauges Containing Radioactive Material

Division 7

TP 019-4 Establishing Quality Assurance Programs for Packaging Used in the Transport of Special Form and Certain Normal Form Radioactive Material

TP 020-4 Establishing Quality Assurance Programs for Packaging Used in the Transport of Spent Fuel, High-Level Waste, and Plutonium

Division 8

OP 031-4 Proposed Revision 2 to Guide 8.13, Instruction Concerning Prenatal Radiation Exposure

Appendix 6

Nuclear Electric Generating Units In Operation Or Under Construction

(As of January 31, 1982)

The following listing includes 156 nuclear power reactor electrical generating units which were in operation, under construction, or under NRC review for construction permits in the United States as of January 31, 1982, representing a total capacity of approximately 149,000 MWe. TYPE is indicated by: BWR — boiling water reactor, PWR — pressurized water reactor, HTGR — high temperature gas-cooled reactor, and LMFBR — liquid metal cooled fast breeder reactor. STATUS is indicated by: OL — has operating license, CP — has construction permit, UR — under review for construction permit. The dates for operation are either actual or those scheduled by the utilities as of January 31, 1982.

This listing includes 14 fewer units than a year ago, reflecting cancellations of plans for future facilities. In addition, delays in planned completion dates have been indicated during fiscal year 1981 for 50 other units. The reasons cited for delays and cancellations include (1) lower demand for electricity, (2) financial problems, (3) construction delays, (4) concerns for reactor safety, and (5) regulatory delays.

Site	Plant	Capacity (Net MWe)	Type	Status	Utility	Commercial Operation
ALABAMA						
Decatur	Browns Ferry Nuclear Power Plant Unit 1	1,065	BWR	OL 1973	Tennessee Valley Authority	1974
Decatur	Browns Ferry Nuclear Power Plant Unit 2	1,065	BWR	OL 1974	Tennessee Valley Authority	1975
Decatur	Browns Ferry Nuclear Power Plant Unit 3	1,065	BWR	OL 1976	Tennessee Valley Authority	1977
Dothan	Joseph M. Farley Nuclear Plant Unit 1	804	BWR	OL 1977	Alabama Power Co.	1978
Dothan	Joseph M. Farley Nuclear Plant Unit 2	829	PWR	OL 1981	Alabama Power Co.	1981
Scottsboro	Bellefonte Nuclear Plant Unit 1	1,235	PWR	CP 1974	Tennessee Valley Authority	1984
Scottsboro	Bellefonte Nuclear Plant Unit 2	1,235	PWR	CP 1974	Tennessee Valley Authority	1985
ARIZONA						
Winterburg	Palo Verde Nuclear Generating Station Unit 1	1,304	PWR	CP 1976	Arizona Public Service Co.	1983
Winterburg	Palo Verde Nuclear Generating Station Unit 2	1,304	PWR	CP 1976	Arizona Public Service Co.	1984

Site	Plant	Capacity (Net MWe)	Type	Status	Utility	Commercial Operation
ARIZONA — (Continued)						
Winterburg	Palo Verde Nuclear Generating Station Unit 3	1,304	PWR	CP 1976	Arizona Public Service Co.	1986
ARKANSAS						
Russelville	Arkansas Nuclear One Unit 1	836	PWR	OL 1974	Arkansas Power & Light Co.	1974
Russelville	Arkansas Nuclear One Unit 2	858	PWR	OL 1978	Arkansas Power & Light Co.	1980
CALIFORNIA						
Eureka	Humboldt Bay Power Plant Unit 3[1]	65	BWR	OL 1962	Pacific Gas & Electirc Co.	1963
San Clemente	San Onofre Nuclear Generating Station Unit 1	436	PWR	OL 1967	So. Calif. Ed. & San Diego Gas & Electric Co.	1968
San Clemente	San Onofre Nuclear Generating Station Unit 2	1,140	PWR	CP 1973	So. Calif. Ed. & San Diego Gas & Electric Co.	1982
San Clemente	San Onofre Nuclear Generating Station, Unit 3	1,140	PWR	CP 1973	So. Calif. Ed. & San Diego Gas & Electric Co.	1983
Diablo Canyon	Diablo Canyon Nuclear Power Plant Unit 1[2]	1,084	PWR	CP 1968	Pacific Gas & Electric Co.	1983
Diablo Canyon	Diablo Canyon Nuclear Power Plan Unit 2	1,106	PWR	CP 1970	Pacific Gas & Electric Co.	1984
Clay Station	Rancho Seco Nuclear Generating Station Unit 1	873	PWR	OL 1974	Sacramento Municipal Utility District	1975
COLORADO						
Platteville	Fort St. Vrain Nuclear Generating Station	330	HTGR	OL 1973	Public Service Co. of Colorado	1979
CONNECTICUT						
Haddam Neck	Haddam Neck Generating Station	555	PWR	OL 19697	Conn. Yankee Atomic Power Co.	1968
Waterford	Millstone Nuclear Power Station Unit 1	654	BWR	OL 1970	Northeast Nuclear Energy Co.	1971
Waterford	Millstone Nuclear Power Station Unit 2	864	PWR	OL 1975	Northeast Nuclear Energy Co.	1975
Waterford	Millstone Nuclear Power Station Unit 3	1,159	PWR	CP 1974	Northeast Nuclear Energy Co.	1986

[1]Shut down indefinitely (not included in summary)
[2]Low power license issued 9/81 and revoked 11/81.

Site	Plant	Capacity (Net MWe)	Type	Status	Utility	Commercial Operation
FLORIDA						
Florida City	Turkey Point Station Unit 3	646	PWR	OL 1972	Florida Power & Light Co.	1972
Florida City	Turkey Point Station Unit 4	646	PWR	OL 1973	Florida Power & Light Co.	1973
Red Level	Crystal River Plant Unit 3	782	PWR	OL 1977	Florida Power Corp.	1977
Ft. Pierce	St. Lucie Plant Unit 1	777	PWR	OL 1976	Florida Power & Light Co.	1976
Ft. Pierce	St. Lucie Plant Unit 2	842	PWR	CP 1977	Florida Power & Light Co.	1983
GEORGIA						
Baxley	Edwin I. Hatch Plant Unit 1	757	BWR	OL 1974	Georgia Power Co.	1975
Baxley	Edwin I. Hatch Plant Unit 2	771	BWR	OL 1978	Georgia Power Co.	1979
Waynesboro	Alvin W. Vogtle, Jr. Plant Unit 1	1,100	PWR	CP 1974	Georgia Power Co.	1987
Waynesboro	Alvin W. Vogtle, Jr. Plant Unit 2	1,100	PWR	CP 1974	Georgia Power Co.	1988
ILLINOIS						
Morris	Dresden Nuclear Power Station Unit 1[1]	200	BWR	OL 1959	Commonwealth Edison Co.	1960
Morris	Dresden Nuclear Power Station Unit 2	772	BWR	OL 1969	Commonwealth Edison Co.	1970
Morris	Dresden Nuclear Power Station Unit 3	773	BWR	OL 1971	Commonwealth Edison Co.	1971
Zion	Zion Nuclear Plant Unit 1	1,040	PWR	OL 1973	Commonwealth Edison Co.	1973
Zion	Zion Nuclear Plant Unit 2	1,040	PWR	OL 1973	Commonwealth Edison Co.	1974
Cordova	Quad-Cities Station Unit 1	769	BWR	OL 1972	Comm. Ed. Co.-Iowa-Ill Gas & Elec. Co.	1973
Cordova	Quad-Cities Station Unit 2	769	BWR	OL 1972	Comm. Ed. Co.-Iowa-Ill Gas & Elec. Co.	1973
Seneca	LaSalle County Nuclear Station Unit 1	1,078	BWR	CP 1973	Commonwealth Edison Co.	1982
Seneca	LaSalle County Nuclear Station Unit 2	1,078	BWR	CP 1973	Commonwealth Edison Co.	1983
Byron	Byron Station Unit 1	1,120	PWR	CP 1975	Commonwealth Edison Co.	1983
Byron	Byron Station Unit 2	1,120	PWR	CP 1975	Commonwealth Edison Co.	1984
Braidwood	Braidwood Unit 1	1,120	PWR	CP 1975	Commonwealth Edison Co.	1985

[1]Shut down indefinitely (not included in summary)

Site	Plant	Capacity (Net MWe)	Type	Status	Utility	Commercial Operation
ILLINOIS (Continued)						
Braidwood	Braidwood Unit 2	1,120	PWR	CP 1975	Commonwealth Edison Co.	1986
Clinton	Clinton Nuclear Power Plant Unit 1	950	BWR	CP 1976	Illinois Power Co.	1983
Clinton	Clinton Nuclear Power Plant Unit 2	950	BWR	CP 1976	Illinois Power Co.	Indef.
INDIANA						
Madison	Marble Hill Unit 1	1,130	PWR	CP 1978	Public Service of Indiana	1986
Madison	Marble Hill Unit 2	1,130	PWR	CP 1978	Public Service of Indiana	1987
IOWA						
Pala	Duane Arnold Energy Center Unit 1	538	BWR	OL 1974	Iowa Elec. Light & Power Co.	1975
KANSAS						
Burlington	Wolf Creek	1,150	PWR	CP 1977	Kansas Gas & Elec. Co.	1984
LOUISIANA						
Taft	Waterford Steam Electric Station	1,151	PWR	CP 1974	Louisiana Power & Light Co.	1983
St. Francisville	River Bend Station Unit 1	934	BWR	CP 1977	Gulf States Utilities Co.	1985
St. Francisville	River Bend Station Unit 2	934	BWR	CP 1977	Gulf States Utilities Co.	Indef.
MAINE						
Wiscasset	Maine Yankee Atomic Power	810	PWR	OL 1972	Maine Yankee Atomic Power Co.	1972
MARYLAND						
Lusby	Calvert Cliffs Nuclear Power Plant Unit 1	825	PWR	OL 1974	Baltimore Gas & Elec. Co.	1975
Lusby	Calvert Cliffs Nuclear Power Plant Unit 2	825	PWR	OL 1976	Baltimore Gas & Elec. Co.	1977
MASSACHUSETTS						
Rowe	Yankee Nuclear Power Station	175	PWR	OL 1960	Yankee Atomic Elec. Co.	1961
Plymouth	Pilgrim Station Unit 1	670	BWR	OL 1972	Boston Edison Co.	1972

Site	Plant	Capacity (Net MWe)	Type	Status	Utility	Commercial Operation
MICHIGAN						
Big Rock Point	Big Rock Point Nuclear Plant	64	BWR	OL 1962	Consumers Power Co.	1963
South Haven	Palisades Nuclear Power Station	635	PWR	OL 1971	Consumers Power Co.	1971
Lagoona Beach	Enrico Fermi Atomic Power Plant Unit 2	1,093	BWR	CP 1972	Detroit Power Co.	1983
Bridgman	Donald C. Cook Plant Unit 1	1,044	PWR	OL 1974	Indiana & Michigan Elec. Co.	1975
Bridgman	Donald C. Cook Plant Unit 2	1,082	PWR	OL 1977	Indiana & Michigan Elec. Co.	1978
Midland	Midland Nuclear Power Plant Unit 1	492	PWR	CP 1972	Consumers Power Co.	1984
Midland	Midland Nuclear Power Plant Unit 2	818	PWR	CP 1972	Consumers Power Co.	1984
MINNESOTA						
Monticello	Monticello Nuclear Generating Plant	536	BWR	OL 1970	Northern States Power Co.	1971
Red Wing	Prairie Island Nuclear Generating Plan Unit 1	503	PWR	OL 1973	Northern States Power Co.	1973
Red Wing	Prairie Island Nuclear Generating Plant Unit 2	500	PWR	OL 1974	Northern States Power Co.	1974
MISSISSIPPI						
Port Gibson	Grand Gulf Nuclear Station Unit 1	1,250	BWR	CP 1974	Mississippi Power & Light Co.	1982
Port Gibson	Grand Gulf Nuclear Station Unit 2	1,250	BWR	CP 1974	Mississippi Power & Light Co.	Indef.
Yellow Creek	Yellow Creek Unit 1	1,285	PWR	CP 1978	Tennessee Valley Authority	1990
Yellow Creek	Yellow Creek Unit 2	1,285	PWR	CP 1978	Tennessee Valley Autority	Indef.
MISSOURI						
Fulton	Callaway Plant Unit 1	1,150	PWR	CP 1976	Union Electric Co.	1982
NEBRASKA						
Fort Calhoun	Fort Calhoun Station Unit 1	478	PWR	OL 1973	Omaha Public Power District	1973
Brownville	Cooper Nuclear Station	764	BWR	OL 1974	Nebraska Public Power District	1974
NEW HAMPSHIRE						
Seabrook	Seabrook Nuclear Station Unit 1	1,198	PWR	CP 1976	Public Service of N.H.	1984
Seabrook	Seabrook Nuclear Station Unit 2	1,198	PWR	CP 1976	Public Service of N.H.	1986

Site	Plant	Capacity (Net MWe)	Type	Status	Utility	Commercial Operation
NEW JERSEY						
Toms River	Oyster Creek Nuclear Power Plant Unit 1	620	BWR	OL 1969	GPU Nuclear Corp.	1969
Salem	Salem Nuclear Generating Station Unit 1	1,079	PWR	OL 1976	Public Service Elec. & Gas Co.	1977
Salem	Salem Nuclear Generating Station Unit 2	1,104	PWR	OL 1981	Public Service Elec. & Gas Co.	1981
Salem	Hope Creek Generating Station Unit 1	1,067	BWR	CP 1974	Public Service Elec. & Gas Co.	1986
NEW YORK						
Indian Point	Indian Point Station Unit 2	864	PWR	OL 1971	Consolidated Edison Co.	1973
Indian Point	Indian Point Station Unit 3	965	PWR	OL 1975	Power Authority of the State of New York	1976
Scriba	Nine Mile Point Nuclear Station Unit 1	610	BWR	OL 1969	Niagara Mohawk Power Co.	1969
Scriba	Nine Mile Point Nuclear Station Unit 2	1,080	BWR	OL 1969	Niagara Mohawk Power Co.	1986
Ontario	R. E. Ginna Nuclear Power Plant Unit 1	470	PWR	OL 1969	Rochester Gas & Elec. Co.	1970
Brookhaven	Shoreham Nuclear Power Station	849	BWR	CP 1973	Long Island Lighting Co.	1983
Scriba	James A. FitzPatrick Nuclear Power Plant	810	BWR	OL 1974	Power Authority of the State of New York	1975
NORTH CAROLINA						
Southport	Brunswick Steam Electric Plant Unit 2	790	BWR	OL 1974	Carolina Power & Light Co.	1975
Southport	Brunswick Steam Electric Plant Unit 1	790	BWR	OL 1974	Carolina Power & Light Co.	1977
Cowans Ford Dam	Wm. B. McGuire Nuclear Station Unit 1	1,180	PWR	OL 1981	Duke Power Co.	1982
Cowans Ford Dam	Wm. B. McGuire Nuclear Station Unit 2	1,180	PWR	CP 1973	Duke Power Co.	1982
Bonsal	Shearon Harris Plant Unit 1	915	PWR	CP 1978	Carolina Power & Light Co.	1985
Bonsal	Shearon Harris Plant Unit 2	915	PWR	CP 1978	Carolina Power & Light Co.	1988
Davie Co.	Perkins Nuclear Station Unit 1	1,280	PWR	UR	Duke Power Co.	Indef.
Davie Co.	Perkins Nuclear Station Unit 2	1,280	PWR	UR	Duke Power Co.	Indef.
Davie Co.	Perkins Nuclear Station Unit 3	1,280	PWR	UR	Duke Power Co.	Indef.

Site	Plant	Capacity (Net MWe)	Type	Status	Utility	Commercial Operation
OHIO						
Oak Harbor	Davis-Besse Nuclear Power Station Unit 1	890	PWR	OL 1977	Toledo Edison-Cleveland Electric Illum. Co.	1977
Perry	Perry Nuclear Power Plant Unit 1	1,205	BWR	CP 1977	Toledo Edison-Cleveland Elec. Illum. Co.	1984
Perry	Perry Nuclear Power Plant Unit 2	1,205	BWR	CP 1977	Toledo Edison-Cleveland Elec. Illum. Co.	1988
Moscow	Wm. H. Zimmer Nuclear Power Station Unit 1	810	BWR	CP 1972	Cincinnati Gas & Elec. Co.	1983
OKLAHOMA						
Inola	Black Fox Unit 1	1,150	BWR	UR[3]	Public Service Co. of Oklahoma	Indef.
Inola	Black Fox Unit 2	1,150	BWR	UR[3]	Public Service Co. of Oklahoma	Indef.
OREGON						
Prescott	Trojan Nuclear Plant Unit 1	1,080	PWR	OL 1975	Portland General Elec. Co.	1976
Arlington	Pebble Springs Unit 1	1,260	PWR	UR	Portland General Elec. Co.	1998
Arlington	Pebble Springs Unit 2	1,260	PWR	UR	Portland General Elec. Co.	2001
PENNSYLVANIA						
Peach Bottom	Peach Bottom Atomic Power Station Unit 2	1,051	BWR	OL 1973	Philadelphia Elec. Co.	1974
Peach Bottom	Peach Bottom Atomic Power Station Unit 3	1,035	BWR	OL 1974	Philadephia Elec. Co.	1974
Pottstown	Limerick Generating Station Unit 1	1,065	BWR	CP 1974	Philadephia Elec. Co.	1985
Pottstown	Limerick Generating Station Unit 2	1,065	BWR	CP 1974	Philadephia Elec. Co.	1987
Shippingport	Beaver Valley Power Station Unit 1	810	PWR	OL 1976	Duquesne Light Co. Ohio Edison Co.	1976
Shippingport	Beaver Valley Power Station Unit 2	852	PWR	CP 1974	Duquesne Light Co. Ohio Edison Co.	1986
Goldsboro	Three Mile Island Nuclear Station, Unit 1	776	PWR	OL 1974	GPU Nuclear Corp.	1974
Goldsboro	Three Mile Island Nuclear[1] Station, Unit 2	906	PWR	OL 1978	GPU Nuclear Corp.	1978
Berwick	Susquehanna Steam Electric Station Unit 1	1,052	BWR	CP 1973	Pennsylvania Power & Light Co.	1983
Berwick	Susquehanna Steam Electric Station Unit 2	1,052	BWR	CP 1973	Pennsylvania Power & Light Co.	1984

[1]Shut down indefinitely (not included in summary)
[3]Limited work authorization issued

Site	Plant	Capacity (Net MWe)	Type	Status	Utility	Commercial Operation
SOUTH CAROLINA						
Hartsville	H. B. Robinson S.E. Plant Unit 2	665	PWR	OL 1970	Carolina Power & Light Co.	1971
Seneca	Oconee Nuclear Station Unit 1	860	PWR	OL 1973	Duke Power Co.	1973
Seneca	Oconee Nuclear Station Unit 2	860	PWR	OL 1973	Duke Power Co.	1974
Seneca	Oconee Nuclear Station Unit 3	860	PWR	OL 1974	Duke Power Co.	1974
Broad River	Virgil C. Summer Nuclear Station Unit 1	900	PWR	CP 1973	So. Carolina Elec. & Gas Co.	1981
Lake Wylie	Catawba Nuclear Station Unit 1	1,145	PWR	CP 1975	Duke Power Co.	1984
Lake Wylie	Catawba Nuclear Station Unit 2	1,145	PWR	CP 1975	Duke Power Co.	1985
Cherokee County	Cherokee Nuclear Station Unit 1	1,280	PWR	CP 1977	Duke Power Co.	Indef.
Cherokee County	Cherokee Nuclear Station Unit 2	1,280	PWR	CP 1977	Duke Power Co.	Indef.
Cherokee County	Cherokee Nuclear Station Unit 3	1,280	PWR	CP 1977	Duke Power Co.	Indef.
TENNESSEE						
Daisy	Sequoyah Nuclear Power Plant Unit 1	1,128	PWR	OL 1980	Tennessee Valley Authority	1981
Daisy	Sequoyah Nuclear Power Plant Unit 2	1,148	PWR	OL 1981	Tennessee Valley Authority	1982
Spring City	Watts Bar Nuclear Plant Unit 1	1,165	PWR	CP 1973	Tennessee Valley Authority	1983
Spring City	Watts Bar Nuclear Plant Unit 2	1,165	PWR	CP 1973	Tennessee Valley Authority	1983
Oak Ridge	Clinch River Breeder Reactor Plant[3]	350	LMFBR	UR	U.S. Government	1990
Hartsville	TVA Plant A Unit 1	1,205	BWR	CP 1977	Tennessee Valley Authority	1990
Hartsville	TVA Plant A Unit 2	1,205	BWR	CP 1977	Tennessee Valley Authority	1991
Hartsville	TVA Plant B Unit 1	1,205	BWR	CP 1977	Tennessee Valley Authority	Indef.
Hartsville	TVA Plant B Unit 2	1,205	BWR	CP 1977	Tennessee Valley Authority	Indef.
Phipps Bend	Phipps Bend Unit 1	1,220	BWR	CP 1978	Tennessee Valley Authority	1993
Phipps Bend	Phipps Bend Unit 2	1,220	BWR	CP 1978	Tennessee Valley Authority	Indef.
TEXAS						
Glen Rose	Comanche Peak Steam Electric Station Unit 1	1,150	PWR	CP 1974	Texas Utilites	1981

[3]Indefinitely postponed.

Site	Plant	Capacity (Net MWe)	Type	Status	Utility	Commercial Operation
TEXAS — (Continued)						
Glen Rose	Comanche Peak Steam Electric Station Unit 2	1,150	PWR	CP 1974	Texas Utilities	1985
Wallis	Allens Creek Unit 1	1,150	BWR	UR	Houston Lighting & Power Co.	Indef.
Bay City	South Texas Nuclear Project Unit 1	1,250	PWR	CP 1975	Houston Lighting & Power Co.	1985
Bay City	South Texas Nuclear Project Unit 2	1,250	PWR	CP 1975	Houston Lighting & Power Co.	Indef.
VERMONT						
Vernon	Vermont Yankee Generating Station	504	BWR	OL 1972	Vermont Yankee Nuclear Power Corp.	1972
VIRGINIA						
Gravel Neck	Surry Power Station Unit 1	775	PWR	OL 1972	Va. Electric & Power Co.	1972
Gravel Neck	Surry Power Station Unit 2	775	PWR	OL 1973	Va. Electric & Power Co.	1973
Mineral	North Anna Power Station Unit 1	865	PWR	OL 1976	Va. Electric & Power Co.	1978
Mineral	North Anna Power Station Unit 2	890	PWR	OL 1980	Va. Electric & Power Co.	1980
Mineral	North Anna Power Station Unit 3	907	PWR	CP 1974	Va. Electric & Power Co.	1989
WASHINGTON						
Richland	WPPSS No. 1 (Hanford)	1,267	PWR	CP 1975	Wash. Public Power Supply System	1986
Richland	WPPSS No. 2 (Handford)	1,103	BWR	CP 1973	Wash. Public Power Supply System	1983
Satsop	WPPSS No. 3	1,242	PWR	CP 1978	Wash. Public Power Supply System	1986
Sedro Wooley	Skagit/Hanford Unit 1	1,277	BWR	UR	Puget Sound Power & Light Co.	Indef.
Sedro Wooley	Skagit/Hanford Unit 2	1,277	BWR	UR	Puget Sound Power & Light Co.	Indef.
Sedro Wooley	Skagit Nuclear Power Project Unit 2	1,277	BWR	UR	Puget Sound Power & Light Co.	Indef.
WISCONSIN						
Genoa	Genoa Nuclear Generating Station (LaCrosse)	48	BWR	OL 1967	Dairyland Power Coop.	1969
Two Creeks	Point Beach Nuclear Plant Unit 1	495	PWR	OL 1970	Wisconsin Michigan Power Co.	1970
Two Creeks	Point Beach Nuclear Plant Unit 2	495	PWR	OL 1971	Wisconsin Michigan Power Co.	1972
Kewanee	Kewanee Nuclear Power Plant	512	PWR	OL 1973	Wisconsin Public Svc. Corp.	1974

INDEX

☆ U. S. GOVERNMENT PRINTING OFFICE : 1982 377-733