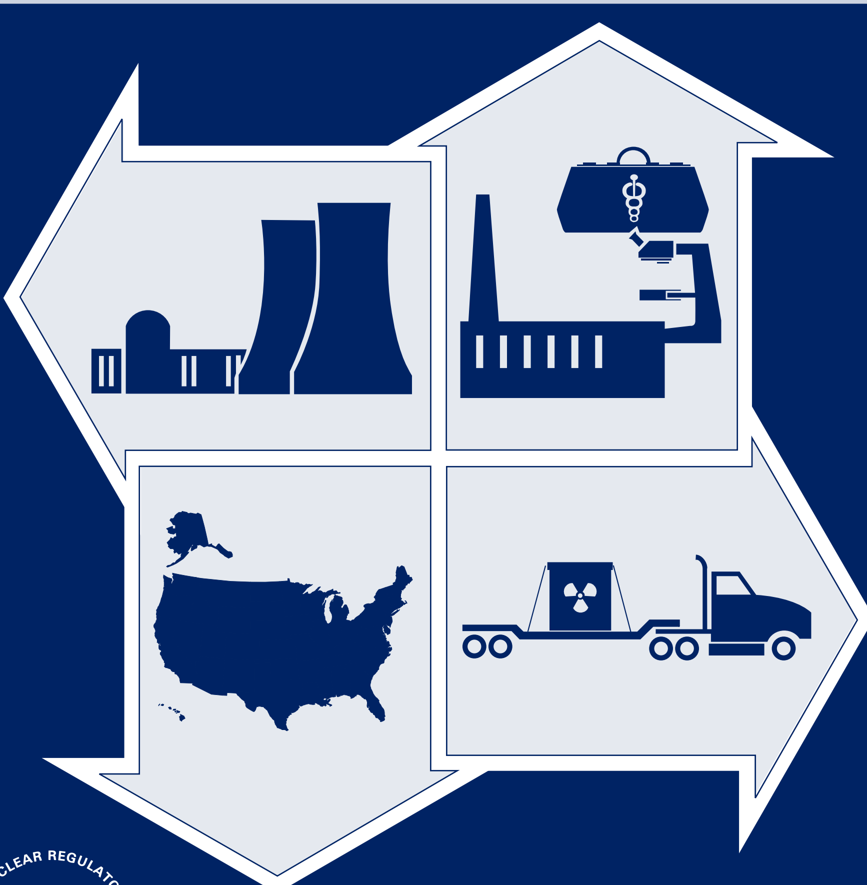
UNITED STATES NUCLEAR REGULATORY COMMISSION

INFORMATION DIGEST



Office of the Chief Financial Officer

2001 Edition

NUREG-1350, Volume 13

AVAILABILITY OF REFERENCE MATERIALS IN NRC PUBLICATIONS

NRC Reference Material

As of November 1999, you may electronically access NUREG-series publications and other NRC records at NRC's Public Electronic Reading Room at www.nrc.gov/NRC/ADAMS/index.html. Publicly released records include, to name a few, NUREG-series publications; *Federal Register* notices; applicant, licensee, and vendor documents and correspondence; NRC correspondence and internal memoranda; bulletins and information notices; inspection and investigative reports; licensee event reports; and Commission papers and their attachments.

NRC publications in the NUREG series, NRC regulations, and *Title 10, Energy*, in the *Code of Federal Regulations* may also be purchased from one of these two sources.

1. The Superintendent of Documents
   U.S. Government Printing Office
   Mail Stop SSOP
   Washington, DC 20402–0001
   Internet: bookstore.gpo.gov
   Telephone: 202–512–1800
   Fax: 202–512–2250
2. The National Technical Information Service
   Springfield, VA 22161–0002
   www.ntis.gov
   1–800–553–6847 or, locally, 703–605–6000

A single copy of each NRC draft report for comment is available free, to the extent of supply, upon written request as follows:

Address: Office of the Chief Information Officer,
Reproduction and Distribution Services Section
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001
E-mail: DISTRIBUTION@nrc.gov
Facsimile: 301–415–2289

Some publications in the NUREG series that are posted at NRC's Web site address www.nrc.gov/NRC/NUREGS/indexnum.html are updated periodically and may differ from the last printed version. Although references to material found on a Web site bear the date the material was accessed, the material available on the date cited may subsequently be removed from the site.

Non-NRC Reference Material

Documents available from public and special technical libraries include all open literature items, such as books, journal articles, and transactions, *Federal Register* notices, Federal and State legislation, and congressional reports. Such documents as theses, dissertations, foreign reports and translations, and non-NRC conference proceedings may be purchased from their sponsoring organization.

Copies of industry codes and standards used in a substantive manner in the NRC regulatory process are maintained at—

The NRC Technical Library
Two White Flint North
11545 Rockville Pike
Rockville, MD 20852–2738

These standards are available in the library for reference use by the public. Codes and standards are usually copyrighted and may be purchased from the originating organization or, if they are American National Standards, from—

American National Standards Institute
11 West 42nd Street
New York, NY 10036–8002
www.ansi.org
212–642–4900

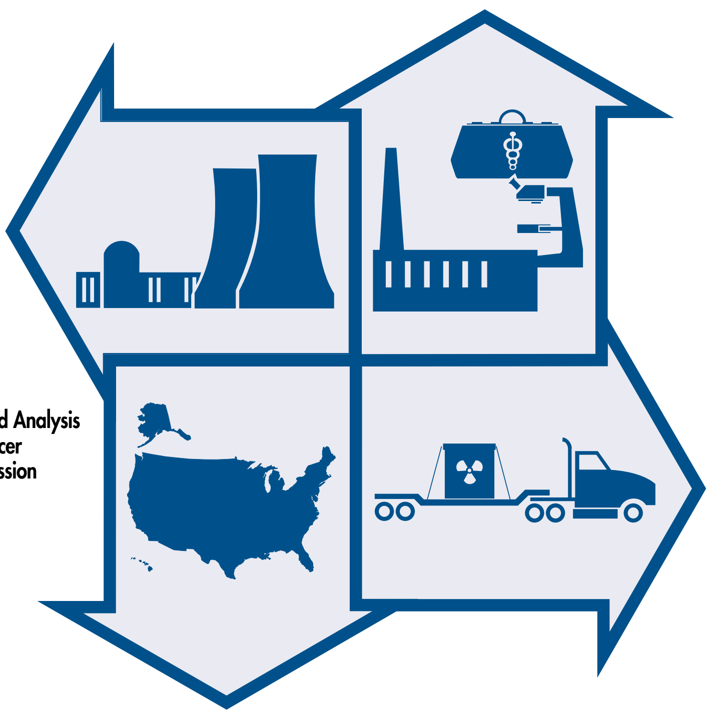
Legally binding regulatory requirements are stated only in laws; NRC regulations; licenses, including technical specifications; or orders, not in NUREG-series publications. The views expressed in contractor-prepared publications in this series are not necessarily those of the NRC.

The NUREG series comprises (1) technical and administrative reports and books prepared by the staff (NUREG–XXXX) or agency contractors (NUREG/CR–XXXX), (2) proceedings of conferences (NUREG/CP–XXXX), (3) reports resulting from international agreements (NUREG/IA–XXXX), (4) brochures (NUREG/BR–XXXX), and (5) compilations of legal decisions and orders of the Commission and Atomic and Safety Licensing Boards and of Directors' decisions under Section 2.206 of NRC's regulations (NUREG–0750).

UNITED STATES NUCLEAR REGULATORY COMMISSION

INFORMATION DIGEST

2001 Edition



NUREG-1350
Volume 13

Manuscript Completed:
May 2001

Date Published:
June 2001

Division of Planning, Budget, and Analysis
Office of the Chief Financial Officer
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

Abstract

The Nuclear Regulatory Commission Information Digest (digest) provides a summary of information about the U.S. Nuclear Regulatory Commission (NRC), NRC's regulatory responsibilities, NRC licensed activities, and general information on domestic and worldwide nuclear energy. The digest, published annually, is a compilation of nuclear- and NRC-related data and is designed to serve as a quick reference to major facts about the agency and the industry it regulates. In general, the data cover 1978 through 2000, with exceptions noted. Information on generating capacity and average capacity factor for operating U.S. commercial nuclear power reactors is obtained from the NRC, as well as from various industry sources. Industry source information is reviewed by the NRC for consistency only and no independent validation and/or verification is performed.

Comments and/or suggestions on the data presented are welcomed and should be directed to JoAnne M. Johnson, United States Nuclear Regulatory Commission, Office of the Chief Financial Officer, Division of Planning, Budget, and Analysis, Washington, DC 20555-0001. For detailed and complete information about tables and figures, refer to the source publications.

Contents

(Continued)

Figures

(Continued)

Figures *(Continued)*

Figures *(Continued)*

Tables

(Continued)

Tables *(Continued)*

For More Information...

The U. S. Nuclear Regulatory Commission (NRC) offers a variety of programs to make the agency, licensee, and nuclear industry information available to the public.

The World Wide Web site for the Nuclear Regulatory Commission (www.nrc.gov) contains a wide variety of information about the agency's regulatory programs. The areas covered include the licensing of power and research reactors, nuclear materials, and radioactive waste; agency radiation protection and emergency response activities; and the background and current status of all ongoing regulatory initiatives. The site also provides access to many publicly available agency documents and information collections; press releases; organizational charts and descriptions; headquarters and regional locations and addresses; the agency telephone directory; current agency regulations; planning and financial management reports; and areas devoted specifically to public comments and participation in the agency's regulatory process. To help the public locate information, the site provides an alphabetically arranged topical index of contents, a search engine, a site contents page arranged by program area, and a text menu of site contents. The agency also welcomes comments on its site. They can be submitted to *nrcweb@nrc.gov*.

The Public Electronic Reading Room on the NRC Web site at <www.nrc.gov> allows the public to use the Internet to search for any of the records that NRC has already released to the public. This site uses NRC's Agencywide Documents Access and Management System (ADAMS) to search two electronic libraries: the Public Legacy Library and the Publicly Available Records System (PARS) Library. The Public Legacy Library currently has a selection of bibliographic descriptions and some full text files of NRC records released to the public *prior* to Fall 1999. Records in this library were copied from the NRC Bibliographic Retrieval System (BRS) and the Nuclear Document System (NUDOCS), the two systems previously used by the public to search for NRC records. The BRS will remain available for searching until all the records are in the Legacy Library. The other library, the Publicly Available Records System (PARS) Library, contains all NRC publicly available records released *since* Fall 1999. The records in the PARS Library are in, both, full text and image and the public can perform full text searches of the database, as well as view, download, and print the files from there.

The NRC Public Document Room (PDR) at NRC headquarters in Rockville, Maryland (OWFN 01-F21), has a complete collection of over two million NRC documents released prior to the Fall of 1999 that are still retained as agency documents. These documents are in storage and can be recalled by the public upon request. The public may view documents at the PDR and there are reference librarians available to help in identifying, retrieving, organizing, and evaluating NRC documents from various resources and formats, including the Public Electronic Reading Room. Members of the public may also access the Electronic Read-

(Continued)

For More Information *(Continued)*

ing Room libraries from computer terminals in the PDR. The PDR also provides reproduction services and, for a fee, the public can order copies of any of the records in the PDR, the Legacy, and the PARS libraries.

Records indexed in the Legacy Library are maintained by the PDR in paper, microfiche or both. Additional microfiche collections of NRC documents released between January 1981 and the fall of 1999 are also maintained in certain libraries under the Government Printing Office's Federal Depository Library Program (FDLP), and in some other libraries throughout the country. For more information, contact the PDR by telephone at their toll-free number (800) 397-4209, or their local number (301) 415-4737. The PDR may also be contacted by Telecommunication Device for the Deaf (TDD) (301) 415-8322 or toll-free at (800) 635-4512; Internet e-mail <pdr@nrc.gov>; FAX (301) 415-3548; or U.S. Mail: U.S. Nuclear Regulatory Commission, PDR, Washington, DC 20555-0001.

The public may also use the Freedom of Information Act (FOIA) and Privacy Act (PA) to obtain information that the NRC has not made publicly available. A FOIA or PA request must be submitted to NRC in writing to: FOIA/PA Officer, U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001. The FOIA requires the NRC to give the public access to records unless the information is exempt under the FOIA from disclosure (e.g., classified national security, business proprietary, personal privacy, or investigative). A request must specifically state that it is a FOIA request, and it must adequately describe the specific records or type of records sought so that the NRC staff can conduct a search for the requested records by exerting a reasonable amount of effort. Disclosure will be made by providing a copy of the documents requested or by making copies of the documents requested available in the NRC Headquarters Public Document Room. Detailed information concerning NRC policies and procedures for obtaining access to information under the FOIA and PA is available in Title 10, Part 9, of the Code of Federal Regulations, which are available in any public library. Information can also be found on the Internet at the FOIA/PA homepage reached through the "FOIA" link at the NRC Web site <www.nrc.gov>.

The agency makes the majority of its regulatory and technical publications available for sale at both the Government Printing Office and the National Technical Information Service. Copies of agency publications are also routinely sent to U.S. Depository Libraries throughout the United States and the Commonwealth of Puerto Rico.

The NRC announces the schedules of selected meetings open to the public. Recorded information about open meetings of the following organizations is available at the agency headquarter's numbers listed.

Advisory Committee on Nuclear Waste
(301) 415-5024

Advisory Committee on Reactor Safeguards
(301) 415-5024

The Commission (301) 415-1292

NRC/Department of Energy Meetings
(800) 841-0286

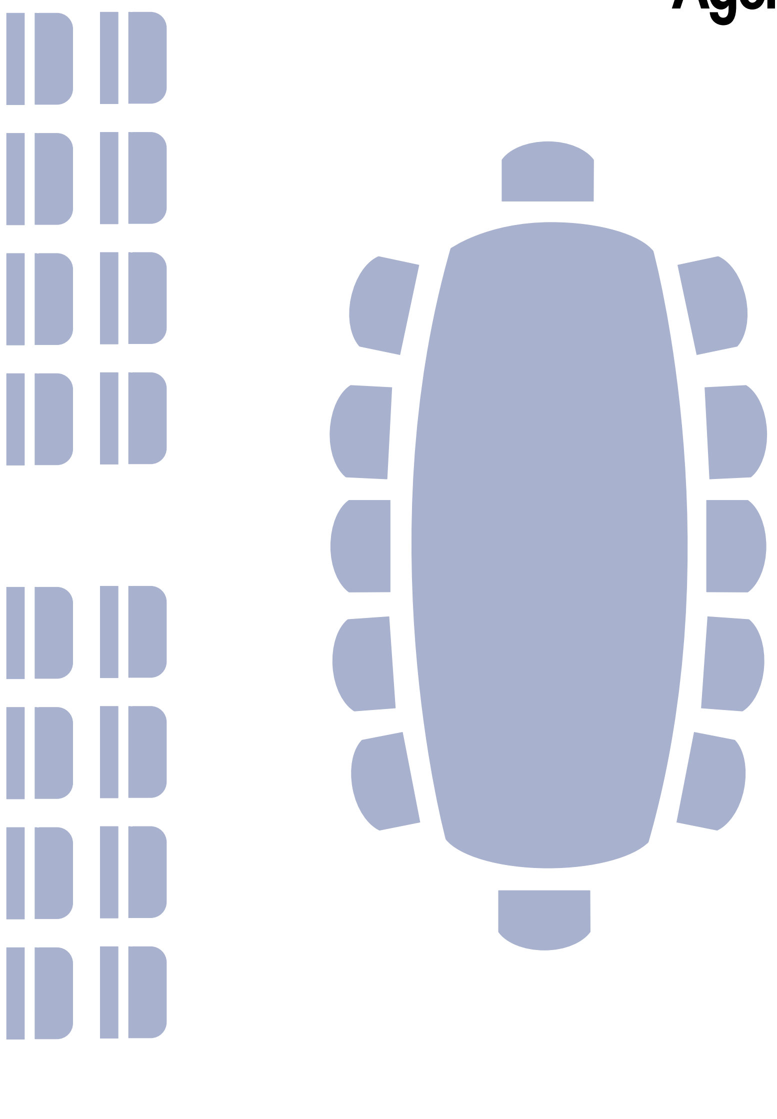
Public Notice of NRC meetings open to the public will be made via the Internet from the NRC Web site at http://www.nrc.gov/PUBLIC/meet.html.

Open Predecisional Enforcement Conferences are also announced on the toll-free telephone recording and electronic bulletin board as are public Commission and Advisory Committee meetings and Atomic Safety and Licensing Board hearings that are published in the Federal Register. A daily posting of upcoming open meetings is also available on the NRC World Wide Web at www.nrc.gov/nrc/public/meet.html.

The NRC is required to answer inquires from small entities concerning information on, advice about, and compliance with the statutes and regulations that affect them. The NRC is expected to interpret and apply the law, or regulations implementing the law, to specific sets of facts that are specified by the small entity. The NRC is required to establish a program to receive and respond to these types of inquiries. To help small entities obtain information quickly, the NRC has established a toll-free telephone number at (800) 368-5642.

To learn more about these and other sources of public information about agency activities send for a free copy of the booklet, "Citizen's Guide to U.S. Nuclear Regulatory Commission Information" (NUREG/BR-0010, Rev. 3), U.S. Nuclear Regulatory Commission, ATTN: Reproduction and Distribution Services Branch, Washington, DC 20555-0001.

NRC as a Regulatory Agency



Mission, Goals, and Statutory Authority

Mission

The mission of the U.S. Nuclear Regulatory Commission (NRC) is to regulate the Nation's civilian use of byproduct, source, and special nuclear materials to ensure adequate protection of public health and safety, to promote the common defense and security, and to protect the environment. The NRC's scope of responsibility includes regulation of commercial nuclear power plants; research, test, and training reactors; fuel cycle facilities; medical, academic, and industrial uses of nuclear materials; and the transport, storage, and disposal of nuclear materials and wastes.

Strategic and Performance Goals

The NRC has developed strategic goals consistent with its mission. These strategic goals are supported by performance goals, which represent outcomes the NRC plans to achieve over the period covered by the strategic plan (FY 2000 - FY 2005).

Strategic Goals: The NRC will conduct an effective regulatory program that allows our Nation to use nuclear materials safely for civilian purposes and in a manner that protects the public and the environment by working to achieve the following strategic goals:

- Prevent radiation-related deaths and illnesses, promote the common defense and security, and protect the environment in the use of civilian nuclear reactors. (Nuclear Reactor Safety)
- Prevent radiation-related deaths and illnesses, promote the common defense and security, and protect the environment in the use of source, byproduct, and special nuclear material. (Nuclear Materials Safety)
- Prevent significant adverse impacts from radioactive waste to the current and future public health and safety and the environment, and promote the common defense and security. (Nuclear Waste Safety)
- Support U.S. interests in the safe and secure use of nuclear materials and in nuclear nonproliferation. (International Nuclear Safety Support)

The safe and secure use of nuclear materials for civilian purposes is the responsibility of NRC licensees[1] and Agreement State licensees, and the regulatory oversight of licensees is the responsibility of the NRC and the Agreement States. Thus, achieving these strategic goals requires the collective efforts of the NRC, the Agreement States, and licensees.

Performance Goals: The protection of public health and safety remains paramount among our goals and will drive our decisions. However, the NRC recognizes that it must consider other key considerations, including the

[1] "Licensees" as used in this strategic plan include persons required to be licensed (as defined in Section 11(s) of the Atomic Energy Act, as amended) as well as, where appropriate, applicants for licenses, certificate of compliance holders and applicants for certificates of compliance, contractors (including subcontractors, suppliers, consultants, and vendors), and all persons subject to NRC's regulatory jurisdiction.

effect of our decisions on the public's trust in our regulatory process, the industries we regulate, and our own effectiveness and efficiency. The agency has established performance goals to support the strategic goals for the Nuclear Reactor Safety, Nuclear Materials Safety, and Nuclear Waste Safety arenas: maintain safety, protect the environment and the common defense and security; increase public confidence; make NRC activities and decisions more effective, efficient, and realistic; and reduce unnecessary regulatory burden.

Collectively, these outcome-based performance goals are the key contributors to the strategic goals. The performance goals and their associated measures reflect the agency's move toward more outcome-based performance. Agency work (programs and activities) is being planned, managed, monitored, and assessed according to their contribution to the achievement of these performance goals, with public health and safety as the primary consideration. This assessment will form the basis to identify whether existing programs are successfully achieving the goals or whether revised or new initiatives are needed. Resources will accordingly be allocated to the work that is necessary to achieve the performance goals. The strategic plan is being used as one of the primary tools to communicate and institutionalize these changes.

NRC concluded the triennial update of the Fiscal Year 2000-2005 Strategic Plan and provided it to OMB and Congress on September 29, 2000. The Strategic Plan is published as NUREG-1614, Vol. 2, Part 1, and is available on the Web at http://www.nrc.gov/NRC/NUREGS/SR1614/V2/index.html

Corporate Management Strategies

The NRC has established overarching corporate management strategies that help us work together more effectively, both within and across strategic arenas. These strategies also help the support offices better serve their customers within the agency to help them achieve the agency's goals. Our corporate management strategies describe the means by which we will conduct business to successfully implement the Strategic Plan and accomplish the agency's mission.

- Employ Innovative and Sound Business Practices;
- Sustain a High-Performing, Diverse Workforce;
- Provide Proactive Information Technology and Information Management Services; and
- Communicate Strategic Change.

Statutory Authority

The NRC was created as an independent agency by the Energy Reorganization Act of 1974, which abolished the Atomic Energy Commission (AEC) and moved the AEC's regulatory function to the NRC. This act, along with the Atomic Energy Act of 1954, as amended, provides the foundation for regulation of the Nation's commercial

Mission, Goals, and Statutory Authority *(Continued)*

nuclear power industry. NRC regulations are issued under the *United States Code of Federal Regulations* (CFR) Title 10, Chapter 1. Principal statutory authorities that govern NRC's work follow:

- Atomic Energy Act of 1954, as amended
- Energy Reorganization Act of 1974, as amended
- Uranium Mill Tailings Radiation Control Act of 1978, as amended
- Nuclear Non-Proliferation Act of 1978
- Low-Level Radioactive Waste Policy Act of 1980
- West Valley Demonstration Project Act of 1980
- Nuclear Waste Policy Act of 1982
- Low-Level Radioactive Waste Policy Amendments Act of 1985
- Diplomatic Security and Anti-Terrorism Act of 1986
- Nuclear Waste Policy Amendments Act of 1987
- Solar, Wind, Waste and Geothermal Power Production Incentives Act of 1990
- Energy Policy Act of 1992
- Low-level Radioactive Waste Policy Amendments Act of 1995

The NRC and its licensees share a common responsibility to protect public health and safety. Federal regulations and the NRC regulatory program are important elements in the protection of the public. NRC licensees, however, have the primary responsibility for the safe use of nuclear materials.

Principles of Good Regulation

The NRC adheres to the following Principles of Good Regulation:

- **Independence** — Nothing but the highest possible standards of ethical performance and professionalism should influence regulation. However, independence does not imply isolation. The NRC will seek all available facts and opinions from licensees and other interested members of the public. The many and possibly conflicting public interests involved must be considered. Final decisions must be based on objective, unbiased assessments of all information and must be documented with reasons explicitly stated.

- **Openness** — Nuclear regulation is the public's business, and it must be transacted publicly and candidly. The public must be informed about and have the opportunity to participate in the regulatory processes as required by law. Open channels of communication must be maintained with Congress, other Government agencies, licensees, and the public, as well as with the international nuclear community.

- **Efficiency** — The American taxpayer, the rate-paying consumer, and licensees are all entitled to the best possible management and administration of regulatory activities. The highest technical and managerial competence is required and must be a constant agency goal. NRC must establish means to evaluate and continually upgrade its regulatory capabilities. Regulatory activities should be consistent with the degree of risk reduction they achieve. Where several effective alternatives are available, the option which minimizes the use of resources should be adopted. Regulatory decisions should be made without undue delay.

- **Clarity** — Regulations should be coherent, logical, and practical. There should be a clear nexus between regulations and agency goals and objectives, whether explicitly or implicitly stated. Agency positions should be readily understood and easily applied.

- **Reliability** — Regulations should be based on the best available knowledge from research and operational experience. Systems interactions, technological uncertainties, and the diversity of licensees and regulatory activities must all be taken into account so that risks are maintained at an acceptably low level. Once established, regulation should be perceived by all stakeholders to be reliable and not unjustifiably in a state of transition. Regulatory actions should always be fully consistent with written regulations and should be promptly, fairly, and decisively administered so as to lend stability to the nuclear operational and planning processes.

Major Activities

The NRC fulfills its responsibilities through a system of licensing and regulatory activities that include the following:

- Licensing the design, construction, operation, and decommissioning of nuclear plants and other nuclear facilities, such as nuclear fuel cycle facilities, uranium enrichment facilities, and test and research reactors
- Licensing the possession, use, processing, handling, and exporting of nuclear materials
- Licensing the siting, design, construction, operation, and closure of low-level radioactive waste disposal sites under NRC jurisdiction and the construction, operation, and closure of the geologic repositories for high-level radioactive waste
- Licensing the operators of civilian nuclear reactors
- Inspecting licensed and certified facilities and activities
- Certifying privatized uranium enrichment facilities
- Conducting research on light-water reactor safety to gain independent expertise and information for making timely regulatory judgments and for anticipating problems of potential safety significance
- Developing and implementing rules and regulations that govern licensed nuclear activities
- Investigating nuclear incidents and allegations concerning any matter regulated by the NRC
- Enforcing NRC regulations and the conditions of NRC licenses
- Conducting public hearings on matters of nuclear and radiological safety, environmental concern, common defense and security, and antitrust matters
- Developing effective working relationships with the States regarding reactor operations and the regulation of nuclear material
- Maintaining the NRC Incident Response Program, including the NRC Operations Center
- Collecting, analyzing, and disseminating information about the operational safety of commercial nuclear power reactors and certain nonreactor activities

Organizations and Functions

The NRC's Commission is composed of five members, with one member designated by the President to serve as Chairman. Each member is appointed by the President, by and with the advice and consent of the Senate, and serves a term of five years. The members' terms are staggered so that one Commissioner's term expires on June 30th every year. No more than three members of the Commission can be from the same political party. As of May 2001, the Commission is composed of the following members:

Commissioner	Expiration of Term
Richard A. Meserve, Chairman	June 2004
Greta Joy Dicus	June 2003
Nils J. Diaz	June 2001
Edward McGaffigan, Jr.	June 2005
Jeffrey S. Merrifield	June 2002

The Chairman serves as the principal executive officer and official spokesman of the Commission. The Executive Director for Operations carries out the program policies and decisions made by the Commission.

The NRC's major program offices follow.

- **Nuclear Reactor Regulation** — Directs all licensing and inspection activities associated with the design, construction, and operation of nuclear power reactors and nonpower reactors

- **Nuclear Material Safety and Safeguards —** Directs all licensing inspection and environmental activities associated with nuclear fuel cycle facilities, uses of nuclear materials, storage and transport of nuclear materials, safeguarding of nuclear materials, management and disposal of low-level and high-level radioactive nuclear wastes, and decontamination and decommissioning of facilities and sites

- **Nuclear Regulatory Research** — Provides independent expertise and information for making timely regulatory judgments, anticipating problems of potential safety significance, and resolving safety issues and provides support for developing technical regulations and standards. Collects, analyzes, and disseminates information about the operational safety of commercial nuclear power reactors and certain nuclear materials activities

- **Regional Offices** — Conduct inspection, enforcement, investigation, licensing, and emergency response programs for nuclear reactors, fuel facilities, and materials licensees within regional boundaries that the Headquarters' offices originate

- **Office of the Chief Information Officer** — Responsible for the strategic use of information technology as a management tool across a spectrum of agency activities and for an agency-wide approach to information management, capital planning and

Organizations and Functions *(Continued)*

performance-based management of information technology, and information management service functions

- **Office of the Chief Financial Officer** — Responsible for NRC's Planning, Budgeting and Performance Management process and for all of the NRC's financial management activities

- **Inspector General** — Provides the Commission with an independent review and appraisal of NRC programs and operations to ensure their effectiveness, efficiency, and integrity

Figure 1 is an organization chart of the NRC.

NRC Locations

Headquarters:

Rockville, Maryland
301-415-7000

Operations Center:

Rockville, Maryland
301-816-5100

The NRC maintains an Operations Center that is a focal point for NRC communications with its licensees, State agencies, and other Federal agencies concerning operating events in the commercial nuclear sector. The Operations Center is staffed 24 hours a day by NRC operations officers.

Regional Offices:

The NRC has four regional offices located throughout the United States as illustrated in Figure 2.

Region I:
King of Prussia, Pennsylvania
610-337-5000

Region II:
Atlanta, Georgia
404-562-4400

Region III:
Lisle, Illinois
630-829-9500

Region IV:
Arlington, Texas
817-860-8100

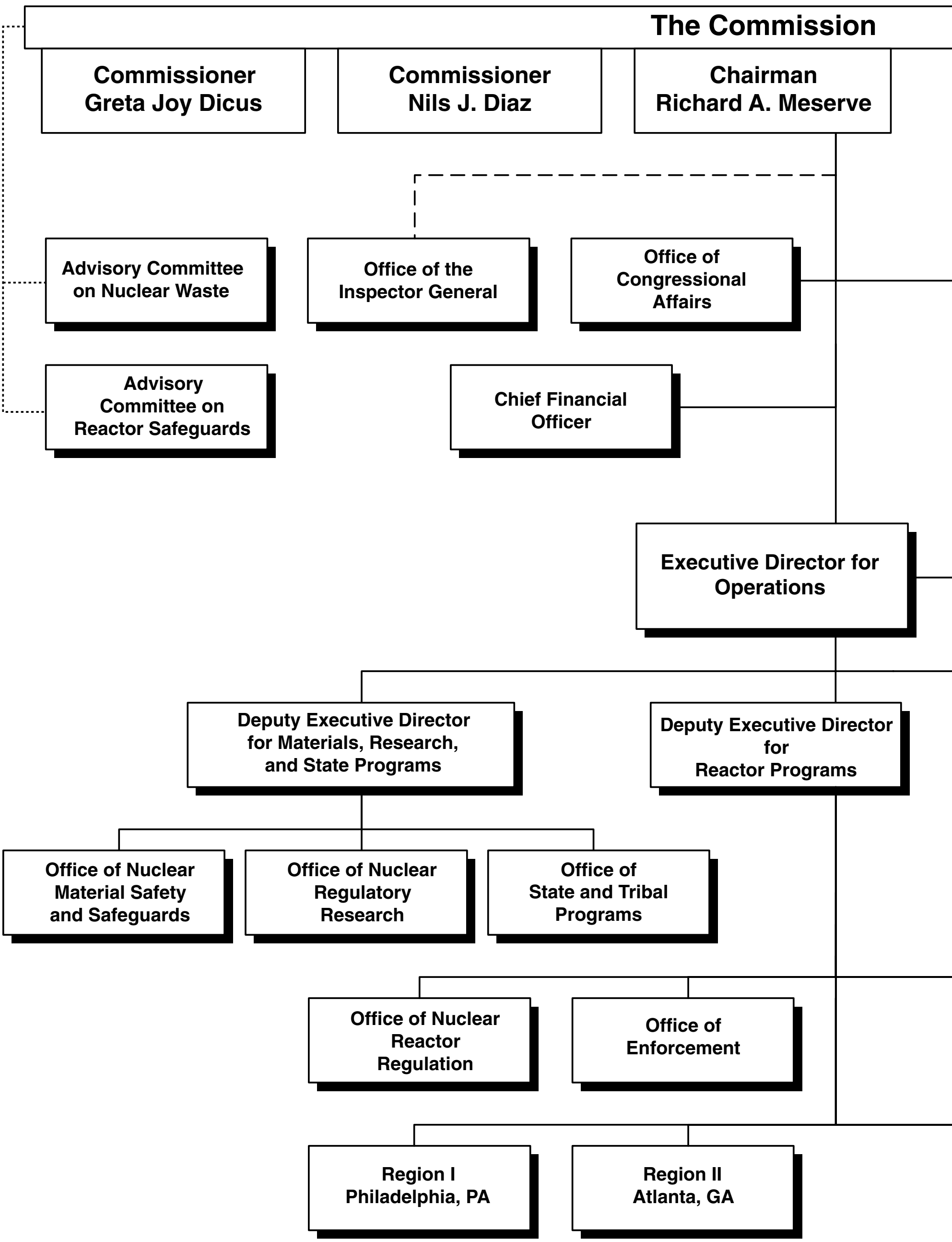
Resident Sites:

At least two NRC resident inspectors who report to the appropriate regional office are located at each nuclear power reactor site. (Refer to Figure 17 for a map of the U.S. commercial nuclear power reactor sites.)

Technical Training Center:

Chattanooga,Tennessee
423-855-6500

Figure 1. **U.S. Nuclear Regulatory Commission Organization Chart**



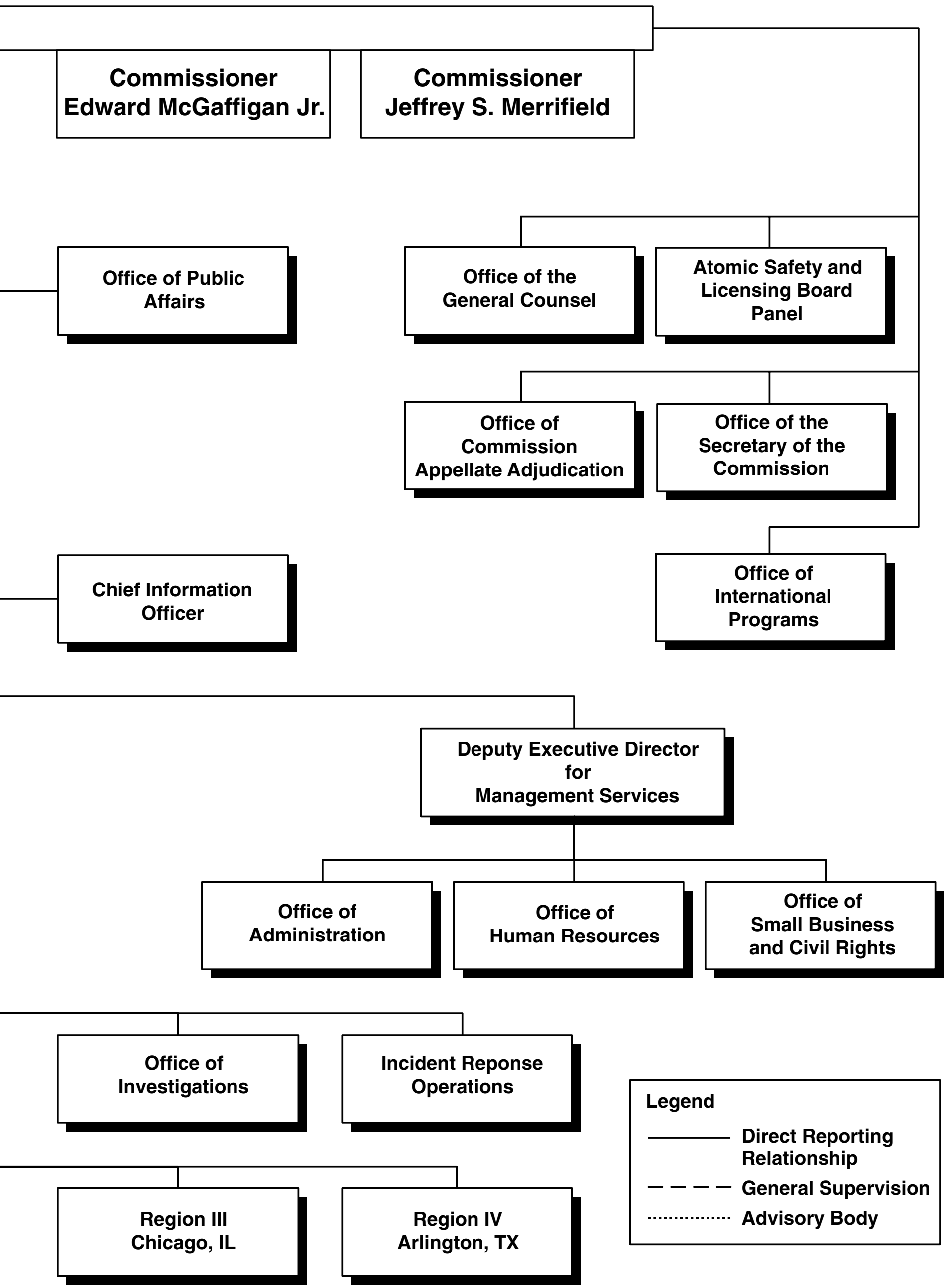
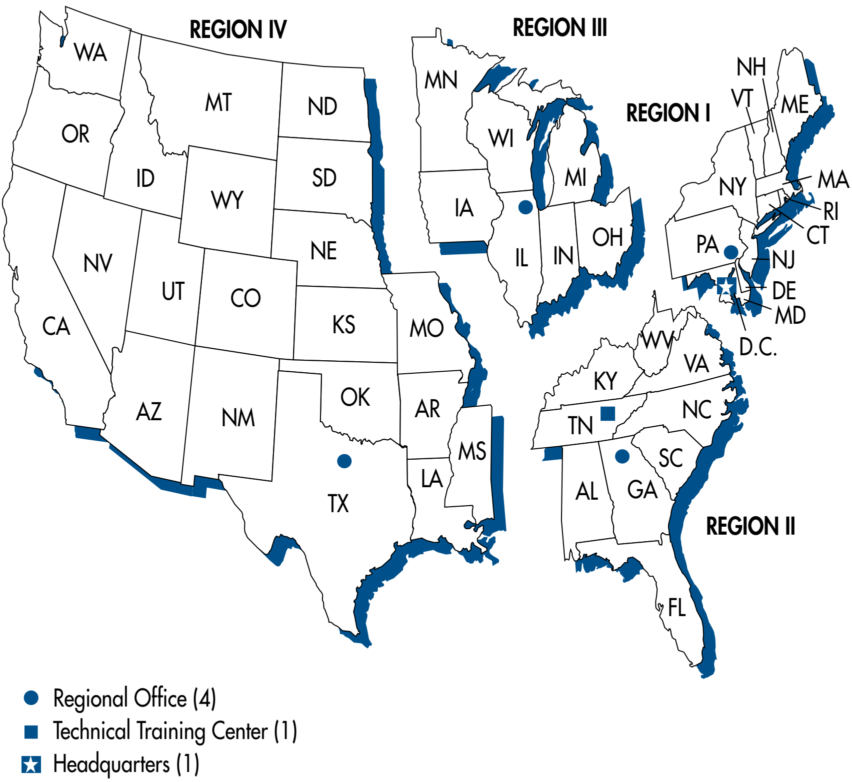

Commissioner
Edward McGaffigan Jr.
Commissioner
Jeffrey S. Merrifield
Office of Public Affairs
Office of the General Counsel
Atomic Safety and Licensing Board Panel
Office of Commission Appellate Adjudication
Office of the Secretary of the Commission
Chief Information Officer
Office of International Programs
Deputy Executive Director for Management Services
Office of Administration
Office of Human Resources
Office of Small Business and Civil Rights
Office of Investigations
Incident Reponse Operations
Region III
Chicago, IL
Region IV
Arlington, TX
Legend
Direct Reporting Relationship
General Supervision
Advisory Body

Figure 2. **NRC Regions**



Note: Alaska and Hawaii are included in Region IV.
Source: Nuclear Regulatory Commission

NRC Fiscal Year 2001 Resources

Appropriation:

The NRC was appropriated $487.3 million for Fiscal Year (FY) 2001. The NRC's FY 2001 personnel ceiling is 2,763 full-time equivalent (FTE) staff.

The NRC allocates funds and staff to the following strategic arenas (see Figure 3):

- Nuclear Reactor Safety
- Nuclear Materials Safety
- Nuclear Waste Safety
- International Nuclear Safety Support
- Management and Support

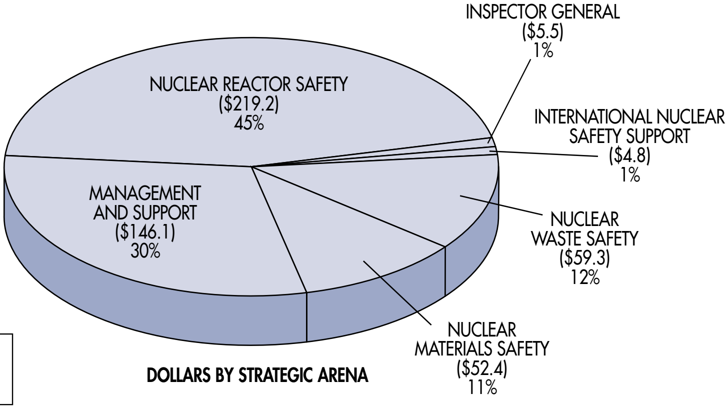
The Office of the Inspector General (OIG) is provided its own appropriation, the amount of which is included in the NRC appropriation.

Civil Penalties:

The NRC's enforcement program supports the agency's overall safety mission in protecting the public and the environment. Consistent with that purpose, enforcement action is used as a deterrent to emphasize the importance of compliance with regulatory requirements and to encourage prompt identification and prompt, comprehensive correction of violations. The NRC enforcement program is governed by the NRC Enforcement Policy, published as NUREG-1600. Three primary enforcement sanctions are available: notices of violation; civil penalties; and orders to modify, suspend, or revoke licenses. The NRC ranks violations according to their level of severity. Severity levels range from Severity Level I for the most significant violations to Severity Level IV for those less serious. Civil penalties are considered for Severity Level III violations and are normally assessed for Severity Level I and II violations and knowing and conscious violations of the reporting requirements of Section 206 of the Energy Reorganization Act. The NRC imposes different levels of civil penalties based on a combination of the type of licensed activity, the type of licensee, the severity level of the violation, and other criteria, including identification, corrective action, and discretion. In FY 2000, approximately 450 thousand dollars in civil penalties was assessed. These civil penalties are deposited in the U.S. Treasury and are not used by the NRC.

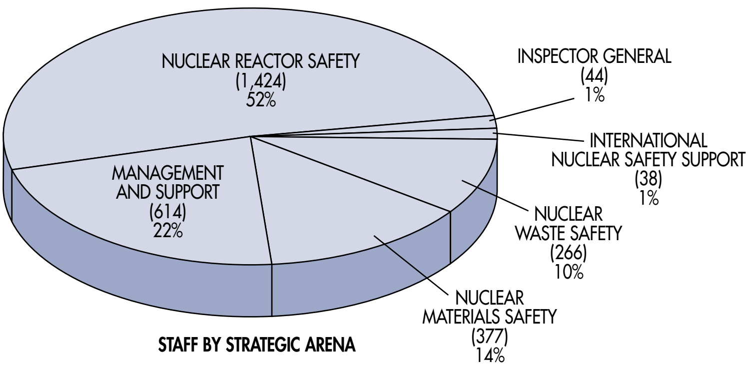
Source: Nuclear Regulatory Commission

Figure 3. **Distribution of NRC FY 2001 Budget Authority (Dollars in Millions) and Staff**



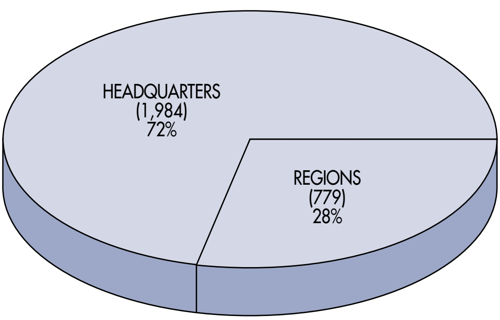
Total Authority: $487.3 Million

DOLLARS BY STRATEGIC ARENA



STAFF BY STRATEGIC ARENA

Total Staff: 2,763 FTEs



STAFF BY LOCATION

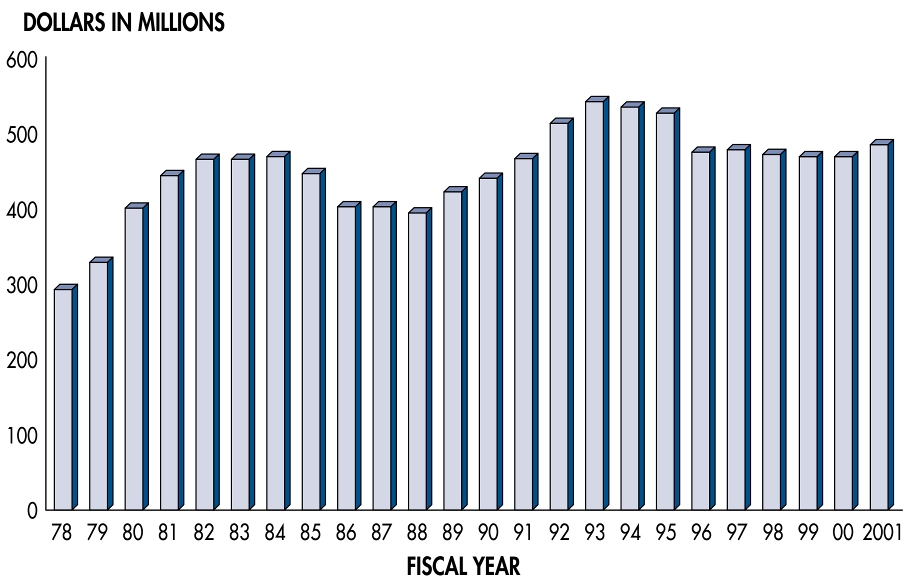
Note: Percentages are rounded to the nearest whole number.

Source: Nuclear Regulatory Commission

Table 1. **NRC Budget Authority (Dollars in Millions), FYs 1978–2001**

Fiscal Year	Actual Dollars
1978	290
1979	327
1980	399
1981	441
1982	466
1983	465
1984	466
1985	444
1986	400
1987	401
1988	393
1989	420
1990	439
1991	465
1992	513
1993	540
1994	535
1995	524
1996	473
1997	477
1998	477
1999	470
2000	470
2001	487

Figure 4. **NRC Budget Authority, FYs 1978–2001**



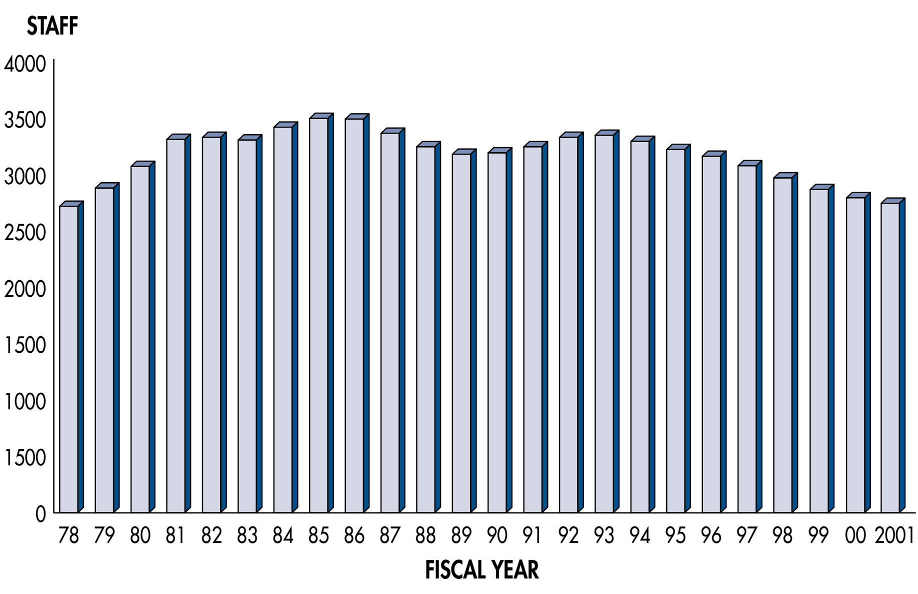
Note: Dollars are rounded to the nearest million.

Source (Table 1 and Figure 4): Nuclear Regulatory Commission

Table 2. **NRC Personnel Ceiling, FYs 1978–2001**

Fiscal Year	Staff
1978	2,723
1979	2,888
1980	3,066
1981	3,300
1982	3,325
1983	3,303
1984	3,416
1985	3,491
1986	3,491
1987	3,369
1988	3,250
1989	3,180
1990	3,195
1991	3,240
1992	3,335
1993	3,343
1994	3,293
1995	3,218
1996	3,160
1997	3,061
1998	2,977
1999	2,881
2000	2,801
2001	2,763

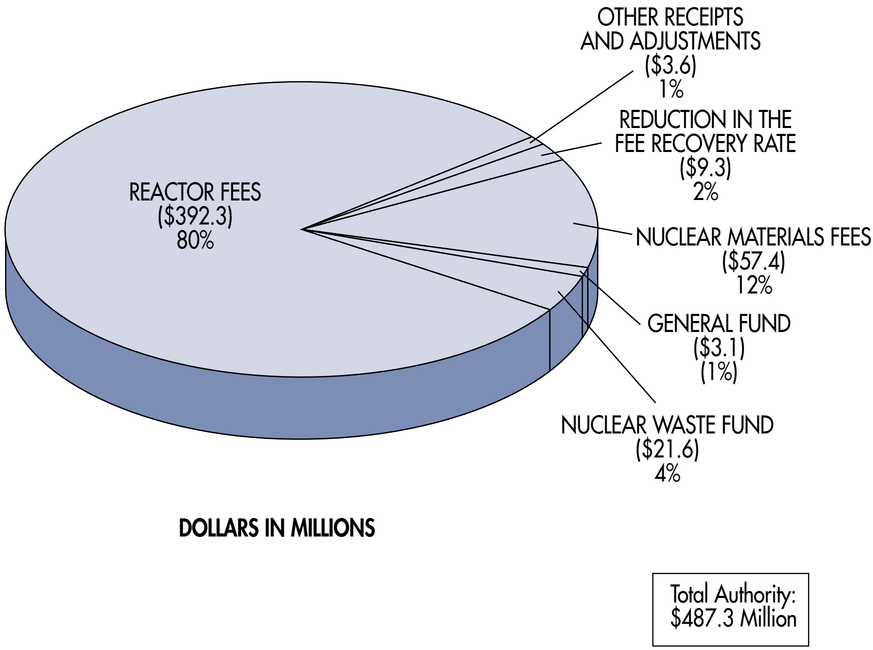
Figure 5. **NRC Personnel Ceiling, FYs 1978–2001**



Note (Table 2 and Figure 5): FYs 1978–1982 data reflect permanent full-time positions, at end-of-year strength. FY 1983–2001 reflect full-time equivalents (FTEs).

Source (Table 2 and Figure 5): Nuclear Regulatory Commission

Figure 6. **Recovery of NRC Budget Authority, FY 2001**



The Omnibus Budget Reconciliation Act of 1990 (OBRA-90), as amended, required the NRC to recover 100 percent of its budget authority, less appropriations from the Nuclear Waste Fund, for FYs 1991–2000 by assessing fees to its licensees. The FY 2001 Energy and Water Development Appropriations Act amended OBRA-90 to decrease the NRC's fee recovery amount. This reduction is being phased in at two percent per year beginning in FY 2001 through FY 2005. In 2001, it is reduced from 100 percent to 98 percent. In FY 2001, the NRC budget authority to be recovered from fees and other offsetting receipts is $453.3 million. The fees assessed to the major classes of NRC licensees in FY 2001 follow:

Class of Licensee	Range of Annual Fees*
Operating Power Reactor	$3,084,000**
Fuel Facility	$510,000 to 3,351,000
Uranium Recovery Facility	$29,900 to $94,300
Transportation Approval	$6,100 to $62,500
Materials User	$590 to $24,200

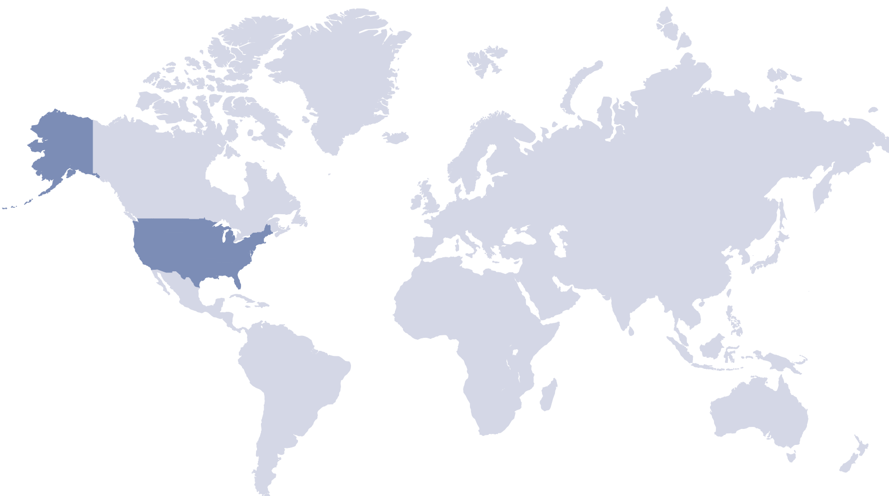
*Based on the proposed FY 2001 fee rule.

**Includes Spent Fuel Storage/Reactor Decommissioning FY 2001 annual fee of $275,000.

Note: Percentages are rounded to the nearest whole number.

Source: Nuclear Regulatory Commission

U.S. and Worldwide Energy



U.S. Electricity

Capability and Net Generation:

U.S. electric generating capability totaled approximately 639 gigawatts in 1999. Nuclear energy accounted for approximately 15 percent of this capability (see Figure 7).

U.S. net electric generation totaled approximately 3,706 thousand gigawatthours in 1999. Nuclear energy accounted for approximately 20 percent of this generation (see Figure 7).

In 2000, U.S. net electric generation totaled approximately 3,792 thousand gigawatthours. Nuclear energy accounted for approximately 20 percent of this generation.

In 1999, 104 nuclear reactors licensed to operate in 31 States generated approximately one-fifth of the Nation's electricity (see Table 3).

- Six States relied on nuclear power for more than 50 percent of their electricity, an increase of two over the previous year.

- Fifteen additional States relied on nuclear power for 25 to 50 percent of their electricity.

Since 1989, nuclear electric generation has increased by 43 percent and coal-fired generation has increased 24 percent, while electricity generated by all other sources has increased by 24 percent (see Table 4 and Figure 9).

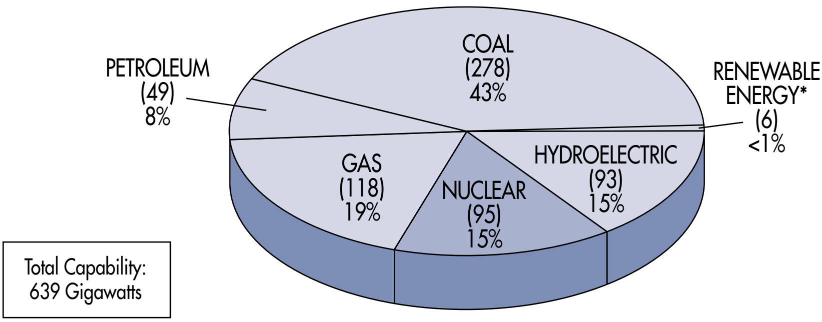
In 1999, electricity from coal and nuclear sources, which accounted for 59 percent of the U.S. generating capability, produced 71 percent of the net electricity generated in 1999 (see Table 5 and Figure 10).

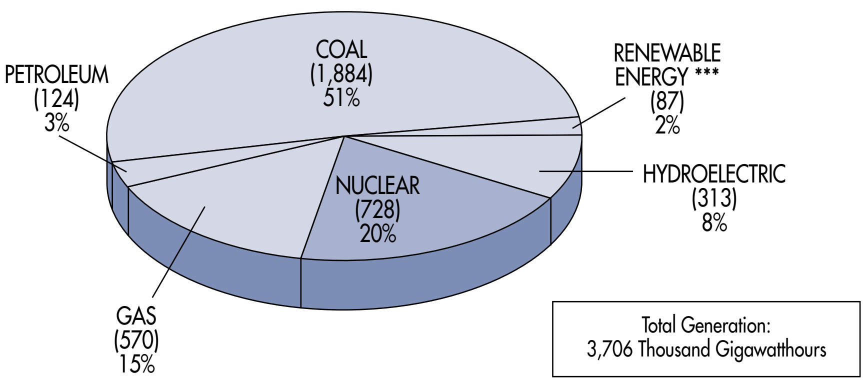
Average Production Expenses

The production expense data presented herein include all nuclear, fossil, and coal-fired utility-owned steam electric plants (see Table 6 and Figure 11).

- In 1999, production expenses averaged $19.23 per megawatthour for nuclear reactors and $20.21 per megawatthour for fossil steam and coal-fired plants.

Figure 7. **U.S. Electric Capability and Net Generation by Energy Source, 1999**





* Renewable energy includes geothermal, wood, refuse, wind, and solar energy.

** Renewable energy includes geothermal, wood, waste, wind, and solar energy. Renewable conventional hydroelectric power is included in hydroelectric power.

Note: Net summer capability. Percentages are rounded to the nearest whole number. Numbers rounded to the nearest thousand.

Source: DOE/EIA Existing Capacity and Planned Capacity at U.S. Electric Utilities by Energy Source, 1999, Table 1 <http://www.eia.doe.gov>, and DOE/EIA Monthly Energy Review (DOE/EIA–0035 (01/04)), Table 7.2 (page 97)

Table 3. **Electric Generating Capability and Electricity Generated in Each State by Nuclear Power, 1999**

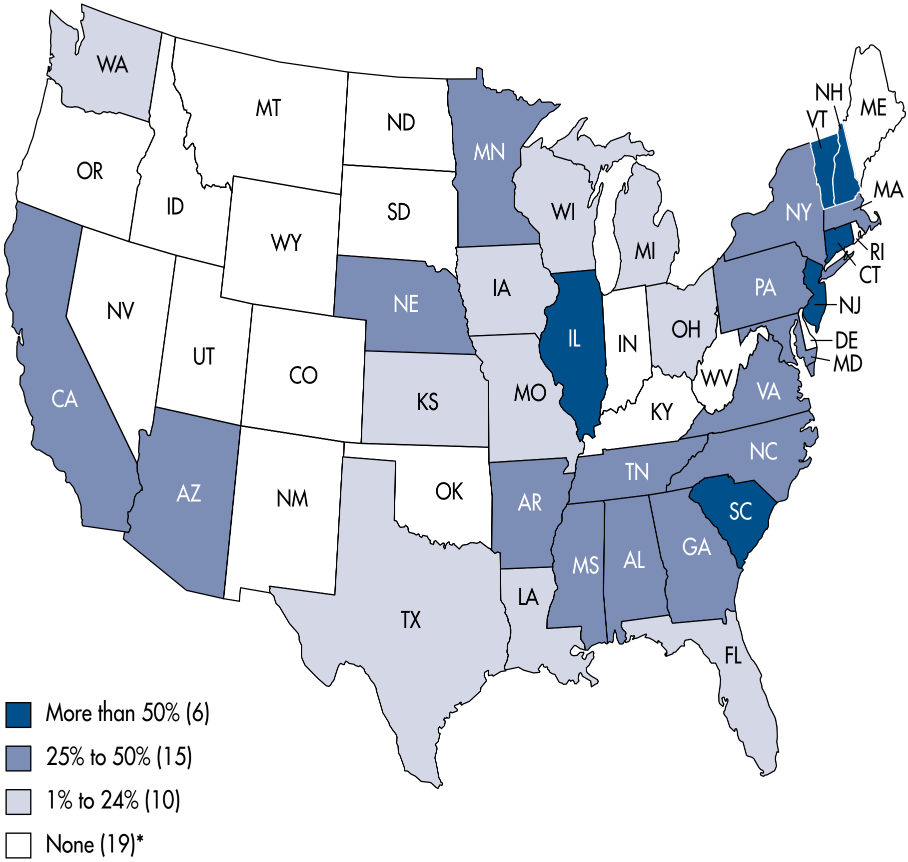
State	Percent Net Nuclear Capability	Percent Net Nuclear Generation	State	Percent Net Nuclear Capability	Percent Net Nuclear Generation
Alabama	23	27	Missouri	7	12
Arizona	25	36	Nebraska	21	34
Arkansas	18	29	New Hampshire	51	62
California	18	36	New Jersey	32	72
Connecticut	70	58	New York	28	36
Florida	11	18	North Carolina	22	34
Georgia	17	28	Ohio	8	11
Illinois	57	53	Pennsylvania	33	42
Iowa	6	11	South Carolina	36	58
Kansas	12	21	Tennessee	20	30
Louisiana	12	19	Texas	7	12
Maryland	15	26	Vermont	65	87
Massachusetts	20	47	Virginia	22	42
Michigan	18	17	Washington	5	5
Minnesota	18	30	Wisconsin	13	21
Mississippi	18	28	Others*	0	0

*There are 19 States and the District of Columbia with no nuclear generating capability.

Note: Net summer capability. Capability is the percent of electricity the State is capable of producing with nuclear energy. Generation is the percent of all sources of electricity actually produced with nuclear energy. Percentages are rounded to the nearest whole number.

Source: DOE/EIA Inventory of Power Plants in the United States, Table 17 <http://www.eia.doe.gov>, and DOE/EIA Electric Power Monthly (11/00), Table 12 <http://www.eia.doe.gov>.

Figure 8. **Net Electricity Generated in Each State by Nuclear Power, 1999**



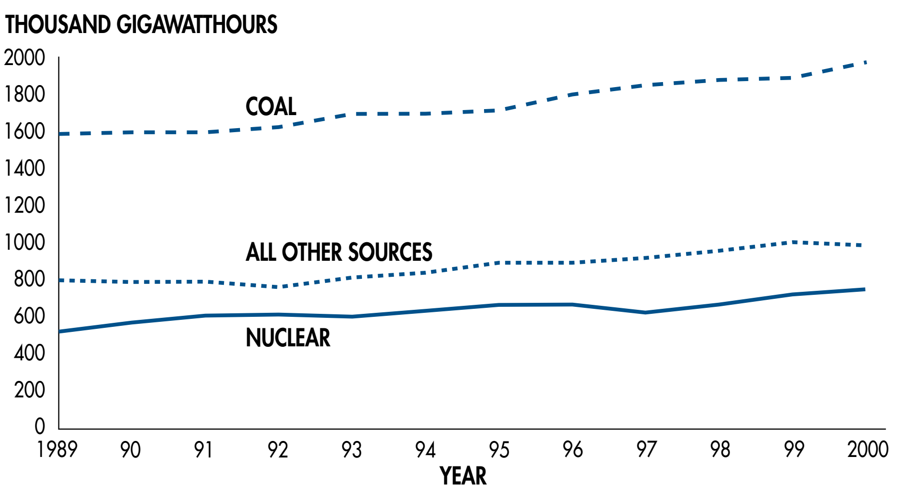
**Note:* There are no commercial reactors in Alaska or Hawaii. Percentages are rounded to the nearest whole number.

Source: DOE/EIA Electric Power Monthly (11/00), Table 12 <http://www.eia.doe.gov>.

Table 4. **U.S. Net Electric Generation (Thousand Gigawatthours) by Source, 1989–2000**

Year	Coal	Petroleum	Gas	Hydroelectric	Nuclear
1989	1,584	164	364	274	529
1990	1,590	124	378	290	577
1991	1,590	119	393	285	613
1992	1,621	99	418	249	619
1993	1,690	112	428	276	610
1994	1,692	106	478	257	640
1995	1,710	75	512	308	673
1996	1,796	82	470	344	675
1997	1,844	93	497	355	629
1998	1,873	127	549	319	674
1999	1,884	124	570	313	728
2000	1,965	109	611	269	754

Figure 9. **U.S. Net Electric Generation by Source, 1989–2000**

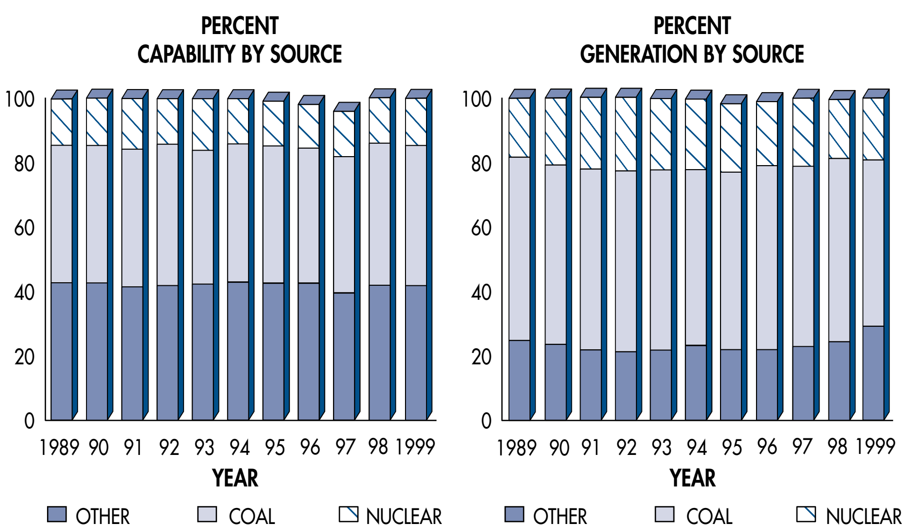


Note: Table 4 and Figure 9 are revised to include all U.S. electric power sectors.
Source (Table 4 and Figure 9): DOE/EIA Monthly Energy Review, (DOE/EIA-0035 (01/04)), Table 7.2, page 97.

Table 5. **U.S. Electric Generating Capability (Gigawatts) by Source, 1989–1999**

Year	Coal	Petroleum	Gas	Hydroelectric	Nuclear
1989	297	78	117	90	98
1990	300	77	120	91	100
1991	300	72	126	92	100
1992	301	72	127	93	99
1993	301	70	132	96	99
1994	301	70	134	96	99
1995	301	64	142	97	100
1996	302	70	135	94	101
1997	303	70	137	76	100
1998	300	63	125	94	97
1999	278	49	118	93	95

Figure 10. **U.S. Electric Generating Capability and Electricity Generated by Source, 1989–1999**



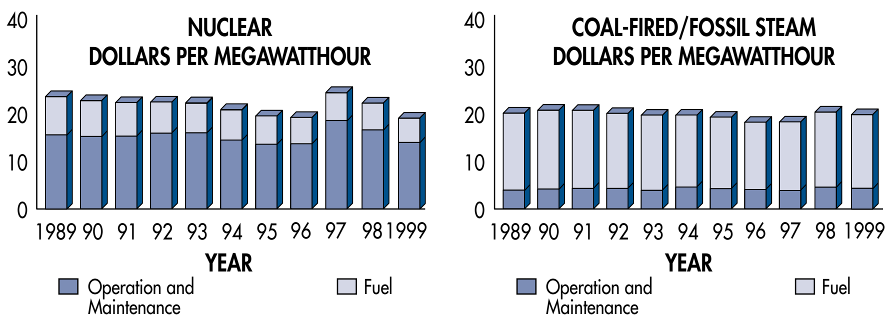
Note (Table 5 and Figure 10): Net summer capability. Percentages are rounded to the nearest whole number.

Source (Table 5 and Figure 10): DOE/EIA Inventory of Power Plants in the United States as of January 1, 1999, Table 1 <http://eia.doe.gov> and DOE/EIA Monthly Energy Review (DOE/EIA-0035 (01/04)), Table 7.2, page 97.

Table 6. **U.S. Average Nuclear Reactor and Coal-Fired/Fossil Steam Plant Production Expenses (Dollars per Megawatthour), 1989-1999**

Year	Operation and Maintenance	Fuel	Total Production Expenses
Nuclear:			
1989	15.05	7.40	22.45
1990	14.65	7.24	21.89
1991	14.72	6.75	21.47
1992	15.35	6.24	21.59
1993	15.26	6.02	21.28
1994	14.01	6.02	20.03
1995	13.49	5.74	19.23
1996	13.76	5.49	19.25
1997*	18.90	5.89	24.79
1998	16.19	5.42	21.61
1999	14.06	5.17	19.23
Coal-Fired:			
1989	4.07	15.70	19.77
1990	4.30	15.84	20.14
1991	4.39	15.85	20.24
1992	4.33	15.37	19.70
1993	4.32	15.31	19.63
1994	4.32	14.88	19.20
1995	4.24	14.51	18.75
1996	4.03	14.20	18.23
1997*	3.96	14.03	17.99
Fossil Steam:**			
1998	4.59	16.01	20.60
1999	4.59	15.62	20.21

Figure 11. **U.S. Average Nuclear Reactor, Coal-Fired and Fossil Steam Plant Production Expenses, 1989–1999**



Source (Table 6 and Figure 11): EIA Electric Power Annual-1998, Table 13 <http://www.eia.doe.gov>.

*Data for prior years was obtained from Utility Data Institute, Inc.

**Includes coal and fossil fuel. Plant production expenses are no longer available for coal-fired fuel exclusively.

U.S. Electricity Generated by Commercial Nuclear Power

In 2000, net nuclear-based electric generation in the United States produced a total of 754 thousand gigawatthours (see Table 7 and Figure 12).

In 1999, the average U.S. net capacity factor was 86 percent. It increased to 88 percent in 2000. Since 1989, the average capacity factor has increased 40 percent (see Table 7).

- Capacity factor is the ratio of electricity generated to the amount of energy that could have been generated (see Glossary).

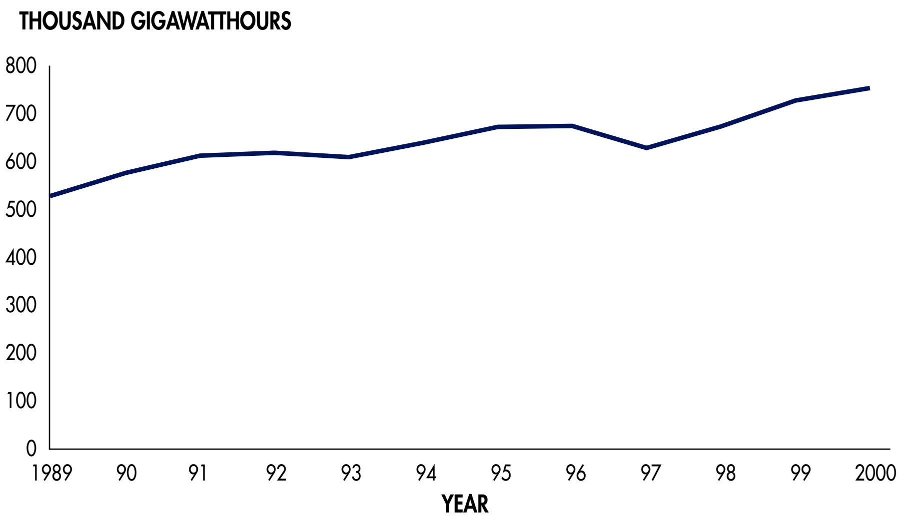
- Ninetynine percent of U.S. commercial nuclear reactors operated above a capacity factor of 70 percent in 2000 (see Table 8).

- In 2000, Combustion Engineering (CE) reactors had the highest average capacity factors compared to those of the other three vendors. The 14 CE reactors had an average capacity factor of 98 percent. The average capacity factors for the other three vendors were the following: 7 Babcock & Wilcox reactors — 93 percent, 35 General Electric reactors — 88 percent, and 48 Westinghouse reactors — 87 percent, (see Table 8).

Table 7. **U.S. Nuclear Power Reactor Average Capacity Factor and Net Generation, 1989–2000**

Year	Number of Operating Reactors	Average Annual Capacity Factor (Percent)	Net Generation of Electricity: Thousands of Gigawatthours	Net Generation of Electricity: Percent of Total U.S.
1989	109	63	529	17.8
1990	111	68	577	19.1
1991	111	71	613	20.0
1992	110	71	619	20.1
1993	109	73	610	19.1
1994	109	75	640	19.7
1995	109	79	673	20.1
1996	110	77	675	19.6
1997	104	74	629	18.0
1998	104	78	674	18.6
1999	104	86	728	19.6
2000	104	88	754	19.8

Figure 12. **Net Generation of U.S. Nuclear Electricity, 1989–2000**



Note (Table 7 and Figure 12): Average annual capacity factor is based on net maximum dependable capacity. See Glossary for definition.

Source (Table 7 and Figure 12): 1989-2000 Net Electricity based on May 2001 DOE/EIA - Monthly Energy Review Table 7.2 page 97, and licensee data as compiled by the Nuclear Regulatory Commission.

Table 8. **U.S. Commercial Nuclear Power Reactor Average Capacity Factor by Vendor and Reactor Type, 1998–2000**

Capacity Factor	Licensed to Operate 1998	1999	2000	Percent of Net Nuclear Generated 1998	1999	2000
Above 70 Percent	86	97	99	93	97	99
50 to 70 Percent	6	4	2	5	3	1
Below 50 Percent	12	3	3	2	0	0
Total	104	104	104	100	100	100

	Licensed to Operate 1998	1999	2000	Average Capacity Factor (Percent) 1998	1999	2000	Percent of Net Nuclear Generated 1998	1999	2000
Vendor:									
Babcock & Wilcox	7	7	7	82	89	93	6	6	6
Combustion Engineering	14	14	14	83	87	91	15	15	14
General Electric	35	35	35	73	85	88	30	33	33
Westinghouse Electric	48	48	48	79	86	87	49	46	47
Total	104	104	104				100	100	100
Reactor Type:									
Boiling-Water Reactor	35	35	35	73	90	88	30	35	33
Pressurized-Water Reactor	69	69	69	81	84	89	70	65	67
Total	104	104	104				100	100	100

Note: Average capacity factor is based on net maximum dependable capacity. See Glossary for definition. Refer to Appendix A for the 1995, 1996, 1997, 1998, 1999 and 2000 average capacity factors for each reactor. Percentages are rounded to the nearest whole number.

Source: Licensee data as compiled by the Nuclear Regulatory Commission

Worldwide Electricity Generated by Commercial Nuclear Power

In 2000, 438 operating reactors in 33 countries had a maximum dependable capacity of 353,491 megawatts electric (net MWe).

- Refer to Appendix I for a world list of nuclear power reactors and Appendix J for nuclear power units by reactor type, worldwide.

Major producers of nuclear electricity during 1999 were the United States and France.

- Approximately 31 percent of the world's net nuclear-generated electricity was produced in the United States (see Figure 13).

- France produced approximately 16 percent of the world's net nuclear-generated electricity. The nuclear portion of its total domestic electricity generation was approximately 75 percent (see Figure 13).

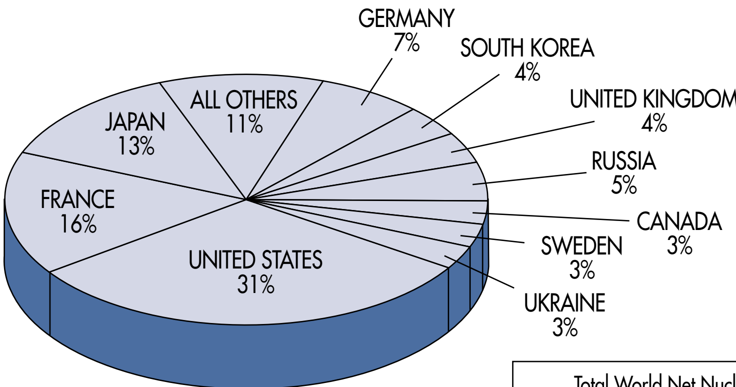
Of the countries cited here, reactors in South Korea (90 percent), Germany (87 percent), and the U.S. (87 percent) had the highest gross capacity factors in 2000. Reactors in the United States had the greatest gross generation at 789 thousand gigawatthours. France was the next highest producer at 396 thousand gigawatthours (see Table 9).

- Refer to Appendix K for a list of the top fifty units by gross capacity factor, worldwide, and Appendix L for a list of the top fifty units by gross generation, worldwide.

Over the past ten years, the average annual gross capacity factor has increased 32 percentage points in the United States, 32 percentage points in Germany, and increased 10 percentage points in Japan (see Table 10).

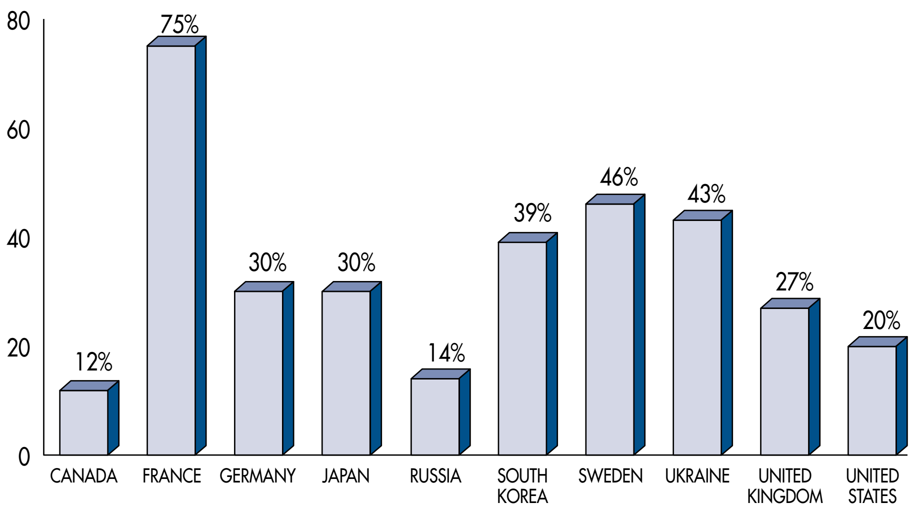
Figure 13. **Net Nuclear Electric Power as Percent of World Nuclear and Total Domestic Electricity Generation, 1999**

PERCENT OF WORLD NUCLEAR GENERATION



Total World Net Nuclear Electric Generation: 2,396 Thousand Gigawatthours

PERCENT OF TOTAL DOMESTIC NET NUCLEAR ELECTRICITY GENERATION



Note: Percentages are rounded to the nearest whole number.

Source: DOE/EIA International Energy Information, Tables 2.6, 2.7, 2.8, 6.1 <http://www.eia.doe.gov>.

Table 9. **Commercial Nuclear Power Reactor Average Gross Capacity Factor and Gross Generation by Selected Country, 2000**

Country	Number of Operating Reactors	Average Gross Capacity Factor (Percent)	Total Gross Nuclear Generation (Thousand Gigawatthours)	Number of Operating Reactors in Top 50 by Capacity Factor	Number of Operating Reactors in Top 50 by Generation
Canada	21	50	74	0	0
France	57	72	396	0	11
Germany	19	87	170	3	11
Japan	52	79	320	6	3
Russia	29	67	129	0	0
South Korea	16	90	108	2	0
Sweden	11	66	57	0	0
Ukraine	14	69	77	0	0
United States	104	87*	789	31	25

Source: Excerpted from *Nucleonics Week* © February 8, 2001, by McGraw-Hill, Inc. Reproduced by permission. Further reproduction prohibited.

Table 10. **Commercial Nuclear Power Reactor Average Gross Capacity Factor by Selected Country, 1990–2000**

Country	Average Gross Annual Capacity Factor (Percent)										
	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Canada	61	72	68	70	76	68	65	61	50	52	50
France	63	63	63	69	67	71	74	72	73	71	72
Germany	66	66	72	69	72	71	79	83	79	88	87
Japan	72	72	72	73	74	79	80	82	83	79	79
Russia	**	**	**	**	**	**	**	**	**	61	67
South Korea	**	**	**	**	**	**	**	**	**	88	90
Sweden	75	85	67	62	76	73	79	75	78	78	66
Ukraine	**	**	**	**	**	**	**	**	**	65	69
United States	66 {68	69 71	69 71	71 73	73 75	77 79	75 77	70 73	76 78	85 86	87 88}*

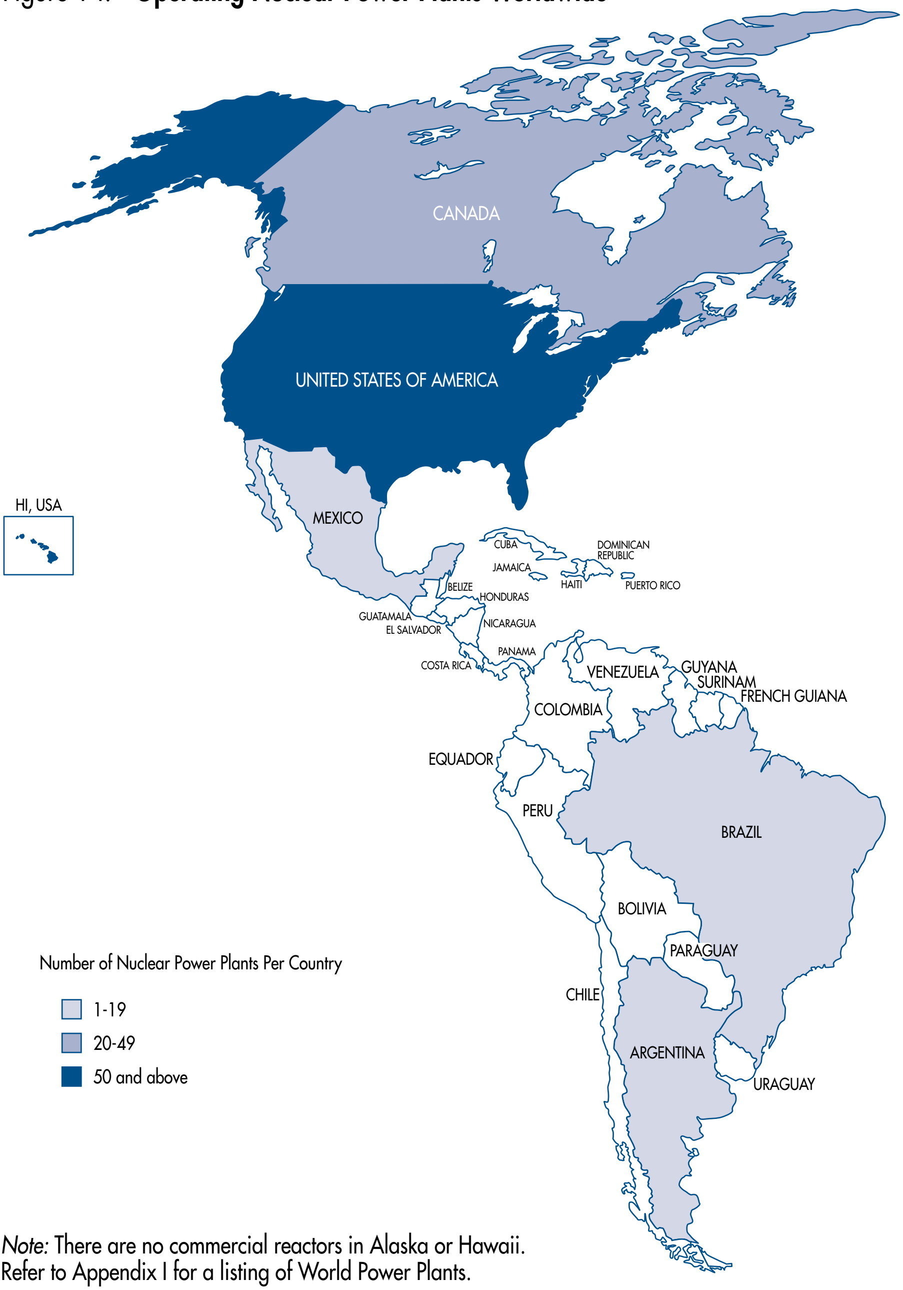
*For comparison, U.S. average gross capacity factor is used. The 2000 U.S. average net capacity factor is 88 percent. Brackets { } denote average net capacity factor. See Glossary for definition.

**Data are not available.

Note: Percentages are rounded to the nearest whole number.

Source: DOE/EIA Commercial Nuclear Power 1991 (DOE/EIA-0438), Table 18 (page 40), Excerpted from Nucleonics Week© February 8, 2001, by McGraw-Hill, Inc. Reproduced by permission. Further reproduction prohibited. Licensee data as compiled by the Nuclear Regulatory Commission.

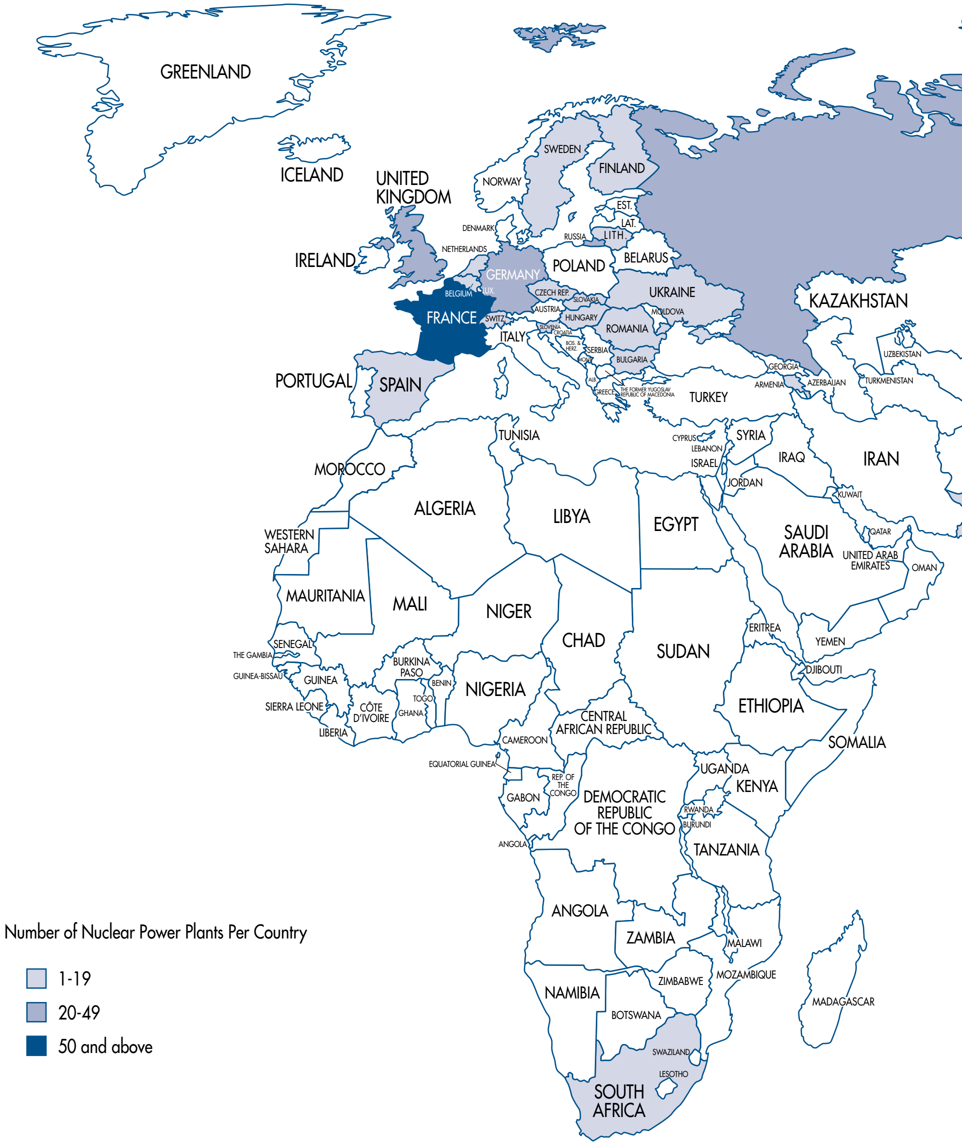
Figure 14. **Operating Nuclear Power Plants Worldwide**



Note: There are no commercial reactors in Alaska or Hawaii.
Refer to Appendix I for a listing of World Power Plants.

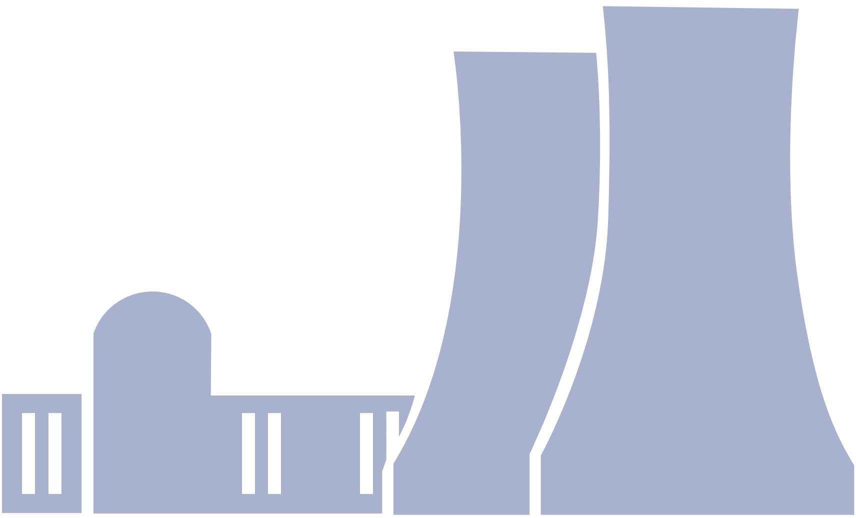
Source: <http://www.lib.utexas.edu/Libs/PCL/Map_collection/world_maps.html>

Figure 15. **Operating Nuclear Power Plants Worldwide (continued)**




RUSSIA
MONGOLIA
KYRGYZSTAN
TAJIKISTAN
AFGHANISTAN
CHINA
NORTH KOREA
JAPAN
SOUTH KOREA
PAKISTAN
NEPAL
BHUTAN
BANGLADESH
INDIA
BURMA
TAIWAN
LAOS
THAILAND
VIETNAM
CAMBODIA
PHILIPINES
SRI LANKA
MALAYSIA
PAPUA NEW GUINEA
INDONESIA
AUSTRALIA
NEW ZEALAND

Operating Nuclear Reactors



U.S. Commercial Nuclear Power Reactors

There are as of December 2000, 104 commercial nuclear power reactors licensed to operate in 31 States (see Figures 17, 18, 19, 20, and 21):

- The above number includes Browns Ferry Unit 1, which has no fuel loaded and requires Commission approval to restart.
- Refer to Appendices A-D for a listing of currently operating, formerly operating, and canceled U.S. commercial nuclear power reactors.

Diversity — Although there are many similarities, each reactor design can be considered unique. A typical light-water reactor is shown in Figure 16:

- 4 reactor vendors
- 35 licensees
- 80 different designs
- 65 sites

Experience—The 104 reactors licensed to operate during 2000 have accumulated 2,050 reactor-years of experience (see Table 11 and Figure 22). An additional 357 reactor-years of experience have been accumulated by permanently shutdown reactors.

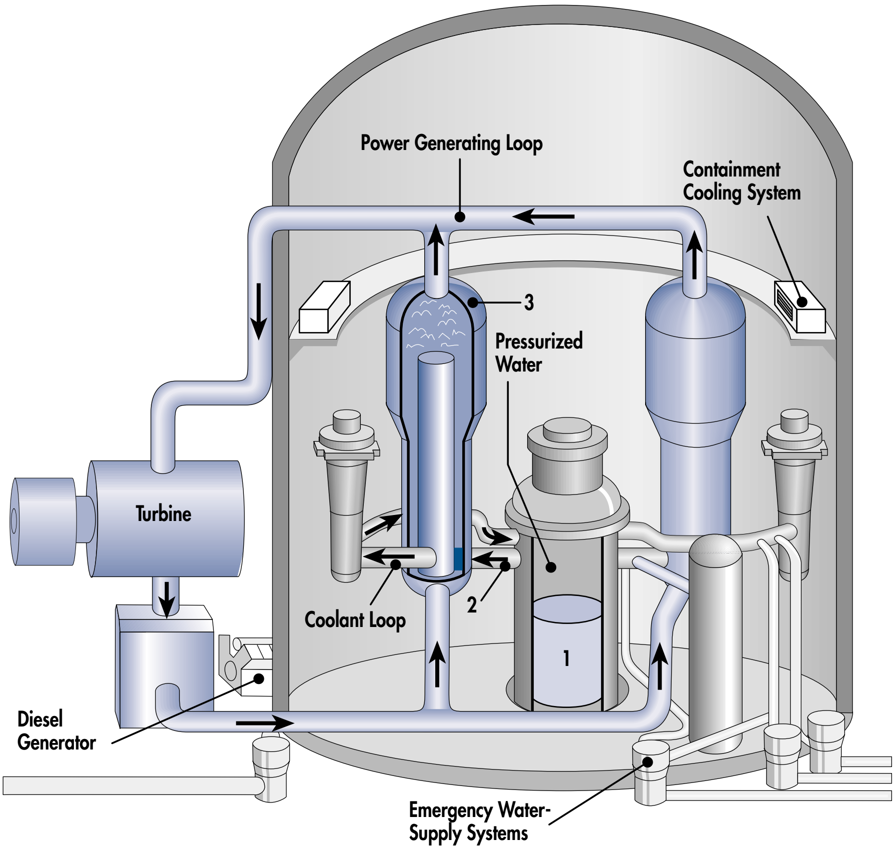
Principal Licensing and Inspection Activities

- The NRC depends primarily on reactor and facility inspections as the basis for its independent determination of licensee compliance with NRC regulations.
- On average, approximately 3,350 inspection hours were expended at each operating reactor during FY 2000 (see Figure 23).
- Approximately 14 separate license changes are requested per power reactor each year:
  - More than 1,400 separate reviews were completed by the NRC in FY 1999.
- Approximately 4,500 reactor operators are licensed by the NRC:
  - Each operator is requalified before renewal of a 6-year license.
- Approximately 3,000 source documents concerning events are reviewed by the NRC annually.
- The NRC is overseeing the decommissioning of 19 nuclear power reactors. Refer to Appendix B for their decommissioning status.

Figure 16. **Typical Nuclear Reactor**

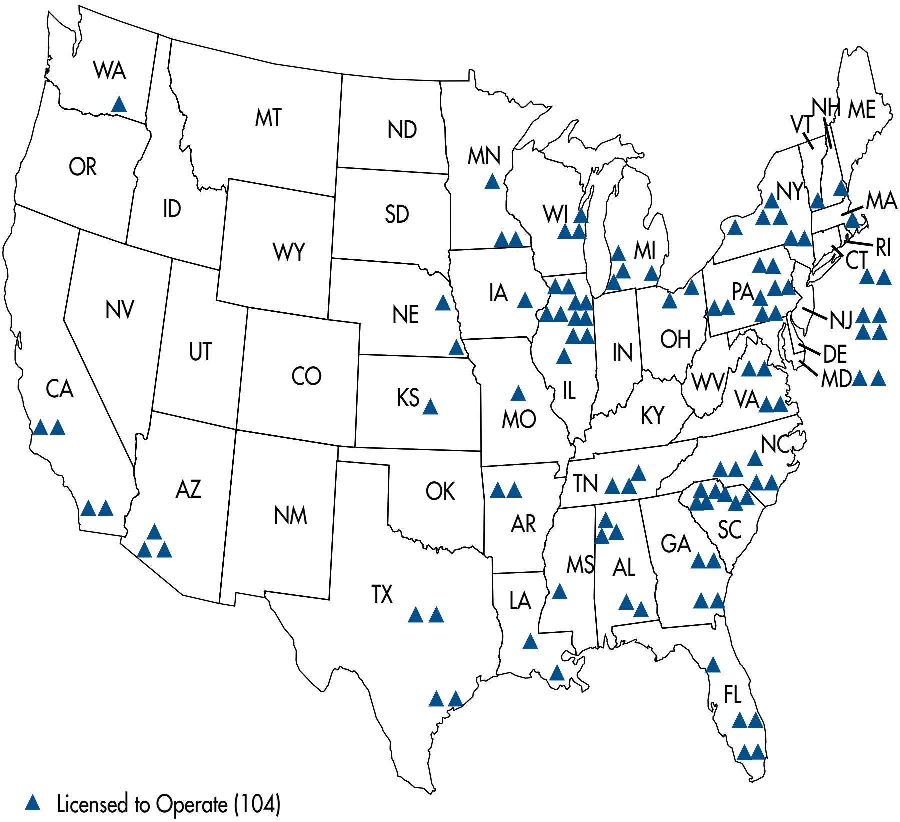
How Nuclear Reactors Work

In a typical commercial pressurized light-water reactor (1) the reactor core creates heat, (2) pressurized-water in the primary coolant loop carries the heat to the steam generator, and (3) the steam generator vaporizes the water in a secondary loop to drive the turbine, which produces electricity. Boiling-water reactors are similar to pressurized-water reactors but use the same loop to cool the reactor and to deliver steam to the turbine. The reactor's core is cooled by water, which is force-circulated by electrically powered pumps. Emergency cooling water is supplied by other pumps, which can be powered by onsite diesel generators. Other safety systems, such as the containment building air coolers, also need electric power.



Source: Nuclear Regulatory Commission

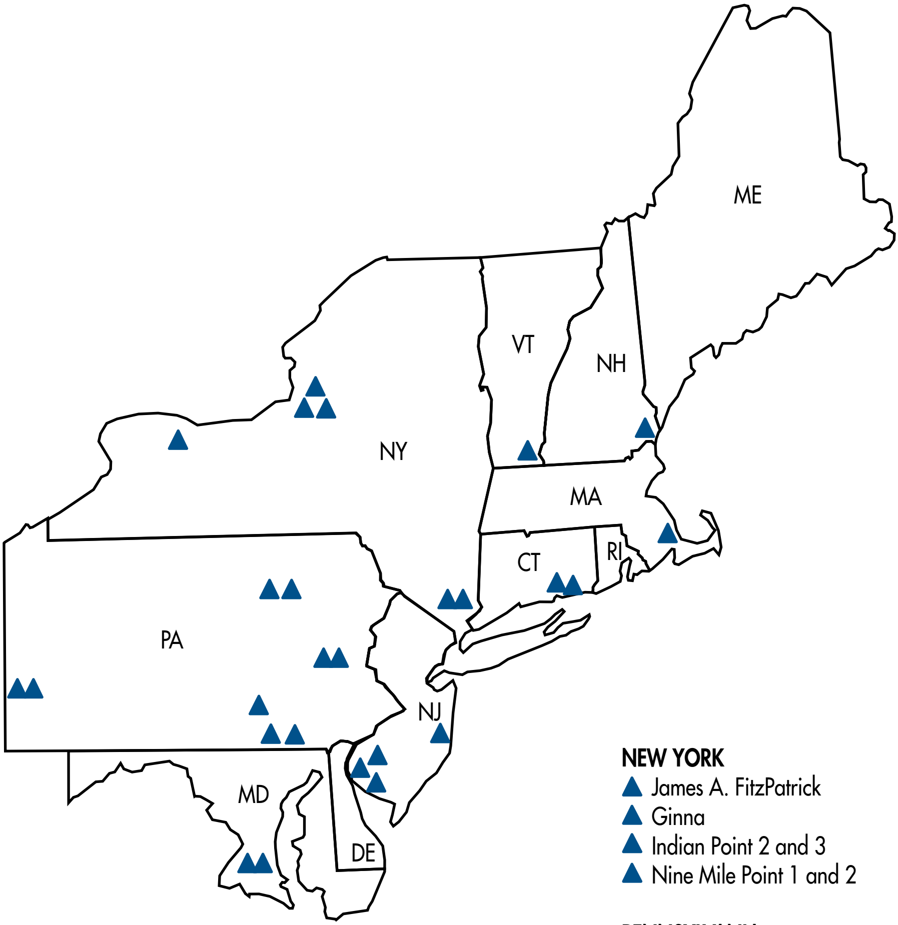
Figure 17. **U.S. Commercial Nuclear Power Reactors**



Note: Includes Browns Ferry Unit 1, which has no fuel loaded and requires Commission approval to restart. There are no commercial reactors in Alaska or Hawaii.

Source: Nuclear Regulatory Commission

Figure 18. **NRC Region I Commercial Nuclear Power Reactors**



NEW YORK
- ▲ James A. FitzPatrick
- ▲ Ginna
- ▲ Indian Point 2 and 3
- ▲ Nine Mile Point 1 and 2

PENNSYLVANIA
- ▲ Beaver Valley 1 and 2
- ▲ Limerick 1 and 2
- ▲ Peach Bottom 2 and 3
- ▲ Susquehanna 1 and 2
- ▲ Three Mile Island 1

CONNECTICUT
- ▲ Millstone 2, and 3

MARYLAND
- ▲ Calvert Cliffs 1 and 2

MASSACHUSETTS
- ▲ Pilgrim 1

NEW HAMPSHIRE
- ▲ Seabrook 1

NEW JERSEY
- ▲ Hope Creek 1
- ▲ Oyster Creek
- ▲ Salem 1 and 2

VERMONT
- ▲ Vermont Yankee

▲ Licensed to Operate (26)

Source: Nuclear Regulatory Commission

Figure 19. **NRC Region II Commercial Nuclear Power Reactors**

ALABAMA
- ▲ Browns Ferry 1, 2, and 3
- ▲ Joseph M. Farley 1 and 2

FLORIDA
- ▲ Crystal River 3
- ▲ St. Lucie 1 and 2
- ▲ Turkey Point 3 and 4

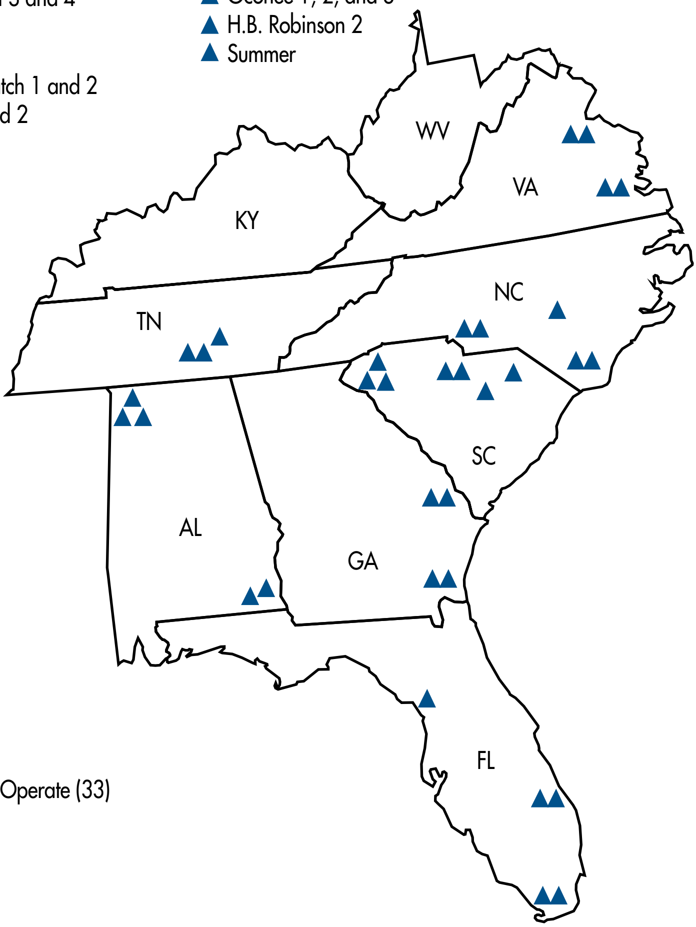
GEORGIA
- ▲ Edwin I. Hatch 1 and 2
- ▲ Vogtle 1 and 2

NORTH CAROLINA
- ▲ Brunswick 1 and 2
- ▲ McGuire 1 and 2
- ▲ Shearon Harris 1

SOUTH CAROLINA
- ▲ Catawba 1 and 2
- ▲ Oconee 1, 2, and 3
- ▲ H.B. Robinson 2
- ▲ Summer

TENNESSEE
- ▲ Sequoyah 1 and 2
- ▲ Watts Bar 1

VIRGINIA
- ▲ North Anna 1 and 2
- ▲ Surry 1 and 2



▲ Licensed to Operate (33)

Source: Nuclear Regulatory Commission

Figure 20. **NRC Region III Commercial Nuclear Power Reactors**

ILLINOIS
- ▲ Braidwood 1 and 2
- ▲ Byron 1 and 2
- ▲ Clinton
- ▲ Dresden 2 and 3
- ▲ La Salle County 1 and 2
- ▲ Quad Cities 1 and 2

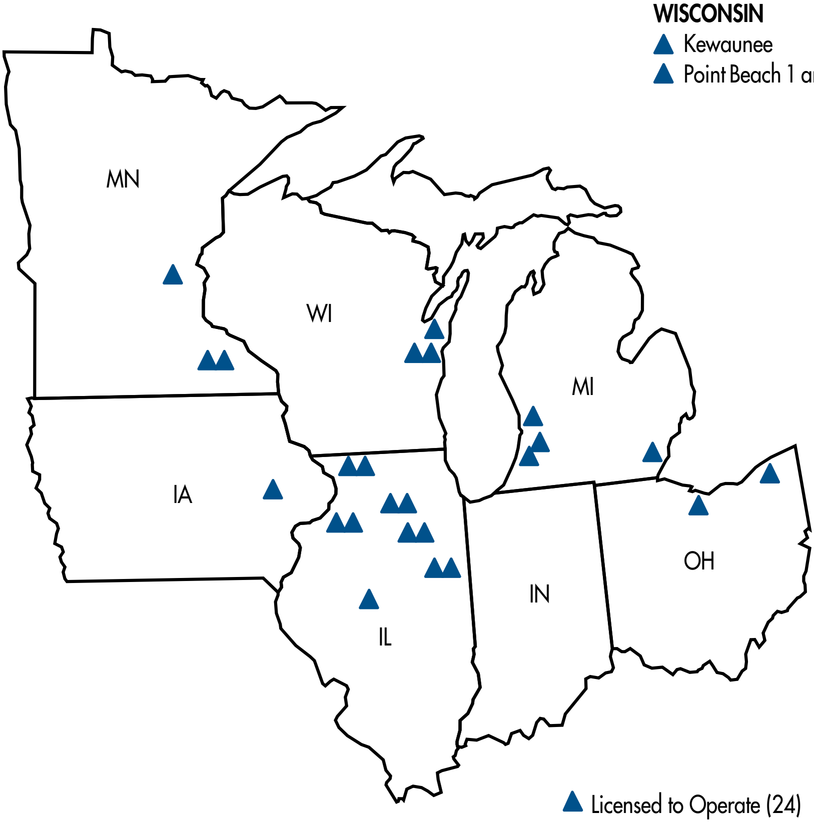
IOWA
- ▲ Duane Arnold

MICHIGAN
- ▲ D.C. Cook 1 and 2
- ▲ Fermi 2
- ▲ Palisades

MINNESOTA
- ▲ Monticello
- ▲ Prarie Island 1 and 2

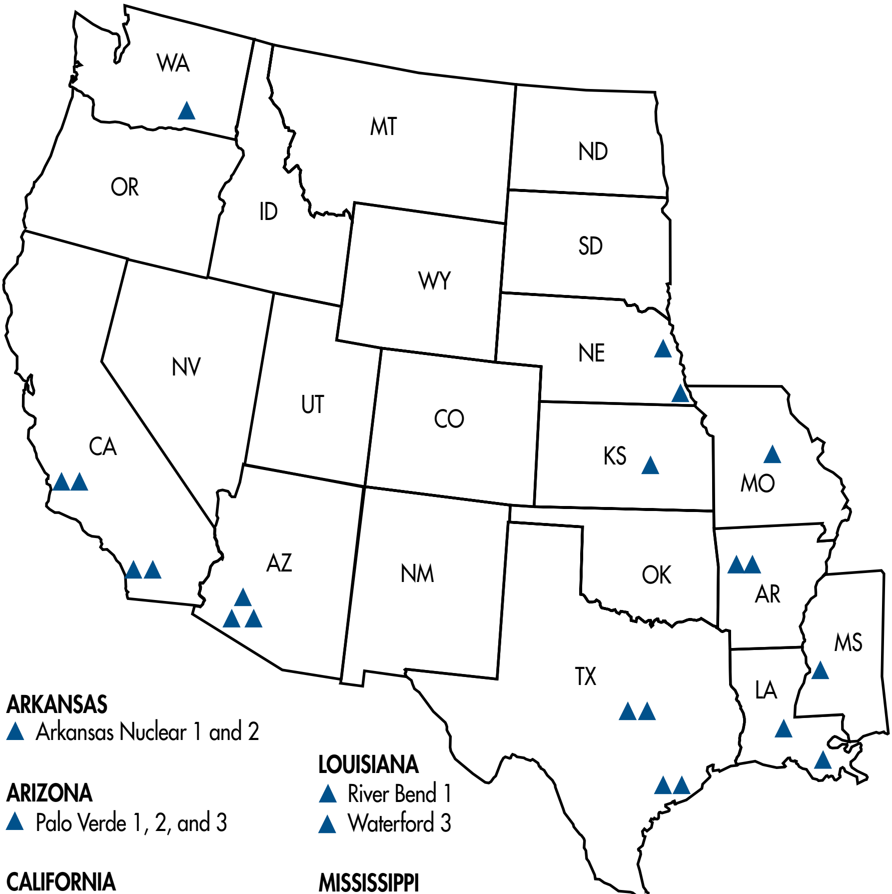
OHIO
- ▲ Davis-Besse
- ▲ Perry 1

WISCONSIN
- ▲ Kewaunee
- ▲ Point Beach 1 and 2



Source: Nuclear Regulatory Commission

Figure 21. **NRC Region IV Commercial Nuclear Power Reactors**



ARKANSAS
▲ Arkansas Nuclear 1 and 2

ARIZONA
▲ Palo Verde 1, 2, and 3

CALIFORNIA
▲ Diablo Canyon 1 and 2
▲ San Onofre 2 and 3

KANSAS
▲ Wolf Creek 1

▲ Licensed to Operate (21)

LOUISIANA
▲ River Bend 1
▲ Waterford 3

MISSISSIPPI
▲ Grand Gulf

MISSOURI
▲ Callaway

NEBRASKA
▲ Cooper
▲ Fort Calhoun

TEXAS
▲ Comanche Peak 1 and 2
▲ South Texas Project 1 and 2

WASHINGTON
▲ Columbia Generating Station*

*Formerly Washington Nuclear 2

Note: There are no commercial reactors in Alaska or Hawaii.

Source: Nuclear Regulatory Commission

Table 11. **U.S. Commercial Nuclear Power Reactor Operating Licenses Issued by Year**

Year	Reactor Name	Number of Licenses Issued	Total Number of Operating Licenses
1969	Dresden 2	4	4
	Ginna		
	Nine Mile Point 1		
	Oyster Creek		
1970	H.B. Robinson 2	2	6
	Point Beach 1		
1971	Dresden 3	2	8
	Monticello		
1972	Palisades	6	14
	Pilgrim 1		
	Quad Cities 1		
	Quad Cities 2		
	Surry 1		
	Turkey Point 3		
1973	Browns Ferry 1	11	25
	Fort Calhoun		
	Indian Point 2		
	Kewaunee		
	Oconee 1		
	Oconee 2		
	Peach Bottom 2		
	Point Beach 2		
	Surry 2		
	Turkey Point 4		
	Vermont Yankee		
1974	Arkansas Nuclear 1	14	39
	Browns Ferry 2		
	Brunswick 2		
	Calvert Cliffs 1		
	Cooper		
	D. C. Cook 1		
	Duane Arnold		
	Edwin I. Hatch 1		
	James A. FitzPatrick		
	Oconee 3		
	Peach Bottom 3		
	Prairie Island 1		
	Prairie Island 2		
	Three Mile Island 1		
1975	Millstone 2	1	40
1976	Beaver Valley 1	7	47
	Browns Ferry 3		
	Brunswick 1		
	Calvert Cliffs 2		
	Indian Point 3		
	Salem 1		
	St. Lucie 1		
1977	Crystal River 3	4	51
	Davis-Besse		
	D.C. Cook 2		
	Joseph M. Farley 1		
1978	Arkansas Nuclear 2	3	54
	Edwin I. Hatch 2		
	North Anna 1		
1980	North Anna 2	2	56
	Sequoyah 1		
1981	Joseph M. Farley 2	4	60
	McGuire 1		
	Salem 2		
	Sequoyah 2		
1982	La Salle County 1	4	64
	San Onofre 2		
	Summer		
	Susquehanna 1		
1983	McGuire 2	3	67
	San Onofre 3		
	St. Lucie 2		
1984	Callaway	6	73
	Diablo Canyon 1		
	Grand Gulf 1		
	La Salle County 2		
	Susquehanna 2		
	Washington Nuclear 2		
1985	Byron 1	9	82
	Catawba 1		
	Diablo Canyon 2		
	Fermi 2		
	Limerick 1		
	Palo Verde 1		
	River Bend 1		
	Waterford 3		
	Wolf Creek 1		

(Continued on page 46)

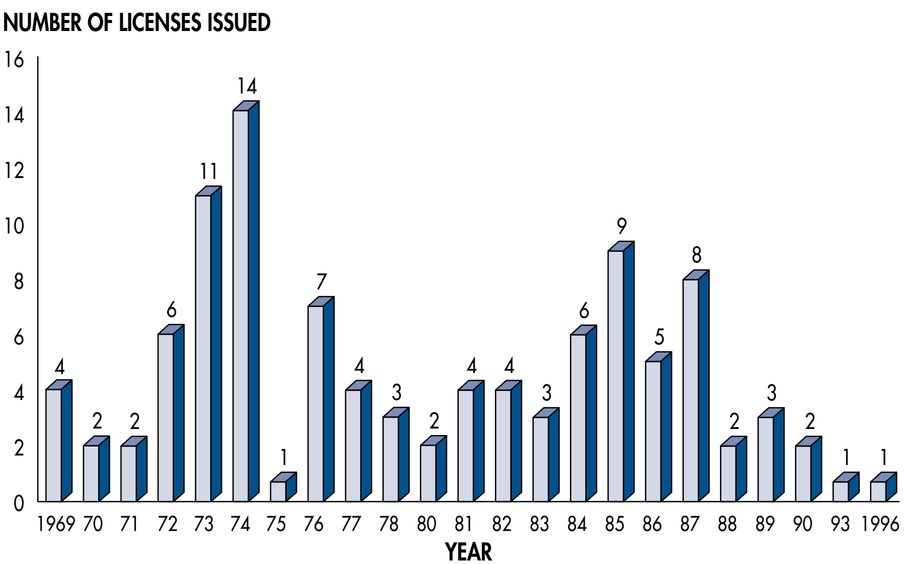
Table 11. **U.S. Commercial Nuclear Power Reactor Operating Licenses Issued by Year** *(Continued)*

Year	Reactor Name	Number of Licenses Issued	Total Number of Operating Licenses
1986	Catawba 2	5	87
	Hope Creek 1		
	Millstone 3		
	Palo Verde 2		
	Perry 1		
1987	Beaver Valley 2	8	95
	Braidwood 1		
	Byron 2		
	Clinton		
	Nine Mile Point 2		
	Palo Verde 3		
	Shearon Harris 1		
	Vogtle 1		
1988	Braidwood 2	2	97
	South Texas Project 1		
1989	Limerick 2	3	100
	South Texas Project 2		
	Vogtle 2		
1990	Comanche Peak 1		
	Seabrook	2	102
1993	Comanche Peak 2	1	103
1996	Watts Bar 1	1	104

Source: Data as compiled by the Nuclear Regulatory Commission

Note: Limited to reactors licensed to operate. Year is based on the date the initial full-power operating license was issued.

Figure 22. **U.S. Commercial Nuclear Power Reactor Operating Licenses Issued by Year**



Note: No licenses issued after 1996.

Oversight of U.S. Commercial Nuclear Power Reactors

Reactor Oversight Process

The NRC itself does not operate nuclear power plants. Rather, it regulates the operation of the nation's 104 nuclear power plants by establishing regulatory requirements for the design, construction and operation of such plants. To ensure that the plants are operated safely within these requirements, the NRC licenses the plants to operate, licenses the plant operators, and establishes technical specifications for the operation of each plant.

The NRC provides continuous oversight of plants through its reactor oversight process (ROP) to verify that they are being operated in accordance with NRC rules and regulations. The NRC has full authority to take whatever action is necessary to protect public health and safety and may demand immediate licensee actions, up to and including a plant shutdown.

The ROP is described on the NRC's web site and in NUREG-1649, Revision 3, "Reactor Oversight Process." In general terms, the ROP uses both inspection findings and performance indicators (PIs) to assess the performance of each plant within a regulatory framework of seven cornerstones of safety. The ROP recognizes that issues of very low safety significance inevitably occur, and plants are expected to effectively address these issues. The NRC performs a baseline level of inspection at each plant. The NRC may perform supplemental inspections and take additional actions as necessary to ensure significant performance issues are addressed. A summary of the NRC's inspection effort is shown in Figure 23. The latest plant-specific inspection findings and PI information can be found on the NRC's web site.

In FY 2000, the NRC integrated its previously distinct programs for inspection, assessment, and enforcement programs into the current ROP. The ROP takes into account improvements in the performance of the nuclear industry over the past twenty-five years and improved approaches of inspecting and evaluating the safety performance of NRC licensed plants. The improvements in plant performance can be attributed both to efforts within the nuclear industry and successful regulatory oversight.

The revised ROP is more risk-informed, objective, predictable, understandable, and focused on the areas of greatest safety significance. Key features of the new program are a risk-informed regulatory framework, risk-informed inspections, a significance determination process to evaluate inspection findings, performance indicators, a streamlined assessment process, and more clearly defined actions the NRC takes for plants based on their performance. The NRC incorporated lessons learned from a pilot program of the revised ROP conducted at nine reactor sites in 1999 and began implementation of the revised ROP for all plants in April 2000. The NRC anticipates making further improvements as experience is gained in the new process.

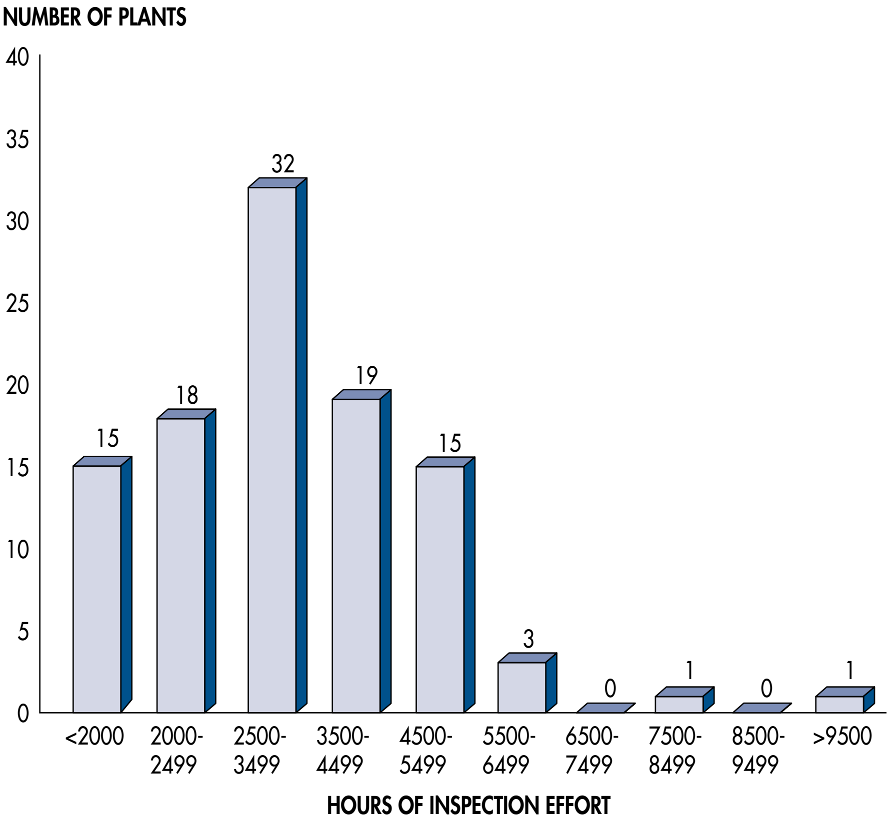
(Continued on page 48)

Oversight of U.S. Commercial Nuclear Power Reactors *(Continued)*

Industry Performance Indicators

In addition to evaluating the performance of each individual plant, the NRC compiles data on overall performance using various industry-level performance indicators, as shown in Figure 24 and appendix F. The indicators can provide additional data for assessing trends in industry performance.

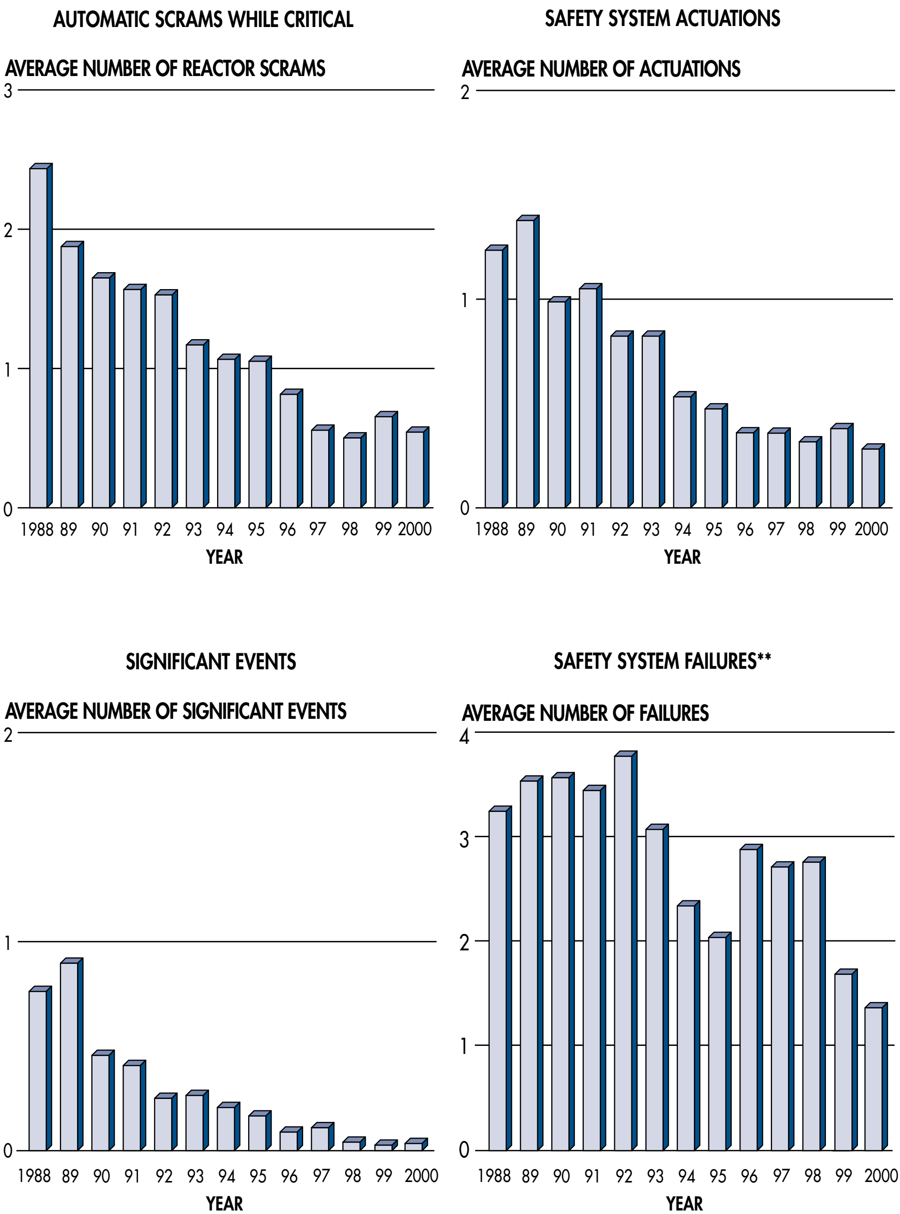
Figure 23. **NRC Inspection Effort at Operating Reactors, FY 2000***



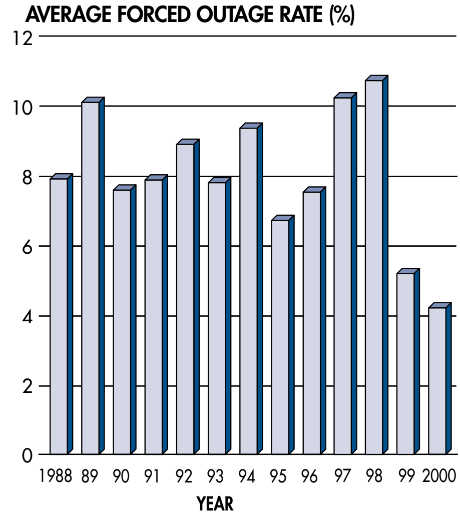
*FY 2000 data includes regular and overtime hours. Includes Browns Ferry 1.

Source: Nuclear Regulatory Commission

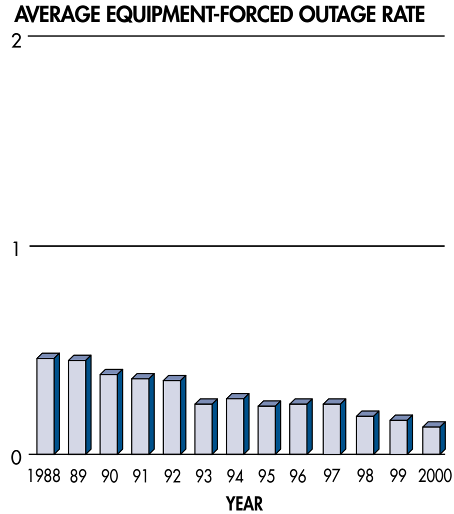
Figure 24. **NRC Performance Indicators; Annual Industry Averages, 1988–2000**



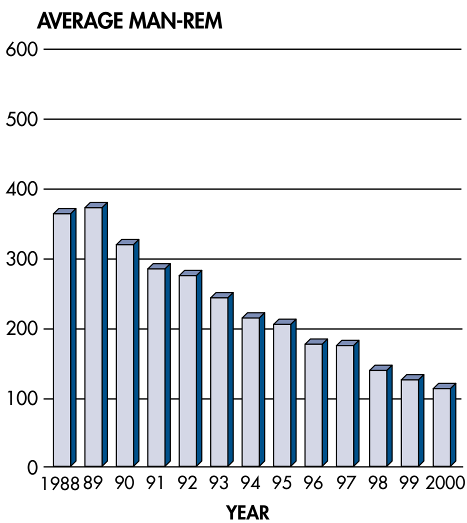
FORCED OUTAGE RATE



EQUIPMENT-FORCED OUTAGES PER 1000 CRITICAL HOURS



COLLECTIVE RADIATION EXPOSURE



Note: Data represent annual industry averages, with plants in extended shutdown excluded. Data are rounded for display purposes. These data may differ slightly from previously published data as a result of refinements in data quality.

Source: Licensee data as compiled by the Nuclear Regulatory Commission

Future U.S. Commercial Nuclear Power Reactor Licensing

Reactor Aging and License Renewal:

Based on the Atomic Energy Act, the NRC issues licenses for commercial power reactors to operate for up to 40 years and allows these licenses to be renewed for another 20 years. The first 40-year operating license will expire in the year 2006. Approximately 10 percent of the remaining operating plants will expire by the end of the year 2010, and more than 40 percent will expire by the year 2015. The age of operating reactors and their average maximum dependable capacity is illustrated in Figure 25.

The decision whether to seek license renewal rests entirely with nuclear power plant owners, and will be based on the plant's economic situation and whether it can meet NRC requirements. Extending reactor operating licenses beyond their current 40-year terms will provide a viable approach for electric utilities to ensure the adequacy of future electricity-generating capacity that offers significant economic benefits when compared to the construction of new reactors.

In December 1991, the NRC issued the rule and associated documentation that describe the requirements a licensee must be able to demonstrate for the NRC to make a determination that the plant can continue to be operated for up to 20 additional years beyond the expiration of its 40-year license. The NRC issued an amendment to the license renewal rule that became effective on June 7, 1995. The amendment to the rule provides a more stable and predictable regulatory process for license renewal by focusing the license renewal safety review on the management of the adverse effects of aging on certain systems, structures, and components during the period of extended operation.

In a separate rulemaking, the NRC revised the scope of environmental effects for license renewal to enhance the agency's environmental review process for reactor license renewal. The final, revised rule became effective on September 5, 1996.

The NRC has developed improved regulatory guidance and standard review plans to standardize the content of license renewal applications and improve the efficiency and effectiveness of the NRC's evaluation for both the safety and environmental reviews.

The first license renewal application was submitted in April 1998 by Baltimore Gas and Electric (BGE) for its Calvert Cliffs units. Duke Energy Company (Duke) submitted a renewal application for its Oconee units in July 1998. Calvert Cliffs' renewed licenses were issued in March 2000 and Oconee's was issued in May 2000. Additionally, Entergy Operations, Inc. submitted an application in February 2000 for its Arkansas Nuclear One, Unit 1, and Southern Nuclear Operating Company submitted an application in March 2000 for its Hatch units, and Florida Power and Light submitted an application in September 2000 for its Turkey Point units.

(Continued on page 56)

Figure 25. **U.S. Commercial Nuclear Power Reactors—Years of Operation**

YEARS OF COMMERCIAL OPERATION	NUMBER OF REACTORS	AVERAGE CAPACITY (MDC)
△ 0–9	2	1134
▲ 10–19	47	1092
▲ 20–29	55	779

Note: There are no commercial reactors in Alaska or Hawaii. Calculated data as of 12/00.

Source: Nuclear Regulatory Commission

Table 12. **U.S. Commercial Nuclear Power Reactor Operating Licenses— Expiration Date by Year**

Year	Reactor Name	Number of Licenses Expired
2009	Dresden 2	4
	Ginna	
	Nine Mile Point 1	
	Oyster Creek	
2010	H.B. Robinson 2	3
	Monticello	
	Point Beach 1	
2011	Dresden 3	2
	Palisades	
2012	Pilgrim 1	6
	Quad Cities 1	
	Quad Cities 2	
	Surry 1	
	Turkey Point 3	
	Vermont Yankee	
2013	Browns Ferry 1	9
	Fort Calhoun	
	Indian Point 2	
	Kewaunee	
	Peach Bottom 2	
	Point Beach 2	
	Prairie Island 1	
	Surry 2	
	Turkey Point 4	
2014	Arkansas Nuclear 1	11
	Browns Ferry 2	
	Brunswick 2	
	Cooper	
	D. C. Cook 1	
	Duane Arnold	
	Edwin I. Hatch 1	
	James A. FitzPatrick	
	Peach Bottom 3	
	Prairie Island 2	
	Three Mile Island 1	
2015	Indian Point 3	2
	Millstone 2	

Year	Reactor Name	Number of Licenses Expired
2016	Beaver Valley 1	6
	Browns Ferry 3	
	Brunswick 1	
	Crystal River 3	
	Salem 1	
	St. Lucie 1	
2017	Davis-Besse	3
	D.C. Cook 2	
	Joseph M. Farley 1	
2018	Arkansas Nuclear 2	3
	Edwin I. Hatch 2	
	North Anna 1	
2020	North Anna 2	3
	Salem 2	
	Sequoyah 1	
2021	Diablo Canyon 1	4
	Joseph M. Farley 2	
	McGuire 2	
	Sequoyah 2	
2022	La Salle County 1	5
	San Onofre 2	
	San Onofre 3	
	Summer	
	Susquehanna 1	
2023	La Salle County 2	4
	McGuire 2	
	St. Lucie 2	
	Columbia Generating Station	
2024	Byron 1	8
	Callaway	
	Catawba 1	
	Grand Gulf 1	
	Limerick 1	
	Palo Verde 1	
	Susquehanna 2	
	Waterford 3	
2025	Diablo Canyon 2	6
	Fermi 2	
	Millstone 3	
	Palo Verde 2	
	River Bend 1	
	Wolf Creek 1	

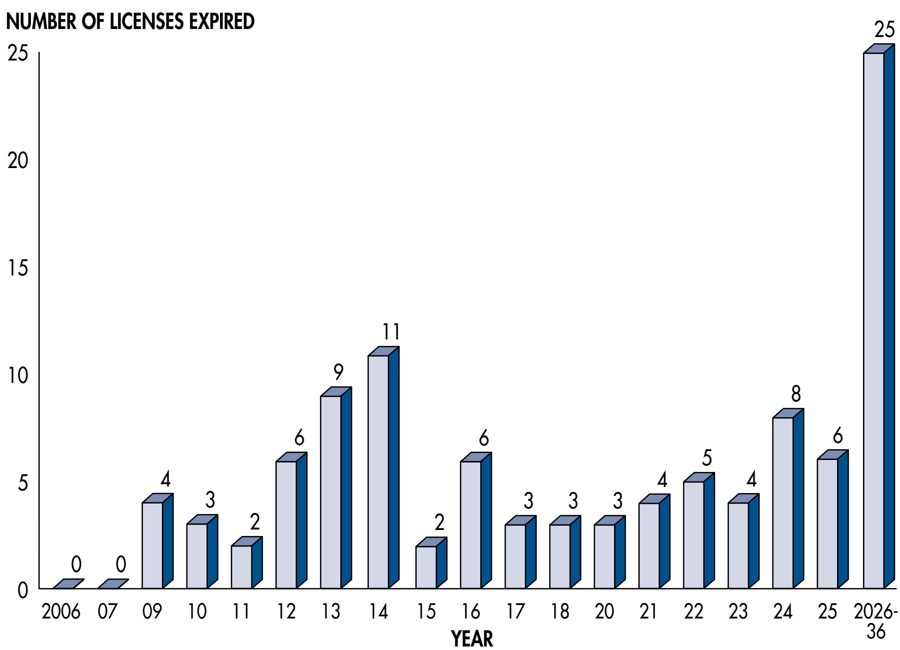
Year	Reactor Name	Number of Licenses Expired
2026	Braidwood 1	9
	Byron 2	
	Catawba 2	
	Clinton	
	Hope Creek 1	
	Nine Mile Point 2	
	Perry 1	
	Seabrook 1	
	Shearon Harris 1	
2027	Beaver Valley 2	5
	Braidwood 2	
	Palo Verde 3	
	South Texas Project 1	
	Vogtle 1	
2028	South Texas Project 2	1
2029	Limerick 2	2
	Vogtle 2	
2030	Comanche Peak 1	1
2033	Comanche Peak 2	3
	Oconee 1	
	Oconee 2	
2034	Calvert Cliffs 1	2
	Oconee 3	
2035	Watts Bar	1
2036	Calvert Cliffs 2	1

*Year assumes that the maximum number of years for construction recapture has been added to the current expiration date. This column is limited to reactors eligible for construction recapture. See Glossary for definition.

Note: Limited to reactors licensed to operate.

Source: Data as compiled by the Nuclear Regulatory Commission

Figure 26. **U.S. Commercial Nuclear Power Reactor Operating Licenses — Expiration Date by Year Assuming Construction Recapture**



The Babcock and Wilcox, Westinghouse, and Boiling Water Reactor Owners Groups have established generic license renewal programs that have developed and submitted technical reports for NRC approval. The Nuclear Energy Institute has established working groups to interact with the NRC on improvements to the license renewal rule implementation guidance, and resolution of generic renewal issues.

The NRC has conducted research providing the technical bases to ensure that critical reactor components, safety systems, and structures provide adequate reliability as reactors age. Research results continue to be useful in assessing safety implications of age-related degradation during the 40-year license and in supporting safety decisions associated with license renewal.

Future Reactor Licensing

In 1989, the NRC revised its regulations to provide a new licensing (10 CFR Part 52) process for future nuclear power plants that is more stable and predictable. This new licensing process includes Early Site Permits, Standard Design Certifications, and Combined Licenses. The NRC has recently initiated several activities with regard to future reactor licensing, specifically the formation of a Future Licensing Organization and an Advanced Reactors Group.

The Future Licensing Organization will perform several activities to ensure that the NRC is prepared to review new applications. These activities include: 1) performing a licensing and inspection readiness assessment, 2) assessing the activities necessary to prepare for Early Site Permit applications, 3) managing rulemaking efforts already underway to update 10 CFR Part 52 to clarify the processes for future application reviews and to incorporate lessons learned from previous Standard Design Certifications (General Electric Advanced Boiling Water Reactor, ASEA Brown Boveri/Combustion Engineering System 80+, and Westinghouse AP600), and 4) managing efforts underway regarding potential Standard Design Certification for Westinghouse's AP1000 reactor design.

The Advanced Reactors Group will review advanced reactor types to support standard design certification. These advanced reactor types include modular high-temperature gas-cooled reactors such as the Pebble Bed Modular Reactor (PBMR) being designed and developed in South Africa and the Gas Turbine-Modular Helium Reactor (GT-MHR) being designed and developed by General Atomics.

Several vendors and industry organizations have initiated discussions with the NRC to establish the feasibility of licensing various advanced reactor designs in the United States. Additional information on these advanced reactors and on the three Standard Design Certified reactors mentioned above is available at the NRC website at http://www.nrc.gov/OPA/gmo/tip/fsadvancedrx.html.

U.S. Nuclear Nonpower Reactors

Nuclear nonpower reactors are designed and utilized for research, testing, and educational purposes, for example:

- In the performance of research and testing in the areas of physics, chemistry, biology, medicine, materials sciences, and related fields
- In educating people for nuclear-related careers in the power industry, national defense, research, and education

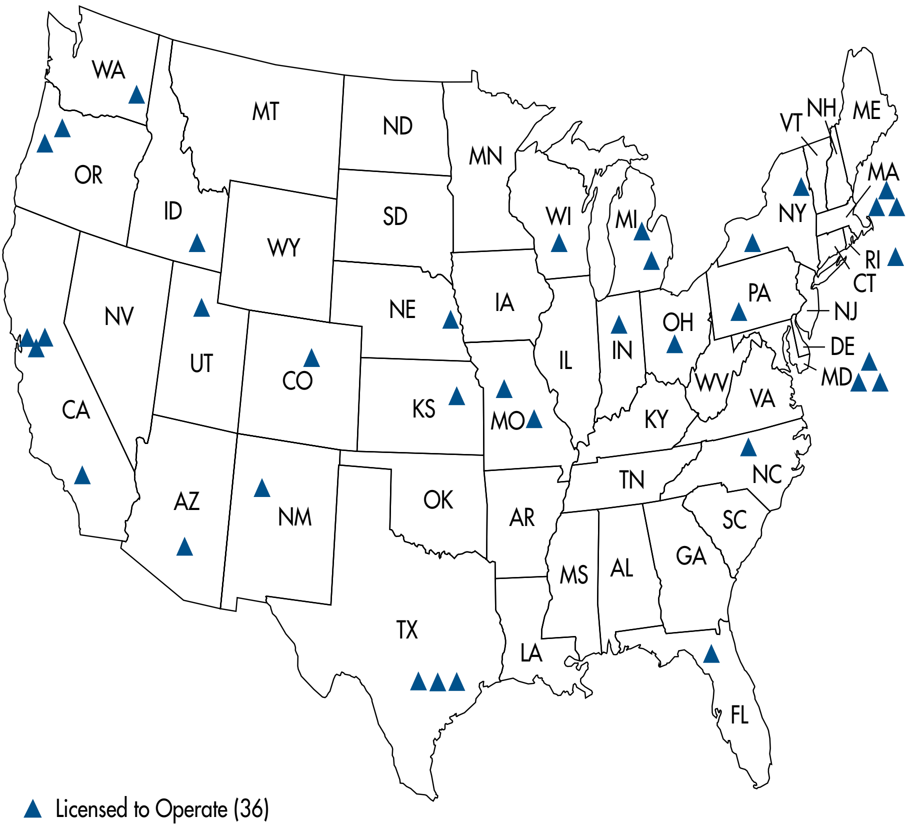
There are 36 nonpower reactors licensed to operate in 23 States (see Figure 27):

- 9 nonpower reactors are being decommissioned.
- 7 nonpower reactors have possession-only licenses.
- Since 1958, 73 licensed nonpower reactors have been decommissioned.
- Refer to Appendix E for a listing of U.S. nuclear nonpower reactors with operating licenses.

Principal Licensing and Inspection Activities

- Approximately 300 nonpower reactor operators are licensed by the NRC.
  - Each operator is requalified before renewal of a 6-year license.
- Approximately 40 nonpower reactor inspections are conducted annually.

Figure 27. **U.S. Nuclear Nonpower Reactor Sites**



Note: There are no nonpower reactors in Alaska or Hawaii.

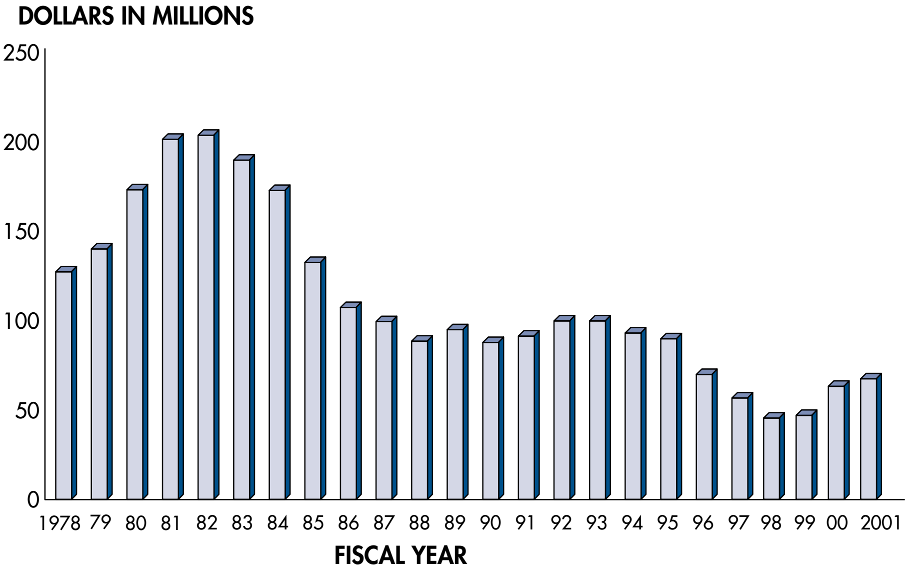
Source: Nuclear Regulatory Commission

Nuclear Regulatory Research

NRC's regulatory research program seeks to provide independent information and expertise to support realistic safety decisionmaking, to assess the safety significance of potential technical issues, to prepare the agency for the future by evaluating potential safety issues involving new designs and technology. As such, the research program is both confirmatory of existing safety margins and anticipatory of future concerns. The challenges and influences that govern NRC's regulatory research program include changes in the practices and performance of the regulated industry, increased economic pressures on licensees, emergence of new safety issues as the industry continues to mature, availability of new technologies, and public awareness and involvement in the regulatory process. The NRC's research program is key to providing the capability to face these challenges. Accordingly, the NRC must have highly skilled, independent expertise, and accurate information necessary to formulate sound technical solutions and make timely and realistic regulatory judgments.

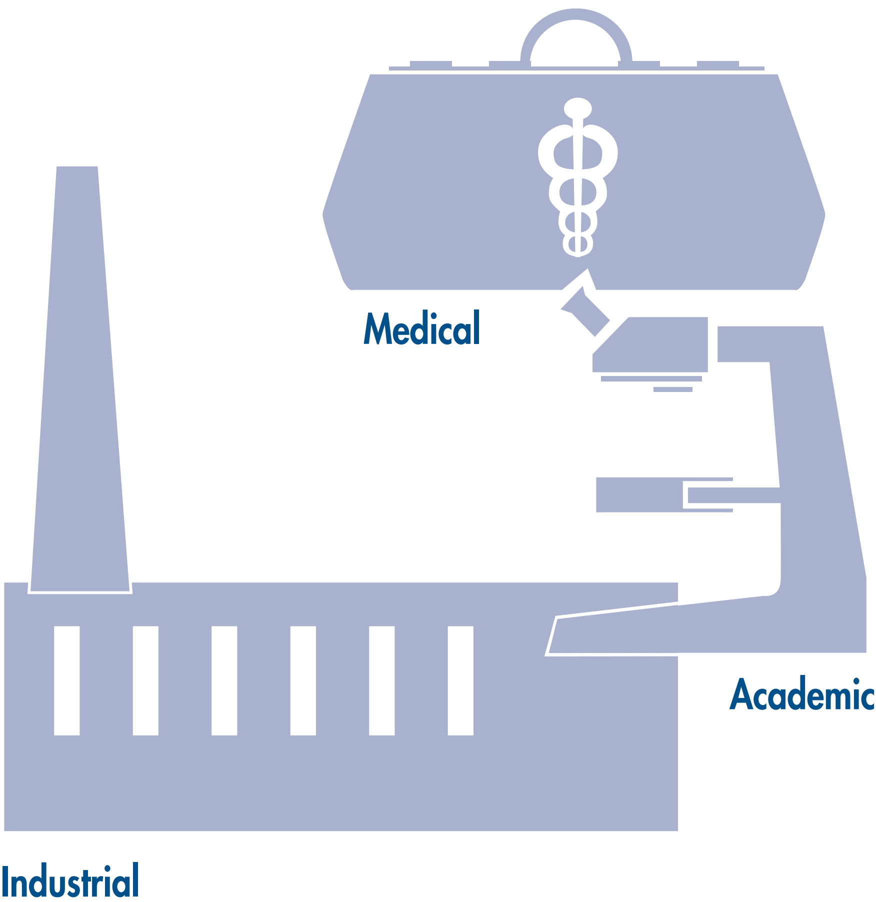
Although the significant reduction of the research program over the years reflects a changing environment and maturing industry, it is also presenting a challenge to the ability to address issues in the future. The current NRC research program focuses on supporting the NRC's review of emerging technologies (e.g., digital instrumentation and control systems), understanding and resolving nuclear plant aging issues arising out of operating experience, decommissioning licensed facilities, understanding the risks associated with nuclear facilities, including providing an independent review of operating experience to identify potential safety concerns, and providing the technical basis to support the NRC to move to a more risk-informed regulatory framework.

Figure 28. **Research Budget Trends, FY 1978–2001**



The NRC research program provides the independent expertise and information necessary for making timely regulatory judgments, anticipating problems of potential safety significance for which new or expanded knowledge can assist NRC in pursuing its mission, and provides support for developing regulations and regulatory guides pertaining to Commission policy or technical requirements. Over the years, the research program has been significantly reduced to reflect the changing environment and the maturing industry.

Nuclear Materials Safety



U.S. Fuel Cycle Facilities

The NRC licenses and inspects all commercial nuclear fuel facilities involved in the processing and fabrication of uranium ore into reactor fuel. A typical fuel fabrication plant is illustrated in Figure 29.

There are seven major fuel fabrication and production facilities licensed to operate in six States (see Figure 30):

- **Uranium Fuel Fabrication Facilities:**
  - Global Nuclear Fuel Americas, LLC (Wilmington, North Carolina)
  - Westinghouse Electric Company, LLC Nuclear Fuel Division (Columbia, South Carolina)
  - Nuclear Fuel Services, Inc. (Erwin, Tennessee)
  - Framatome Fuels (Lynchburg, Virginia)
  - BWX Technologies Naval Nuclear Fuel Division (Lynchburg, Virginia)
  - Framatome ANP Richland, Inc. (Richland, Washington)
- **Uranium Hexafluoride Production Facility:**
  - Honeywell International, Inc. (Metropolis, Illinois)

In addition, NRC regulates the two gaseous diffusion uranium enrichment facilities, which are leased by the United States Enrichment Corporation from the Department of Energy (DOE). NRC promulgated regulations for the gaseous diffusion plants in 10 CFR Part 76 in September 1994. The two plants came under NRC regulation on March 3, 1997.

- **Gaseous Diffusion Enrichment Facilities:**
  - U. S. Enrichment Corporation (Paducah, Kentucky)
  - U. S. Enrichment Corporation (Portsmith, Ohio)

NRC regulates 14 other facilities that possess significant quantities of special nuclear material (other than reactors) or process source material (other than uranium recovery facilities).

NRC is also engaged in a cooperative effort with the DOE on processing and solidification of high-level radioactive waste for long-term isolation. Since 1980, the West Valley Demonstration Project Act has required NRC to oversee the protection of public safety for the high-level waste vitrification demonstration project at the Western New York Nuclear Center, West Valley, New York. Under a joint project between the DOE and the New York State Energy Research and Development Authority, the West Valley Demonstration Project began converting liquid high-level waste into glass logs in July 1996.

In 1996, NRC also initiated a cooperative project with the DOE's Tank Waste Remediation System Privatization Project in Hanford, Washington. Under a memorandum of understanding (MOU) signed in early 1997, the NRC provided technical, safety, and regulatory review assistance to DOE's efforts for regulating the construction and operation of the proposed vitrification facility. In June 2000, DOE terminated the privatization contract and replaced it with a management and operating contract. This effectively completed the MOU and ended NRC's participation, although the NRC has indicated its willingness to participate in the future if NRC expertise is needed.

- **Proposed Mixed Oxide Fuel Fabrication Facility:**
  - Duke Cogema Stone & Webster (Aiken, South Carolina)

The Nuclear Regulatory Commission is reviewing an application for construction of a mixed oxide (MOX) fuel fabrication facility at the Department of Energy's Savannah River Site.

The Department of Energy announced plans to construct this MOX facility through a contract with the consortium of Duke Engineering & Services, COGEMA Inc., and Stone & Webster (known as DCS). If NRC grants the license, DCS could build and operate the MOX facility. The facility is intended to convert surplus U.S. weapons-grade plutonium, supplied by the Department of Energy, into fuel for use in commercial nuclear reactors. Such use would render the plutonium essentially inaccessible and unattractive for weapons use.

DCS submitted an environmental report on the MOX facility in December 2000, and submitted its request for authorization to construct the facility in February 2001.

Before deciding whether to authorize construction, the NRC will prepare an environmental impact statement and will conduct a technical evaluation of the application to determine whether it meets NRC requirements.

Principal Licensing and Inspection Activities:

- NRC issues approximately 75 new, renewal, license amendments, and safety and safeguards reviews for fuel cycle facilities annually.

- NRC routinely conducts safety, safeguards, and environmental protection inspections of approximately 15 fuel cycle facilities or sites.

Figure 29. **Typical Fuel Fabrication Plant**

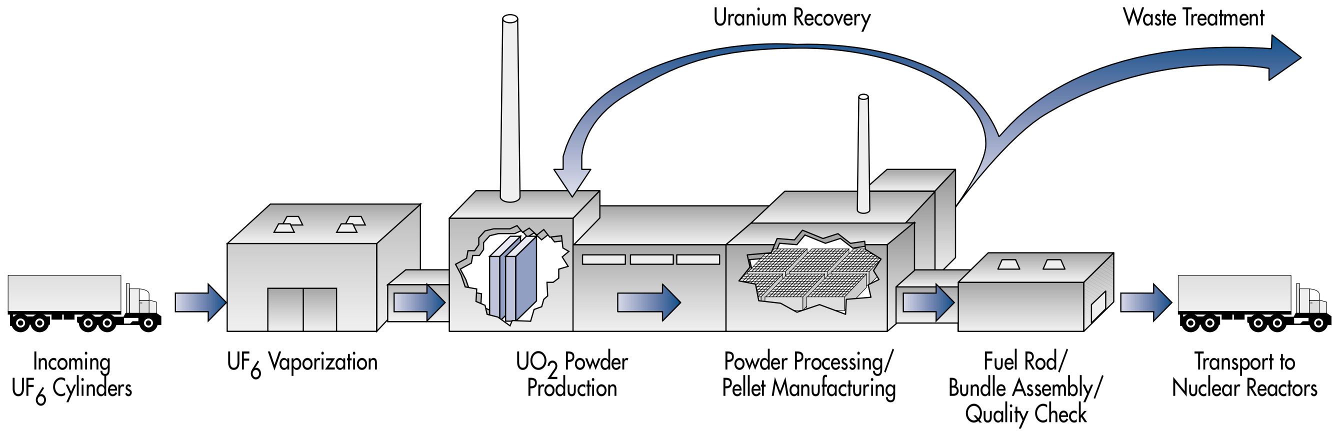
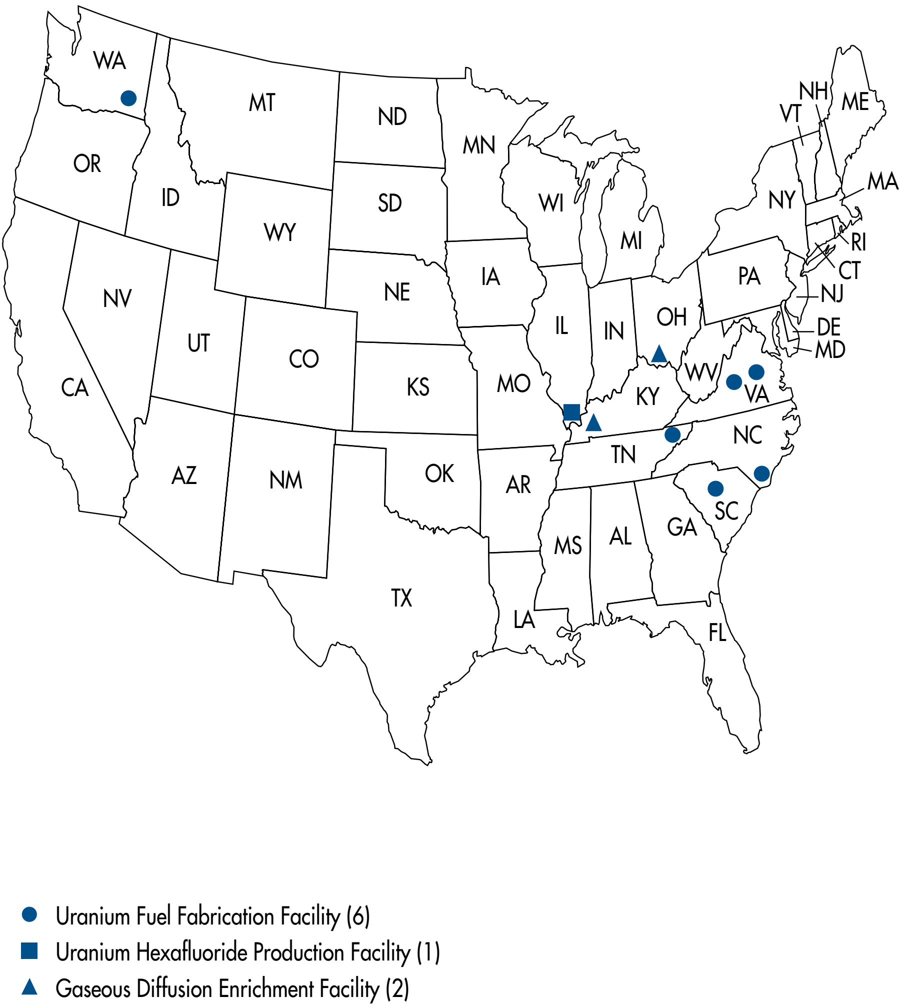


Figure 30. **Major U.S. Fuel Cycle Facility Sites**



Note: There are no fuel cycle facilities in Alaska and Hawaii.

Source: Nuclear Regulatory Commission

U.S. Materials Licenses

Approximately 21,000 licenses are issued for medical, academic, and industrial uses of nuclear materials (see Table 13):

- Approximately 5,000 licenses are administered by the NRC.
- Approximately 16,000 licenses are administered by the 32 States that participate in the Agreement States Program. An Agreement State is one that has signed an agreement with the NRC that authorizes the State to regulate the use of radioactive materials within that State (see Figure 31). Pennsylvania is actively working toward becoming an Agreement State.

Medical — An estimated 10-12 million diagnostic and therapeutic clinical procedures using radioactive materials are performed annually in the United States.

Academic — Used in universities, colleges, and other academic institutions in course work and research

Industrial — Used in such areas as radiography, gauging devices, gas chromatography, well logging, and smoke detectors

Principal Licensing and Inspection Activities

- NRC issues approximately 3,600 new licenses, renewals, or license amendments for materials licenses annually.
- NRC conducts approximately 1,500 health and safety inspections of its nuclear materials licensees annually.

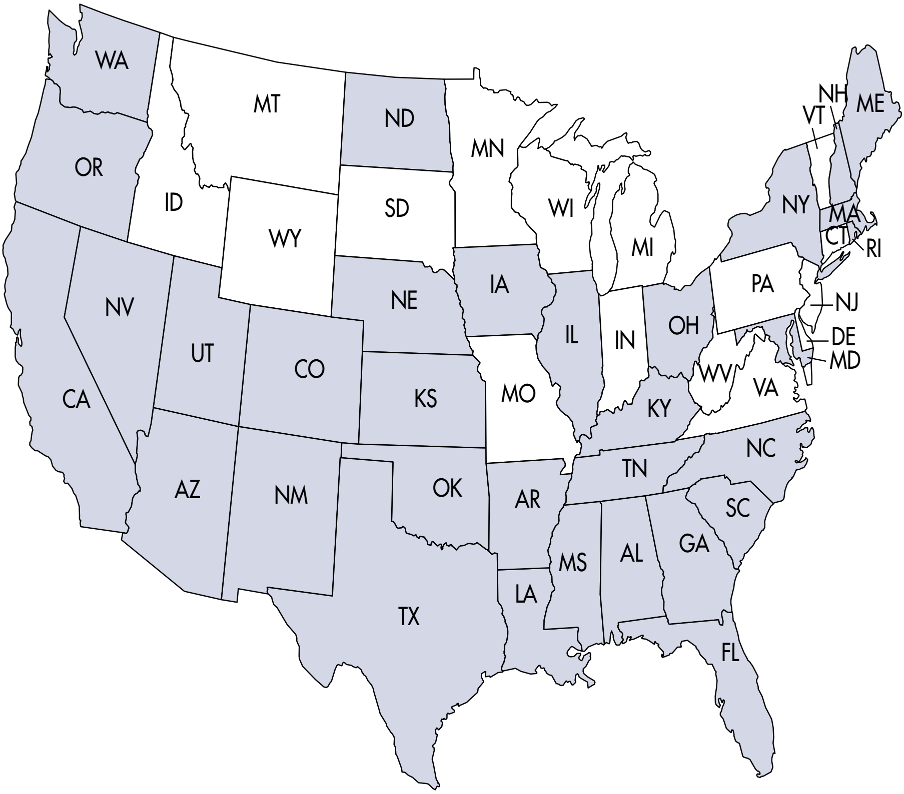
Table 13. **U.S. Materials Licenses by State**

State	NRC	Agreement States	State	NRC	Agreement States
	Number of Licenses			Number of Licenses	
Alabama	19	422	Montana	78	0
Alaska	51	0	Nebraska	5	136
Arizona	18	290	Nevada	6	232
Arkansas	7	270	New Hampshire	11	85
California	59	2,167	New Jersey	504	0
Colorado	22	333	New Mexico	19	218
Connecticut	192	0	New York	51	1,360
Delaware	65	0	North Carolina	16	608
District of Columbia	48	0	North Dakota	10	69
Florida	22	1,268	Ohio	27	704
Georgia	18	483	Oklahoma	42	222
Hawaii	56	0	Oregon	10	415
Idaho	88	0	Pennsylvania	745	0
Illinois	48	735	Rhode Island	2	72
Indiana	291	0	South Carolina	17	335
Iowa	4	183	South Dakota	44	0
Kansas	14	324	Tennessee	27	557
Kentucky	11	406	Texas	57	1,493
Louisiana	12	537	Utah	15	206
Maine	3	128	Vermont	35	0
Maryland	64	570	Virginia	383	0
Massachusetts	36	529	Washington	18	409
Michigan	516	0	West Virginia	182	0
Minnesota	162	0	Wisconsin	267	0
Mississippi	8	325	Wyoming	86	0
Missouri	299	0	Others*	156	0
			Total	**4,957**	**16,091**

*"Others" includes territories such as Puerto Rico, Virgin Islands, and Guam.

Note: NRC data as of 02/26/01. Agreement States data are latest available as of 04/26/01.

Figure 31. **NRC Agreement States**



Agreement States (32)

Note: The State of Oklahoma became an Agreement State in September 2000.
Alaska and Hawaii are not Agreement States.

Source: Nuclear Regulatory Commission

Nuclear Gauges

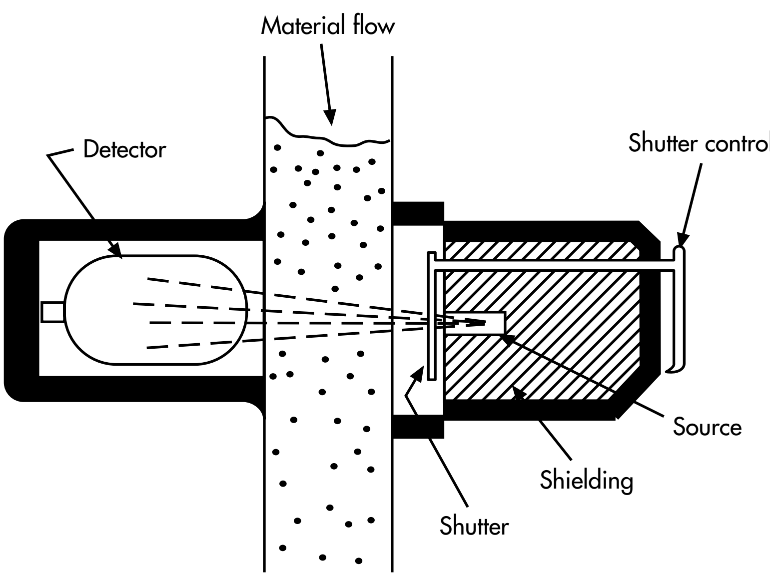
The cross section shows a fixed fluid gauge installed on a process pipe (see Figure 32). Such devices are widely used in beverage, food, plastics, process and chemical industries to measure the densities, flow rates, levels, thicknesses, and weights of a wide variety of materials and surfaces.

Nuclear gauges are used as non-destructive devices to measure physical properties of products and industrial proceses to ensure environment, quality control and low-cost fabrication, construction and installations.

Fixed gauges consist of a radioactive source that is contained in a source holder safely.

When the source holders' shutter is opened manually or by activating a remote electrical button, a beam of radiation is directed at the material or product being processed or controlled. A detector mounted opposite to the source, measures the radiation passing through the media of the material or the product. The required information is shown on a local read out or is displayed on a computer monitor. The type and strength of radiation energy are selected to ensure that the passage of the radiation does not cause any detectable changes in the material and does not radioactively contaminate the material.

Figure 32. **Cross Section of a Fixed Fluid Gauge**



Teletherapy Devices

Teletherapy is one of the primary radiation oncology treatment modalities. Teletherapy devices provide external high radiation beams for treatment of cancerous tumors. Both the primary tumor and the areas to which cancer may have spread (regional lympatic) may be treated at the same time.

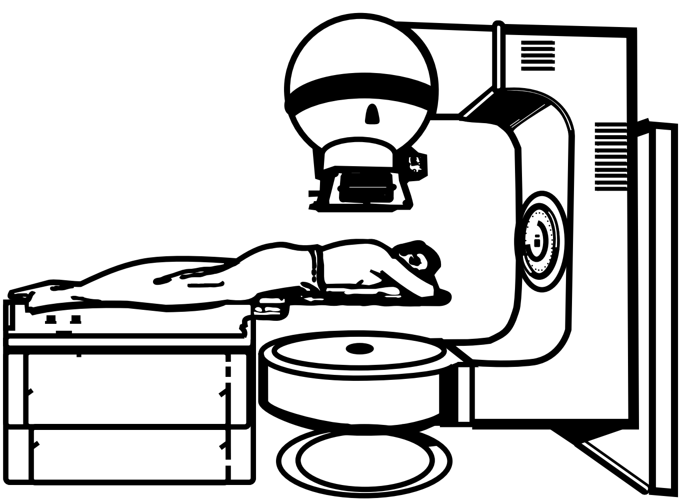
The Cobalt-60 source is in the equipment's head, which is surrounded by lead or depleted uranium shielding, with a port for treatment (see Figure 33).

Cobalt-60 teletherapy units use sources from 3 to 12 Kilo Curies, with an energy output of 1.17 & 1.33 Mev. Typical output generated by these sources is 50-200 rad/min.

Treatment distance between the source and the skin of the patient is 80 to 120 centimeters. Cesium-137 teletherapy units were formerly used by a few facilities. Few, if any, of these units remain as the average penetrating energy is approximately half of that provided by the cobalt sources.

Linear accelerators are replacing the Cobalt-60 units. A 4 MeV linear accelerator can provide about the same energy as a Cobalt-60 unit, but with a higher output (100 to 300 rad/min). Higher energy accelerators are now being used (6 MeV to 30 MeV). These higher energy photons provide greater dose depth. Also, the high energy electrons may be used directly in some cases.

Figure 33. **Cobalt-60 Teletherapy Unit**

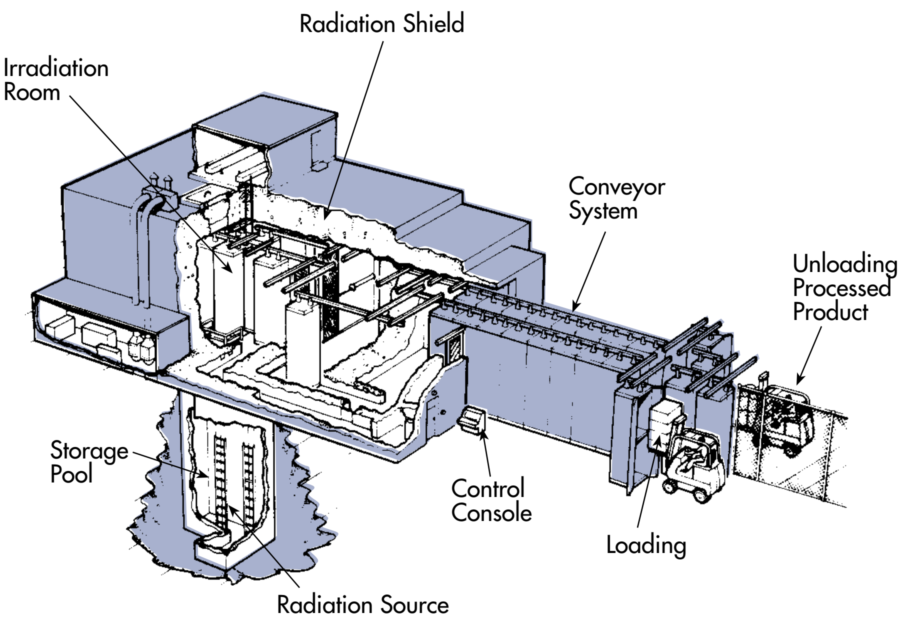


Commercial Product Irradiators

The Illustration below shows a typical large commercial gamma irradiator which may be used for sterilization of medical supplies and equipment, disinfestation of food products, insect eradication through sterile male release program, chemical and polymer synthesis and modifications or extension of shelf-life of poultry and perishable products.

In this type of irradiator, when in use, the Cobalt-60 sealed source is raised out of the pool water and exposed to the product within a radiation volume that is maintained inaccessible during use by an entry control system.

Figure 34. **Commercial Gamma Irradiator**



International Activities

The NRC participates in a wide range of mutually beneficial programs to exchange information with counterparts in the international community, and to enhance the safety and security of peaceful nuclear activities worldwide. This low cost, high impact program provides health and safety information and assistance to other countries, or joint cooperative activities, to develop and improve regulatory organizations and overall nuclear safety. These activities include:

- Assisting in United States government international policy and priority formulation by developing legal instruments in the nuclear field to address vital issues such as nuclear non-proliferation, safety, safeguards, radiation protection, spent fuel and waste management, nuclear safety research, and liability.

- Contributing to the implementation of national nuclear policy by supporting presidential summits and the International Nuclear Regulators Association.

- Licensing imports and exports of nuclear facilities, major components, material, and related commodities.

- Ensuring prompt notification of safety problems that warrant action or investigation.

- Providing for bilateral information exchange and cooperation on nuclear safety, safeguards, waste management, and radiological protection with the regulatory authorities of : Argentina, Armenia, Belgium, Brazil, Canada, China, Czech Republic, Egypt, Finland, France, Germany, Greece, Hungary, Indonesia, Israel, Italy, Japan, Kazakhstan, Lithuania, Mexico, Netherlands, Peru, Philippines, Republic of Korea (South Korea), Romania, Russia, Slovak Republic, Slovenia, South Africa, Spain, Sweden, Switzerland, Taiwan, Ukraine, and the United Kingdom.

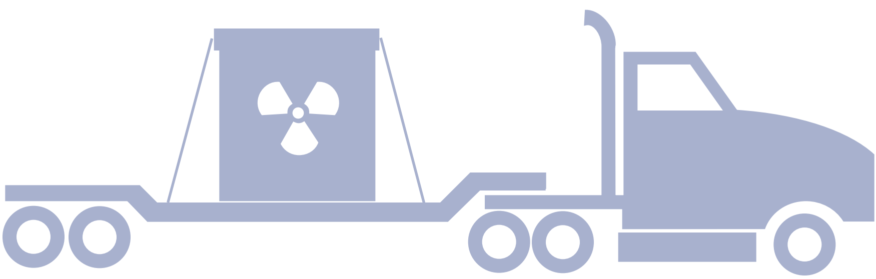
- Assisting Russia, Ukraine, Armenia, Kazakhstan, and Central and Eastern European countries (Bulgaria, Hungary, the Czech and Slovak Republics, and Lithuania) that use Soviet-designed reactors to improve nuclear safety regulation. These assistance efforts are carried out primarily through training, workshops, and peer review of regulatory documents, working group meetings, and technical information and specialist exchanges.

- Participating in the programs of the International Atomic Energy Agency (IAEA), and the Organization for Economic Cooperation and Development's Nuclear Energy Agency concerned with safety research and regulatory matters, radiation protection, risk assessment, waste management, transportation, safeguards, physical protection of nuclear materials, standards, training, and technical assistance.

- Implementing IAEA safeguards at NRC-licensed nuclear facilities in the U.S. and helping strengthen and maintain IAEA effectiveness worldwide.

- Sharing technical information, funding, technical support, and results of specific joint research projects and programs.

Radioactive Waste



U.S. Low-Level Radioactive Waste Disposal

Commercial low-level waste disposal facilities must be licensed by either NRC or Agreement States in accordance with health and safety requirements. The facilities are to be designed, constructed, and operated to meet safety standards. The operator of the facility must also extensively characterize the site on which the facility is located and analyze how the facility will perform for thousands of years into the future. NRC's requirements place restrictions on the types of waste that can be disposed of. A new low-level waste disposal facility, typical of those that have been considered for the east or midwest United States, is shown in Figure 35. Current low-level waste disposal uses shallow land disposal sites with or without concrete vaults.

Approximately 3,346 thousand cubic feet of low-level radioactive waste was disposed of in 2000 (see Figures 36 and 37).

- The NRC has developed a classification system for low-level waste based on its potential hazards and has specified disposal and waste form requirements for each of the three general classes of waste — A, B, and C. Class A waste contains lower concentrations of radioactive material than Class C waste.

The volume and radioactivity of waste vary from year to year based on the types and quantities of waste shipped each year (see Figures 37 and 38).

The Low-Level Radioactive Waste Policy Amendments Act (LLRWPAA) of 1985 authorized the following:

- Formation of regional compacts; ten compacts now active.
- Exclusion of waste generated outside a compact
- System of milestones, incentives, and penalties to ensure that States and compacts will be responsible for their own waste

Active, Licensed Disposal Facilities

- Barnwell, South Carolina (access authorized for all low-level waste generators)
- Hanford, Washington (restricted access to only the Northwest and Rocky Mountain compacts)
- Clive, Utah (restricted to only contain Class A waste)

Other Disposal Facilities

Closed Sites

- Beatty, Nevada—closed 1993
- Sheffield, Illinois—closed 1978
- Maxey Flats, Kentucky—closed 1977
- West Valley, New York—closed 1975

Figure 35. **Low-Level Waste Disposal Site**

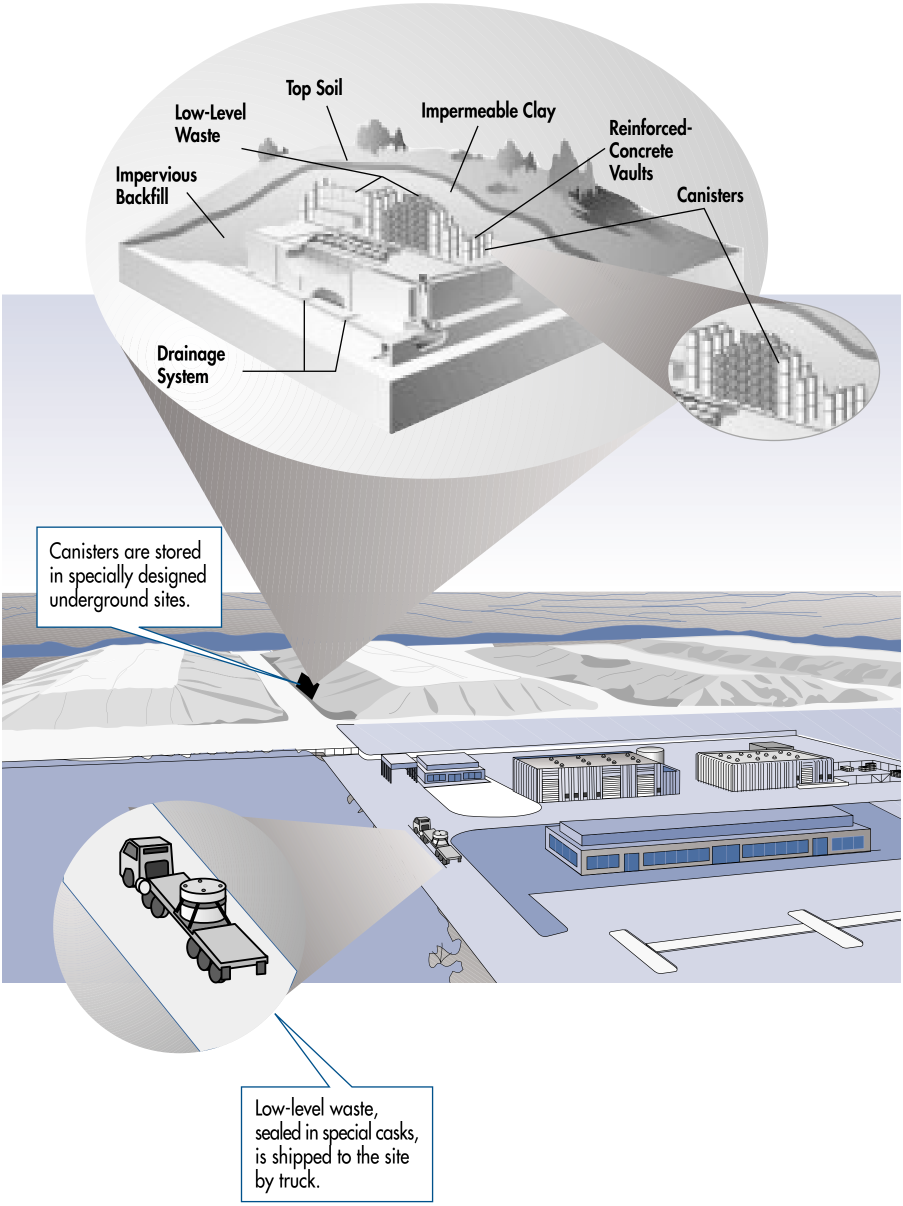
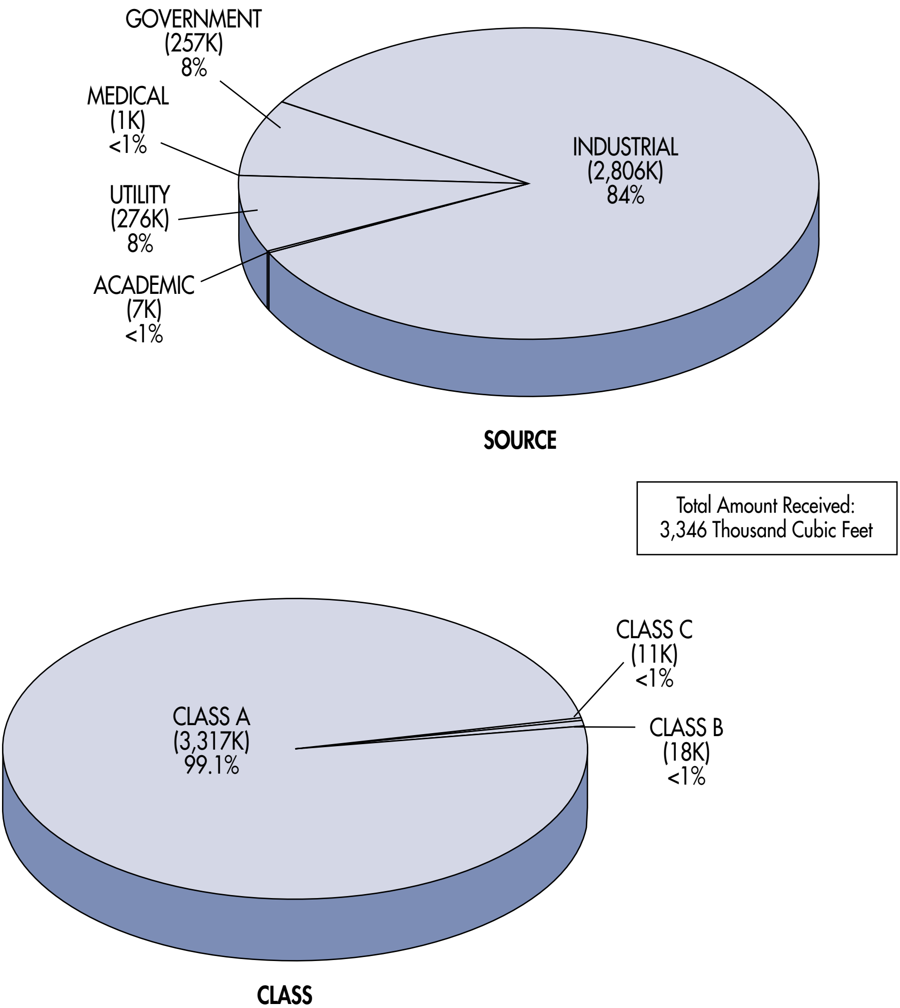


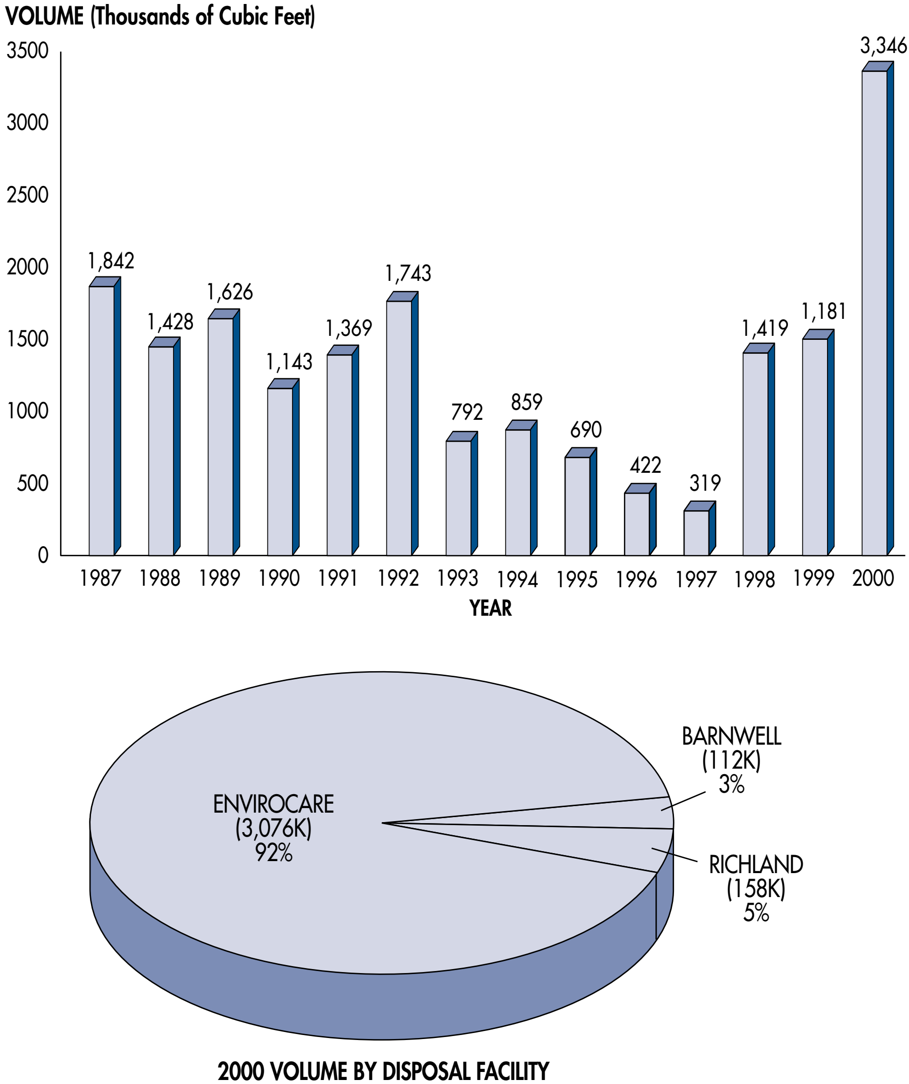
Figure 36. **Volume of Low-Level Radioactive Waste Received at U.S. Disposal Facilities (Cubic Feet), 2000**



Note: Class A waste contains lower concentrations of radioactive material than Class C waste. Determination of the classification of waste, however, is a complex process. For more information, see 10 CFR Part 61. Volumes are rounded to the nearest thousand cubic feet and percentages are rounded to the nearest whole number.

Source: Manifest Information Management System, Idaho National Engineering and Environmental Laboratory <http://mims.inel.gov>

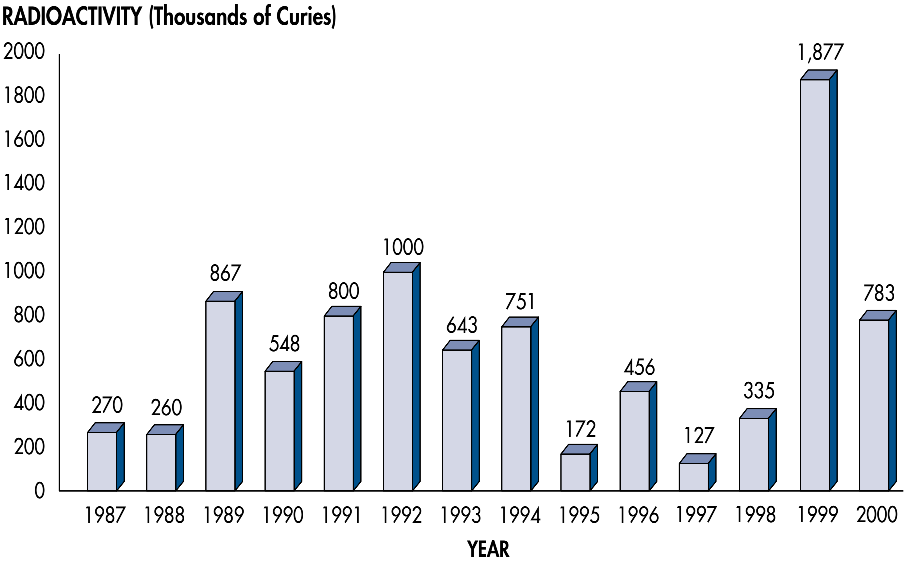
Figure 37. **Volume of Low-Level Waste Received at U.S. Disposal Facilities, 1987–2000**

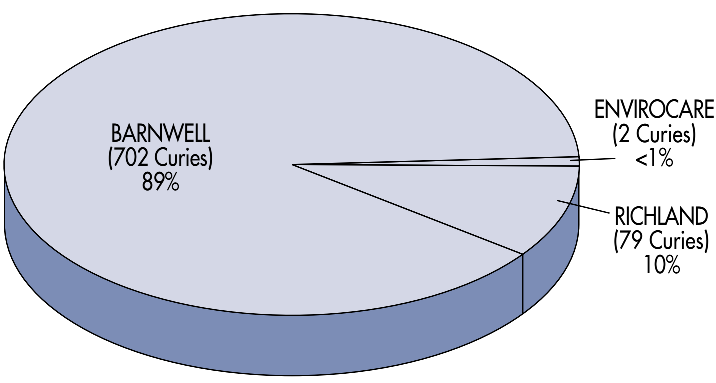


Note: Volumes are rounded to the nearest thousand cubic feet and percentages are rounded to the nearest whole number.

Source: Manifest Information Management System, Idaho National Engineering and Environmental Laboratory <http://mims.inel.gov>

Figure 38. **Radioactivity of Low-Level Waste Received at U.S. Disposal Facilities, 1987–2000**





2000 RADIOACTIVITY BY DISPOSAL FACILITY

Note: Radioactivity is rounded to the nearest thousand curies and percentages are rounded to the nearest whole number.

Source: Manifest Information Management System, Idaho National Engineering and Environmental Laboratory <http://mims.inel.gov>

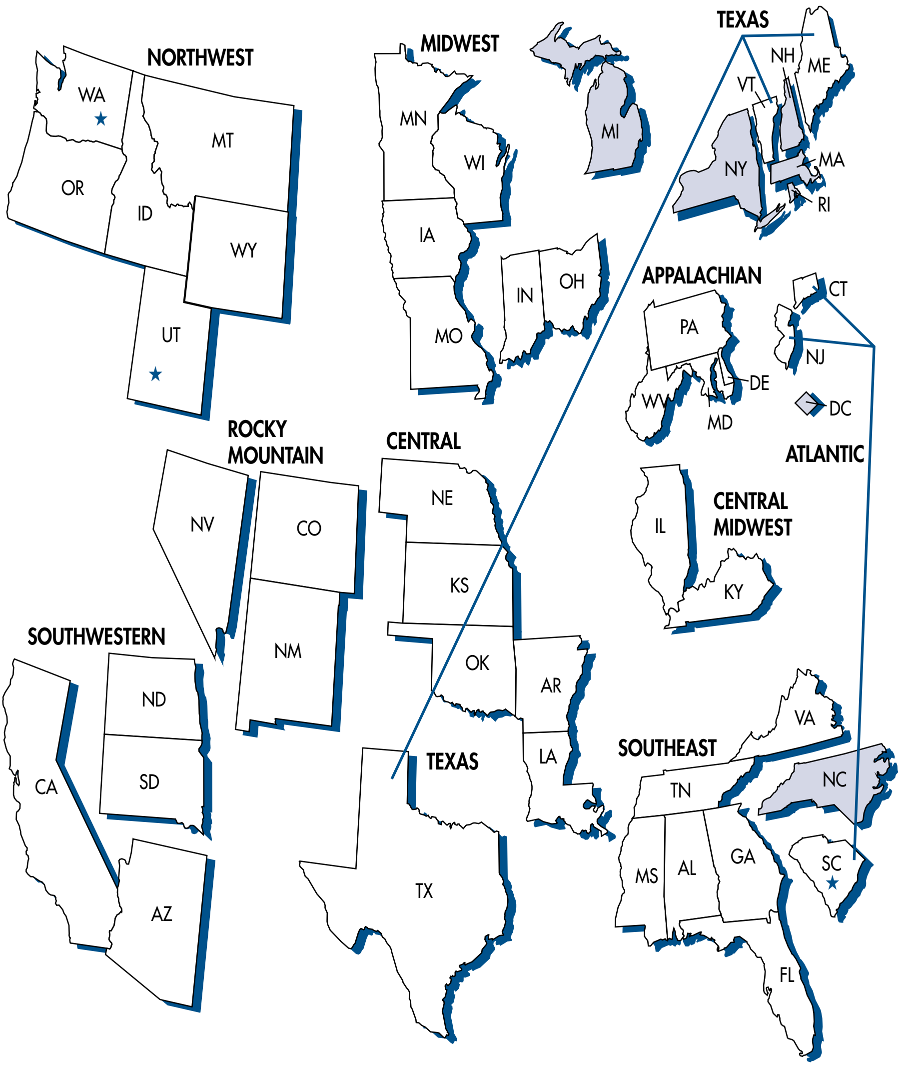
Table 14. **U.S. Low-Level Waste Compacts**

Compact	Percent of Total Volume of Low-Level Waste Disposed in 2000
Northwest	4.7%
Alaska	
Hawaii	
Idaho	
Montana	
Oregon	
Utah	
Washington	
Wyoming	
Southwestern	1.8%
Arizona	
California	
North Dakota	
South Dakota	
Rocky Mountain	<1%
Colorado	
Nevada	
New Mexico	
Midwest	2.6%
Indiana	
Iowa	
Minnesota	
Missouri	
Ohio	
Wisconsin	
Central	<1%
Arkansas	
Kansas	
Louisiana	
Nebraska	
Oklahoma	
Texas	1.7%
Maine	
Texas	
Vermont	
Central Midwest	3.0%
Illinois	
Kentucky	
Appalachian	13.7%
Delaware	
Maryland	
Pennsylvania	
West Virginia	
Atlantic	8.3%
Connecticut	
New Jersey	
South Carolina	
Southeast	61.2%
Alabama	
Florida	
Georgia	
Mississippi	
Tennessee	
Virginia	
Unaffiliated	2.5%
District of Columbia	
Massachusetts	
Michigan	
New Hampshire	
New York	
North Carolina	
Puerto Rico	
Rhode Island	
U.S. Army	

Note: Refer to INEEL Website for 1999 Low-Level Waste compacts data.

Source: Manifest Information Management System, Idaho National Engineering and Environmental Laboratory <http://mims.inel.gov>.

Figure 39. **U.S. Low-Level Waste Compacts**



★ Active Disposal Site (3)

☐ Approved Compact (10)

☐ Unaffiliated (9)

Note: Data as of March 2001.

Alaska and Hawaii belong to the Northwest Compact. Puerto Rico is unaffiliated.

Source: Nuclear Regulatory Commission

U.S. High-Level Radioactive Waste Disposal

The Yucca Mountain Disposal Plan

The Nuclear Waste Policy Act of 1982 and the Nuclear Waste Policy Amendments Act of 1987 specify a detailed approach for the disposal of high-level radioactive waste with the Department of Energy (DOE) having operational responsibility and the NRC having regulatory responsibility for the transportation, storage, and geologic disposal of the waste.

- The disposal of high-level radioactive waste requires a determination of acceptable health and environmental impacts over thousands of years.
- Current plans call for the ultimate disposal of the waste in solid form in a licensed, deep, geologic structure.
- The Amendments Act redirected DOE to investigate only one potential high-level waste repository at Yucca Mountain, Nevada. DOE released it's Viability Assessment in December 1998, and concluded that Yucca Mountain remains a promising site for a geological repository and that work should proceed to support a decision in 2001 on whether to recommend the site to the President for development as a repository. (See Figure 40 for a conceptual design of the Yucca Mountain disposal plan.)
- NRC issued its proposed regulations for public comment in February 1999.
- DOE has issued for public comment the Draft Environmental Impact Statement .
- DOE plans to issue a Site Recommendation Consideration Report in 2001 for Stakeholder review comment.
- Ultimately, any high-level waste repository will require an NRC license. DOE is currently scheduled to submit an application for a license to authorize construction of a repository at Yucca Mountain in 2003.

Spent Fuel Storage

In 1997, approximately 36,600 metric tons of spent nuclear fuel was stored at commercial nuclear power reactors. By the year 2005, this amount is expected to increase to 52,000 metric tons:

- All of the operating nuclear power reactors are storing used fuel under NRC license in spent fuel pools (SFPs) (see Figure 41).
- Most U.S. nuclear power plants were not originally designed to have a storage capacity for all the spent fuel produced by their reactors. Utilities originally planned for spent fuel to remain in the SFP for a few years after discharge and then to be sent to a reprocessing facility. However, the U.S. Government declared a moratorium on reprocessing in 1977. Although the ban was later lifted, reprocessing was eliminated as a feasible option. Consequently, utilities expanded the storage capacity of their SFPs by using high-density storage racks. This has been only a short-term solution and many utilities have reached, or will soon reach, their SFP storage capacity. (See Figure 42)
- In 1990, the NRC amended its regulations to authorize licensees to store spent fuel at reactor sites in dry storage systems approved by the NRC. Thirteen dry

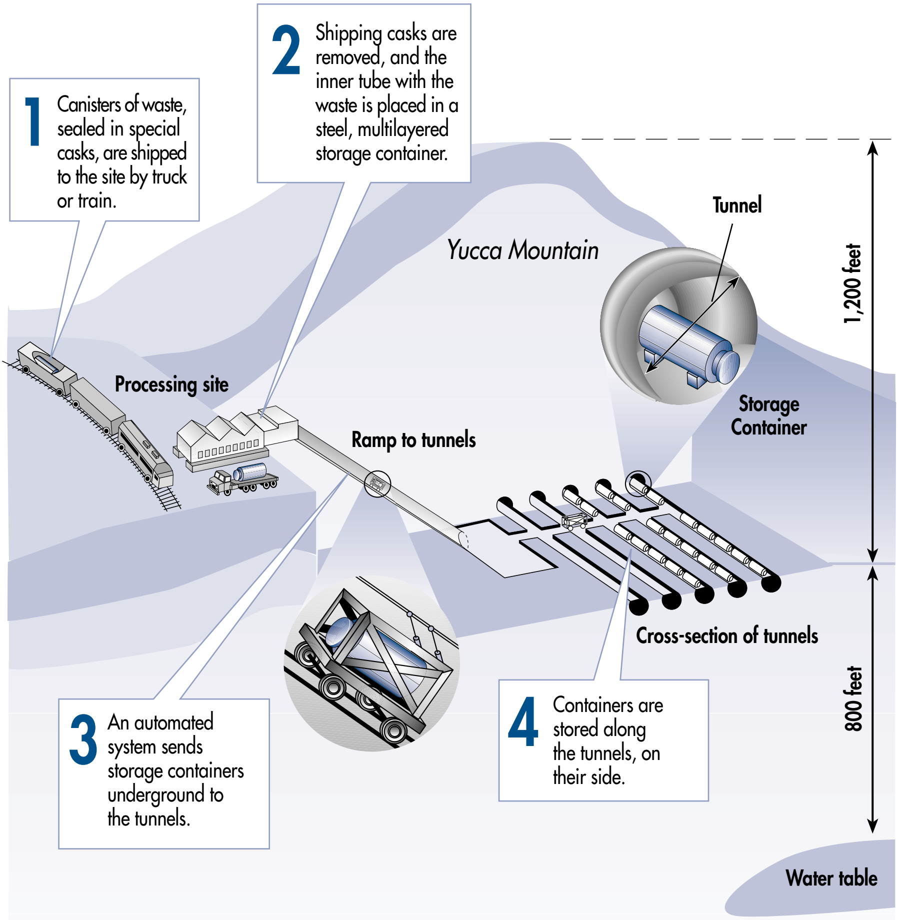
(Continued)

U.S. High-Level Radioactive Waste Disposal *(Continued)*

storage designs have received certificates of compliance as a result of this rule change (see Appendix G).

- Currently, there are 20 operating independent spent fuel storage installation sites (ISFSIs) in the U.S. (See Figure 43).
- Refer to NUREG-1571, "Information Handbook on Independent Spent Fuel Storage Installations" (December 1996), for a general overview.
- Refer to Appendix H for a list of NRC Dry Spent Fuel Storage Licensees.
- The NRC is responsible for approving transportable dry storage systems, also called dual purpose casks (see Figure 44).

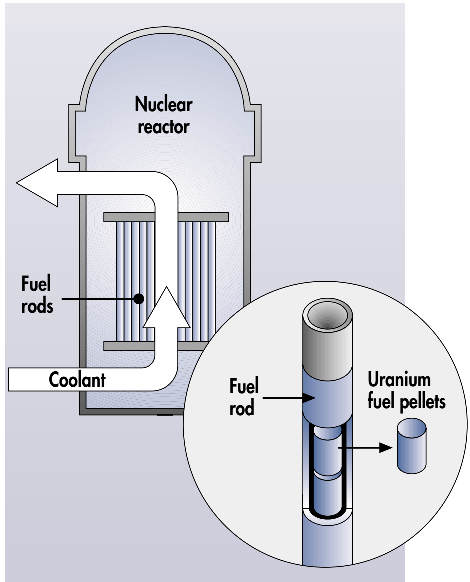
Figure 40. **The Yucca Mountain Disposal Plan**

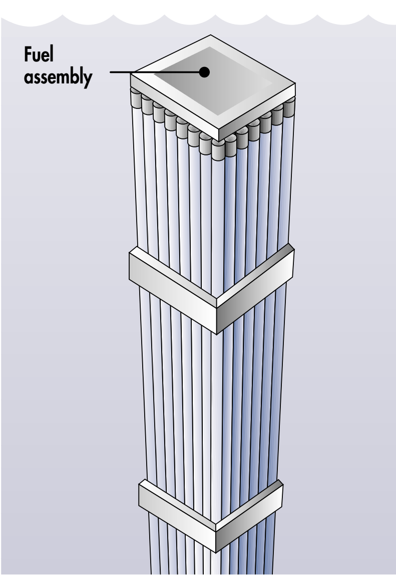


Source: Department of Energy and the Nuclear Energy Institute

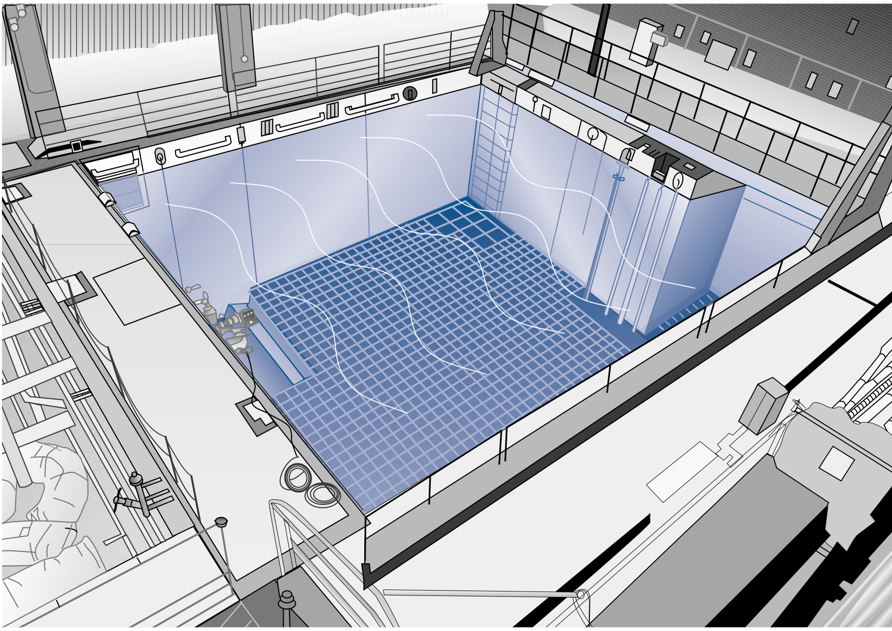
Figure 41. **Spent Fuel Generation and Storage After Use**

1 Nuclear reactors are powered by enriched uranium-235 fuel. Fission generates heat, which produces steam that turns turbines to produce electricity. A reactor rated at several hundred megawatts may contain 100 or more tons of fuel in the form of bullet-sized pellets loaded into long rods.





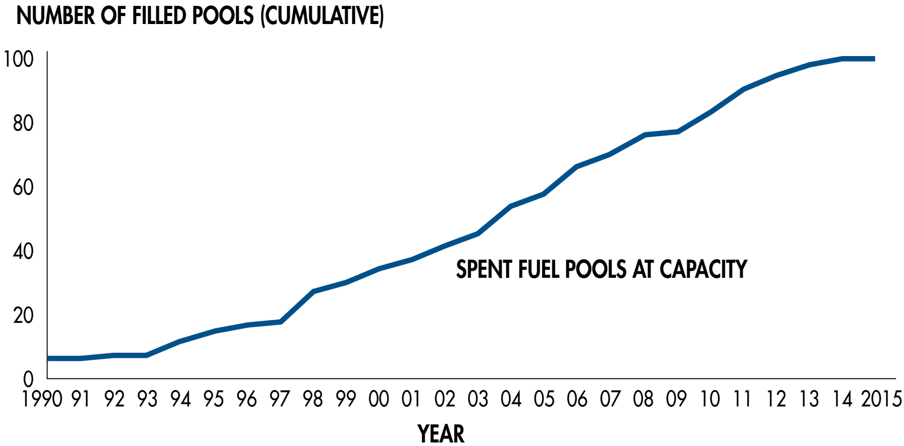
2 After about six years, spent fuel assemblies—typically 14 feet long and containing nearly 200 fuel rods—are removed from the reactor and allowed to cool in storage pools for a few years. At this point, the 900-pound assemblies contain only about one-fifth the original amount of U-235.



3 *Commercial light-water nuclear reactors store spent fuel outside the primary containment in a steel-lined, seismically designed concrete pool. The spent fuel is cooled while in the spent fuel storage pool by water that is force-circulated using electrically powered pumps. Makeup water to the pool is provided by other pumps that can be powered from an onsite emergency diesel generator. Support features, such as water and radiation level detectors, are also provided. Spent fuel is stored in the spent fuel storage pool until it can be transferred on site to a dry cask storage location (see Figure 44) or transported off site to a high-level radioactive waste disposal site.*

Source: Department of Energy and the Nuclear Energy Institute

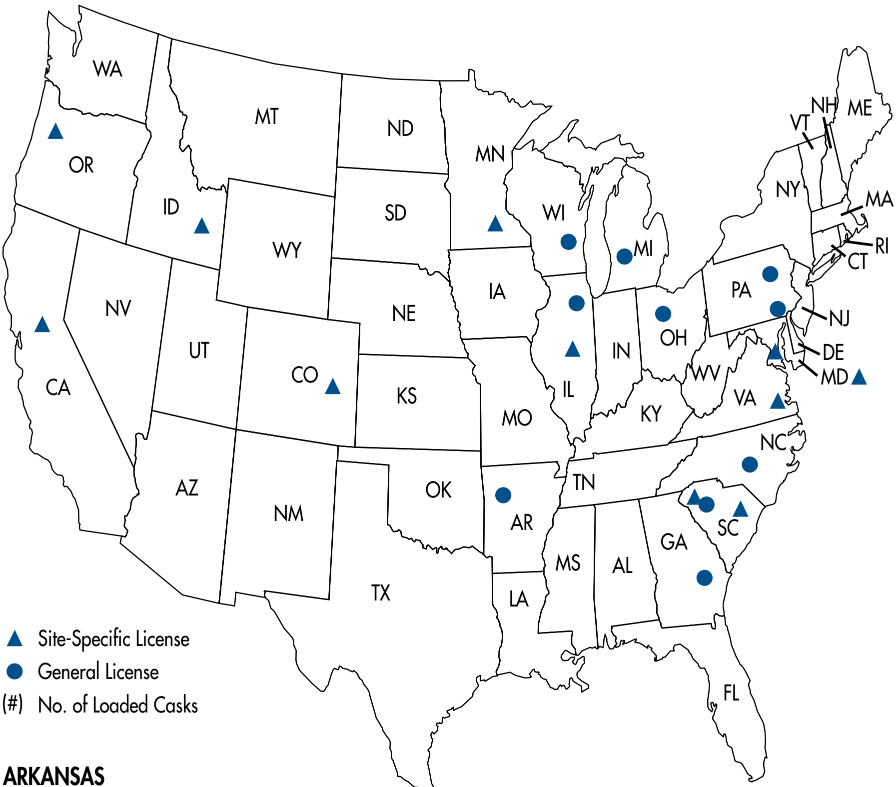
Figure 42. **Nuclear Fuel Storage Pool Capacity**



Note: All operating nuclear power reactors are storing used fuel under NRC license in spent fuel pools. Some operating nuclear reactors are using dry cask storage. Information is based on loss of full-core reserve in the spent fuel pools.

Source: Energy Resources International and DOE/RW-0431 – Revision 1

Figure 43. **Licensed/Operating Independent Spent Fuel Storage Installations**



ARKANSAS
● Arkansas Nuclear (17)

CALIFORNIA
▲ Rancho Seco (*)

COLORADO
▲ Fort St. Vrain (244)**

GEORGIA
● Hatch (3)

IDAHO
▲ DOE: TMI-2 Fuel Debris (2)

ILLINOIS
▲ GE Morris (3217)**
● Dresden (1)

MARYLAND
▲ Calvert Cliffs (36)

MICHIGAN
● Palisades (18)

MINNESOTA
▲ Prairie Island (12)

NORTH CAROLINA
● McGuire (1)

OHIO
● Davis-Besse (3)

OREGON
▲ Trojan (*)

PENNSYLVANIA
● Susquehanna (8)
● Peach Bottom (4)

SOUTH CAROLINA
●▲ Oconee (58)***
▲ H.B. Robinson (8)

VIRGINIA
▲ Surry (40)
▲ North Anna (9)

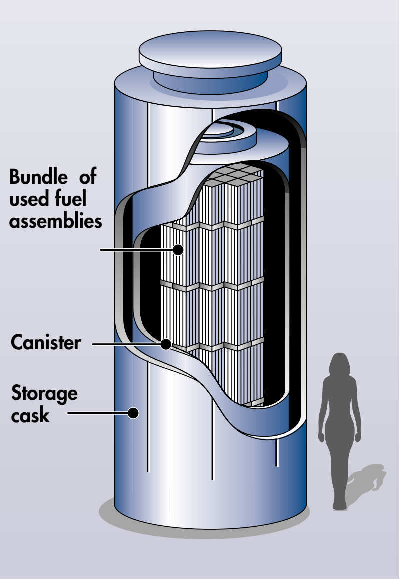
WISCONSIN
● Point Beach (12)

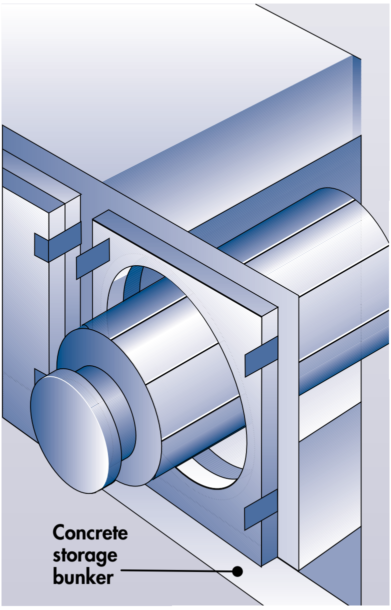
Data as of March 2001
*Licensed but none loaded yet
**Fuel Assemblies
***Oconee loaded 40 casks under a site-specific license and continues to load casks under the general license provisions.
Source: Nuclear Regulatory Commission

Figure 44. **Dry Storage of Spent Fuel**

At some nuclear reactors across the country, spent fuel is kept on site, above ground, in systems basically similar to the ones shown here.

1 Once the spent fuel has cooled, it is loaded into special canisters, each of which is designed to hold about 24 (Pressurized-Water Reactor) or 68 (Boiling-Water Reactor) assemblies. Water and air are removed. The canister is filled with inert gas, welded shut, and rigorously tested for leaks. It may then be placed in a "cask" for storage or transportation.





2 The canisters can also be stored in above-ground concrete bunkers, each of which is about the size of a one-car garage. Eventually they may be transported elsewhere for storage.

U.S. Nuclear Materials Transportation and Safeguards

The NRC reviews and licenses the design of containers used to transport radioactive materials; conducts transport-related safety inspections; performs quality assurance inspections of designers, fabricators, and suppliers of approved transportation containers; and carries out safeguards inspections of nuclear materials licensees.

Under a memorandum of understanding, the NRC requires licensed materials to be shipped in accordance with the hazardous materials transportation safety regulations of the Department of Transportation.

Both the NRC and the Department of Energy continue joint operation of a national database and information support system to track movement of domestic and foreign nuclear materials under safeguards control.

Principal Licensing and Inspection Activities

- NRC examines transport-related safety during approximately 1,000 safety inspections of fuel, reactor, and materials licensees annually.
- NRC reviews, evaluates, and certifies approximately 100 new, renewal, or amended container-design applications for the transport of nuclear materials annually.
- NRC reviews and evaluates approximately 100 license applications for the export of nuclear materials from the United States annually.
- NRC conducts comprehensive physical security and materials control and accounting license reviews and conducts inspections at the major fuel fabrication facilities annually.
- NRC inspects about 20 dry storage and transport package licensees annually.

Decommissioning

Decommissioning is the safe removal of a facility from service and reduction of residual radioactivity to a level that permits release of the property and termination of the license (see Glossary).

Nuclear Power Reactors:

In July 1996, the NRC issued a revised rule for power reactor decommissioning. The rule is intended to clarify the applicability of certain regulations to permanently shutdown nuclear power reactors and to provide for public participation in the decommissioning process. In 1997, the NRC issued rules for site release criteria. The rules provided for unrestricted and, under certain conditions, restricted release of a site. The NRC is currently overseeing the decommissioning of 19 nuclear power reactors. Refer to Appendix B for their decommissioning status.

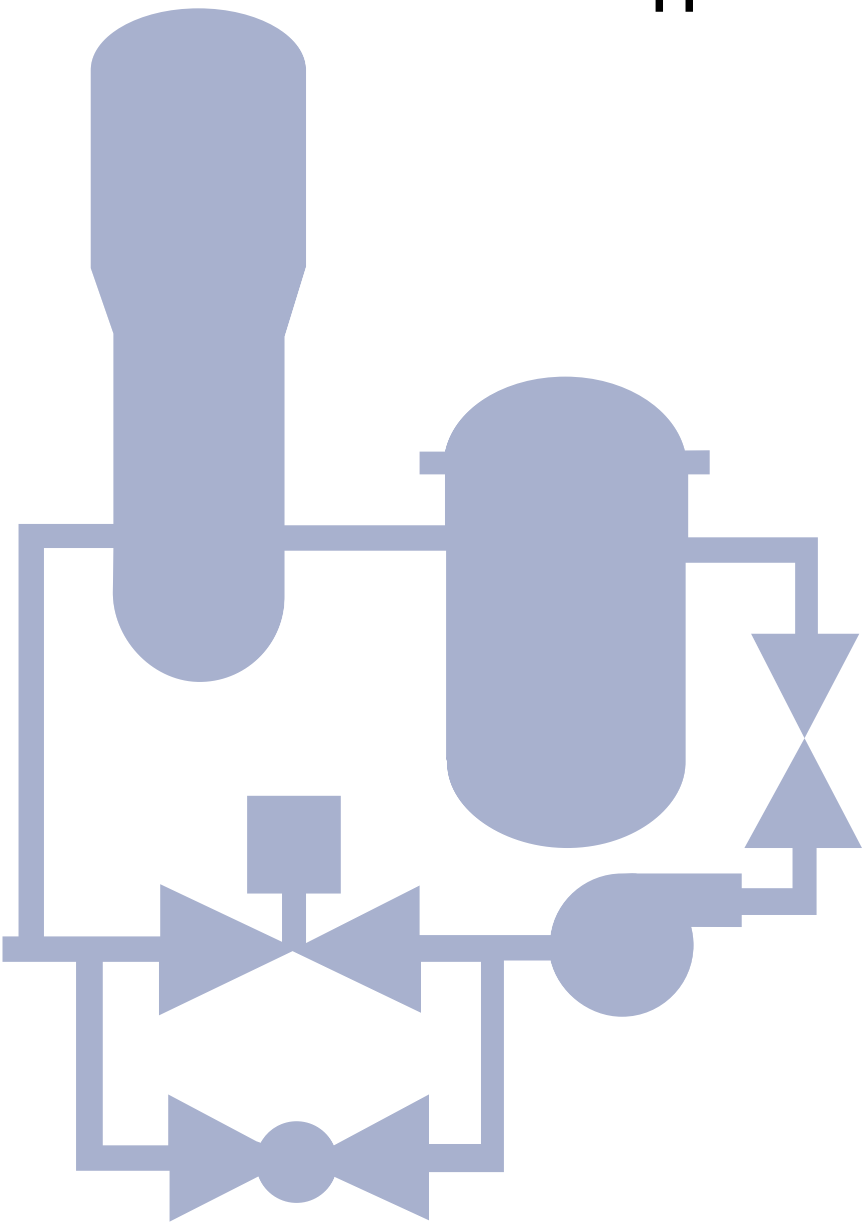
Other Sites and Facilities:

Over the last 40 years, operations at licensed nuclear facilities have caused radiological contamination at a number of sites. This contamination must be reduced or stabilized in a timely and efficient manner to ensure protection of the public and the environment before the sites can be released and the license terminated. The NRC's Site Decommissioning Management Plan (SDMP) lists 24 sites and 3 complex decommissioning sites that require special attention to resolve issues, and to prompt timely decommissioning at these sites (see Table 15). The list is updated periodically and published as supplements to NUREG-1444. The staff is in the process of completing a rebaselining of the sites listed in the SDMP. The purpose of the rebaselining effort is to establish milestones and schedules for completing decommissioning and license termination at the site.

Table 15. **Site Decommissioning Management Plan and Other Complex Sites List**

Company	Location
SDMP Sites	
AAR Manufacturing, Inc. (Brooks & Perkins)	Livonia, MI
Army, Department of, Jefferson Proving Ground	Jefferson, IN
Babcock & Wilcox	Parks Township, PA
Babcock & Wilcox SLDA	Vandergrift, PA
Cabot Corporation	Reading, PA
Cabot Corporation	Revere, PA
Dow Chemical Company	Bay City and Midland, MI
Fansteel, Inc.	Muskogee, OK
Hartley and Hartley (Kawkawlin) Landfill	Bay County, MI
Heritage Minerals	Lakehurst, NJ
Kaiser Aluminum	Tulsa, OK
Kerr-McGee	Cimarron, OK
Kerr-McGee	Cushing, OK
Lake City Army Ammunition Plant (formerly Remington Arms Company)	Independence, MO
Michigan Department of Natural Resources (MDNR)	Pine County, MN
Molycorp, Inc.	Washington, PA
Molycorp, Inc.	York, PA
Permagrain Products	Media, PA
Safety Light Corporation	Bloomsburg, PA
Sequoyah Fuels Corporation	Gore, OK
Shieldalloy Metallurgical Corporation	Newfield, NJ
Watertown GSA	Watertown, MA
Westinghouse Electric Corporation	Waltz Mill, PA
Whittaker Corporation	Greenville, PA
Complex Decommissioning Sites	
KUWPCA	Vandergrift, PA
UCAR (Union Carbide)	Lawrenceberg, TN
Mallinkrodt	St. Louis, MO

Appendices



Abbreviations Used In Appendices

ABB-CE	Asea Brown Boveri-Combustion Engineering
ACE	ACEOWEN, Ateliers de Constructions Electriques de Charleroi S.A. (ACEC) and Cocerill Ougree-Providence (COP); with Westinghouse (Belgium)
ACLF	ACECO/Creusot-loire/Framatome/ Westinghouse-Europe
AE	Architect-Engineer
AEC	Atomic Energy Commission
AECL	Atomic Energy of Canada, Ltd.
AEE	Atomenergoexport
AEP	American Electric Power
AGN	Aerojet-General Nucleonics
ASEA	Asea Brown Boveri-Asea Atom
B&R	Burns & Roe
B&W	Babcock & Wilcox
BALD	Baldwin Associates
BECH	Bechtel
BRRT	Brown & Root
BWR	Boiling-Water Reactor
COMB	Combustion Engineering
COMM. OP.	Date of Commercial Operation
CON TYPE	Containment Type
DRYAMB	Dry, Ambient Pressure
DRYSUB	Dry, Subatmospheric
HTG	High-Temperature Gas-Cooled
ICECND	Wet, Ice Condenser
LMFB	Liquid Metal Fast Breeder
MARK 1	Wet, Mark I
MARK 2	Wet, Mark II
MARK 3	Wet, Mark III
OCM	Organic Cooled & Moderated
PTHW	Pressure Tube, Heavy Water
SCF	Sodium Cooled, Fast
SCGM	Sodium Cooled, Graphite Moderated
CP	Construction Permit
CP ISSUED	Date of Construction Permit Issuance
CPPR	Construction Permit Power Reactor
CWE	Commonwealth Edison Company
CX	Critical Assembly
DANI	Daniel International
DBDB	Duke & Bechtel
DER	Design Electric Rating
DOE	Department of Energy
DPR	Demonstration Power Reactor
DUKE	Duke Power Company
EBSO	Ebasco
EXP. DATE	Expiration Date of Operating License
FENOC	FirstEnergy Nuclear Operating Co.
FRAM	Framatome
FLUR	Fluor Pioneer
G&H	Gibbs & Hill
GCR	Gas-Cooled Reactor
GE	General Electric
GHDR	Gibbs & Hill & Durham & Richardson
GIL	Gilbert Associates
GPC	Georgia Power Company
HIT	Hitachi
HTG	High-Temperature Gas-Cooled
HWR	Pressurized Heavy-Water Reactor
IES	Iowa Electric
JONES	J. A. Jones
KAIS	Kaiser Engineers
KWU	Kraftwerk Union, Siemens AG
LIC. TYPE:	License Type
CP	Construction Permit
OL-FP	Operating License-Full Power
OL-LP	Operating License-Low Power
MAE	Ministry of Atomic Energy, Russian Federation
MDC	Maximum Dependable Capacity - Net
MHI	Mitsubishi Heavy Industries, Ltd.
MWe	Megawatts Electrical
MWt	Megawatts Thermal
NIAG	Niagara Mohawk Power Corporation
NPF	Nuclear Power Facility
NSP	Northern States Power Company
NSSS	Nuclear Steam System Supplier & Design Type
1	GE Type 1
2	GE Type 2
3	GE Type 3
4	GE Type 4
5	GE Type 5
6	GE Type 6
2LP	Westinghouse Two-Loop
3LP	Westinghouse Three-Loop
4LP	Westinghouse Four-Loop
CE	Combustion Engineering
CE80	CE Standard Design
LLP	B&W Lowered Loop
RLP	B&W Raised Loop
OL	Operating License
OL ISSUED	Date of Latest Full Power Operating License
PECO	Philadelphia Energy Company
PG&E	Pacific Gas & Electric Company
PHWR	Pressurized Heavy-Water-Moderated Reactor

PSE	Pioneer Services & Engineering
PUBS	Public Service Electric & Gas Company
PWR	Pressurized-Water Reactor
R	Research
S&L	Sargent & Lundy
S&W	Stone & Webster
SBEC	Southern Services & Bechtel
SSI	Southern Services Incorporated
STP	South Texas Project
TXU	Texas Utilities
TNPG	The Nuclear Power Group
TOSH	Toshiba
TR	Test Reactor
TVA	Tennessee Valley Authority
UE&C	United Engineers & Constructors
UTR	Universal Training Reactor
VT	Vermont
WDCO	Westinghouse Development Corporation
WEST	Westinghouse Electric

U.S. Commercial Nuclear Power Reactors

Unit Operating Utility Location Docket Number	NRC Region	Con Type NSSS AE Constructor	Licensed MWt	Net MDC	CP Issued OL Issued Comm. Op Exp. Date	License Type & Number	1995-2000* Average Capacity Factors (Percent)
Arkansas Nuclear 1 Entergy Operations, Inc. 6 MI WNW of Russellville, AR 050-00313	IV	PWR-DRYAMB B&W LLP BECH BECH	2568	0836	12/06/1968 05/21/1974 12/19/1974 05/20/2014	OL-FP DPR-51	81.6 85.6 99.0 82.6 91.7 87.3
Arkansas Nuclear 2 Entergy Operations, Inc. 6 MI WNW of Russellville, AR 050-00368	IV	PWR-DRYAMB COMB CE BECH BECH	2815	0858	12/06/1972 09/01/1978 03/26/1980 07/17/2018	OL-FP NPF-6	75.6 93.7 92.6 86.9 82.8 69.9
Beaver Valley 1 FirstEnergy Nuclear Operating Company 17 MI W of McCandless, PA 050-00334	I	PWR-DRYSUB WEST 3LP S&W S&W	2652	0810	06/26/1970 07/02/1976 10/01/1976 01/29/2016	OL-FP DPR-66	76.7 80.0 56.3 33.2 86.1 82.7
Beaver Valley 2 FirstEnergy Nuclear Operating Company 17 MI W of McCandless, PA 050-00412	I	PWR-DRYSUB WEST 3LP S&W S&W	2652	0810	05/03/1974 08/14/1987 11/17/1987 05/27/2027	OL-FP NPF-73	84.1 66.2 85.7 16.9 80.1 86.5
Braidwood 1 Exelon Generating Co., LLC 24 MI SSW of Joilet, IL 050-00456	III	PWR-DRYAMB WEST 4LP S&L CWE	3411	1116	12/31/1975 07/02/1987 07/29/1988 10/17/2026	OL-FP NPF-72	67.2 70.5 83.9 78.6 101.0 96.4
Braidwood 2 Exelon Generating Co., LLC 24 MI SSW of Joilet, IL 050-00457	III	PWR-DRYAMB WEST 4LP S&L CWE	3411	1116	12/31/1975 05/20/1988 10/17/1988 12/18/2027	OL-FP NPF-77	97.2 81.3 85.5 97.4 92.0 98.4
Browns Ferry 1 Tennessee Valley Authority 10 MI NW of Decatur, AL 050-00259	II	BWR-MARK1 GE 4 TVA TVA	3293	0	05/10/1967 12/20/1973 08/01/1974 12/20/2013	OL-FP DPR-33	0.0 0.0 0.0 0.0 0.0 0.0
Browns Ferry 2 Tennessee Valley Authority 10 MI NW of Decatur, AL 050-00260	II	BWR-MARK1 GE 4 TVA TVA	3293	1118	05/10/1967 08/02/1974 03/01/1975 06/28/2014	OL-FP DPR-52	98.6 86.0 89.7 98.9 89.1 99.1

(Continued)

Unit Operating Utility Location Docket Number	NRC Region	Con Type NSSS AE Constructor	Licensed MWt	Net MDC	CP Issued OL Issued Comm. Op Exp. Date	License Type & Number	1995-2000* Average Capacity Factors (Percent)
Browns Ferry 3 Tennessee Valley Authority 10 MI NW of Decatur, AL 050-00296	II	BWR-MARK 1 GE 4 TVA TVA	3293	1118	07/31/1968 08/18/1976 03/01/1977 07/02/2016	OL-FP DPR-68	70.4 94.1 91.4 80.8 99.4 92.6
Brunswick 1 Progress Energy 2 MI N of Southport, NC 050-00325	II	BWR-MARK 1 GE 4 UE&C BRRT	2558	0820	02/07/1970 11/12/1976 03/18/1977 09/08/2016	OL-FP DPR-71	85.9 84.7 102.1 83.6 97.4 93.7
Brunswick 2 Progress Energy 2 MI N of Southport, NC 050-00324	II	BWR-MARK 1 GE 4 UE&C BRRT	2558	0811	02/07/1970 12/27/1974 11/03/1975 12/27/2014	OL-FP DPR-62	94.1 78.3 91.7 95.4 85.8 99.0
Byron 1 Exelon Generation Co., LLC 17 MI SW of Rockford, IL 050-00454	III	PWR-DRYAMB WEST 4LP S&L CWE	3411	1114	12/31/1975 02/14/1985 09/16/1985 10/31/2024	OL-FP NPF-37	79.5 70.6 74.0 77.6 92.0 95.7
Byron 2 Exelon Generation Co., LLC 17 MI SW of Rockford, IL 050-00455	III	PWR-DRYAMB WEST 4LP S&L CWE	3411	1114	12/31/1975 01/30/1987 08/21/1987 11/06/2026	OL-FP NPF-66	84.5 80.6 94.0 85.7 94.8 103.1
Callaway AmerenUE 10 MI SE of Fulton, MO 050-00483	IV	PWR-DRYAMB WEST 4LP BECH DANI	3565	1143	04/16/1976 10/18/1984 12/19/1984 10/18/2024	OL-FP NPF-30	83.7 90.0 90.9 84.8 87.2 101.1
Calvert Cliffs 1 Calvert Cliffs Nuclear Power Plant Inc. 40 MI S of Annapolis, MD 050-00317	I	PWR-DRYAMB COMB CE BECH BECH BECH	2700	0825	07/07/1969 07/31/1974 05/08/1975 07/31/2034 07/31/2034	OL-FP DPR-53	96.1 65.8 97.9 81.9 96.8 89.0
Calvert Cliffs 2 Calvert Cliffs Nuclear Power Plant Inc. 40 MI S of Annapolis, MD 050-00318	I	PWR-DRYAMB COMB CE BECH BECH	2700	0835	07/07/1969 11/30/1976 04/01/1977 08/13/2036	OL-FP DPR-69	80.3 98.2 81.2 97.7 86.6 100.8

Unit Operating Utility Location Docket Number	NRC Region	Con Type NSSS AE Constructor	Licensed MWt	Net MDC	CP Issued OL Issued Comm. Op Exp. Date	License Type & Number	1995-2000* Average Capacity Factors (Percent)
Catawba 1 Duke Power Co. 6 MI NNW of Rock Hill, SC 050-00413	II	PWR-ICECND WEST 4LP DUKE DUKE	3411	1129	08/07/1975 01/17/1985 06/29/1985 12/06/2024	OL-FP NPF-35	88.2 63.6 92.8 88.2 91.7 90.0
Catawba 2 Duke Power Co. 6 MI NNW of Rock Hill, SC 050-00414	II	PWR-ICECND WEST 4LP DUKE DUKE	3411	1129	08/07/1975 05/15/1986 08/19/1986 02/24/2026	OL-FP NPF-52	80.3 93.1 86.8 85.2 89.5 90.6
Clinton AmerGen Energy Co. 6 MI E of Clinton, IL 050-00461	III	BWR-MARK 3 GE 6 S&L BALD	2894	0930	02/24/1976 04/17/1987 11/24/1987 09/29/2026	OL-FP NPF-62	75.0 65.0 0.0 0.0 57.7 84.3
Columbia Generating Station Energy Northwest 12 MI NW of Richland, WA 050-00397	IV	BWR-MARK 2 GE 5 B&R BECH	3486	1107	03/19/1973 04/13/1984 12/13/1984 12/20/2023	OL-FP NPF-21	72.5 57.1 63.0 68.1 62.8 88.5
Comanche Peak 1 TXU Electric & Gas 4 MI N of Glen Rose, TX 050-00445	IV	PWR-DRYAMB WEST 4LP G&H BRRT	3411	1150	12/19/1974 04/17/1990 08/13/1990 02/08/2030	OL-FP NPF-87	77.5 76.8 94.1 86.2 85.4 95.2
Comanche Peak 2 TXU Electric & Gas 4 MI N of Glen Rose, TX 050-00446	IV	PWR-DRYAMB WEST 4LP BECH BRRT	3445	1150	12/19/1974 04/06/1993 08/03/1993 02/02/2033	OL-FP NPF-89	91.0 73.0 80.0 95.3 86.9 87.8
Cooper Nebraska Public Power District 23 MI S of Nebraska City, NE 050-00298	IV	BWR-MARK 1 GE 4 B&R B&R	2381	0758	06/04/1968 01/18/1974 07/01/1974 01/18/2014	OL-FP DPR-46	61.7 94.5 81.5 75.2 97.3 70.6
Crystal River 3 Progress Energy 7 MI NW of Crystal River, FL 050-00302	II	PWR-DRYAMB B&W LLP GIL JONES	2544	0843	09/25/1968 01/28/1977 03/13/1977 12/03/2016	OL-FP DPR-72	101.0 33.6 0.0 88.2 88.9 97.2

(Continued)

Unit Operating Utility Location Docket Number	NRC Region	Con Type NSSS AE Constructor	Licensed MWt	Net MDC	CP Issued OL Issued Comm. Op Exp. Date	License Type & Number	1995-2000* Average Capacity Factors (Percent)
Davis-Besse FirstEnergy Nuclear Operating Co. 21 MI ESE of Toledo, OH 050-00346	III	PWR-DRYAMB B&W LLP BECH	2772	0873	03/24/1971 04/22/1977 07/31/1978 04/22/2017	OL-FP NPF-3	100.5 84.3 93.9 78.1 96.4 87.4
D.C. Cook 1 Indiana/Michigan Power Co. 11 MI S of Benton Harbor, MI 050-00315	III	PWR-ICECND WEST 4LP AEP AEP	3250	1020	03/25/1969 10/25/1974 08/28/1975 10/25/2014	OL-FP DPR-58	61.6 95.3 51.9 0.0 0.0 1.5
D.C. Cook 2 Indiana/Michigan Power Co. 11 MI S of Benton Harbor, MI 050-00316	III	PWR-ICECND WEST 4LP AEP AEP	3411	1090	03/25/1969 12/23/1977 07/01/1978 12/23/2017	OL-FP DPR-74	92.6 86.2 63.3 0.0 0.0 51.4
Diablo Canyon 1 Pacific Gas & Electric Co. 12 MI WSW of San Luis Obispo, CA 050-00275	IV	PWR-DRYAMB WEST 4LP PG&E PG&E	3338	1073	04/23/1968 11/02/1984 05/07/1985 09/22/2021	OL-FP DPR-80	79.2 93.2 87.1 98.0 87.5 83.3
Diablo Canyon 2 Pacific Gas & Electric Co. 12 MI WSW of San Luis Obispo, CA 050-00323	IV	PWR-DRYAMB WEST 4LP PG&E PG&E	3411	1087	12/09/1970 08/26/1985 03/13/1986 04/26/2025	OL-FP DPR-82	92.6 83.1 93.3 84.5 88.7 96.2
Dresden 2 Exelon Generation Co., LLC 9 MI E of Morris, IL 050-00237	III	BWR-MARK 1 GE 3 S&L UE&C	2527	0784	01/10/1966 02/20/1991 06/09/1970 12/22/2009	OL-FP DPR-19	27.5 31.4 82.5 79.1 92.1 101.3
Dresden 3 Exelon Generation Co., LLC 9 MI E of Morris, IL 050-00249	III	BWR-MARK 1 GE 3 S&L UE&C	2527	0784	10/14/1966 01/12/1971 11/16/1971 01/12/2011	OL-FP DPR-25	51.2 43.4 59.5 88.2 90.6 93.7
Duane Arnold Nuclear Management Company 8 MI NW of Cedar Rapids, IA 050-00331	III	BWR-MARK 1 GE 4 BECH BECH	1658	0520	06/22/1970 02/22/1974 02/01/1975 02/21/2014	OL-FP DPR-49	82.8 86.2 91.2 82.3 80.1 97.5

Unit Operating Utility Location Docket Number	NRC Region	Con Type NSSS AE Constructor	Licensed MWt	Net MDC	CP Issued OL Issued Comm. Op Exp. Date	License Type & Number	1995-2000* Average Capacity Factors (Percent)
Edwin I. Hatch 1 Southern Nuclear Operating Co. 11 MI N of Baxley, GA 050-00321	II	BWR-MARK 1 GE 4 BECH GPC	2763	0863	09/30/1969 10/13/1974 12/31/1975 08/06/2014	OL-FP DPR-57	99.6 80.7 85.7 96.5 81.1 84.5
Edwin I. Hatch 2 Southern Nuclear Operating Co. 11 MI N of Baxley, GA 050-00366	II	BWR-MARK 1 GE 4 BECH GPC	2763	0878	12/27/1972 06/13/1978 09/05/1979 06/13/2018	OL-FP NPF-5	75.0 98.8 84.2 80.6 94.4 89.5
Fermi 2 Detroit Edison Co. 25 MI NE of Toledo, OH 050-00341	III	BWR-MARK 1 GE 4 S&L DANI	3430	1129	09/26/1972 07/15/1985 01/23/1988 03/20/2025	OL-FP NPF-43	66.9 62.3 63.6 67.8 100.3 86.2
Fort Calhoun Omaha Public Power District 19 MI N of Omaha, NE 050-00285	IV	PWR-DRYAMB COMB CE GHDR GHDR	1500	0476	06/07/1968 08/09/1973 09/26/1973 08/09/2013	OL-FP DPR-40	80.4 74.5 91.2 77.8 85.6 92.8
Ginna Rochester Gas & Electric Corp. 20 MI NE of Rochester, NY 050-00244	I	PWR-DRYAMB WEST 2LP GIL BECH	1520	0480	04/25/1966 12/10/1984 07/01/1970 09/18/2009	OL-FP DPR-18	88.4 70.2 92.6 104.1 84.0 90.5
Grand Gulf 1 Entergy Operations, Inc. 25 MI S of Vicksburg, MS 050-00416	IV	BWR-MARK 3 GE 6 BECH BECH	3833	1204	09/04/1974 11/01/1984 07/01/1985 11/01/2024	OL-FP NPF-29	79.2 89.3 102.9 82.0 79.9 100.6
H.B. Robinson 2 Progress Energy 26 MI from Florence, SC 050-00261	II	PWR-DRYA MB WEST 3LP EBSO EBSO	2300	0683	04/13/1967 09/23/1970 03/07/1971 07/31/2010	OL-FP DPR-23	86.1 91.0 103.6 87.9 95.0 104.0
Hope Creek 1 PSEG Nuclear, LLC 18 MI SE of Wilmington, DE 050-00354	I	BWR-MARK1 GE 4 BECH BECH	3293	1031	11/04/1974 07/25/1986 12/20/1986 04/11/2026	OL-FP NPF-57	78.2 74.6 70.9 92.3 85.3 80.3

(Continued)

Unit Operating Utility Location Docket Number	NRC Region	Con Type NSSS AE Constructor	Licensed MWt	Net MDC	CP Issued OL Issued Comm. Op Exp. Date	License Type & Number	1995-2000* Average Capacity Factors (Percent)
Indian Point 2 Consolidated Edison Co. 24 MI N of New York City, NY 050-00247	I	PWR-DRYA MB WEST 4LP UE&C WDCO	3071	0951	10/14/1966 09/28/1973 08/01/1974 09/28/2013	OL-FP DPR-26	59.3 94.9 38.4 23.0 88.5 12.1
Indian Point 3 New York Power Authority 24 MI N of New York City, NY 050-00286	I	PWR-DRYAMB WEST 4LP UE&C WDCO	3025	0965	08/13/1969 04/05/1976 08/30/1976 12/15/2015	OL-FP DPR-64	17.4 69.3 51.3 89.8 86.0 99.5
James A. FitzPatrick New York Power Authority 8 MI NE of Oswego, NY 050-00333	I	BWR-MARK 1 GE 4 S&W S&W	2536	0813	05/20/1970 10/17/1974 07/28/1975 10/17/2014	OL-FP DPR-59	70.7 78.6 94.7 73.2 93.5 84.4
Joseph M. Farley 1 Southern Nuclear Operating Co. 18 MI SE of Dothan, AL 050-00348	II	PWR-DRYAMB WEST 3LP SSI DANI	2775	0847	08/16/1972 06/25/1977 12/01/1977 06/25/2017	OL-FP NPF-2	80.7 100.1 75.2 78.9 97.4 71.5
Joseph M. Farley 2 Southern Nuclear Operating Co. 18 MI SE of Dothan, AL 050-00364	II	PWR-DRYAMB WEST 3LP SSI BECH	2775	0852	08/16/1972 03/31/1981 07/30/1981 03/31/2021	OL-FP NPF-8	70.7 79.5 101.1 84.7 71.7 100.0
Kewaunee Nuclear Management Co. 27 MI E of Green Bay, WI 050-00305	III	PWR-DRYAMB WEST 2LP PSE PSE	1650	0498	08/06/1968 12/21/1973 06/16/1974 12/21/2013	OL-FP DPR-43	84.7 70.6 52.8 78.4 98.8 82.7
La Salle County 1 Exelon Generation Co., LLC 11 MI SE of Ottawa, IL 050-00373	III	BWR-MARK 2 GE 5 S&L CWE	3323	1077	09/10/1973 04/17/1982 01/01/1984 04/17/2022	OL-FP NPF-11	92.2 36.3 0.0 30.8 88.3 99.6
La Salle County 2 Exelon Generation Co., LLC 11 MI SE of Ottawa, IL 050-00374	III	BWR-MARK 2 GE 5 S&L CWE	3323	1087	09/10/1973 02/16/1983 10/19/1984 12/16/2023	OL-FP NPF-18	65.8 62.0 0.0 0.0 73.1 92.4

Unit Operating Utility Location Docket Number	NRC Region	Con Type NSSS AE Constructor	Licensed MWt	Net MDC	CP Issued OL Issued Comm. Op Exp. Date	License Type & Number	1995-2000* Average Capacity Factors (Percent)
Limerick 1 Exelon Generation Co., LLC 21 MI NW of Philadelphia, PA 050-00352	I	BWR-MARK 2 GE 4 BECH BECH	3458	1134	06/19/1974 08/08/1985 02/01/1986 10/26/2024	OL-FP NPF-39	88.2 84.2 95.3 77.6 98.1 89.5
Limerick 2 Exelon Generation Co., LLC 21 MI NW of Philadelphia, PA 050-00353	I	BWR-MARK 2 GE 4 BECH BECH	3458	1115	06/19/1974 08/25/1989 01/08/1990 06/22/2029	OL-FP NPF-85	86.2 91.9 85.0 93.5 85.0 99.0
McGuire 1 Duke Power Co. 17 MI N of Charlotte, NC 050-00369	II	PWR-ICECND WEST 4LP DUKE DUKE	3411	1129	02/23/1973 07/08/1981 12/01/1981 06/12/2021	OL-FP NPF-9	89.6 86.3 70.8 80.9 89.1 103.4
McGuire 2 Duke Power Co. 17 MI N of Charlotte, NC 050-00370	II	PWR-ICECND WEST 4LP DUKE DUKE	3411	1129	02/23/1973 05/27/1983 03/01/1984 03/03/2023	OL-FP NPF-17	91.9 73.2 67.2 92.1 89.2 87.5
Millstone 2 Dominion Nuclear Connecticut, Inc 3.2 MI WSW of New London, CT 050-00336	I	PWR-DRYAMB COMB CE BECH BECH	2700	0871	12/11/1970 09/26/1975 12/26/1975 07/31/2015	OL-FP DPR-65	35.5 13.4 0.0 0.0 57.9 81.7
Millstone 3 Dominion Nuclear Connecticut, Inc 3.2 MI WSW of New London, CT 050-00423	I	PWR-DRYSUB WEST 4LP S&W S&W	3411	1137	08/09/1974 01/31/1986 04/23/1986 11/25/2025	OL-FP NPF-49	80.2 24.3 0.0 34.0 82.7 99.9
Monticello Nuclear Management Co. 30 MI NW of Minneapolis, MN 050-00263	III	BWR-MARK 1 GE 3 BECH BECH	1775	0615	06/19/1967 01/09/1981 06/30/1971 09/08/2010	OL-FP DPR-22	101.3 81.6 76.8 82.4 91.8 83.6

(Continued)

Unit Operating Utility Location Docket Number	NRC Region	Con Type NSSS AE Constructor	Licensed MWt	Net MDC	CP Issued OL Issued Comm. Op Exp. Date	License Type & Number	1995-2000* Average Capacity Factors (Percent)
Nine Mile Point 1 Niagara Mohawk Power Corp. 6 MI NE of Oswego, NY 050-00220	I	BWR-MARK 1 GE 2 NIAG S&W	1850	0565	04/12/1965 12/26/1974 12/01/1969 08/22/2009	OL-FP DPR-63	87.0 94.2 54.5 87.9 72.0 94.3
Nine Mile Point 2 Niagara Mohawk Power Corp. 6 MI NE of Oswego, NY 050-00410	I	BWR-MARK 2 GE 5 S&W S&W	3467	1142	06/24/1974 07/02/1987 03/11/1988 10/31/2026	OL-FP NPF-69	78.1 89.6 91.7 71.4 89.3 81.1
North Anna 1 Virginia Electric & Power Co. 40 MI NW of Richmond, VA 050-00338	II	PWR-DRYSUB WEST 3LP S&W S&W	2893	0893	02/19/1971 04/01/1978 06/06/1978 04/01/2018	OL-FP NPF-4	99.8 88.5 91.5 90.5 103.8 92.0
North Anna 2 Virginia Electric & Power Co. 40 MI NW of Richmond, VA 050-00339	II	PWR-DRYSUB WEST 3LP S&W S&W	2893	0897	02/19/1971 08/21/1980 12/14/1980 08/21/2020	OL-FP NPF-7	77.2 77.7 99.7 89.0 91.4 101.8
Oconee 1 Duke Power Co. 30 MI W of Greenville, SC 050-00269	II	PWR-DRYAMB B&W LLP DBDB DUKE	2568	0846	11/06/1967 02/06/1973 07/15/1973 02/06/2033	OL-FP DPR-38	85.8 74.8 43.0 77.1 83.8 84.9
Oconee 2 Duke Power Co. 30 MI W of Greenville, SC 050-00270	II	PWR-DRYAMB B&W LLP DBDB DUKE	2568	0846	11/06/1967 10/06/1973 09/09/1974 10/06/2033	OL-FP DPR-47	94.1 59.4 79.2 72.1 84.4 100.9
Oconee 3 Duke Power Co. 30 MI W of Greenville, SC 050-00287	II	PWR-DRYAMB B&W LLP DBDB DUKE	2568	0846	11/06/1967 07/19/1974 12/16/1974 07/19/2034	OL-FP DPR-55	87.3 73.3 62.7 79.8 99.4 88.5
Oyster Creek AmerGen Energy Co. 9 MI S of Toms River, NJ 050-00219	I	BWR-MARK 1 GE 2 B&R B&R	1930	0619	12/15/1964 07/02/1991 12/01/1969 04/09/2009	OL-FP DPR-16	95.8 79.8 93.6 74.3 99.4 71.9

Unit Operating Utility Location Docket Number	NRC Region	Con Type NSSS AE Constructor	Licensed MWt	Net MDC	CP Issued OL Issued Comm. Op Exp. Date	License Type & Number	1995-2000* Average Capacity Factors (Percent)
Palisades Consumers Energy Co. 5 MI S of South Haven, MI 050-00255	III	PWR-DRYAMB COMB CE BECH BECH	2530	0760	03/14/1967 02/21/1991 12/31/1971 03/24/2011	OL-FP DPR-20	76.0 82.9 90.8 80.0 80.2 89.6
Palo Verde 1 Arizona Nuclear Power Project 36 MI W of Phoenix, AZ 050-00528	IV	PWR-DRYAMB COMB CE80 BECH BECH	3800	1243	05/25/1976 06/01/1985 01/28/1986 12/31/2024	OL-FP NPF-41	79.3 80.8 98.6 87.4 88.7 100.4
Palo Verde 2 Arizona Nuclear Power Project 36 MI W of Phoenix, AZ 050-00529	IV	PWR-DRYAMB COMB CE80 BECH BECH	3876	1243	05/25/1976 04/24/1986 09/19/1986 12/09/2025	OL-FP NPF-51	84.4 86.7 85.6 101.8 90.0 87.2
Palo Verde 3 Arizona Nuclear Power Project 36 MI W of Phoenix, AZ 050-00530	IV	PWR-DRYAMB COMB CE80 BECH BECH	3876	1247	05/25/1976 11/25/1987 01/08/1988 03/25/2027	OL-FP NPF-74	87.1 99.9 86.5 87.6 100.3 90.3
Peach Bottom 2 Exelon Generation Co., LLC 17.9 MI S of Lancaster, PA 050-00277	I	BWR-MARK 1 GE 4 BECH BECH	3458	1093	01/31/1968 10/25/1973 07/05/1974 08/08/2013	OL-FP DPR-44	97.8 79.8 100.0 75.9 98.8 88.8
Peach Bottom 3 Exelon Generation Co., LLC 17.9 MI S of Lancaster, PA 050-00278	I	BWR-MARK 1 GE 4 BECH BECH	3458	1093	01/31/1968 07/02/1974 12/23/1974 07/02/2014	OL-FP DPR-56	78.0 98.2 79.0 90.1 89.4 99.5
Perry 1 First Energy Nuclear Gen Co. 7 MI NE of Painesville, OH 050-00440	III	BWR-MARK 3 GE 6 GIL KAIS	3579	1169	05/03/1977 11/13/1986 11/18/1987 03/18/2026	OL-FP NPF-58	89.2 73.1 80.2 96.7 89.8 93.9
Pilgrim 1 Entergy Nuclear Generation Co. 4 MI SE of Plymouth, MA 050-00293	I	BWR-MARK 1 GE 3 BECH BECH	1998	0665	08/26/1968 09/15/1972 12/01/1972 06/08/2012	OL-FP DPR-35	76.4 90.5 73.4 96.9 76.2 93.7

(Continued)

Unit Operating Utility Location Docket Number	NRC Region	Con Type NSSS AE Constructor	Licensed MWt	Net MDC	CP Issued OL Issued Comm. Op Exp. Date	License Type & Number	1995-2000* Average Capacity Factors (Percent)
Point Beach 1 Nuclear Management Co. 13 MI NNW of Manitowoc, WI 050-00266	III	PWR-DRYAMB WEST 2LP BECH BECH	1519	0515	07/19/1967 10/05/1970 12/21/1970 10/05/2010	OL-FP DPR-24	89.3 97.7 19.4 54.9 78.4 92.3
Point Beach 2 Nuclear Management Co. 13 MI NNW of Manitowoc, WI 050-00301	III	PWR-DRYAMB WEST 2LP BECH BECH	1519	0507	07/25/1968 03/08/1973 10/01/1972 03/08/2013	OL-FP DPR-27	79.7 69.2 19.0 77.5 80.0 78.4
Prairie Island 1 Nuclear Management Co. 28 MI SE of Minneapolis, MN 050-00282	III	PWR-DRYAMB WEST 2LP FLUR NSP	1650	0525	06/25/1968 04/05/1974 12/16/1973 08/09/2013	OL-FP DPR-42	100.6 83.0 78.4 89.7 89.0 98.9
Prairie Island 2 Nuclear Management Co. 28 MI SE of Minneapolis, MN 050-00306	III	PWR-DRYAMB WEST 2LP FLUR NSP	1650	0524	06/25/1968 10/29/1974 12/21/1974 10/29/2014	OL-FP DPR-60	88.5 99.7 81.2 78.6 100.5 91.1
Quad Cities 1 Excelon Generation Co., LLC 20 MI NE of Moline, IL 050-00254	III	BWR-MARK 1 GE 3 S&L UE&C	2511	0762	02/15/1967 12/14/1972 02/18/1973 12/14/2012	OL-FP DPR-29	87.4 39.7 82.6 42.1 94.1 91.3
Quad Cities 2 Excelon Generation Co., LLC 20 MI NE of Moline, IL 050-00265	III	BWR-MARK 1 GE 3 S&L UE&C	2511	0762	02/15/1967 12/14/1972 03/10/1973 12/14/2012	OL-FP DPR-30	37.1 69.1 39.0 50.6 97.9 92.1
River Bend 1 Entergy Operations, Inc 24 MI NNW of Baton Rouge, LA 050-00458	IV	BWR-MARK 3 GE 6 S&W S&W	2894	0936	03/25/1977 11/20/1985 06/16/1986 08/29/2025	OL-FP NPF-47	96.7 83.4 83.2 95.1 69.6 89.4
Salem 1 PSEG Nuclear, LLC 18 MI S of Wilmington, DE 050-00272	I	PWR-DRYAMB WEST 4LP PUBS UE&C	3411	1106	09/25/1968 08/13/1976 06/30/1977 08/13/2016	OL-FP DPR-70	26.0 0.0 0.0 63.1 82.7 92.2

Unit Operating Utility Location Docket Number	NRC Region	Con Type NSSS AE Constructor	Licensed MWt	Net MDC	CP Issued OL Issued Comm. Op Exp. Date	License Type & Number	1995-2000* Average Capacity Factors (Percent)
Salem 2 PSEG Nuclear, LLC 18 MI S of Wilmington, DE 050-00311	I	PWR-DRYAMB WEST 4LP PUBS UE&C	3411	1106	09/25/1968 05/20/1981 10/13/1981 04/18/2020	OL-FP DPR-75	20.8 0.0 25.5 80.9 82.0 86.3
San Onofre 2 Southern California Edison Co. 4 MI SE of San Clemente, CA 050-00361	IV	PWR-DRYAMB COMB CE BECH BECH	3390	1070	10/18/1973 09/07/1982 08/08/1983 02/16/2022	OL-FP NPF-10	69.1 91.0 70.5 89.1 87.9 90.7
San Onofre 3 Southern California Edison Co. 4 MI SE of San Clemente, CA 050-00362	IV	PWR-DRYAMB COMB CE BECH BECH	3390	1080	10/18/1973 09/16/1983 04/01/1984 11/15/2022	OL-FP NPF-15	79.3 93.2 72.1 95.8 88.9 101.6
Seabrook 1 North Atlantic Energy Service Corp. 13 MI S of Portsmouth, NH 050-00443	I	PWR-DRYAMB WEST 4LP UE&C UE&C	3411	1161	07/07/1976 03/15/1990 08/19/1990 10/17/2026	OL-FP NPF-86	83.1 96.8 78.3 81.1 85.8 78.1
Sequoyah 1 Tennessee Valley Authority 9.5 MI NE of Chattanooga, TN 050-00327	II	PWR-ICECND WEST 4LP TVA TVA	3411	1122	05/27/1970 09/17/1980 07/01/1981 09/17/2020	OL-FP DPR-77	70.1 94.7 85.1 87.8 101.6 78.3
Sequoyah 2 Tennessee Valley Authority 9.5 MI NE of Chattanoogo, TN 050-00328	II	PWR-ICECND WEST 4LP TVA TVA	3411	1117	05/27/1970 09/15/1981 06/01/1982 09/15/2021	OL-FP DPR-79	91.7 78.3 89.2 97.3 91.8 92.3
Shearon Harris 1 Progress Energy 20 MI SW of Raleigh, NC 050-00400	II	PWR-DRYAMB WEST 3LP EBSO DANI	2775	0860	01/27/1978 01/12/1987 05/02/1987 10/24/2026	OL-FP NPF-63	79.2 93.6 78.3 93.4 96.2 91.0
South Texas Project 1 STP Nuclear Operating Co. 12 MI SSW of Bay City, TX 050-00498	IV	PWR-DRYAMB WEST 4LP BECH EBSO	3800	1250	12/22/1975 03/22/1988 08/25/1988 08/20/2027	OL-FP NPF-76	84.9 93.1 90.1 98.4 88.0 78.2

(Continued)

Unit Operating Utility Location Docket Number	NRC Region	Con Type NSSS AE Constructor	Licensed MWt	Net MDC	CP Issued OL Issued Comm. Op Exp. Date	License Type & Number	1995-2000* Average Capacity Factors (Percent)
South Texas Project 2 STP Nuclear Operating Co. 12 MI SSW of Bay City, TX 050-00499	IV	PWR-DRYAMB WEST 4LP BECH EBSO	3800	1250	12/22/1975 03/28/1989 06/19/1989 12/15/2028	OL-FP NPF-80	90.6 95.2 91.0 90.1 89.4 96.1
St. Lucie 1 Florida Power & Light Co. 12 MI SE of Ft. Pierce, FL 050-00335	II	PWR-DRYAMB COMB CE EBSO EBSO	2700	0839	07/01/1970 03/01/1976 12/21/1976 03/01/2016	OL-FP DPR-67	74.9 70.9 77.8 94.9 88.9 102.0
St. Lucie 2 Florida Power & Light Co. 12 MI SE of Ft. Pierce, FL 050-00389	II	PWR-DRYAMB COMB CE EBSO EBSO	2700	0839	05/02/1977 06/10/1983 08/08/1983 04/06/2023	OL-FP NPF-16	71.9 94.8 88.4 90.8 98.1 92.3
Summer South Carolina Electric & Gas Co. 26 MI NW of Columbia, SC 050-00395	II	PWR-DRYAMB WEST 3LP GIL DANI	2900	0952	03/21/1973 11/12/1982 01/01/1984 08/06/2022	OL-FP NPF-12	97.5 88.0 87.5 101.8 88.2 74.9
Surry 1 Virginia Electric & Power Co. 17 MI NW of Newport News, VA 050-00280	II	PWR-DRYSUB WEST 3LP S&W S&W	2546	0801	06/25/1968 05/25/1972 12/22/1972 05/25/2012	OL-FP DPR-32	83.6 101.4 80.4 78.4 104.4 93.1
Surry 2 Virginia Electric & Power Co. 17 MI NW of Newport News, VA 050-00281	II	PWR-DRYSUB WEST 3LP S&W S&W	2546	0801	06/25/1968 01/29/1973 05/01/1973 01/29/2013	OL-FP DPR-37	80.1 86.4 91.9 100.0 83.7 92.9
Susquehanna 1 PPL Susquehanna, LLC 7 MI NE of Berwick, PA 050-00387	I	BWR-MARK 2 GE 4 BECH BECH	3441	1090	11/02/1973 11/12/1982 06/08/1983 07/17/2022	OL-FP NPF-14	78.8 81.0 95.2 68.9 92.3 85.4
Susquehanna 2 PPL Susquehanna, LLC 7 MI NE of Berwick, PA 050-00388	I	BWR-MARK 2 GE 4 BECH BECH	3441	1094	11/02/1973 06/27/1984 02/12/1985 03/23/2024	OL-FP NPF-22	85.5 95.0 80.6 94.7 81.3 97.3

(Continued)

Unit Operating Utility Location Docket Number	NRC Region	Con Type NSSS AE Constructor	Licensed MWt	Net MDC	CP Issued OL Issued Comm. Op Exp. Date	License Type & Number	1995-2000* Average Capacity Factors (Percent)
Three Mile Island 1 AmerGen Energy Co. 10 MI SE of Harrisburg, PA 050-00289	I	PWR-DRYAMB B&W LLP GIL UE&C	2568	0786	05/18/1968 04/19/1974 09/02/1974 04/19/2014	OL-FP DPR-50	92.8 102.8 86.0 97.7 77.4 103.5
Turkey Point 3 Florida Power & Light Co. 25 MI S of Miami, FL 050-00250	II	PWR-DRYAMB WEST 3LP BECH BECH	2300	0693	04/27/1967 07/19/1972 12/14/1972 07/19/2012	OL-FP DPR-31	89.5 97.3 86.5 87.7 100.7 93.4
Turkey Point 4 Florida Power & Light Co. 25 MI S of Miami, FL 050-00251	II	PWR-DRYAMB WEST 3LP BECH BECH	2300	0693	04/27/1967 04/10/1973 09/07/1973 04/10/2013	OL-FP DPR-41	99.5 87.7 89.7 101.7 94.5 91.9
Vermont Yankee VT Yankee Nuclear Power Corp. 5 MI S of Battleboro, VT 050-00271	I	BWR-MARK 1 GE 4 EBSO EBSO	1593	0506	12/11/1967 02/28/1973 11/30/1972 03/21/2012	OL-FP DPR-28	86.7 84.8 95.5 71.9 90.9 101.5
Vogtle 1 Southern Nuclear Operating Co. 26 MI SE of Augusta, GA 050-00424	II	PWR-DRYAMB WEST 4LP SBEC GPC	3565	1149	06/28/1974 03/16/1987 06/01/1987 01/16/2027	OL-FP NPF-68	98.1 79.8 81.2 99.6 93.5 91.2
Vogtle 2 Southern Nuclear Operating Co. 26 MI SE of Augusta, GA 050-00425	II	PWR-DRYAMB WEST 4LP SBEC GPC	3565	1162	06/28/1974 03/31/1989 05/20/1989 02/09/2029	OL-FP NPF-81	90.0 88.5 101.3 80.2 87.0 102.4
Waterford 3 Entergy Operations, Inc. 20 MI W of New Orleans, LA 050-00382	IV	PWR-DRYAMB COMB CE EBSO EBSO	3390	1075	11/14/1974 03/16/1985 09/24/1985 12/18/2024	OL-FP NPF-38	82.4 94.5 71.4 89.3 79.0 89.8
Watts Bar 1 Tennessee Valley Authority 10 MI S of Spring City, TN 050-00390	II	PWR-ICECND WEST 4LP TVA TVA	3411	1118	01/23/1973 02/07/1996 05/27/1996 11/09/2035	OL NPF-90	– 89.1 77.7 94.7 84.4 92.4

(Continued)

Unit Operating Utility Location Docket Number	NRC Region	Con Type NSSS AE Constructor	Licensed MWt	Net MDC	CP Issued OL Issued Comm. Op Exp. Date	License Type & Number	1995-2000* Average Capacity Factors (Percent)
Wolf Creek 1 Wolf Creek Nuclear Operating Corp. 3.5 MI NE of Burlington, KS 050-00482	IV	PWR-DRYAMB WEST 4LP BECH DANI	3565	1170	05/31/1977 06/04/1985 09/03/1985 03/11/2025	OL-FP NPF-42	98.7 80.2 82.7 101.5 89.3 88.3

**Note:* Average capacity factors are listed in year order starting with 1995.

Source: Nuclear Regulatory Commission and licensee data as compiled by the Nuclear Regulatory Commission.

U.S. Commercial Nuclear Power Reactors Formerly Licensed To Operate

Unit Location	Con Type MWt	OL Issued Shut Down	Decommissioning Alternative Selected Current Status
Big Rock Point Charleviox, MI	BWR 240	05/01/1964 08/29/1997	DECON DECON
Bonus * Punta Higuera, PR	BWR 50	04/02/1964 06/01/1968	ENTOMB ENTOMB
CVTR ** Parr, SC	PTHW 65	11/27/1962 01/01/1967	SAFSTOR SAFSTOR
Dresden 1 Morris, IL	BWR 700	09/28/1959 10/31/1978	SAFSTOR SAFSTOR
Elk River * Elk River, MN	BWR 58	11/06/1962 02/01/1968	DECON DECON Completed
Fermi 1 Newport, MI	SCF 200	05/10/1963 09/22/1972	SAFSTOR SAFSTOR
Fort St. Vrain Platteville, CO	HTG 842	12/21/1973 08/18/1989	DECON DECON Completed
GE VBWR Pleasanton, CA	BWR 50	08/31/1957 12/09/1963	SAFSTOR SAFSTOR
Haddam Neck Meriden, CT	PWR 1825	12/27/1974 12/05/1996	DECON DECON
Hallam * Hallam, NE	SCGM 256	01/02/1962 09/01/1964	ENTOMB ENTOMB
Humboldt Bay 3 Eureka, CA	BWR 200	08/28/1962 07/02/1976	SAFSTOR SAFSTOR
Indian Point 1 Buchanan, NY	PWR 615	03/26/1962 10/31/1974	SAFSTOR SAFSTOR
La Crosse Genoa, WI	BWR 165	07/03/1967 04/30/1987	SAFSTOR SAFSTOR
Maine Yankee Wiscasset, ME	PWR 2700	06/29/1973 12/06/1996	DECON DECON
Millstone 1 Waterford, CT	BWR 2011	10/31/1986 07/21/1998	SAFSTOR SAFSTOR
Pathfinder Sioux Falls, SD	BWR 190	03/12/1964 09/16/1967	SAFSTOR DECON Completed

(Continued)

Unit Location	Con Type MWt	OL Issued Shut Down	Decommissioning Alternative Selected Current Status
Peach Bottom 1 Peach Bottom, PA	HTG 115	01/24/1966 10/31/1974	SAFSTOR SAFSTOR
Piqua * Piqua, OH	OCM 46	08/23/1962 01/01/1966	ENTOMB ENTOMB
Rancho Seco Herald, CA	PWR 2772	08/16/1974 06/07/1989	SAFSTOR SAFSTOR (1)
San Onofre 1 San Clemente, CA	PWR 1347	03/27/1967 11/30/1992	SAFSTOR SAFSTOR
Saxton Saxton, PA	PWR 23.5	11/15/1961 05/01/1972	DECON DECON in progress
Shippingport * Shippingport, PA	PWR 236	N/A 1982	DECON DECON Completed
Shoreham Wading River, NY	BWR 2436	04/21/1989 06/28/1989	DECON DECON Completed
Three Mile Island 2 Londonderry Township, PA	PWR 2770	02/08/1978 03/28/1979	(2)
Trojan Rainier, OR	PWR 3411	11/21/1975 11/09/1992	DECON DECON in progress
Yankee-Rowe Franklin County, MA	PWR 0600	12/24/1963 10/01/1991	DECON DECON in progress
Zion 1 Zion, IL	PWR 3250	10/19/1973 02/21/1997	SAFSTOR SAFSTOR
Zion 2 Zion, IL	PWR 3250	11/14/1973 09/19/1996	SAFSTOR SAFSTOR

* AEC/DOE owned; not regulated by NRC.

** Holds byproduct license from State of South Carolina.

Notes: See Glossary for definitions of decommissioning alternatives.

(1) Dismantlement of radioactive contaminated secondary system piping and components is ongoing.

(2) Three Mile Island 2 has been placed in a post-defueling monitored storage mode until Unit 1 permanently ceases operation, at which time both units are planned to be decommissioned.

Source: DOE Integrated Data Base for 1990; U.S. Spent Fuel and Radioactive Waste, Inventories, Projections, and Characteristics (DOE/RW-0006, Rev. 6), and Nuclear Regulatory Commission

Canceled U.S. Commercial Nuclear Power Reactors

Unit Utility	Con Type MWe per Unit	Canceled Date Status
Allens Creek 1 Houston Lighting & Power Company	BWR 1150	1982 Under CP Review
Allens Creek 2 Houston Lighting & Power Company	BWR 1150	1976 Under CP Review
Atlantic 1 & 2 Public Service Electric & Gas Company	PWR 1150	1978 Under CP Review
Bailly Northern Indiana Public Service Company	BWR 645	1981 With CP
Barton 1 & 2 Alabama Power & Light	BWR 1159	1977 Under CP Review
Barton 3 & 4 Alabama Power & Light	BWR 1159	1975 Under CP Review
Bellefonte 1 & 2 Tennessee Valley Authority	PWR 1235	(1) With CP
Black Fox 1 & 2 Public Service Company of Oklahoma	BWR 1150	1982 Under CP Review
Blue Hills 1 & 2 Gulf States Utilities Company	PWR 918	1978 Under CP Review
Callaway 2 Union Electric Company	PWR 1150	1981 With CP
Cherokee 1 Duke Power Company	PWR 1280	1983 With CP
Cherokee 2 & 3 Duke Power Company	PWR 1280	1982 With CP
Clinch River Project Management Corp.; DOE; TVA	LMFB 350	1983 Under CP Review
Clinton 2 Illinois Power Company	BWR 933	1983 With CP
Davis-Besse 2 & 3 Toledo Edison Company	PWR 906	1981 Under CP Review
Douglas Point 1 & 2 Potomac Electric Power Company	BWR 1146	1977 Under CP Review
Erie 1 & 2 Ohio Edison Company	PWR 1260	1980 Under CP Review

(Continued)

Unit Utility	Con Type MWe per Unit	Canceled Date Status
Forked River 1 Jersey Central Power & Light Company	PWR 1070	1980 With CP
Fort Calhoun 2 Omaha Public Power District	PWR 1136	1977 Under CP Review
Fulton 1 & 2 Philadelphia Electric Company	HTG 1160	1975 Under CP Review
Grand Gulf 2 Entergy Operations, Incorporated	BWR 1250	1990 With CP
Greene County Power Authority of the State of NY	PWR 1191	1980 Under CP Review
Greenwood 2 & 3 Detroit Edison Company	PWR 1200	1980 Under CP Review
Hartsville A1 & A2 Tennessee Valley Authority	BWR 1233	1984 With CP
Hartsville B1 & B2 Tennessee Valley Authority	BWR 1233	1982 With CP
Haven 1 Wisconsin Electric Power Company	PWR 900	1980 Under CP Review
Haven 2 (formerly Koshkonong 2) Wisconsin Electric Power Company	PWR 900	1978 Under CP Review
Hope Creek 2 Public Service Electric & Gas Company	BWR 1067	1981 With CP
Jamesport 1 & 2 Long Island Lighting Company	PWR 1150	1980 With CP
Marble Hill 1 & 2 Public Service of Indiana	PWR 1130	1985 With CP
Midland 1 Consumers Power Company	PWR 492	1986 With CP
Midland 2 Consumers Power Company	PWR 818	1986 With CP
Montague 1 & 2 Northeast Nuclear Energy Company	BWR 1150	1980 Under CP Review
New England 1 & 2 New England Power Company	PWR 1194	1979 Under CP Review

Unit Utility	Con Type MWe per Unit	Canceled Date Status
New Haven 1 & 2 New York State Electric & Gas Corporation	PWR 1250	1980 Under CP Review
North Anna 3 Virginia Electric & Power Company	PWR 907	1982 With CP
North Anna 4 Virginia Electric & Power Company	PWR 907	1980 With CP
North Coast 1 Puerto Rico Water Resources Authority	PWR 583	1978 Under CP Review
Palo Verde 4 & 5 Arizona Public Service Company	PWR 1270	1979 Under CP Review
Pebble Springs 1 & 2 Portland General Electric Company	PWR 1260	1982 Under CP Review
Perkins 1, 2, & 3 Duke Power Company	PWR 1280	1982 Under CP Review
Perry 2 Cleveland Electric Illuminating Co.	BWR 1205	1994 Under CP Review
Phipps Bend 1 & 2 Tennessee Valley Authority	BWR 1220	1982 With CP
Pilgrim 2 Boston Edison Company	PWR 1180	1981 Under CP Review
Pilgrim 3 Boston Edison Company	PWR 1180	1974 Under CP Review
Quanicassee 1 & 2 Consumers Power Company	PWR 1150	1974 Under CP Review
River Bend 2 Gulf States Utilities Company	BWR 934	1984 With CP
Seabrook 2 Public Service Co. of New Hampshire	PWR 1198	1988 With CP
Shearon Harris 2 Carolina Power & Light Company	PWR 900	1983 With CP
Shearon Harris 3 & 4 Carolina Power & Light Company	PWR 900	1981 With CP
Skagit/Hanford 1 & 2 Puget Sound Power & Light Company	PWR 1277	1983 Under CP Review

(Continued)

Unit Utility	Con Type MWe per Unit	Canceled Date Status
Sterling Rochester Gas & Electric Corporation	PWR 1150	1980 With CP
Summit 1 & 2 Delmarva Power & Light Company	HTG 1200	1975 Under CP Review
Sundesert 1 & 2 San Diego Gas & Electric Company	PWR 974	1978 Under CP Review
Surry 3 & 4 Virginia Electric & Power Company	PWR 882	1977 With CP
Tyrone 1 Northern States Power Company	PWR 1150	1981 Under CP Review
Tyrone 2 Northern States Power Company	PWR 1150	1974 With CP
Vogtle 3 & 4 Georgia Power Company	PWR 1113	1974 With CP
Washington Nuclear 1 Energy Northwest	PWR 1266	1995 With CP
Washington Nuclear 3 Energy Northwest	PWR 1242	1995 With CP
Washington Nuclear 4 Energy Northwest	PWR 1218	1982 With CP
Washington Nuclear 5 Energy Northwest	PWR 1242	1982 With CP
Watts Bar 2 Tennessee Valley Authority	PWR 1165	(1) With CP
Yellow Creek 1 & 2 Tennessee Valley Authority	BWR 1285	1984 With CP
Zimmer 1 Cincinnati Gas & Electric Company	BWR 810	1984 With CP

Note: Cancellation is defined as public announcement of cancellation or written notification to NRC. Only docketed applications are indicated.

(1) Bellefonte 1 and 2 and Watts Bar 2 have not been formally cancelled; however TVA has stopped construction and is presently evaluating options (e.g. cancellation or conversion).

Source: DOE/EIA Commercial Nuclear Power 1991 (DOE/EIA-0438 (91)), Appendix E (page 105) and Nuclear Regulatory Commission

U.S. Commercial Nuclear Power Reactors by Licensee

Utility	Unit
Ameren UE	Callaway
AmerGen Energy Company	Clinton
AmerGen Energy Company	Oyster Creek
AmerGen Energy Company	Three Mile Island 1
Arizona Public Service Company	Palo Verde 1, 2, & 3
Calvert Cliffs Nuclear Power Plant	Calvert Cliffs 1 & 2
Consolidated Edison Company	Indian Point 2
Consumer Energy Company	Palisades
Detroit Edison Company	Fermi 2
Dominion Nuclear Connecticut, Inc.	Millstone 2, & 3
Duke Energy Corporation	Catawba 1 & 2
Duke Energy Corporation	McGuire 1 & 2
Duke Energy Corporation	Oconee 1, 2, & 3
Energy Northwest	Columbia
Entergy Nuclear Generation Company	Pilgrim 1
Entergy Nuclear Generation Company	Arkansas Nuclear 1 & 2
Entergy Nuclear Generation Company	Grand Gulf 1
Entergy Nuclear Generation Company	River Bend 1
Entergy Nuclear Generation Company	Waterford 3
Exelon	Braidwood 1 & 2
Exelon	Byron 1 & 2
Exelon	Dresden 2 & 3
Exelon	La Salle County 1 & 2
Exelon	Limerick 1 & 2
Exelon	Peach Bottom 2 & 3
Exelon	Quad Cities 1 & 2
FirstEnergy Nuclear Operating Company	Beaver Valley 1 & 2
FirstEnergy Nuclear Operating Company	Davis-Besse
FirstEnergy Nuclear Operating Company	Perry 1
Florida Power & Light Company	St. Lucie 1 & 2
Florida Power & Light Company	Turkey Point 3 & 4
Indiana/Michigan Power Company	D. C. Cook 1 & 2
Nebraska Public Power District	Cooper
Niagara Mohawk Power Corporation	Nine Mile Point 1 & 2
North Atlantic Energy Service Corporation	Seabrook 1
Nuclear Management Company	Duane Arnold
Nuclear Management Company	Kewaunee

(Continued)

Appendix D. U.S. Commercial Nuclear Power Reactors by Licensee *(Continued)*

Utility	Unit
Nuclear Management Company	Monticello
Nuclear Management Company	Point Beach 1 & 2
Nuclear Management Company	Prairie Island 1 & 2
New York Power Authority	Indian Point 3
New York Power Authority	James A. FitzPatrick
Omaha Public Power District	Fort Calhoun
Pacific Gas & Electric Company	Diablo Canyon 1 & 2
PPL Susquehanna, LLC	Susquehanna 1 & 2
Progress Energy	Brunswick 1 & 2
Progress Energy	Crystal River 3
Progress Energy	H. B. Robinson 2
Progress Energy	Shearon Harris 1
PSEG Nuclear, LLC	Hope Creek 1
PSEG Nuclear, LLC	Salem 1 & 2
Rochester Gas & Electric Corporation	Ginna
South Carolina Electric & Gas Company	Summer
Southern California Edison Company	San Onofre 2 & 3
Southern Nuclear Operating Company	Joseph M. Farley 1 & 2
Southern Nuclear Operating Company	Edwin I. Hatch 1& 2
Southern Nuclear Operating Company	Vogtle 1 & 2
STP Nuclear Operating Company	South Texas Project 1 & 2
Tennessee Valley Authority	Browns Ferry 1, 2, & 3
Tennessee Valley Authority	Sequoyah 1 & 2
Tennessee Valley Authority	Watts Bar 1
TXU Electric & Gas	Comanche Peak 1 & 2
VT Yankee Nuclear Power Corporation	Vermont Yankee
Virginia Electric & Power Company	North Anna 1 & 2
Virginia Electric & Power Company	Surry 1 & 2
Wolf Creek Nuclear Operating Corporation	Wolf Creek 1

Source: Nuclear Regulatory Commission

Appendix E

U.S. Nuclear Nonpower Reactors

Licensee Location	Reactor Type OL Issued	License Type Docket Number	License Number
Aerotest San Ramon, CA	Triga (Indus) 07/02/1965	OL 50-228	R-98
Armed Forces Radiobiology Research Institute Bethesda, MD	Triga 06/26/1962	OL 50-170	R-84
Cornell University Ithaca, NY	Triga Mark II 01/11/1962	OL 50-157	R-80
Dow Chemical Company Midland, MI	Triga 07/03/1967	OL 50-264	R-108
General Electric Company Pleasanton, CA	Nuclear Test 10/31/1957	OL 50-73	R-33
Idaho State University Pocatello, ID	AGN-201 #103 10/11/1967	OL 50-284	R-110
Kansas State University Manhattan, KS	Triga 10/16/1962	OL 50-188	R-88
Massachusetts Institute of Technology Cambridge, MA	HWR Reflected 06/09/1958	OL 50-20	R-37
McClellan AFB Sacramento, CA	Triga 08/13/98	OL 50-607	R-130
National Institute of Standards & Technology Gaithersburg, MD	Nuclear Test 06/30/1970	OL 50-184	TR-5
North Carolina State University Raleigh, NC	Pulstar 08/25/1972	OL 50-297	R-120
Ohio State University Columbus, OH	Pool 02/24/1961	OL 50-150	R-75
Oregon State University Corvallis, OR	Triga Mark II 03/07/1967	OL 50-243	R-106
Pennsylvania State University University Park, PA	Triga 07/08/1955	OL 50-5	R-2

(Continued)

Licensee Location	Reactor Type OL Issued	License Type Docket Number	License Number
Purdue University West Lafayette, IN	Lockheed 08/16/1962	OL 50-182	R-87
Reed College Portland, OR	Triga Mark I 07/02/1968	OL 50-288	R-112
Rensselaer Polytechnic Institute Troy, NY	Critical Assembly 07/03/1964	OL 50-225	CX-22
Rhode Island Atomic Energy Commission Narragansett, RI	GE Pool 07/21/1964	OL 50-193	R-95
Texas A&M University College Station, TX	AGN-201M #106 08/26/1957	OL 50-59	R-23
Texas A&M University College Station, TX	Triga 12/07/1961	OL 50-128	R-128
U.S. Geological Survey Denver, CO	Triga Mark I 02/24/1969	OL 50-274	R-113
University of Arizona Tucson, AZ	Triga Mark I 12/05/1958	OL 50-113	R-52
University of California/Irvine Irvine, CA	Triga Mark I 11/24/1969	OL 50-326	R-116
University of Florida Gainesville, FL	Argonaut 05/21/1959	OL 50-83	R-56
University of Lowell Lowell, MA	GE Pool 12/24/1974	OL 50-223	R-125
University of Maryland College Park, MD	Triga 10/14/1960	OL 50-166	R-70
University of Michigan Ann Arbor, MI	Pool 09/13/1957	OL 50-2	R-28
University of Missouri/Rolla Rolla, MO	Pool 11/21/1961	OL 50-123	R-79
University of Missouri/Columbia Columbia, MO	Tank 10/11/1966	OL 50-186	R-103

Licensee Location	Reactor Type OL Issued	License Type Docket Number	License Number
University of New Mexico Albuquerque, NM	AGN-201M#112 09/17/1966	OL 50-252	R-102
University of Texas Austin, TX	Triga Mark II 01/17/1992	OL 50-602	R-92
University of Utah Salt Lake City, UT	Triga Mark I 09/30/1975	OL 50-407	R-126
University of Wisconsin Madison, WI	Triga 11/23/1960	OL 50-156	R-74
Veterans Administration Omaha, NE	Triga 06/26/1959	OL 50-131	R-57
Washington State University Pullman, WA	Triga 03/06/1961	OL 50-27	R-76
Worcester Polytechnic Institute Worcester, MA	GE 12/16/1959	OL 50-134	R-61

Nonpower Reactors Under Decommission Orders or Amendments:

- General Atomics (two non-power reactors) in San Diego, CA
- Georgia Institute of Technology in Atlanta, GA
- Iowa State University in Ames, IA
- Manhattan College in Riverdale, NY
- University of Illinois in Urbana, IL
- University of Washington in Seattle, WA
- University of Virginia (Cavalier) in Charlottesville, VA
- CBS Corporation in Waltz Mill, PA

Nonpower Reactors with Possession Only Amendments (no authority to operate the reactor):

- Cornell University Zero Power Reactor in Ithaca, NY
- General Electric Company (two non-power reactors) in SunOS, CA
- National Aeronautics and Space Administration (two non-power reactors) in Sandusky, OH
- State University of New York in Buffalo, NY
- University of Virginia in Charlottesville, VA

Source: Nuclear Regulatory Commission

Appendix F

NRC Performance Indicators: Annual Industry Averages, Fiscal Years 1988–2000

Indicator	1988	1989	1990	1991	1992	1993
Automatic Scrams	2.41	1.88	1.61	1.57	1.51	1.18
Safety System Actuations	1.22	1.38	0.99	1.06	0.81	0.81
Significant Events	0.77	0.90	0.45	0.40	0.25	0.26
Safety System Failures	3.25	3.53	3.58	3.44	3.78	3.09
Forced Outage Rate	7.86	10.13	7.60	7.90	8.89	7.79
Equipment Forced Outage Rate	0.46	0.45	0.38	0.36	0.35	0.24
Collective Radiation Exposure	364.00	374.00	320.00	286.00	277.00	244.00

Indicator	1994	1995	1996	1997	1998	1999	2000
Automatic Scrams	1.05	1.04	0.80	0.54	0.48	0.64	0.52
Safety System Actuations	0.62	0.46	0.39	0.35	0.31	0.29	0.29
Significant Events	0.21	0.17	0.08	0.10	0.04	0.03	0.02
Safety System Failures	2.32	2.03	2.89	2.71	2.76	1.68	1.37
Forced Outage Rate	9.40	6.76	7.54	10.21	10.73	5.20	4.24
Equipment Forced Outage Rate	0.26	0.23	0.24	0.24	0.18	0.16	0.13
Collective Radiation Exposure	215.00	202.00	178.00	176.00	140.00	128.00	115.00

Source: Licensee data as compiled by the Nuclear Regulatory Commission

Dry Spent Fuel Storage Designs: NRC Approved for General Use

Vendor	Storage Design Model	Capacity (Assemblies)	Certificate of Compliance Issue Date
General Nuclear Systems, Incorporated	CASTOR V/21	21 PWR	08/17/1990
Westinghouse Electric	MC-10	24 PWR	08/17/1990
NAC International, Inc.	NAC S/T	26 PWR	08/17/1990
NAC International, Inc.	NAC-C28 S/T	28 Canisters (fuel rods from 56 PWR assemblies)	08/17/1990
Transnuclear, Inc.	TN-24	24 PWR	11/04/1993
Sierra Nuclear Corporation	VSC-24	24 PWR	05/03/1993
Transnuclear West, Inc.	NUHOMS-24P NUHOMS-52B	24 PWR 52 BWR	01/18/1995
Holtec International	HI-STAR 100	24 PWR 68 BWR	10/04/1999
Holtec International	HI-STORM 100	24 PWR 68 BWR	05/31/2000
Transnuclear, Inc.	TN-32	32 PWR	04/19/2000
NAC International, Inc.	NAC-MPC	34-36 PWR	04/10/2000
NAC International, Inc.	NAC-UMS	24 PWR 56 BWR	11/20/2000
Transnuclear, Inc.	TN-68	68 BWR	05/30/2000

Note: PWR - Pressurized-Water Reactor; BWR - Boiling-Water Reactor

Source: Nuclear Regulatory Commission (10 CFR 72.214)

Appendix H

Dry Spent Fuel Storage Licensees

Reactor Name Utility	Date Issued	Vendor	Storage Model
Surry 1, 2 Virginia Electric & Power Company	07/02/1986	Generals Nuclear Systems, Incorporated	Metal Cask CASTOR V/21 TN-32 NAC-I28 CASTOR X/33 MC-10
H. B. Robinson 2 Carolina Power & Light Company	08/13/1986	Transnuclear West, Incorporated	Concrete Module NUHOMS-7P
Oconee 1, 2, 3 Duke Energy Company	01/29/1990	Transnuclear West, Incorporated	Concrete Module NUHOMS-24P
Fort St. Vrain* Department of Energy	11/04/1991	FW Energy Applications, Incorporated	Modular Vault Dry Store
Calvert Cliffs 1, 2 Calvert Cliffs Nuclear Power Plant	11/25/1992	Transnuclear West, Incorporated	Concrete Module NUHOMS-24P
Palisades Consumers Energy Company	Under General License	BNFL Fuel Solutions	Ventilated Cask VSC-24
Prairie Island 1, 2 Nuclear Management Company, LLC	10/19/1993	Transnuclear West, Incorporated	Metal Cask TN-40
Point Beach 1, 2 Nuclear Management Company, LLC	Under General License	BNFL Fuel Solutions	Ventilated Cask VSC-24
Davis-Besse First Energy Nuclear Operating Company	Under General License	Transnuclear West, Incorporated	Concrete Module NUHOMS-24P
Arkansas Nuclear 1, 2 Entergy Operations, Inc	Under General License	BNFL Fuel Solutions	Ventilated Cask VSC-24
North Anna Virginia Electric & Power Company	06/30/1998	Transnuclear West, Incorporated	Metal Cask TN-32
Trojan Portland General Electric Corp	03/31/1999	BNFL Fuel Solutions	TranStor
Department of Energy; TMI-2 Fuel Debris	03/19/1999	Transnuclear West, Incorporated	Customized NUHOMS
Susquehana Pennsylvania Power & Light	Under General License	Transnuclear West, Incorporated	Concrete Module NUHOMS-52B

Reactor Name Utility	Date Issued	Vendor	Storage Model
Peach Bottom 2, 3 Exelon Generating Company	Under General License	Transnuclear Incorporated	TN-68
Hatch 1, 2 Southern Nuclear Operating Company	Under General License	Holtec International Company	HI-STAR 100 HI-STORM 100
Dresden 1, 2, 3 Exelon Generating Company	Under General License	Holtec International Company	HI-STAR 100 HI-STORM 100
Rancho Seco Sacramento Municipal Utility District	06/30/2000	Transnuclear West, Incorporated	Modified NUHOMS-24 P

*Plant undergoing decommissioning. Transferred to DOE 6/4/99.
Source: Nuclear Regulatory Commission

Appendix I

World List of Nuclear Power Reactors

Country	In Operation		Under Construction, on Order, or Construction Halted		Total	
	Number of Units	Net MWe	Number of Units	Net MWe	Number of Units	Net MWe
Argentina	2	935	1	1,627	3	1,627
Armenia	1	376	0	376	1	376
Belgium	7	5,712	0	5,680	7	5,712
Brazil	2	1,855	1	1,229	3	3,084
Bulgaria	6	3,538	0	0	6	3,538
Canada	22	15,149	0	0	22	15,149
China	3	2,167	8	6,420	11	8,587
Czech Republic	4	1,648	2	1,824	6	3,610
Finland	4	2,656	0	0	4	2,656
France	57	60,303	2	2,900	59	63,203
Germany	20	22,360	0	0	20	22,360
Hungary	4	1,755	0	0	4	1,755
India	14	2,548	4	2,772	18	5,320
Iran	0	0	1	950	1	950
Japan	52	43,255	6	5,638	58	48,893
Lithuania	2	2,370	0	0	2	2,370
Mexico	2	1,364	0	0	2	1,364
Netherlands	1	452	0	0	1	452
North Korea	0	0	2	2000	2	2000
Pakistan	2	425	0	0	2	425
Romania	1	655	4	2,480	5	3,135
Russia	26	19,849	5		31	24,174
Slovakia	6	2,512	2	880	8	3,392
Slovenia	1	620	0	0	1	620
South Africa	2	1,842	0	0	2	1,842
South Korea	16	12,970			20	16,770
Spain	9	7,345	0	0	9	7,345
Sweden	11	9,460	0	0	11	9,460
Switzerland	5	3,170	0	0	5	3,170
Taiwan	6	4884	5	6,290	8	8,369
Ukraine	13	11,195	5	4,750	18	15,945
United Kingdom	33	12,038	0	0	33	12,038
United States	104	98,083	3	3,603	107	101,686
Total	**438**	**353,491**	**52**	**47,001**	**490**	**400,492**

Note: Operable, under construction or on order (30 MWe and over) or construction halted as of 12/31/00.

Source: Reprinted with permission from the March 2001 Nuclear News.

Nuclear Power Units by Reactor Type, Worldwide

Reactor Type	2000			
	In Operation		Total	
	Number of Units	Net MWe	Number of Units	Net MWe
Pressurized light-water reactors	256	227,690	289	259,492
Boiling light-water reactors	92	79,774	98	86,866
Gas-cooled reactors, all varieties	32	10,850	32	10,850
Heavy-water reactors, all varieties	43	21,839	52	27,241
Graphite-moderated light-water reactors	13	12,545	14	13,470
Liquid-metal-cooled fast-breeder reactors	2	793	5	2,573
Total	**438**	**353,491**	**490**	**400,492**

Source: Reprinted with permission from the March 2001 Nuclear News. Copyright © 2001 by the American Nuclear Society, Inc.

Appendix K

Top Fifty Reactors by Capacity Factor, Worldwide

Country	Unit	Reactor Type	Vendor	2000 Gross Capacity Factor (Percent)	2000 Gross Generation (MWh)
U.S.	San Onofre-3	PWR	CE	102.17	10,114,183
U.S.	North Anna-2	PWR	West.	101.20	8,418,070
U.S.	LaSalle-1	BWR	GE	101.08	10,040,352
U.S.	Palo Verde-1	PWR	CE	101.00	11,595,720
South Korea	Wolsong-3	PHWR	AECL	100.89	6,336,316
South Korea	Kori-3	PWR	West.	100.88	8,418,484
U.S.	Farley-2	PWR	West.	100.84	7,723,934
U.S.	Robinson-2	PWR	West	100.77	6,541,213
U.S.	Limerick-2	BWR	GE	100.56	10,272,700
U.S.	Byron-2	PWR	West.	100.54	10,377,125
U.S.	Vogtle-2	PWR	West	100.45	10,791,318
U.S.	Vermont Yankee	BWR	GE	100.22	4,753,633
Belgium	Tihange-1	PWR	ACLF	99.82	8,847,280
Japan	Takahama-2	PWR	MHI	99.54	7,222,136
U.S.	Millstone-3	PWR	West.	99.35	10,542,503
U.S.	Three Mile Island-1	PWR	B&W	98.67	7,548,847
Spain	Garona	BWR	GE	98.43	4,029,214
U.S.	Comanche Peak-1	PWR	West.	98.22	10,017,003
U.S.	Browns Ferry-2	BWR	GE	98.08	9,950,610
Japan	Sendai-2	PWR	MHI	98.05	7,665,129
U.S.	Dresden-2	BWR	GE	97.98	7,178,002
U.S.	Indian Point-3	PWR	West.	97.96	8,716,993
U.S.	Oconee-2	PWR	B&W	97.85	7,830,521
Taiwan	Chinshan-1	BWR	GE	97.80	5,463,914
Spain	Asco-2	PWR	West.	97.69	8,795,210
Japan	Kashiwazaki-7	BWR	Toshiba	97.62	11,627,860
U.S.	Brunswick-2	BWR	GE	97.44	7,266,890
U.S.	Prairie Island-1	PWR	West.	97.38	4,790,310
U.S.	Grand Gulf-1	BWR	GE	96.92	11,118,227

Country	Unit	Reactor Type	Vendor	2000 Gross Capacity Factor (Percent)	2000 Gross Generation (MWh)
Japan	Fukushima I-1	BWR	GE	96.91	3,915,724
U.S.	Peach Bottom-3	BWR	GE	96.40	9,814,500
U.S.	McGuire-1	PWR	West.	96.30	10,362,609
Switzerland	Beznau-2	PWR	West.	95.82	3,198,427
Finland	Olkiluoto-1	BWR	Asea	95.46	7,310,180
U.S.	South Texas-2	PWR	West.	95.50	11,031,181
Finland	Olkiluoto-2	BWR	Asea	95.46	7,295,312
Japan	Genkai-1	PWR	MHI	95.39	4,683,875
U.S.	Perry	BWR	GE	95.37	10,472,020
U.S.	Braidwood-2	PWR	West.	95.27	9,833,127
Japan	Fukushima II-2	BWR	Hitachi	95.19	9,197,804
Germany	Emsland	PWR	Siemens	95.10	11,385,996
U.S.	Duane Arnold	BWR	GE	94.92	4,716,586
Belgium	Doel-1	PWR	ACEC.	94.73	3,428,300
Germany	Brokdorf	PWR	Siemens	94.29	11,926,546
U.S.	LaSalle-2	BWR	GE	94.07	9,333,264
U.S.	Diablo Canyon-2	PWR	West.	94.02	9,613,530
U.S.	Point Beach-1	PWR	West.	94.01	4,325,410
U.S.	Pilgrim	BWR	GE	93.70	5,728,570
U.S.	Byron-1	PWR	West.	93.89	9,691,079
Germany	Neckar-2	PWR	Siemens	93.64	11,227,420

Note: U.S. units believed to belong on this list, but which do not reveal their gross generation, are: Florida Power & Light's St. Lucie-1, AmerenUE's Callaway, Calvert Cliffs-2, Florida Power's Crystal River-3, and PPL's Susquehanna-2. CE, the former Combustion Engineering, is now part of Westinghouse.

Source: Excerpted from Nucleonics Week © February 8, 2001, by McGraw Hill, Inc. Reproduced by permission. Further reproduction prohibited.

Appendix L

Top Fifty Reactors by Generation, Worldwide

Country	Unit	Reactor Type	Vendor	2000 Gross Generation (MWh)	2000 Gross Capacity Factor (Percent)
Germany	Isar-2	PWR	Siemens	11,942,563	92.18
Germany	Brokdorf	PWR	Siemens	11,926,546	94.29
Germany	Grohnde	PWR	Siemens	11,679,822	92.98
Japan	Kashiwazaki-7	BWR	Toshiba	11,627,860	97.62
U.S.	Palo Verde-1	PWR	CE	11,595,720	101.00
Germany	Emsland	PWR	Siemens	11,385,996	95.10
Germany	Philippsburg-2	PWR	Siemens	11,287,670	90.24
Germany	Neckar-2	PWR	Siemens	11,227,420	93.64
U.S.	Grand Gulf-1	BWR	GE	11,118,227	96.92
U.S.	South Texas-2	PWR	West.	11,031,181	95.50
U.S.	Vogtle-2	PWR	West.	10,791,318	100.45
Germany	Gundremmingen-C	BWR	Siemens	10,697,909	90.62
U.S.	Millstone-3	PWR	West.	10,542,503	99.35
U.S.	Perry	BWR	GE	10,472,020	95.37
U.S.	Palo Verde-3	PWR	CE	10,461,000	91.12
U.S.	Byron-2	PWR	West.	10,377,125	100.54
U.S.	McGuire-1	PWR	West.	10,362,609	96.30
France	Belleville-2	PWR	Fram.	10,302,101	86.05
France	Paluel-2	PWR	Fram.	10,292,223	84.78
U.S.	Limerick-2	BWR	GE	10,272,700	100.56
France	Paluel-3	PWR	Fram.	10,266,418	84.57
France	Flamanville-2	PWR	Fram.	10,254,024	84.47
Germany	Grafenrheinfeld	PWR	Siemens	10,206,922	86.39
U.S.	San Onofre-3	PWR	CE	10,114,183	102.17
Germany	Unterweser	PWR	Siemens	10,111,138	85.27
France	Nogent-2	PWR	Fram.	10,088,352	84.26
U.S.	Palo Verde-2	PWR	CE	10,043,254	87.48
U.S.	LaSalle-1	BWR	GE	10,040,352	101.08
U.S.	Comanche Peak-1	PWR	West.	10,017,003	98.22
France	Penly-2	PWR	Fram.	10,010,985	82.47
U.S.	Browns Ferry-2	BWR	GE	9,950,610	98.08
U.S.	Braidwood-2	PWR	West.	9,833,127	95.27
U.S.	Peach Bottom-3	BWR	GE	9,814,500	96.40
Germany	Gundremmingen-B	BWR	Siemens	9,797,120	82.99
Japan	Kashiwazaki-6	BWR	Toshiba	9,732,120	81.71

Country	Unit	Reactor Type	Vendor	2000 Gross Generation (MWh)	2000 Gross Capacity Factor (Percent)
U.S.	Byron-1	PWR	West.	9,691,079	93.89
France	Cattenom-2	PWR	Fram.	9,661,307	80.75
U.S.	Braidwood-1	PWR	West.	9,659,965	93.59
U.S.	Vogtle-1	PWR	West.	9,620,939	89.56
U.S.	Diablo Canyon-2	PWR	West.	9,613,530	94.02
France	Cattenom-4	PWR	Fram.	9,599,771	80.24
France	Paluel-1	PWR	Fram.	9,515,707	78.39
U.S.	Watts Bar-1	PWR	West.	9,500,183	89.38
France	Nogent-1	PWR	Fram.	9,499,405	79.34
U.S.	Catawba-2	PWR	West.	9,479,473	89.56
France	Cattenom-3	PWR	Fram.	9,443,828	78.94
U.S.	Wolf Creek	PWR	West.	9,430,537	88.44
Germany	Kruemmel	BWR	Siemens	9,430,460	81.58
U.S.	Catawba-1	PWR	West.	9,421,924	89.01
Japan	Tsuruga-2	PWR	MHI	9,381,612	92.07

Note: U.S. units believed to belong on this list but do not disclose gross generation are AmerenUE's Callaway and PPL's Susquehanna-2.

Source: Excerpted from Nucleonics Week © February 8, 2001 by McGraw Hill, Inc. Reproduced by permission. Further reproduction prohibited.

Appendix M

Quick Reference Metric Conversion Tables

SPACE AND TIME

Quantity	From Inch-Pound Units	To Metric Units	Multiply by
Length	mi (statute)	km	1.609 347
	yd	m	*0.914 4
	ft (int)	m	*0.304 8
	in	cm	*2.54
Area	mi^2	km^2	2.589 998
	acre	m^2	4 046.873
	yd^2	m^2	0.836 127 4
	ft^2	m^2	*0.092 903 04
	in^2	cm^2	*6.451 6
Volume	acre foot	m^3	1 233.489
	yd^3	m^3	0.764 554 9
	ft^3	m^3	0.028 316 85
	ft^3	L	28.316 85
	gallon	L	3.785 412
	fl oz	mL	29.573 53
	in^3	cm^3	16.387 06
Velocity	mi/h	km/h	1.609 347
	ft/s	m/s	*0.304 8
Acceleration	ft/s^2	m/s^2	*0.304 8

NUCLEAR REACTION and IONIZING RADIATION

Quantity	From Inch-Pound Units	To Metric Units	Multiply by
Activity (of a radionuclide)	curie (Ci)	MBq	*37,000.0
	dpm	Bq (becquerel)	0.016 667
Absorbed dose	rad	Gy (gray)	*0.01
	rad	cGy	*1.0
Dose equivalent	rem	Sv (sievert)	*0.01
	rem	mSv	*10.0
	mrem	mSv	*0.01
	mrem	µSv	*10.0
Exposure (X- and gamma rays)	roentgen (R)	C/kg (coulomb)	0.000 258

*Exact conversion factors

HEAT

Quantity	From Inch-Pound Units	To Metric Units	Multiply by
Thermodynamic temperature	°F	°K	*°K = (°F + 459.67)/1.8
Celsius temperature	°F	°C	*°C = (°F–32)/1.8
Linear expansion coefficient	$°F^{-1}$	$°K^{-1}$ or $°C^{-1}$	*1.8
Thermal conductivity	(Btu • in)/(ft^2 • h • °F)	W/(m • °C)	0.144 227 9
Coefficient of heat transfer	Btu / (ft^2 • h • °F)	W/(m^2 • °C)	5.678 263
Heat capacity	Btu/°F	kJ/°C	1.899 108
Specific heat capacity	Btu/(lb • °F)	kJ/(kg •°C)	*4.186 8
Entropy	Btu/°F	kJ/°C	1.899 108
Specific entropy	Btu/(lb • °F)	kJ/(kg •°C)	*4.186 8
Specific internal energy	Btu/lb	kJ/kg	*2.326

MECHANICS

Quantity	From Inch-Pound Units	To Metric Units	Multiply by
Mass (weight)	ton (short) lb (avdp)	t (metric ton) kg	*0.907 184 74 *0.453 592 37
Moment of mass	lb • ft	kg • m	0.138 255
Density	ton (short)/yd^3 lb/ft^3	t/m3 kg/m3	1.186 553 16.018 46
Concentration (mass)	lb/gal	g/L	119.826 4
Momentum	lb • ft/s	kg •m/s	0.138 255
Angular momentum	lb • ft^2/s	kg •m^2/s	0.042 140 11
Moment of Inertia	lb • ft^2	kg •m^2	0.042 140 11
Force	kip (kilopound) lbf	kN (kilonewton) N (newton)	4.448 222 4.448 222

*Exact conversion factors

(Continued)

MECHANICS *(Continued)*

Quantity	From Inch-Pound Units	To Metric Units	Multiply by
Moment of Force, torque	lbf • ft	N • m	1.355 818
	lbf • in	N • m	0.122 984 8
Pressure	atm (std)	kPa (kilopascal)	*101.325
	bar	kPa	*100.0
	lbf/in^2 (formerly psi)	kPa	6.894 757
	inHg (32°F)	kPa	3.386 38
	ftH_2O (39.2°F)	kPa	2.988 98
	inH_2O (60°F)	kPa	0.248 84
	mmHg (0°C)	kPa	0.133 322
Stress	kip/in^2 (formerly ksi)	MPa	6.894 757
	lbf/in^2 (formerly psi)	MPa	0.006 894 757
	lbf/in^2 (formerly psi)	kPa	6.894 757
	lbf/ft^2	kPa	0.047 880 26
Energy, work	kwh	MJ	*3.6
	cal_{th}	J (joule)	*4.184
	Btu	kJ	1.055 056
	ft • lbf	J	1.355 818
	therm (US)	MJ	105.480 4
Power	Btu/s	kW	1.055 056
	hp (electric)	kW	*0.746
	Btu/h	W	0.293 071 1

To convert from metric units to inch-pound units, divide the metric unit by the conversion factor.

*Exact conversion factors

Note: The information contained in this table is intended to familiarize NRC personnel with commonly used SI units and provide a quick reference to aid in the understanding of documents containing SI units. The conversion factors provided have not been approved as NRC guidelines for development of licensing actions, regulations, or policy.

Source: Federal Standard 376A (May 5, 1983), Preferred Metric Units for General Use by the Federal Government; and International Commission of Radiation Units and Measurements, ICRU Report 33 (1980), Radiation Quantities and Unit

Glossary

AGREEMENT STATE: A State that has signed an agreement with the NRC allowing the State to regulate the use of radioactive material within that State.

BOILING-WATER REACTOR (BWR): A nuclear reactor in which water, used as both coolant and moderator, is allowed to boil in the core.

CAPABILITY: The maximum load that a generating station can carry under specified conditions for a given period of time without exceeding approved limits of temperature and stress. Net summer capability is used in the digest. Measured in watts except as noted otherwise.

CAPACITY FACTOR (Gross): The ratio of the gross electricity generated, for the period of time considered, to the energy that could have been generated at continuous full-power operation during the same period.

CAPACITY FACTOR (Net): The ratio of the net electricity generated, for the period of time considered, to the energy that could have been generated at continuous full-power operation during the same period.

CASK: A heavily shielded container used to store and/or ship radioactive materials. Lead and steel are common materials used in the manufacture of casks.

COMPACT: A group of two or more States formed to dispose of low-level radioactive waste on a regional basis. Forty-four States have formed ten compacts.

CONSTRUCTION RECAPTURE: The maximum number of years that could be added to the license expiration date to recover the period from the construction permit to the date when the operating license was granted. A licensee is required to submit an application for such a change.

CONTAMINATION: The deposition of unwanted radioactive material on the surfaces of structures, areas, objects, or personnel.

DECOMMISSION: The process of safely removing a facility from service followed by reducing residual radioactivity to a level that permits the release of the property for unrestricted and, under certain conditions, restricted use.

DECON: A method of decommissioning in which the equipment, structures, and portions of a facility and site containing radioactive contaminants are removed or decontaminated to a level that permits the property to be released for unrestricted use shortly after cessation of operations.

(Continued)

DECONTAMINATION: The reduction or removal of contaminated radioactive material from a structure, area, object, or person.

ENTOMB: A method of decommissioning in which radioactive contaminants are encased in a structurally long-lived material, such as concrete. The entombment structure is appropriately maintained, and continued surveillance is carried out until the radioactivity decays to a level permitting unrestricted release of the property.

FISCAL YEAR: The 12-month period, from October 1 through September 30, used by the Federal Government in budget formulation and execution. The fiscal year is designated by the calendar year in which it ends.

FUEL CYCLE: The series of steps involved in supplying fuel for nuclear power reactors.

FULL-TIME EQUIVALENT: A measurement equal to one staff person working a full-time work schedule for 1 year.

GENERATION (Gross): The total amount of electric energy produced by a generating station as measured at the generator terminals. Measured in watthours except as noted otherwise.

GENERATION (Net): The gross amount of electric energy produced minus the electric energy consumed at a generating station for station use. Measured in watthours except as noted otherwise.

GIGAWATT: One billion watts.

GIGAWATTHOUR: One billion watthours.

HIGH-LEVEL WASTE: High-level radioactive waste (HLW) means (1) irradiated (spent) reactor fuel; (2) liquid waste resulting from the operation of the first cycle solvent extraction system, and the concentrated wastes from subsequent extraction cycles, in a facility for reprocessing irradiated reactor fuel; and (3) solids into which such liquid wastes have been converted. HLW is primarily in the form of spent fuel discharged from commercial nuclear power reactors. It also includes some reprocessed HLW from defense activities, and a small quantity of reprocessed commercial HLW.

LOW-LEVEL WASTE: Low-level radioactive waste (LLW) is a general term for a wide range of wastes. Industries; hospitals and medical, educational, or research institutions; private or Government laboratories; and nuclear fuel cycle facilities (e.g., nuclear power reactors and fuel fabrication plants) using radioactive materials generate low-level wastes as part of their normal operations. These wastes are generated in many physical and chemical forms and levels of contamination.

MAXIMUM DEPENDABLE CAPACITY (Gross): Dependable main-unit gross capacity, winter or summer, whichever is smaller. The dependable capacity varies because the unit efficiency varies during the year because of temperature variations in cooling water. It is the gross electrical output as measured at the output terminals of the turbine generator during the most restrictive seasonal conditions (usually summer). Measured in watts except as noted otherwise.

MAXIMUM DEPENDABLE CAPACITY (Net): Gross maximum dependable capacity minus the normal station service loads. Measured in watts except as noted otherwise.

MEGAWATT (MW): One million watts.

MEGAWATTHOUR (MWh): One million watthours.

METRIC TON: Approximately 2,200 pounds.

NET SUMMER CAPABILITY: The steady hourly output that generating equipment is expected to supply to system load exclusive of auxiliary power, as demonstrated by tests at the time of summer peak demand. Measured in watts except as noted otherwise.

NONPOWER REACTOR: A nuclear reactor used for research, training, and test purposes, and for the production of radioisotopes for medical and industrial uses.

POSSESSION-ONLY LICENSE: A form of license that allows possession but not operation.

PRESSURIZED-WATER REACTOR (PWR): A nuclear reactor in which heat is transferred from the core to a heat exchanger via water kept under high pressure without boiling the water.

PRODUCTION EXPENSE: Production expenses are a component of generation expenses that includes costs associated with operation, maintenance, and fuel.

RADIOACTIVITY: The rate at which radioactive material emits radiation. Measured in units of becquerels or disintegrations per second.

SAFSTOR: A method of decommissioning in which the nuclear facility is placed and maintained in such condition that the nuclear facility can be safely stored and subsequently decontaminated (deferred decontamination) to levels that permit release for unrestricted use.

SPENT NUCLEAR FUEL: Fuel that has been removed from a nuclear reactor because it can no longer sustain power production for economic or other reasons.

(Continued)

URANIUM FUEL FABRICATION FACILITY: A facility that (1) manufactures reactor fuel containing uranium for any of the following: (i) preparation of fuel materials; (ii) formation of fuel materials into desired shapes; (iii) application of protective cladding; (iv) recovery of scrap material; and (v) storage associated with such operations; or (2) conducts research and development activities.

URANIUM HEXAFLUORIDE PRODUCTION FACILITY: A facility that receives natural uranium in the form of ore concentrate; enriches it, either by gaseous diffusion or gas centrifuge methods; and converts it into uranium hexafluoride (UF_6).

VIABILITY ASSESSMENT: A DOE decisionmaking process to judge the prospects for geologic disposal of high-level radioactive wastes at Yucca Mountain based on (1) specific design work on the critical elements of the repository and waste package, (2) a total system performance assessment that will describe the probable behavior of the repository, (3) a plan and cost estimate for the work required to complete a license application, and (4) an estimate of the costs to construct and operate the repository.

WATT: The electrical unit of power. The rate of energy transfer equivalent to 1 ampere flowing under a pressure of 1 volt at unity power factor.

WATTHOUR: An electrical energy unit of measure equal to 1 watt of power supplied to, or taken from, an electrical circuit steadily for 1 hour.

WHEELING SERVICE: The movement of electricity from one system to another over transmission facilities of intervening systems. Wheeling service contracts can be established between two or more systems.

NRC FORM 335 (2-89) NRCM 1102, 3201, 3202 — U.S. NUCLEAR REGULATORY COMMISSION — **BIBLIOGRAPHIC DATA SHEET** *(See instructions on the reverse)*	1. REPORT NUMBER (Assigned by NRC, Add Vol., Supp., Rev., and Addendum Numbers, if any.) NUREG-1350 Volume 13
2. TITLE AND SUBTITLE U. S. Nuclear Regulatory Commission Information Digest 2001 Edition	3. DATE REPORT PUBLISHED — MONTH: June — YEAR: 2001 4. FIN OR GRANT NUMBER
5. AUTHOR(S) Jo Anne Johnson	6. TYPE OF REPORT Annual 7. PERIOD COVERED *(Inclusive Dates)* 2000

8. PERFORMING ORGANIZATION - NAME AND ADDRESS *(If NRC, provide Division, Office or Region, U.S. Nuclear Regulatory Commission, and mailing address; if contractor, provide name and mailing address.)*

Division of Planning, Budget, and Analysis
Office of the Chief Financial Officer
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

9. SPONSORING ORGANIZATION - NAME AND ADDRESS *(If NRC, type "Same as above"; if contractor, provide NRC Division, Office or Region, U.S. Nuclear Regulatory Commission, and mailing address.)*

Same as 8, above

10. SUPPLEMENTARY NOTES

11. ABSTRACT *(200 words or less)*

The Nuclear Regulatory Commission Information Digest provides a summary of info rmation about the U.S. Nuclear Regulatory Commission (NRC), NRC's regulatory responsibilities, NRC licensed activities, and general information on domestic and world-wide nuclear energy. The digest, published annually, is a compilation of nuclear- and NRC - related data and is designed to serve as a quick reference to major facts about the agency and the industry it regulates. Information on generating capacity and average capacity factor for operating U.S. commercial nuclear power reactors is obtained from monthly operating reports that are submitted directly to the NRC by the licensee. This information is reviewed by the NRC for consistency only and no independent validation and/or verification is performed .

12. KEY WORDS/DESCRIPTORS *(List words or phrases that will assist researchers in locating the report.)*	
Information Digest 2001 Edition NRC Facts	13. AVAILABILITY STATEMENT: unlimited 14. SECURITY CLASSIFICATION *(This Page)* unclassified *(This Report)* unclassified 15. NUMBER OF PAGES 16. PRICE

NRC FORM 335 (2-89)

This form was electronically produced by Elite Federal Forms, Inc.