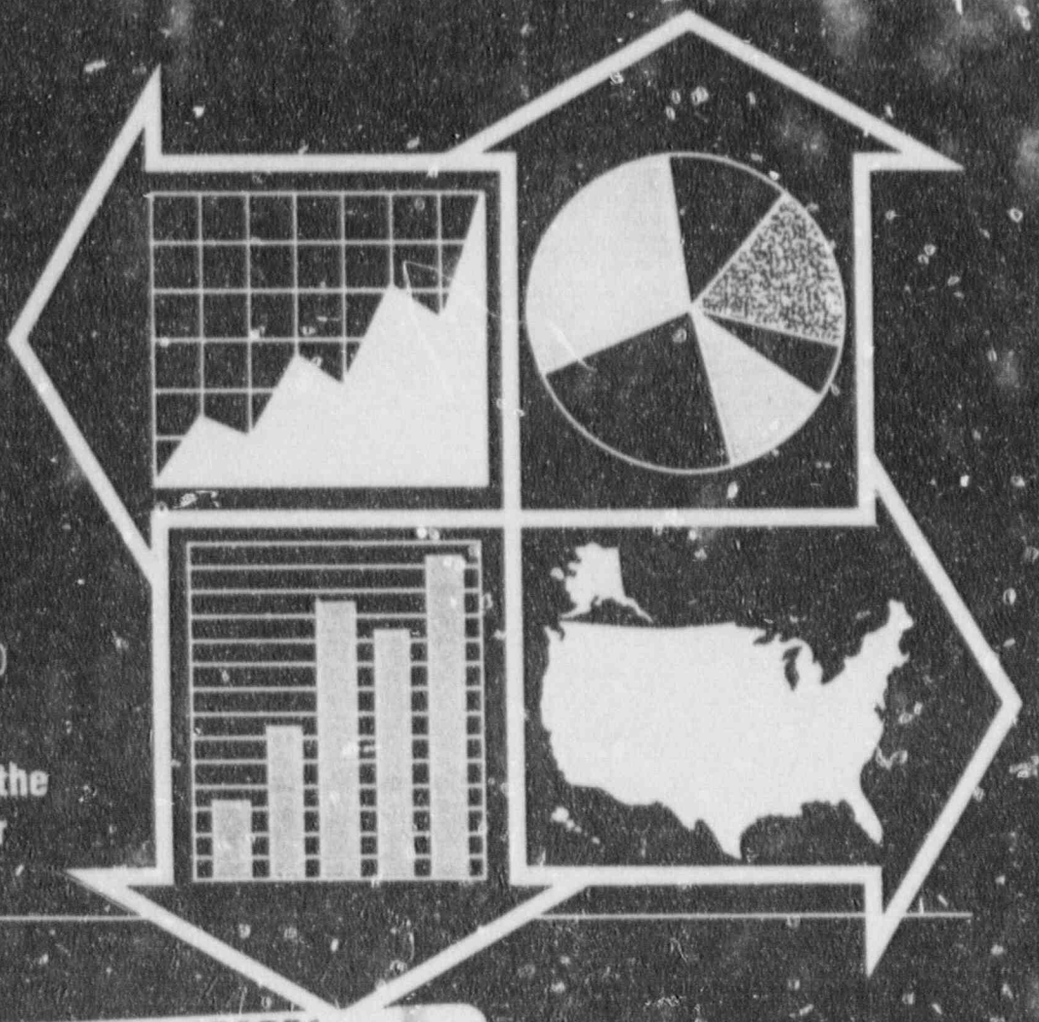
Nuclear Regulatory Commission

Information Digest

1992 Edition



NUREG-1350
Volume 4

Office of the Controller

Availability Notice

Availability of Reference Materials Cited in NRC Publications

Most documents cited in NRC publications will be available from one of the following sources:

1. The NRC Public Document Room, 2120 L Street, NW, Lower Level, Washington, DC 20555

2. The Superintendent of Documents, U.S. Government Printing Office, P.O. Box 37082, Washington, DC 20013-7082

3. The National Technical Information Service, Springfield, VA 22161

Although the listing that follows represents the majority of documents cited in NRC publications, it is not intended to be exhaustive.

Referenced documents available for inspection and copying for a fee from the NRC Public Document Room include NRC correspondence and internal NRC memoranda; NRC Office of Inspection and Enforcement bulletins, circulars, information notices, inspection and investigation notices; Licensee Event Reports; vendor reports and correspondence; Commission papers; and applicant and licensee documents and correspondence.

The following documents in the NUREG series are available for purchase from the GPO Sales Program: formal NRC staff and contractor reports, NRC-sponsored conference proceedings, and NRC booklets and brochures. Also available are Regulatory Guides, NRC regulations in the Code of Federal Regulations, and Nuclear Regulatory Commission Issuances.

Documents available from the National Technical Information Service include NUREG series reports and technical reports prepared by other federal agencies and reports prepared by the Atomic Energy Commission, forerunner agency to the Nuclear Regulatory Commission.

Documents available from public and special technical libraries include all open literature items, such as books, journal and periodical articles, and transactions. Federal Register notices, federal and state legislation, and congressional reports can usually be obtained from these libraries.

Documents such as theses, dissertations, foreign reports and translations, and non-NRC conference proceedings are available for purchase from the organization sponsoring the publication cited.

Single copies of NRC draft reports are available free, to the extent of supply, upon written request to the Office of Administration, Distribution and Mail Services Section, U.S. Nuclear Regulatory Commission, Washington, DC 20555.

Copies of industry codes and standards used in a substantive manner in the NRC regulatory process are maintained at the NRC Library, 7920 Norfolk Avenue, Bethesda, Maryland, and are available there for reference use by the public. Codes and standards are usually copy-righted and may be purchased from the originating organization or, if they are American National Standards, from the American National Standards Institute, 1430 Broadway, New York, NY 10018.

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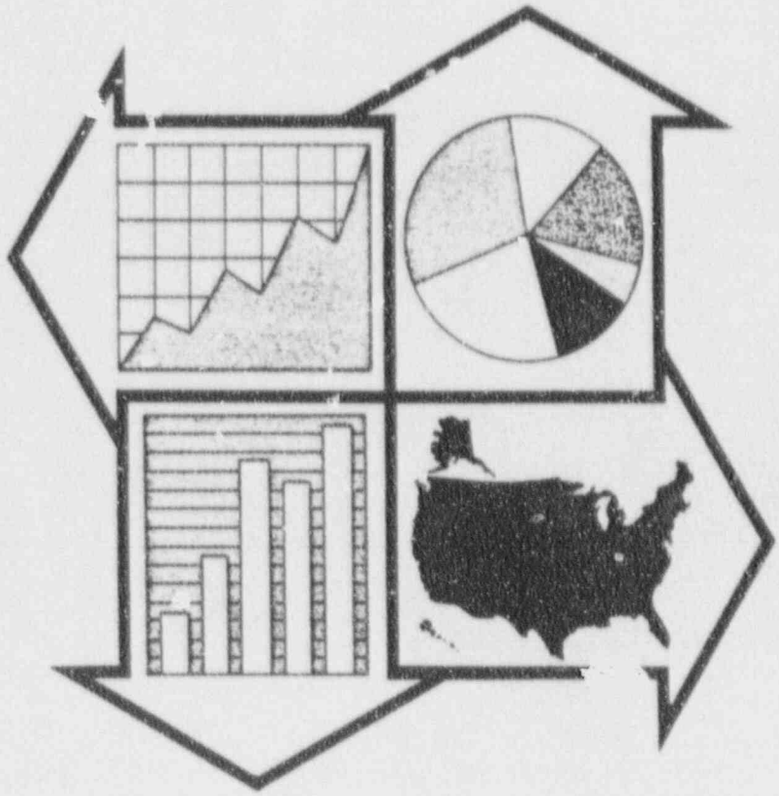

Abstract

The Nuclear Regulatory Commission Information Digest provides a summary of information about the U.S. Nuclear Regulatory Commission (NRC), NRC's regulatory responsibilities, the activities NRC licenses, and general information on domestic and worldwide nuclear energy. This digest is a compilation of nuclear- and NRC-related data and is designed to provide a quick reference to major facts about the agency and the industry it regulates. In general, the data cover 1975 through 1991, with exceptions noted. 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.

For detailed and complete information about tables and figures, refer to the source publications. This digest is published annually.

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Editor's Note

The scope and presentation of data were changed in Volume 4, and readers should be alert to these changes. Comments and/or responses, especially where these changes can be improved, are welcomed. Comments should be directed to Karen Olive, M/S 10204, Division of Budget and Analysis, Office of the Controller, Washington, D.C. 20555 (301) 492–8153.

For More Information...

The U.S. Nuclear Regulatory Commission (NRC) offers a variety of programs to make agency, licensee, and nuclear industry information available to the public. The agency maintains a Public Document Room in Washington, D.C., that provides public access to documents pertaining to the licensing and regulation of nuclear facilities and materials and related agency information. The NRC has also established Local Public Document Rooms (LPDRs) near the site of each commercial nuclear power reactor, low-level waste repository, the proposed high-level waste repository, and certain fuel cycle facilities. The LPDR collections consist of all publicly available documents about the facility, including hearing transcripts, safety evaluation reports, environmental impact statements, and inspection and licensee event reports. Power reactor LPDRs also maintain a microfiche file of all documents made publicly available by the NRC since 1981, in addition to those about the nearby nuclear facility.

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.

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. 1), at the following address:

U.S. Nuclear Regulatory Commission
ATTN: Distribution and Mail Services
Washington, D.C. 20555

NRC as a Regulatory Agency

Mission and Statutory Authority

The mission of the U.S. Nuclear Regulatory Commission (NRC) is to ensure adequate protection of the public health and safety, the common defense and security, and the environment in the use of nuclear materials in the United States. The NRC's scope of responsibility includes regulation of commercial nuclear power reactors; nonpower 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 waste.

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 NRC. This act, along with the Atomic Energy Act of 1954, as amended, provides the foundation for regulation of the nation's commercial 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 are:

- 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; and
- Solar, Wind, Waste and Geothermal Power Production Incentives Act of 1990

The NRC and its licensees share a common responsibility to protect the 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. All available facts and opinions must be sought openly 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 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:

- Licensing the construction and operation of nuclear reactors and other nuclear facilities, such as nuclear fuel cycle facilities and nonpower test and research reactors.
- Licensing the possession, use, processing, handling, and export of nuclear material.
- 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 repository for high-level radioactive waste.
- Licensing the operators of nuclear power and nonpower test and research reactors.
- Inspecting licensed facilities and activities.
- Conducting the principal U.S. Government research program on light-water reactor safety.
- Conducting research to provide 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

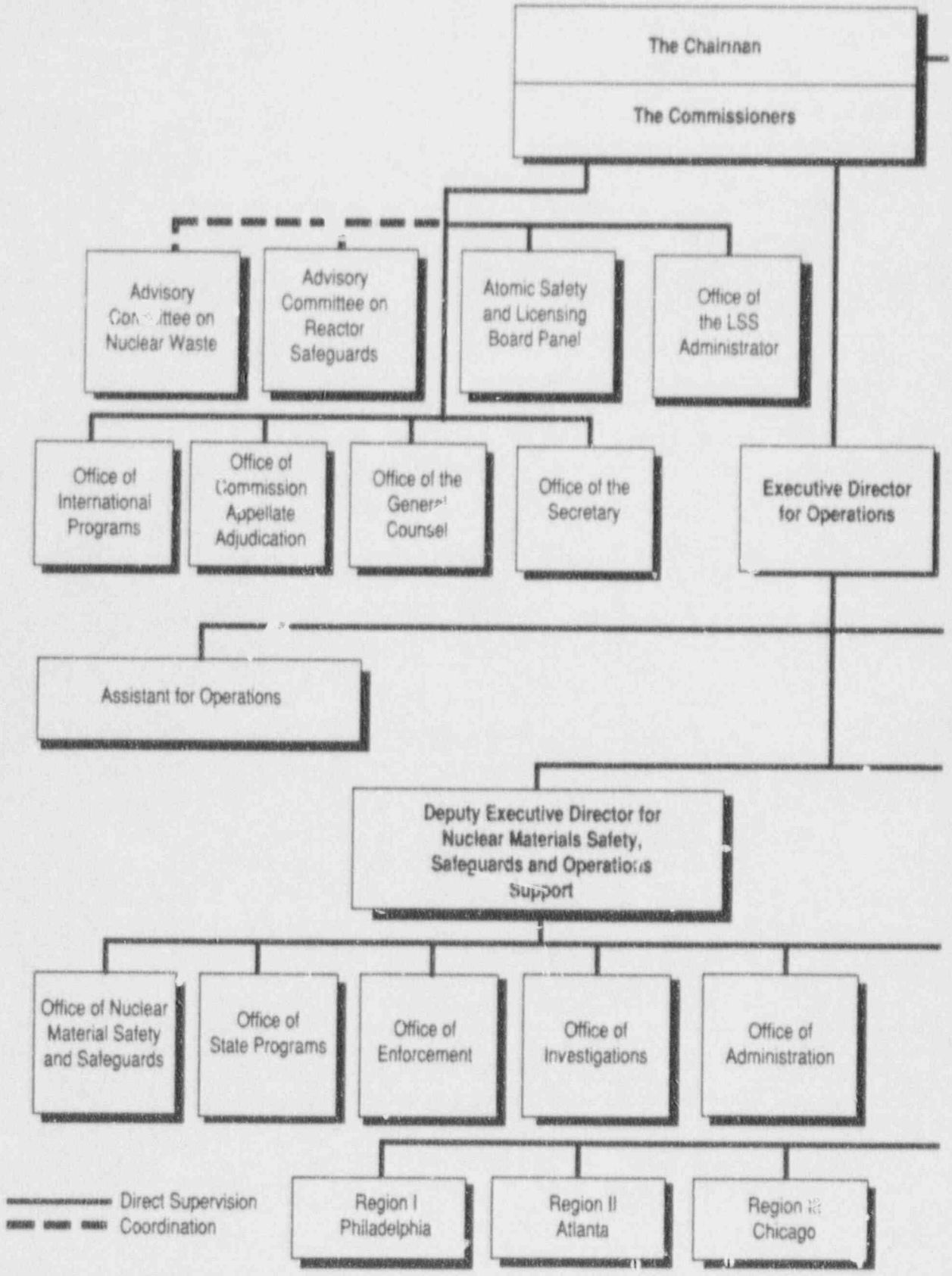
The NRC is headed by five Commissioners appointed by the President and confirmed by the Senate for 5-year terms. One of them is designated by the President to be the Chairman, serving as the principal executive officer and official spokesperson of the Commission. The staff, headed by the Executive Director for Operations, carries out the policies and decisions made by the Commission. The NRC's principal offices are:

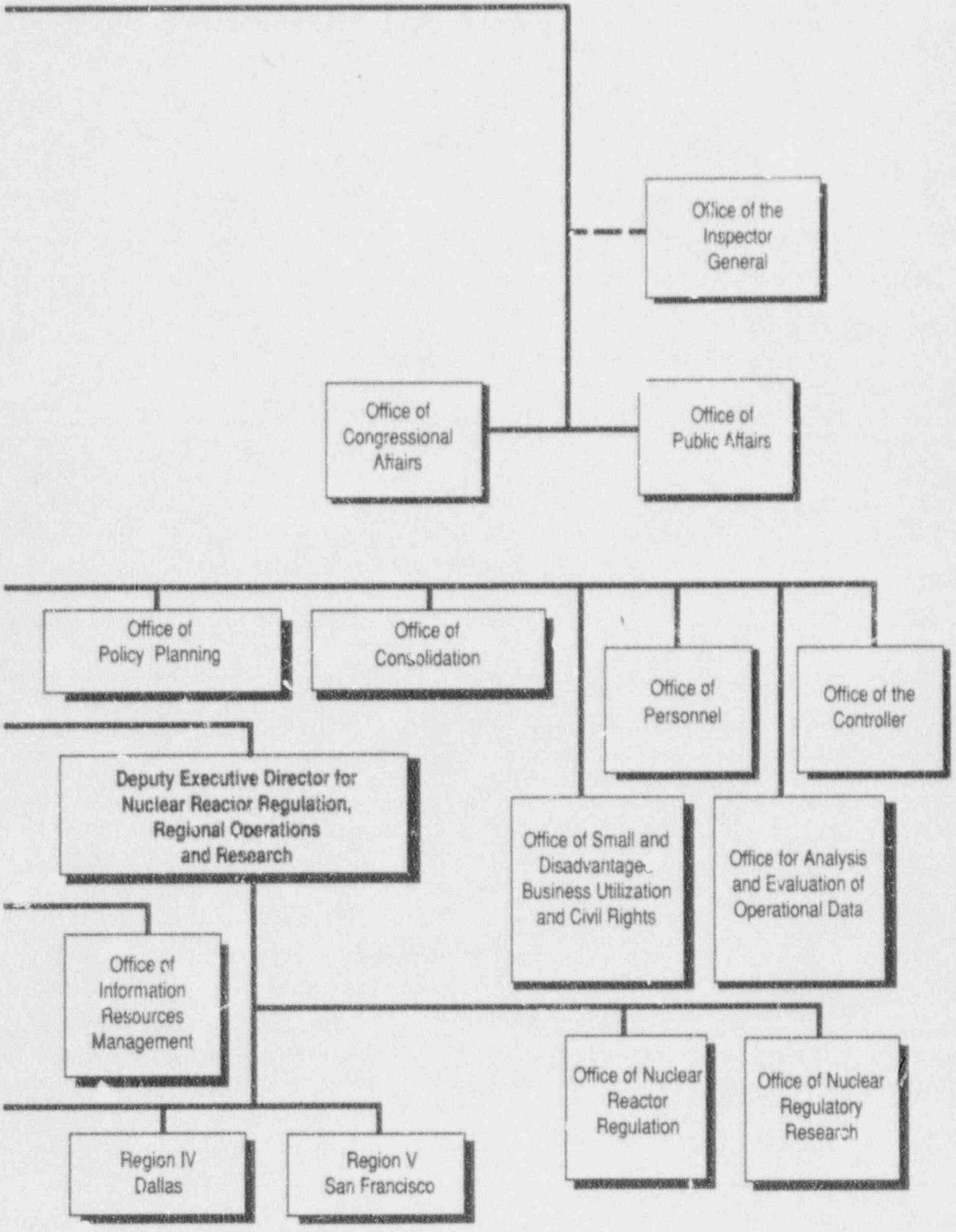
- **Nuclear Reactor Regulation**—Directs all licensing and inspection activities associated with the design, construction, and operation of nuclear power reactors and nonpower reactors.
- **Nuclear Regulatory Research**—Provides independent expertise and information for making timely regulatory judgments, anticipating problems of potential safety significance, and resolving safety issues and developing technical regulations and standards.
- **Nuclear Material Safety and Safeguards**—Directs all licensing and inspection activities associated with nuclear fuel cycle facilities, uses of nuclear material, transport of nuclear material, safeguarding of nuclear material at nuclear facilities and in transit, management and disposal of low-level and high-level radioactive nuclear waste, and decontamination and decommissioning of facilities and sites.
- **Analysis and Evaluation of Operational Data**—Collects, analyzes, and disseminates information about the operational safety of commercial nuclear power reactors and certain nonreactor activities, and manages the NRC's Incident Response Program and the NRC's Technical Training Center.
- **Regional Offices**—Conduct inspection, enforcement, licensing, and emergency response programs that the headquarters offices originate.
- **Inspector General**—Provides the Commission with an independent review and appraisal of NRC programs and operations to ensure their effectiveness, efficiency, and integrity.

Refer to the "Nuclear Regulatory Commission 1990 Annual Report" (NUREG–1145) for additional information regarding NRC offices and their functions.

Figure 1 is an organization chart of the NRC.

Figure 1. **U.S. Nuclear Regulatory Commission (NRC)**




Office of the Inspector General
Office of Congressional Affairs
Office of Public Affairs
Office of Policy Planning
Office of Consolidation
Office of Personnel
Office of the Controller
Deputy Executive Director for Nuclear Reactor Regulation, Regional Operations and Research
Office of Small and Disadvantaged Business Utilization and Civil Rights
Office for Analysis and Evaluation of Operational Data
Office of Information Resources Management
Office of Nuclear Reactor Regulation
Office of Nuclear Regulatory Research
Region IV Dallas
Region V San Francisco

NRC Locations

Headquarters:

Greater Washington, D.C., Area
(301) 492–7000

The NRC is in the process of consolidating its headquarters staff in Rockville, Maryland. The consolidation is expected to be completed in 1994.

Operations Center:

Bethesda, Maryland
(301) 951–0550

The NRC maintains an Operations Center that provides 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 five regional offices located throughout the United States (see Figure 2):

Region I
King of Prussia, Pennsylvania
(215) 337–5000

Region II
Atlanta, Georgia
(404) 331–4503

Region III
Glen Ellyn, Illinois
(708) 790–5500

Region IV
Arlington, Texas
(817) 860–8100

Region V
Walnut Creek, California
(510) 975–0200

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 16 for a map of the U.S. commercial nuclear power reactor sites.

Technical Training Center:

Chattanooga, Tennessee
(615) 855–6500

Uranium Recovery Field Office:

Golden, Colorado
(303) 231–5800

Figure 2. **NRC Regions**

Note: Alaska and Hawaii are included in Region V.

Source: Nuclear Regulatory Commission

NRC Fiscal Year 1992 Resources

The Energy and Water Development Appropriations Act (Public Law 102–104) appropriated $512.5 million to the NRC for Fiscal Year (FY) 1992.

The NRC's FY 1992 personnel ceiling is 3,335 full-time equivalent (FTE) staff.

The NRC allocates funds and staff to the following programs (see Figures 3 and 4):

- Reactor Safety and Safeguards Regulation (RSSR)
- Nuclear Safety Research (NSR)
- Nuclear Material and Low-Level Waste Safety and Safeguards Regulation (NMLLWSSR)
- High-Level Nuclear Waste Regulation (HLNWR)
- Special and Independent Reviews, Investigations, and Enforcement (SIRIE)
- Nuclear Safety Management and Support (NSMS)
- Inspector General (IG)

These programs fall into three categories – reactor-related, nonreactor-related, and executive management and support.

In 1980 constant dollars, the NRC's FY 1992 budget has decreased approximately 23 percent (see Table 1 and Figure 5).

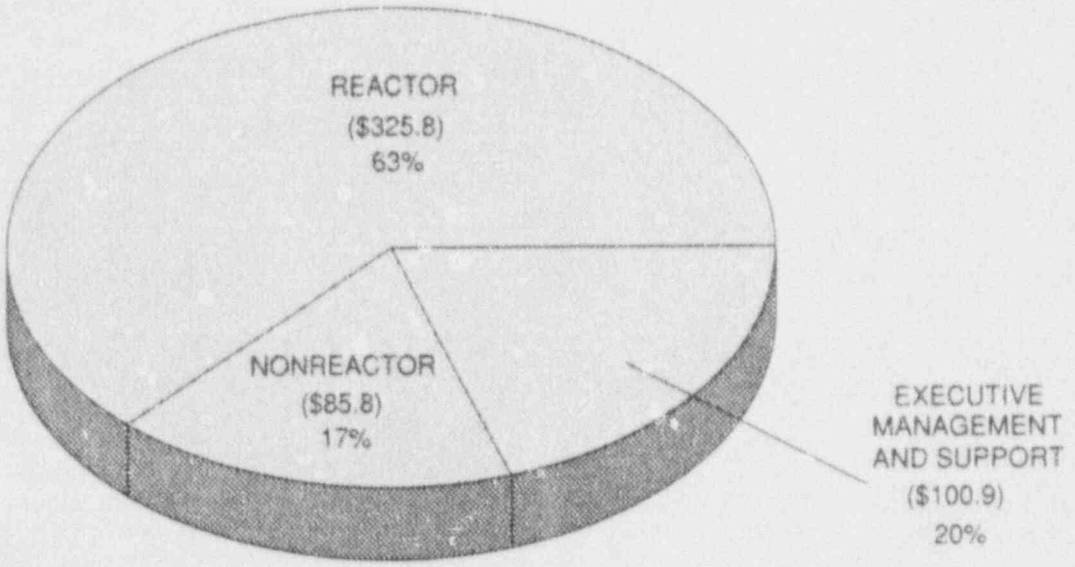
The NRC personnel ceiling has increased approximately 9 percent since 1980 (see Table 2 and Figure 6).

Public Law 101–508, the Omnibus Budget Reconciliation Act of 1990, requires the NRC to recover 100 percent of its budget authority, less appropriations from the Nuclear Waste Fund, for FYs 1991–1995 by assessing fees to its licensees. In FY 1991, the NRC was required to collect approximately $445 million through these fees (see Figure 7). In FY 1992, the NRC is required to collect approximately $493 million. The fees assessed to the major classes of NRC licensees in FY 1991 were:

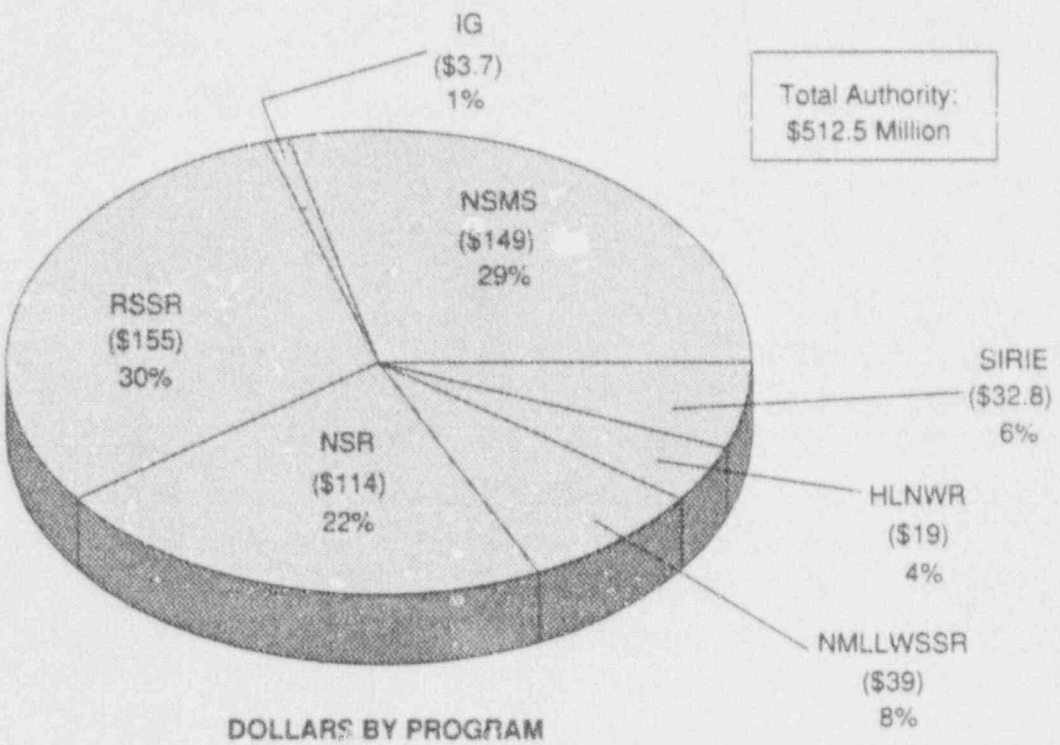
Class of Licensee	Range of Annual Fees
Operating Power Reactor	$2,903,000 to $3,132,000
Fuel Facility	$683,500 to $1,643,500
Uranium Recovery Facility	$67,100 to $100,100
Transportation Approval	$1,800 to $29,100
Materials User	$290 to $10,800

The NRC's enforcement program seeks to protect the public health and safety by ensuring compliance with requirements and correction of violations and deterrence of future violations. More significant violations result in civil penalties. In FY 1991, approximately $3 million in civil penalties was paid. These civil penalties are deposited in the U.S. Treasury and are not used by the NRC. Refer to the "Nuclear Regulatory Commission 1990 Annual Report" (NUREG–1145) for additional information regarding the enforcement program.

Figure 3. **Distribution of NRC FY 1992 Budget Authority (Dollars in Millions)**



DOLLARS BY CATEGORY

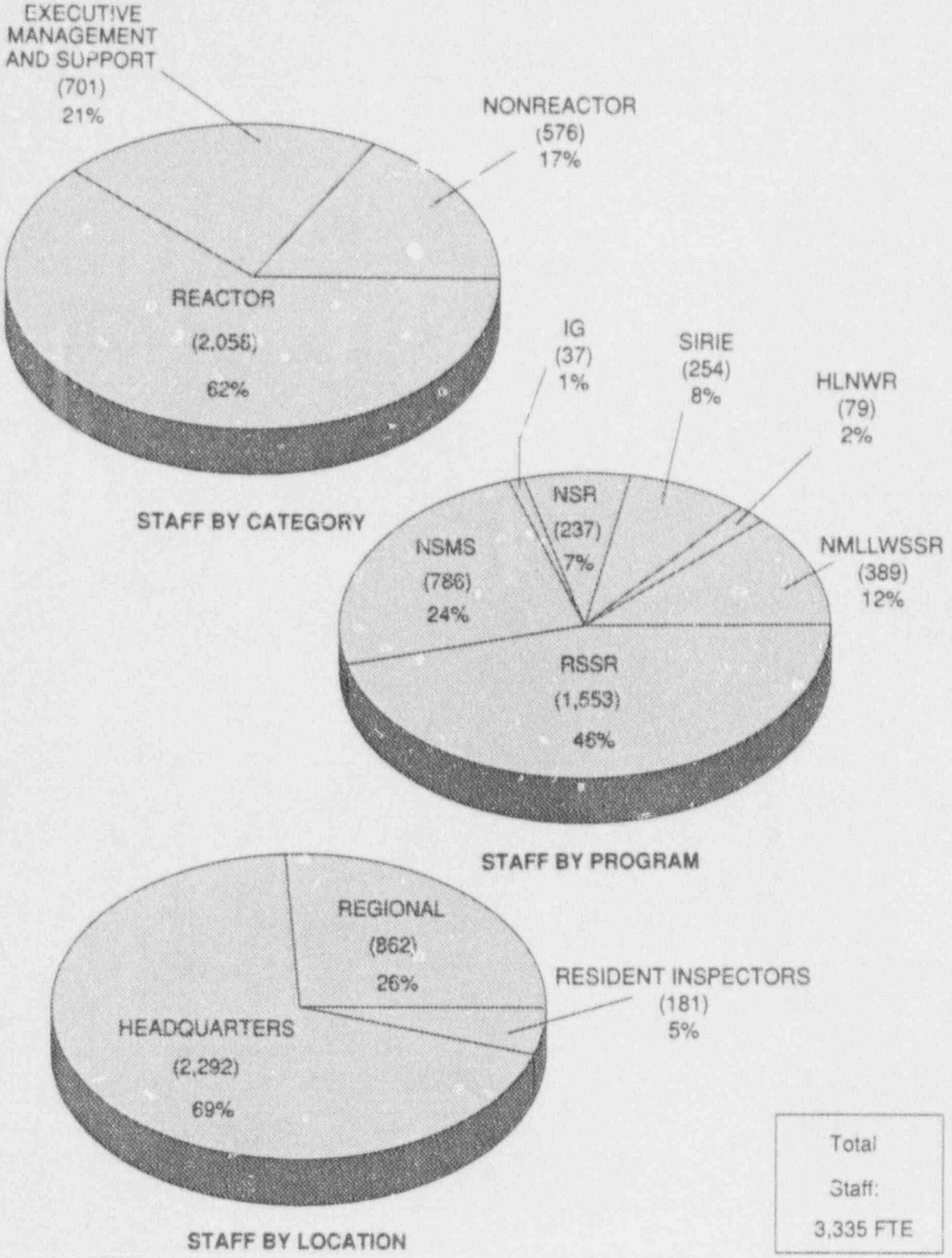


DOLLARS BY PROGRAM

Note: Percentages are rounded to the nearest whole number.

Source: Nuclear Regulatory Commission

Figure 4. **Distribution of NRC FY 1992 Staff**



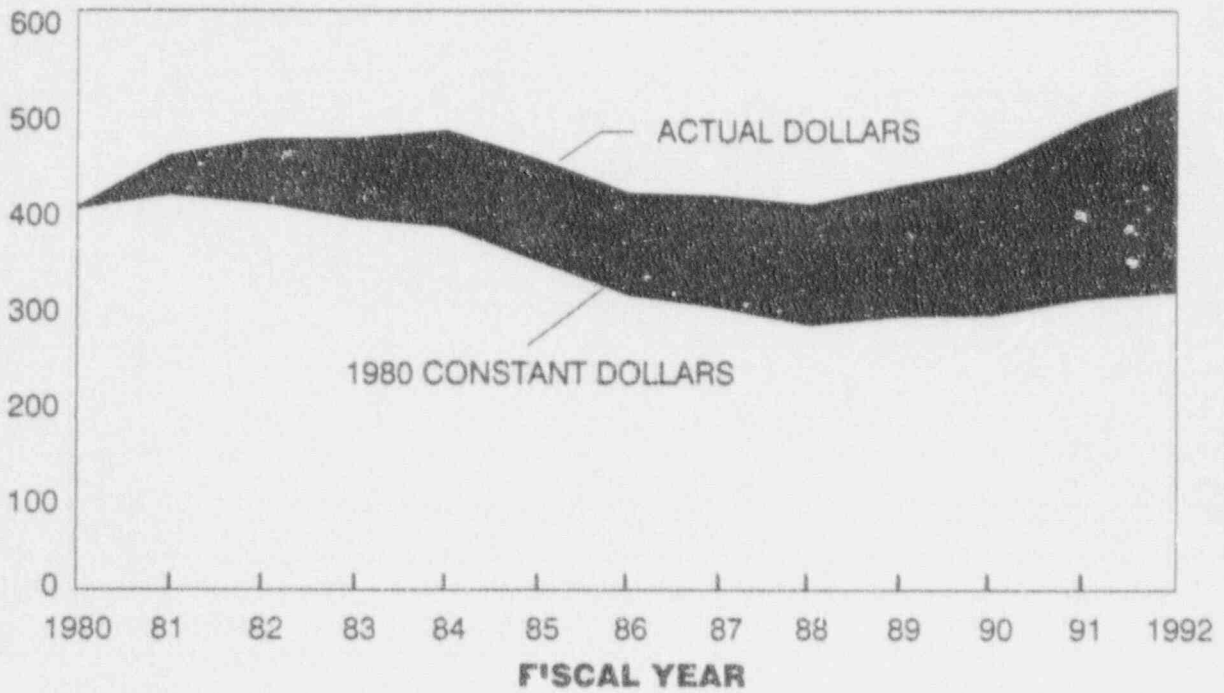
Note: Percentages are rounded to the nearest whole number.

Source: Nuclear Regulatory Commission

Table 1. **NRC Budget Authority, FYs 1980-1992 (Dollars in Millions)**

Fiscal Year	Actual Dollars	1980 Constant Dollars
1980	$400	$400
1981	441	403
1982	466	401
1983	465	385
1984	466	370
1985	444	341
1986	400	299
1987	401	290
1988	393	273
1989	420	276
1990	439	281
1991	465	287
1992	513	308

Figure 5. **NRC Budget Authority, FYs 1980-1992**



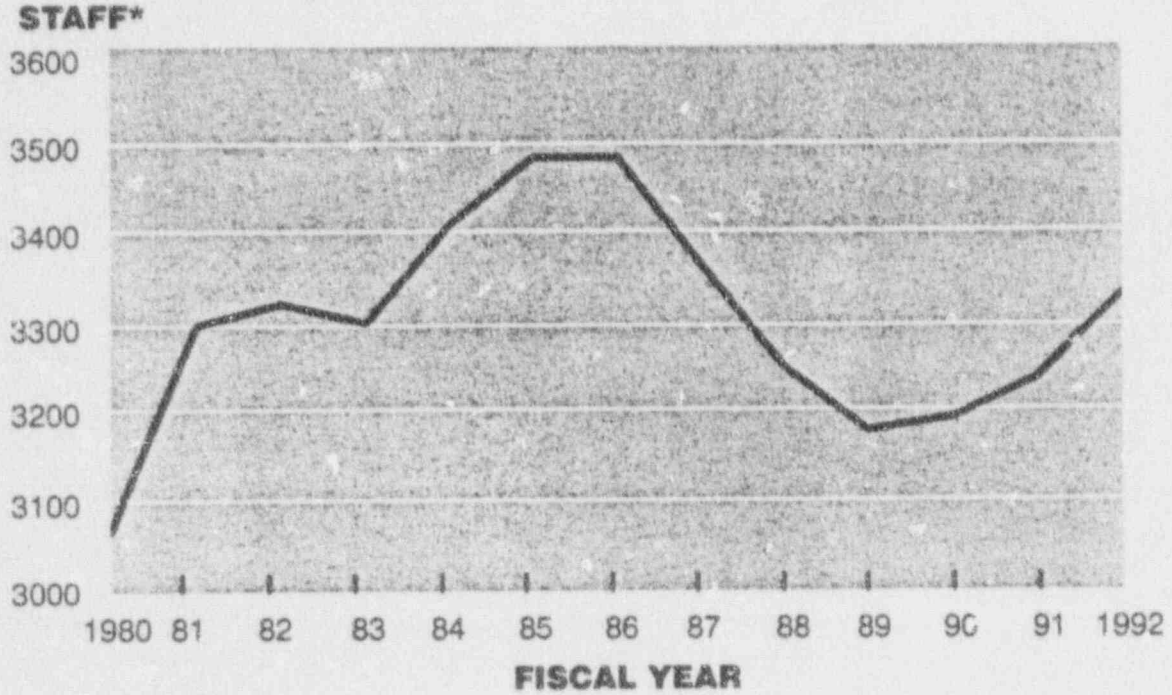
Note: Dollars are rounded to the nearest million.

Source (Table 1 and Figure 5): Nuclear Regulatory Commission

Table 2. **NRC Personnel Ceiling, FYs 1980-1992**

Fiscal Year	Staff*
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

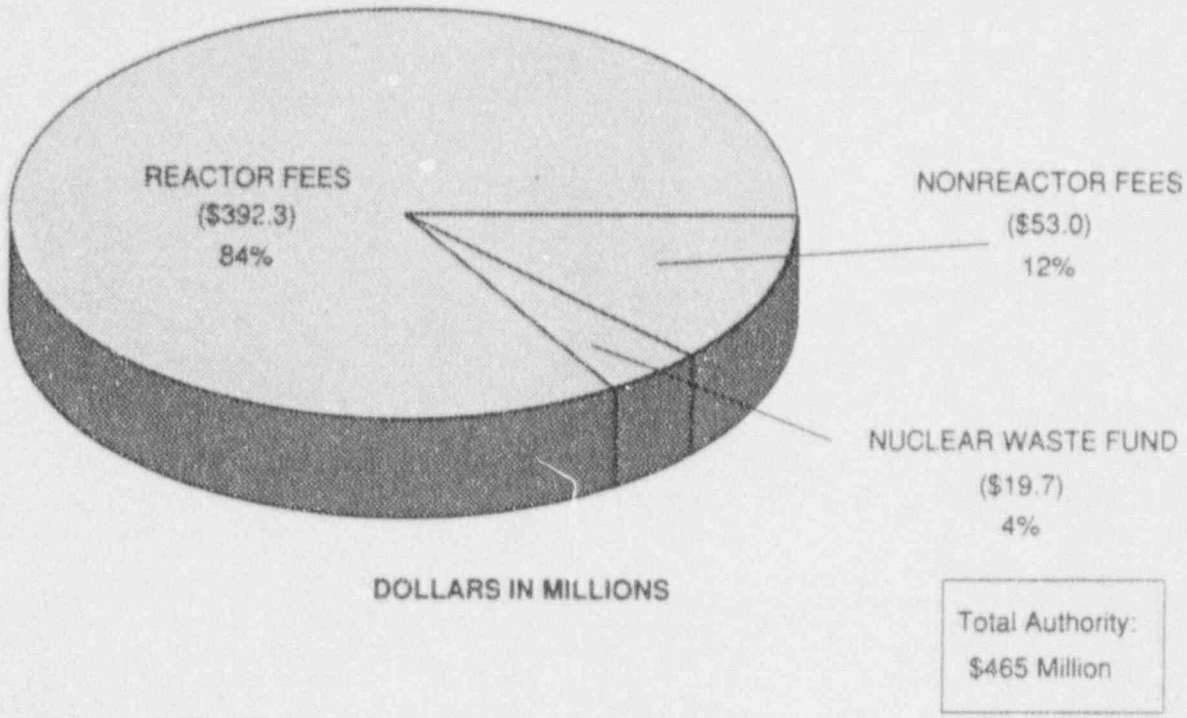
Figure 6. **NRC Personnel Ceiling, FYs 1980-1992**



*FY1980–1981 data reflect permanent positions at end-of-year strength. Starting in FY 1982, the data reflect full-time equivalents.

Source (Table 2 and Figure 6): Nuclear Regulatory Commission

Figure 7. **Sources of NRC FY 1991 Budget Authority**



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 690 gigawatts in 1990. Nuclear energy accounted for approximately 14 percent of this capability (see Figure 8).

U.S. net electric generation totaled approximately 2,807 thousand gigawatthours in 1990. Nuclear energy accounted for approximately 21 percent of this generation (see Figure 8).

In 1990, 111 operating nuclear reactors in 33 States generated approximately one-fifth of the nation's electricity (see Table 3 and Figure 9).

- 7 States relied on nuclear power for more than 50 percent of their electricity.
- 11 additional States relied on nuclear power for 25 to 50 percent of their electricity.

Since 1975, nuclear electric generation has tripled and coal-fired generation has doubled, while electricity generated by all other sources has decreased by 25 percent (see Table 4 and Figure 10).

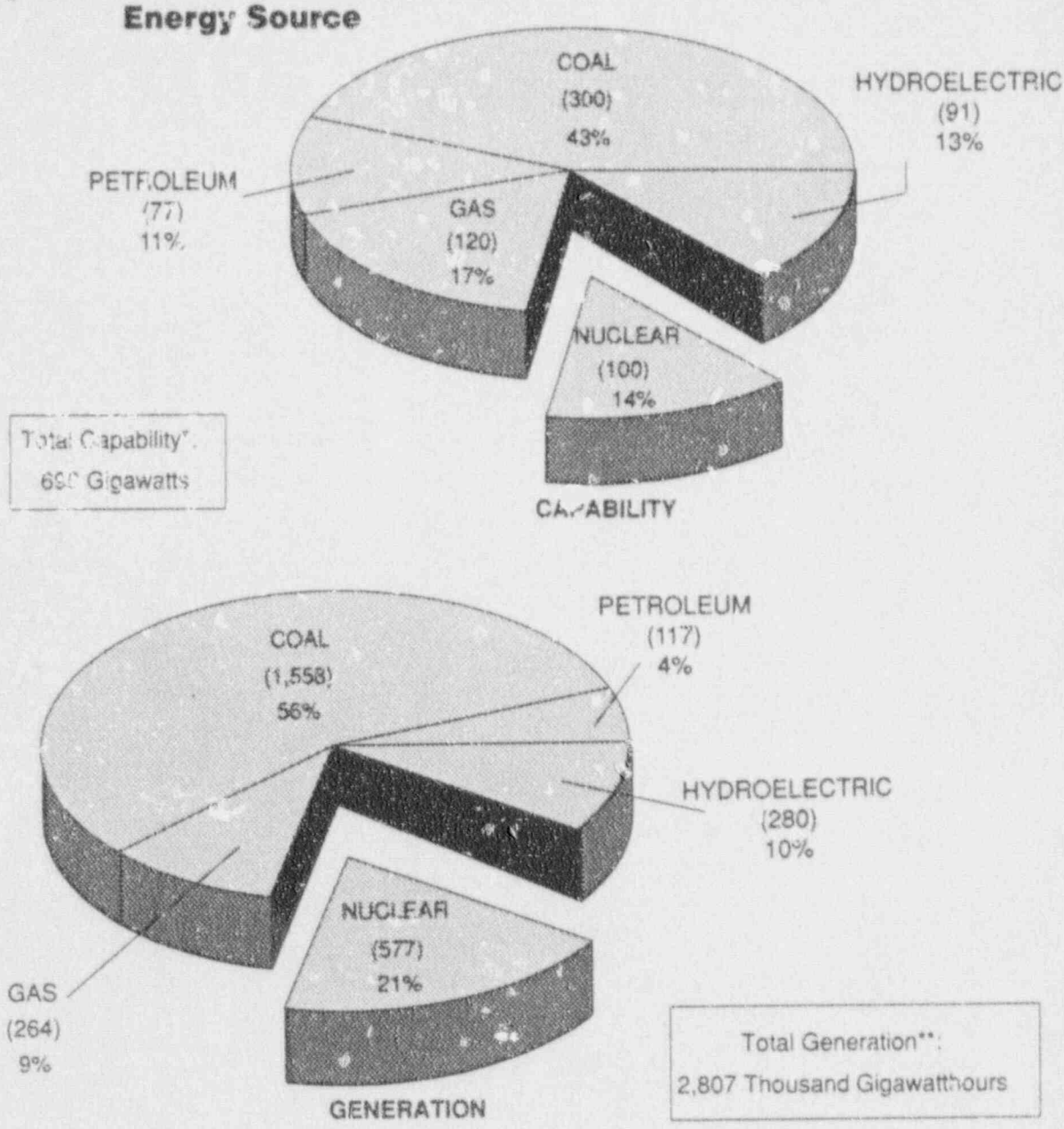
Electricity from coal and nuclear sources, which accounted for 57 percent of the U.S. generating capability, produced 77 percent of the net electricity generated in 1990 (see Table 5 and Figure 11).

Average Generation Expenses:

The generation expense data presented here include all nuclear and coal-fired power plants owned and operated by the major investor-owned electric utilities in the United States (see Glossary). For jointly owned plants, only the portion owned by the major investor-owned electric utilities is included (see Table 6 and Figure 12).

- In 1990, generation expenses averaged 5.74 cents per kilowatthour for nuclear reactors and 2.98 cents per kilowatthour for coal-fired plants. Production expenses averaged 2.27 cents per kilowattnour for nuclear reactors and 2.12 cents per kilowatthour for coal-fired plants.
- Recently built nuclear reactors generally incur higher interest costs, which are a major component of the capital expenses.

Figure 8. **1990 U.S. Electric Capability and Net Generation by Energy Source**



*Total does not equal sum of components due to independent rounding. Total value includes approximately 4 gigawatts of other generating capability (geothermal, refuse, waste heat, waste steam, solar, wind, and wood), which represents less than 1 percent of total capability.

**Total value includes approximately 11 thousand gigawatthours of generation by other energy sources (geothermal, wood, wind, waste, and solar), which represents less than 1 percent of total generation.

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

Source: DOE/EIA Electric Power Annual 1990 (DOE/EIA–0348(90)) and DOE/EIA Monthly Energy Review (DOE/EIA–0035 (91/12))

Table 3. **1990 Electric Generating Capability and Electricity Generated in Each State by Nuclear Power**

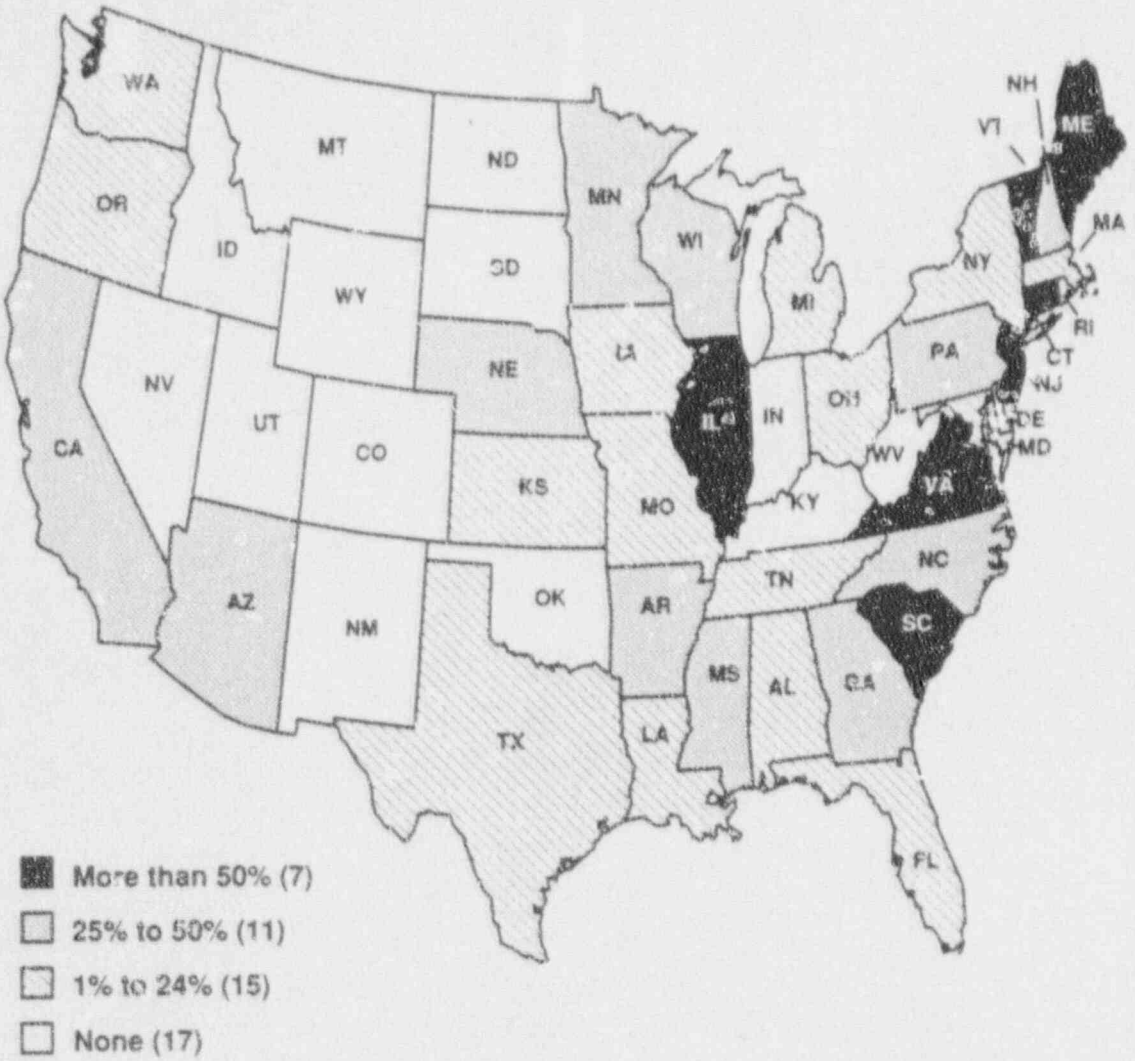
State	Percent Net Nuclear Capability	Percent Net Nuclear Generation
Alabama	24	16
Arizona	25	33
Arkansas	18	30
California	11	29
Connecticut	45	62
Florida	12	18
Georgia	18	25
Illinois	39	57
Iowa	7	10
Kansas	12	23
Louisiana	12	24
Maine	36	54
Maryland	17	4
Massachusetts	8	14
Michigan	18	24
Minnesota	17	30
Mississippi	16	32
Missouri	7	14
Nebraska	23	35
New Hampshire	44	38
New Jersey	28	65
New York	16	18
North Carolina	23	33
Ohio	8	8
Oregon	10	12
Pennsylvania	26	35
South Carolina	43	62
Tennessee	14	19
Texas	6	7
Vermont	47	72
Virginia	25	51
Washington	5	6
Wisconsin	14	25
Others*	0	0

*There are 17 States with no nuclear generating capability.

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

Source: DOE/EIA Electric Power Annual 1990 (DOE/EIA–0348 (90) and DOE/EIA Report on Electric Power Generation

Figure 9. **1990 Net Electricity Generated in Each State by Nuclear Power**



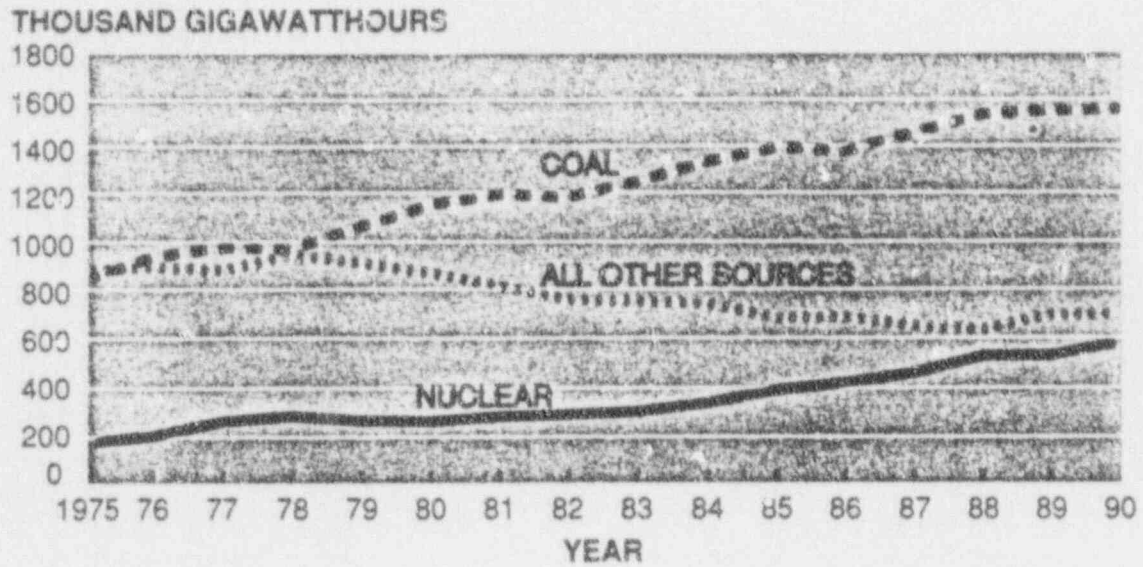
Note: There are no commercial reactors in Alaska or Hawaii. Percentages are rounded to the nearest whole number.

Source: DOE/EIA Report on Electric Power Generation

Table 4. **U.S. Net Electric Generation by Source, 1975-1990 (Thousand Gigawatthours)**

Year	Coal	Petroleum	Gas	Hydroelectric	Nuclear
1975	853	289	300	300	173
1976	944	320	295	284	191
1977	985	358	306	220	251
1978	976	365	305	280	276
1979	1,075	304	329	280	255
1980	1,162	246	346	276	251
1981	1,203	206	346	261	273
1982	1,192	147	305	309	283
1983	1,259	144	274	332	294
1984	1,342	120	297	321	328
1985	1,402	100	292	281	384
1986	1,386	137	249	291	414
1987	1,464	118	273	250	455
1988	1,541	149	253	223	527
1989	1,554	158	267	265	529
1990	1,558	117	264	280	577

Figure 10. **U.S. Net Electric Generation by Source, 1975-1990**

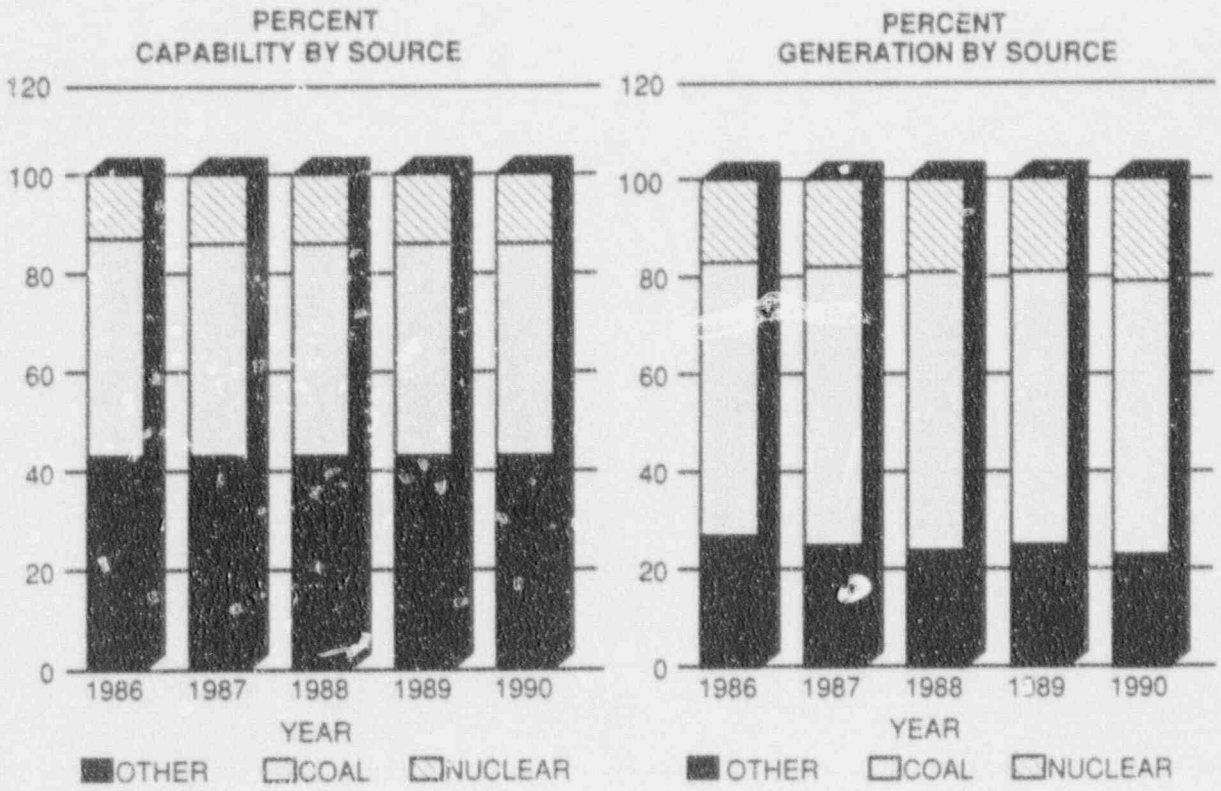


Source (Table 4 and Figure 10): DOE/EIA Monthly Energy Review (DOE/EIA–0035 (91/12))

Table 5. **U.S. Electric Generating Capability by Source, 1986-1990 (Gigawatts)**

Year	Coal	Petroleum	Gas	Hydroelectric	Nuclear
1986	290	78	117	89	85
1987	293	76	118	90	94
1988	295	77	116	90	95
1989	297	78	117	90	98
1990	300	77	120	91	100

Figure 11. **U.S. Electric Generating Capability and Electricity Generated by Source, 1986-1990**



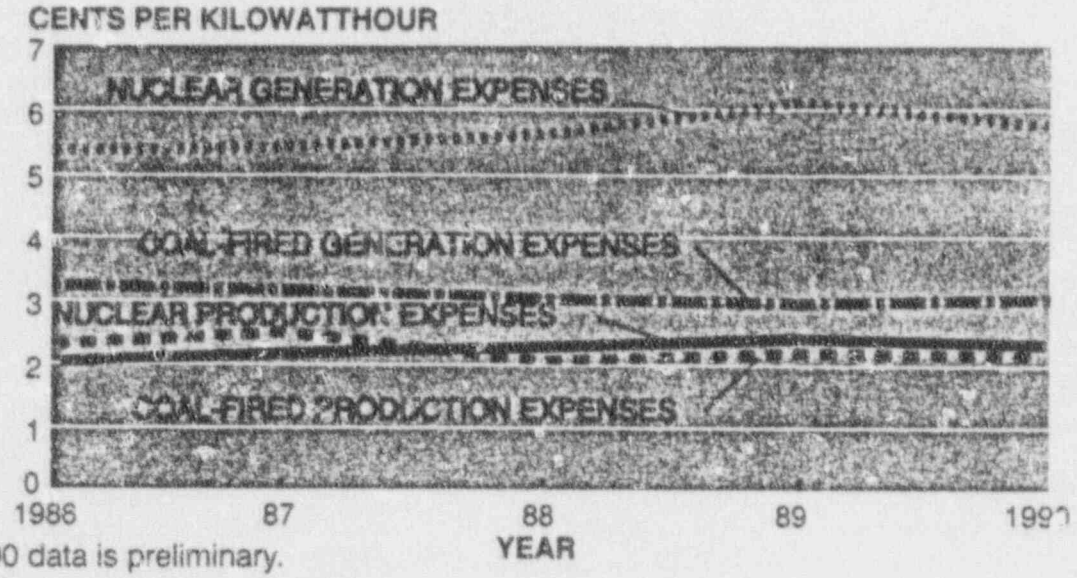
Note (Table 5 and Figure 11): Net summer capability. Percentages are rounded to the nearest whole number.

Source (Table 5 and Figure 11): DOE/EIA Electric Power Annual 1990 (DOE/EIA-0348(90))

Table 6. **U.S. Average Nuclear Reactor and Coal-Fired Plant Generation Expenses, 1986-1990 (Cents Per Kilowatthour)**

Year	Production Expenses: Operation and Maintenance	Production Expenses: Fuel	Capital Expenses	Total Generation Expenses
Nuclear:				
1986	1.25	0.75	3.34	5.34
1987	1.37	0.76	3.25	5.38
1988	1.46	0.79	3.35	5.60
1989	1.62	0.75	3.73	6.10
1990*	1.55	0.72	3.47	5.74
Coal-Fired:				
1986	0.44	1.85	0.99	3.27
1987	0.45	1.69	1.03	3.17
1988	0.36	1.65	1.06	3.07
1989	0.39	1.75	0.79	2.93
1990*	0.35	1.77	0.86	2.98

Figure 12. **U.S. Average Nuclear Reactor and Coal-Fired Plant Generation and Production Expenses, 1986-1990**



*1990 data is preliminary.

Note (Table 6 and Figure 12): Generation expenses include costs associated both with production expenses (operation, maintenance, and fuel costs) and with capital expenses (taxes, depreciation, interest, and return on equity, etc.). Costs have not been adjusted to reflect inflation. Totals do not equal sum of components due to independent rounding.

Source (Table 6 and Figure 12): DOE/EIA Electric Plant Cost and Power Production Expenses 1989 (DOE/EIA–0455(89))

U.S. Electricity Generated by Commercial Nuclear Power

Net nuclear-based electric generation in the United States surpassed its previous-year level for the eleventh consecutive year, reaching an all time high in 1991 of 613 thousand gigawatthours (see Table 7 and Figure 13).

In 1990, the average U.S. net capacity factor was 68 percent. In 1991, it increased to 71 percent. This is the third consecutive year that the average U.S. capacity factor has increased (see Table 7).

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

- More than half of the U.S. commercial nuclear reactors operated above a capacity factor of 70 percent in 1991 (see Table 8).

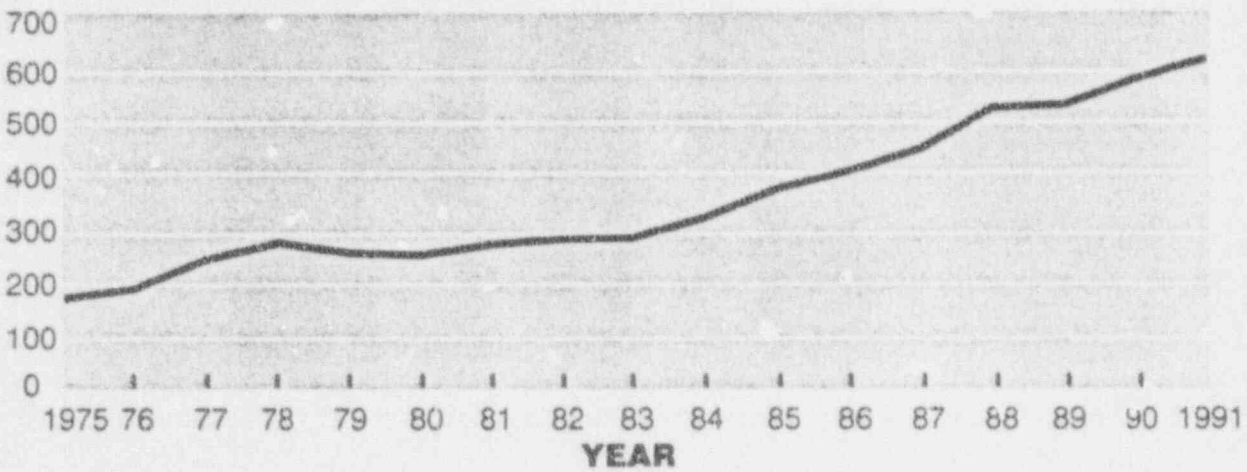
- Babcock and Wilcox (B&W) reactors had the highest average capacity factors compared to those of the other three vendors. The seven B&W reactors had an average capacity factor of 83 percent. The average capacity factors for the other three vendors were the following: 15 Combustion Engineering reactors— 76 percent, 52 Westinghouse reactors—72 percent, and 37 General Electric reactors—65 percent (see Table 8).

Table 7. **U.S. Commercial Nuclear Power Reactor Average Capacity Factor and Net Generation, 1975-1991**

Year	Number of Operating Reactors	Average Annual Capacity Factor (Percent)	Net Generation of Electricity	
			Thousands of Gigawatthours	Percent of Total U.S.
1975	51	67	167	8.7
1976	55	64	185	9.1
1977	63	64	240	11.3
1978	66	67	271	12.3
1979	66	61	255	11.2
1980	67	58	248	10.9
1981	70	61	268	11.7
1982	72	58	270	12.4
1983	74	58	280	12.1
1984	82	58	317	13.1
1985	89	63	371	15.0
1986	95	60	404	16.2
1987	102	62	446	17.3
1988	108	65	522	19.3
1989	109	63	528	19.0
1990	111	68	576	20.5
1991	111	71	613	*

*Data are not available.

Figure 13. **Net Generation of U.S. Nuclear Electricity, 1975-1991**



Note (Table 7 and Figure 13): Average annual capacity factor is based on net maximum dependable capacity. See Glossary for definition.

Source (Table 7 and Figure 13): Licensee data as compiled by the Nuclear Regulatory Commission

Table 8. **1991 U.S. Commercial Nuclear Power Reactor Average Capacity Factor by Vendor and Reactor Type**

1991 Capacity Factor	Number of Operating Reactors	Percent of Net Nuclear Generated
Above 70 Percent	69	72
50 to 70 Percent	28	23
Below 50 Percent	14*	5
Total	111	

	Number of Operating Reactors	Average Capacity Factor (Percent)	Percent of Net Nuclear Generated
Vendor:			
Babcock & Wilcox	7	83	7
Combustion Engineering	15	76	15
General Electric	37 *	65	30
Westinghouse Electric	52	72	48
Total	111		
Reactor Type:			
Boiling-Water Reactor	37 *	65	30
Pressurized-Water Reactor	74	73	70
Total	111		

*Includes two reactors (Browns Ferry 1 and Browns Ferry 3) that were shut down for the entire year.

Note: Average capacity factor is based on net maximum dependable capacity. See Glossary for definition. Refer to Appendix A for the 1991 average capacity factor 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 1991, 414 operating reactors in 32 countries had a maximum dependable capacity of 323,092 megawatts electric (net MWe). World nuclear- based capacity rose 1 percent from that in 1990.

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

Major producers of nuclear electricity during 1990 were the United States and France.

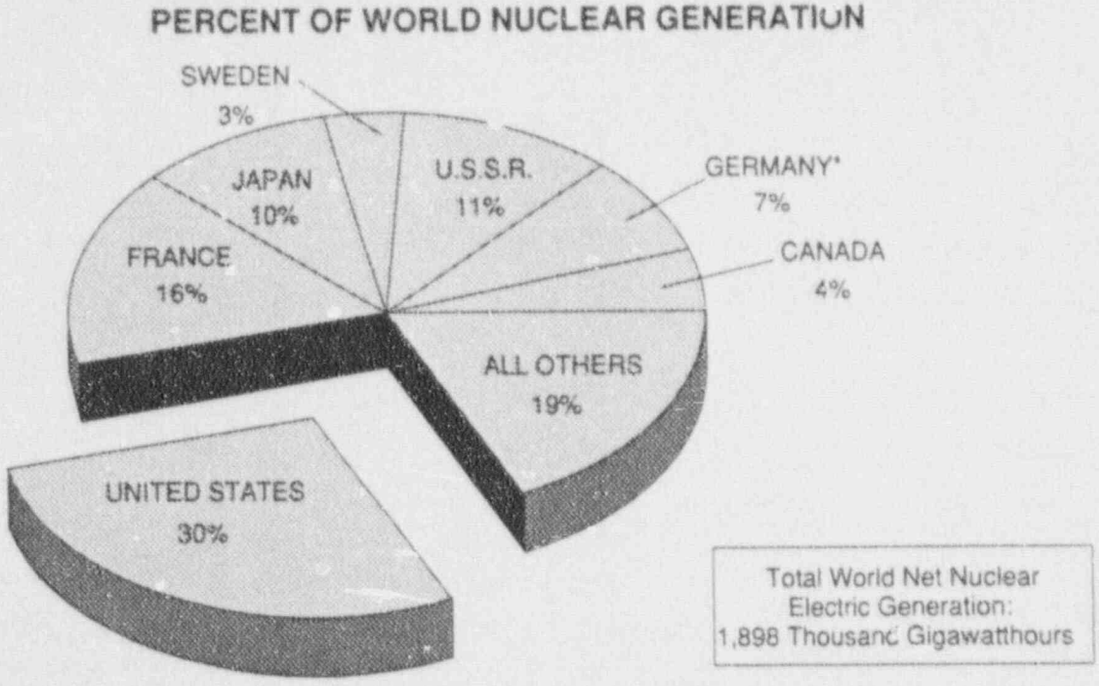
- Approximately 30 percent of the world's net nuclear-generated electricity was produced in the United States (see Figure 14).
- Although France produced approximately 16 percent of the world's net nuclear-generated electricity, the nuclear portion of its total domestic electricity generation was approximately 75 percent (see Figure 14).

In 1991, reactors in Sweden (85 percent), Canada and Japan (72 percent), and the United States (69 percent) had the highest average gross capacity factors. Reactors in the United States had the greatest gross generation by almost double the next highest producer, France (see Table 9).

- Refer to Appendix H for a list of the top 50 units by gross capacity factor, worldwide, and Appendix I for a list of the top 50 units by gross generation, worldwide.

Over the past ten years, the average annual gross capacity factor has gone up 21 percentage points in Sweden, 12 percentage points in Japan, and 11 percentage points in the United States. However, the capacity factor has gone down 16 percentage points in Canada.

Figure 14. **1990 Net Nuclear Electric Power as Percent of World Nuclear and Total Domestic Electricity Generation**



*Data are for West Germany only.

Note: Percentages are rounded to the nearest whole number.

Source: DOE/EIA International Energy Annual 1990 (DOE/EIA–0219(90))

Table 9. **1991 Commercial Nuclear Power Reactor Average Gross Capacity Factor and Gross Generation by Selected Country**

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	19	72	86	7	0
France	57	63	331	1	12
Germany*	22	66	147	3	10
Japan	42	72	206	5	3
Sweden	12	85	78	3	2
United States	111	69**	643	17	20
U.S.S.R.	***	***	***	***	***

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Table 10. **Commercial Nuclear Power Reactor Average Gross Capacity Factor by Selected Country, 1981-1991**

	Average Gross Annual Capacity Factor (Percent)										
Country	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
Canada	88	82	79	72	72	73	72	77	74	61	72
France	58	53	62	70	71	67	60	58	62	63	63
Germany*	67	70	70	76	87	78	75	74	69	66	66
Japan	60	39	68	70	71	76	77	71	71	72	72
Sweden	64	61	60	76	71	81	77	77	74	75	85
United States	58 [61	57 58	54 58	56 58	58 63	57 60	57 62	64 65	62 63	66 68	69 71]**
U.S.S.R.	***	***	***	***	***	***	***	***	***	***	***

*Data are for West Germany only.

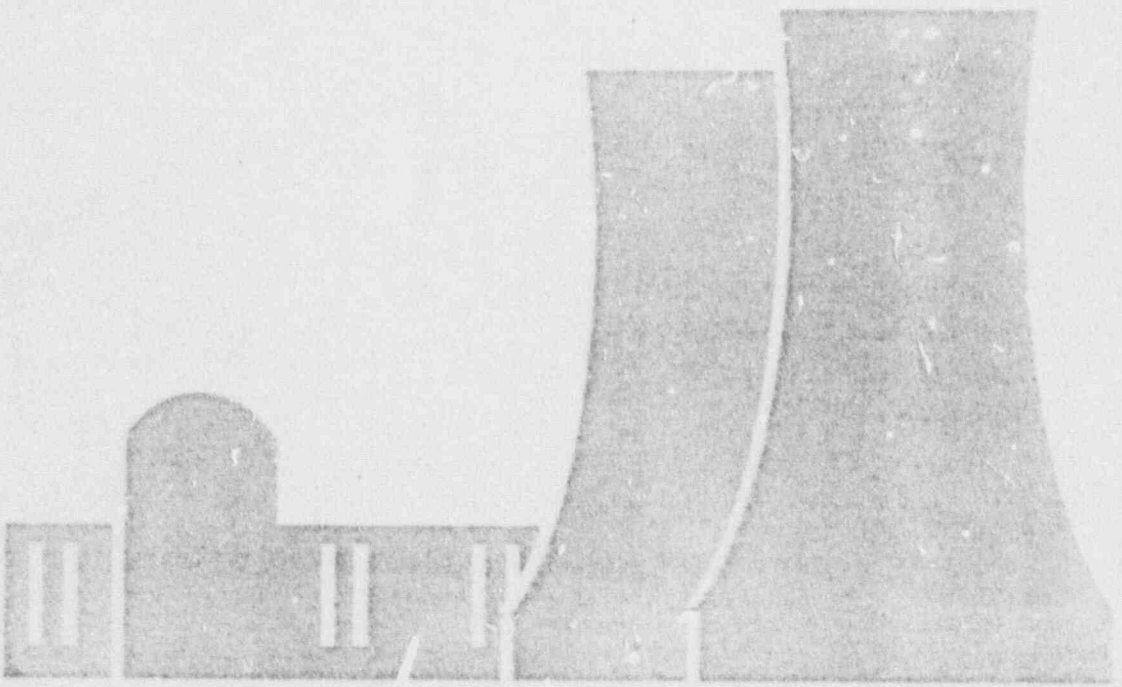
**For comparison, U.S. average gross capacity factor is used. The 1991 U.S. average net capacity factor is 71 percent. Brackets [ ] in Table 10 denote average net capacity factor. See Glossary for definition.

***Data are not available.

Note (Table 9 and 10): Percentages are rounded to the nearest whole number.

Source: DOE/EIA Commercial Nuclear Power 1991 (DOE/EIA–0438) and licensee data as compiled by the Nuclear Regulatory Commission

Operating Nuclear Reactors



U.S. Commercial Nuclear Power Reactors

There are 111 commercial nuclear power reactors currently licensed to operate in 33 States (see Figures 16–21):

- 3 are under construction (Watts Bar 1 and 2 and Comanche Peak 2).
- 5 are partially completed, but construction has been deferred (Bellefonte 1 and 2, Perry 2, and Washington Nuclear 1 and 3).
- 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 15:

- 4 reactor vendors
- 50 licensees
- 80 different designs
- 73 sites

Experience: The 111 reactors currently licensed to operate have accumulated 1,497 reactor-years of experience (see Table 11 and Figure 22). An additional 107 reactor-years of experience have been accumulated by permanently shut down 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:
  - Approximately 3,000 power reactor inspections are conducted by the NRC annually.
  - On average, 4,430 inspection hours were expended at each operating reactor during FY 1991 (see Figure 23).
- Approximately 20 separate license changes are requested per power reactor each year— resulting in more than 2,000 separate NRC reviews per year.
- Approximately 5,000 reactor operators are licensed:
  - Each operator is licensed for a specific reactor.
  - Each operator is requalified before renewal of a 6-year license.
- Approximately 5,000 reactor event reports are assessed by the NRC annually.

Figure 15. **Typical Nuclear Reactor**

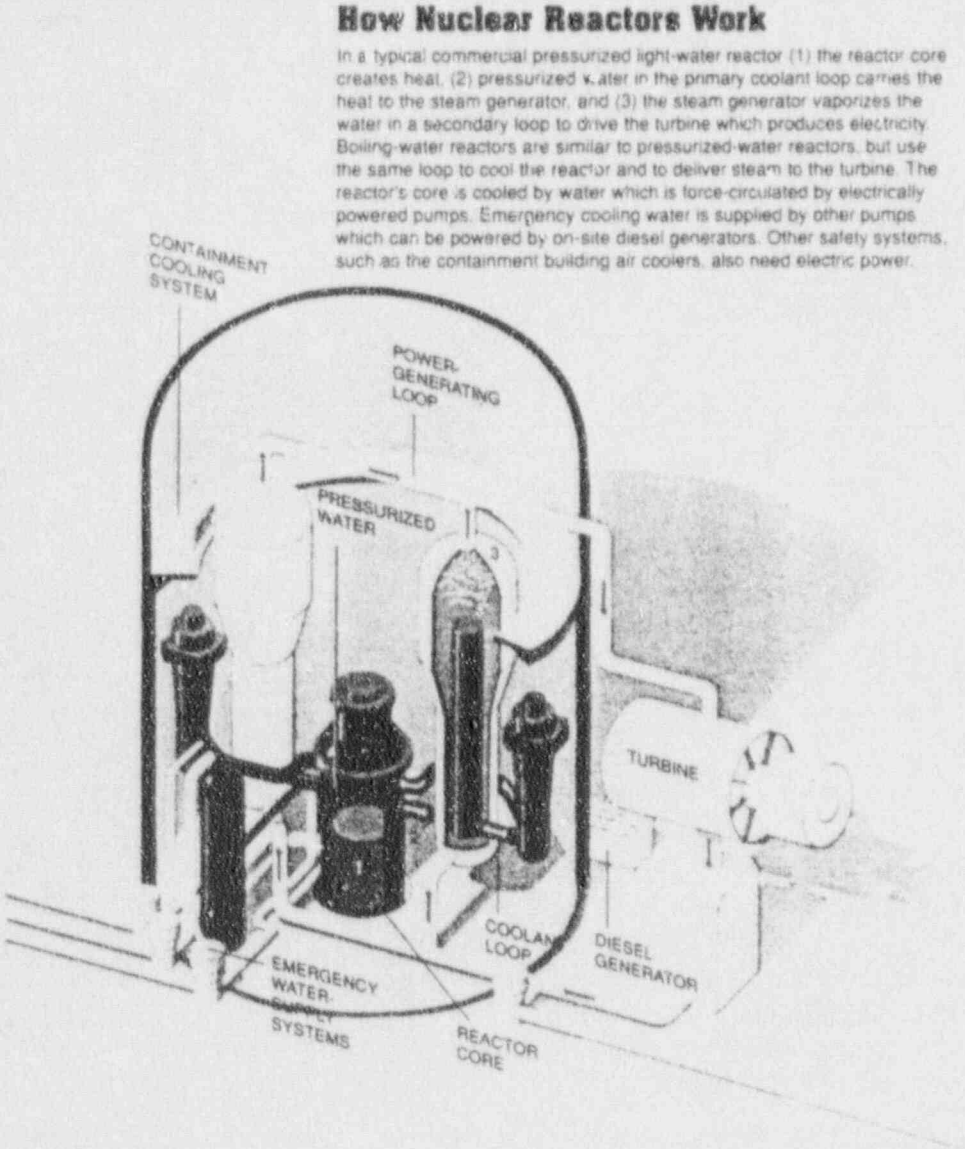


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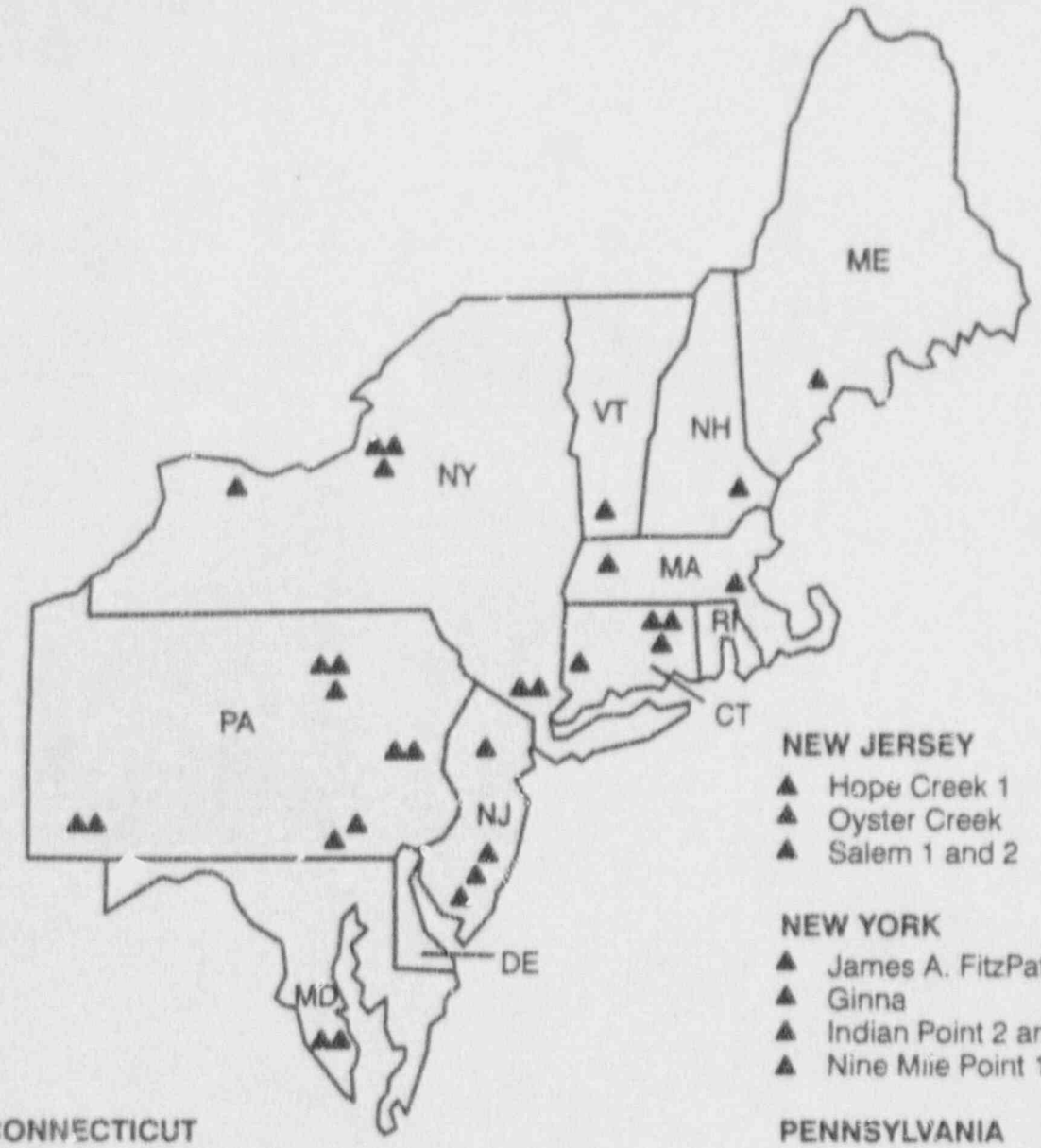
Figure 16. **U.S. Commercial Nuclear Power Reactor Sites**

▲ Currently Licensed to Operate (111)
■ Under Construction (3)
● Deferred Construction (5)

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

Source: Nuclear Regulatory Commission

Figure 17. **NRC Region I Commercial Nuclear Power Reactor Sites**



CONNECTICUT
- Haddam Neck
- Millstone 1, 2, and 3

MAINE
- Maine Yankee

MARYLAND
- Calvert Cliffs 1 and 2

MASSACHUSETTS
- Pilgrim 1
- Yankee-Rowe

NEW HAMPSHIRE
- Seabrook 1

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

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

VERMONT
- Vermont Yankee

Source: Nuclear Regulatory Commission

▲ Currently Licensed to Operate (30)

Figure 18. **NRC Region II Commercial Nuclear Power Reactor Sites**

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

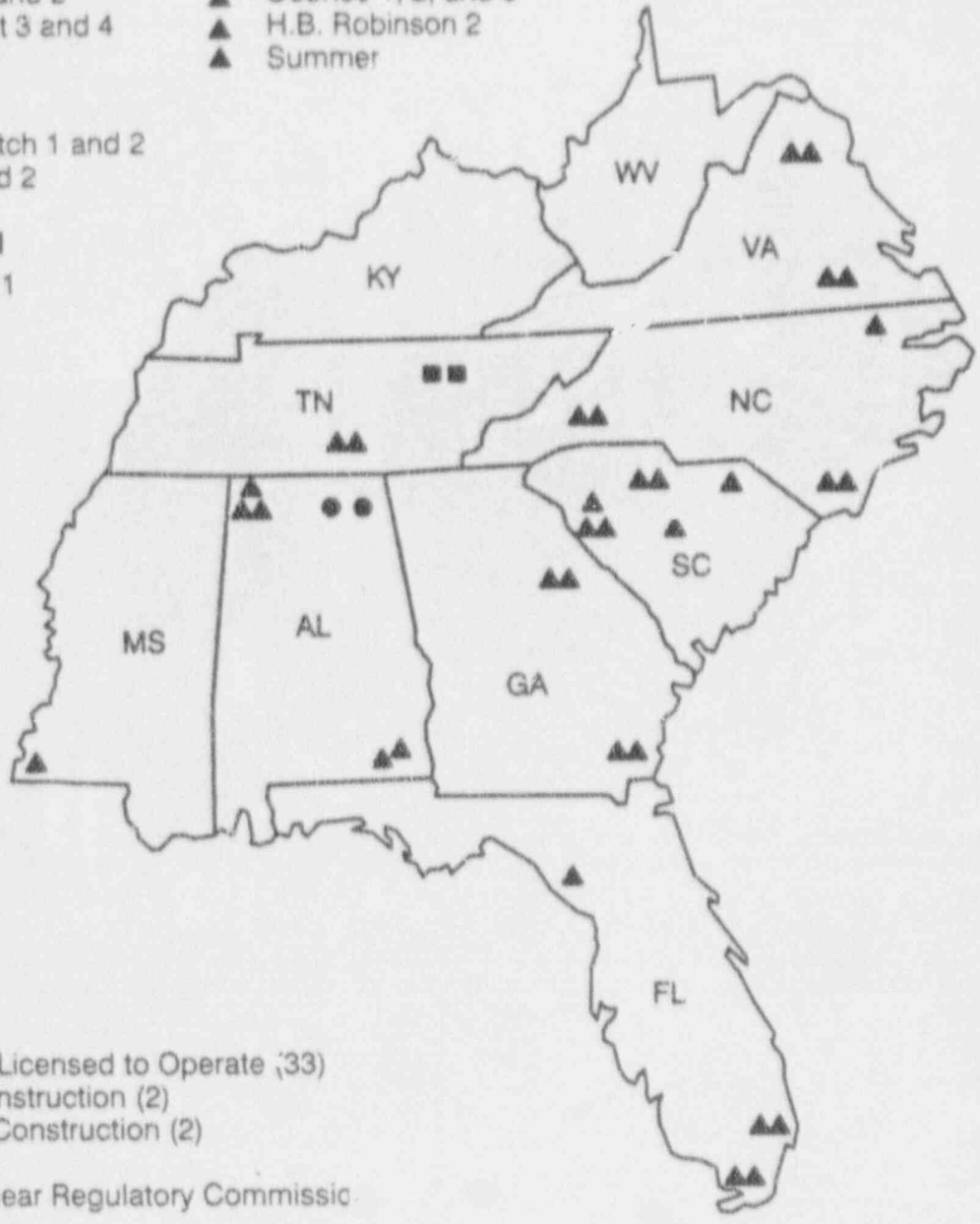
MISSISSIPPI
- ▲ Grand Gulf 1

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 and 2

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



▲ Currently Licensed to Operate (33)
■ Under Construction (2)
● Deferred Construction (2)

Source: Nuclear Regulatory Commissio

Figure 19. **NRC Region III Commercial Nuclear Power Reactor Sites**

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
- ▲ Zion 1 and 2

IOWA
- ▲ Duane Arnold

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

MINNESOTA
- ▲ Monticello
- ▲ Prairie Island 1 and 2

MISSOURI
- ▲ Callaway

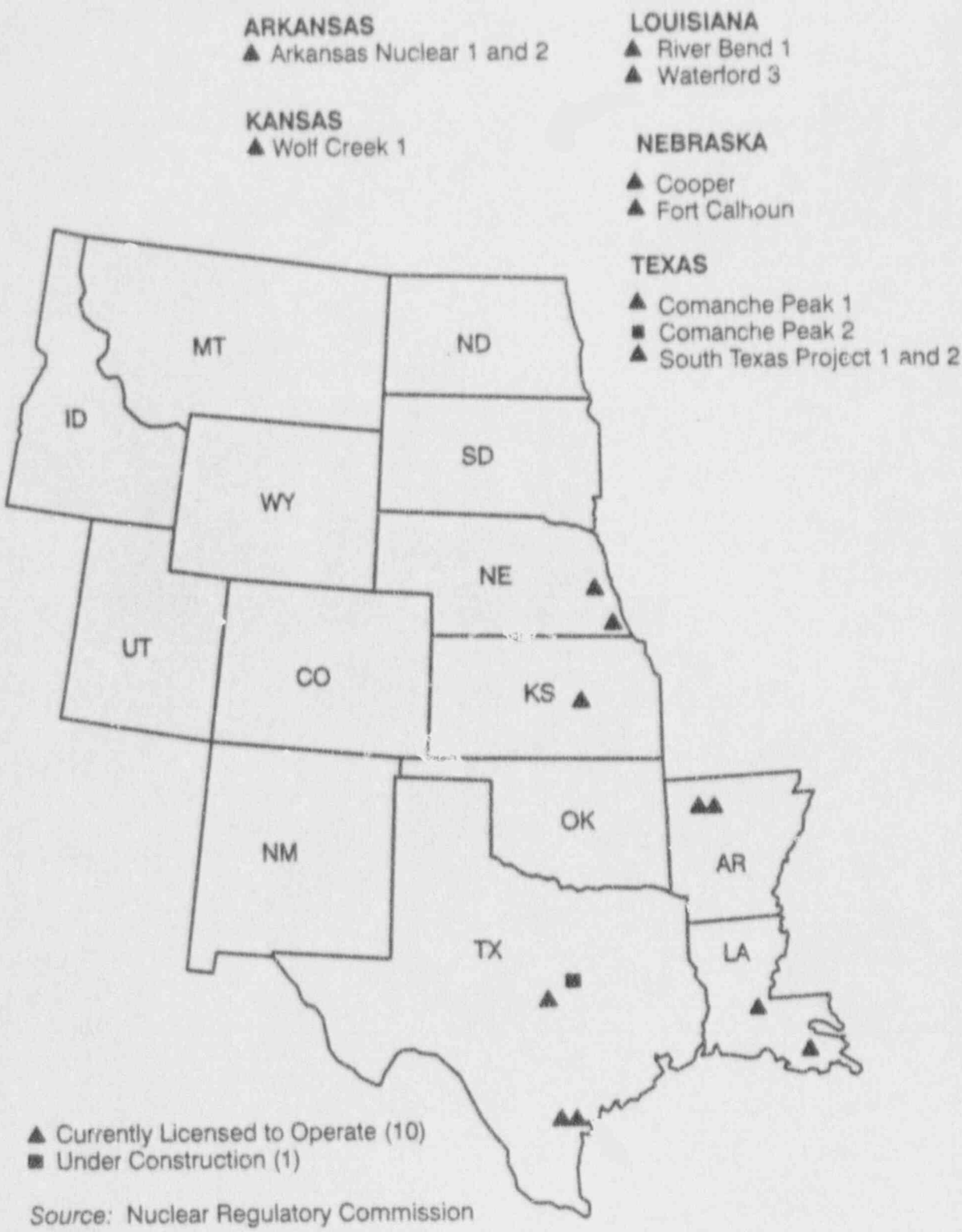
OHIO
- ▲ Davis-Besse
- ▲ Perry 1
- ● Perry 2

WISCONSIN
- ▲ Kewaunee
- ▲ Point Beach 1 and 2

▲ Currently Licensed to Operate (28)
● Deferred Construction (1)

Source: Nuclear Regulatory Commission

Figure 20. **NRC Region IV Commercial Nuclear Power Reactor Sites**



Source: Nuclear Regulatory Commission

Figure 21. **NRC Region V Commercial Nuclear Power Reactor Sites**

ARIZONA
▲ Palo Verde 1, 2, and 3

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

OREGON
▲ Trojan

WASHINGTON
▲ Washington Nuclear 2
● Washington Nuclear 1 and 3

▲ Currently Licensed to Operate (10)
● Deferred Construction (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
1960	Yankee-Rowe	1	1
1962	Big Rock Point	1	2
1967	Haddam Neck	2	4
	San Onofre 1		
1969	Dresden 2	4	8
	Ginna		
	Nine Mile Point 1		
	[illegible]		
1970	[illegible]	3	11
	[illegible]		
	[illegible]		
1971	Dresden 3	2	13
	Monticello		
1972	Palisades	6	19
	Pilgrim 1		
	Quad Cities 1		
	Quad Cities 2		
	Surry 1		
	Turkey Point 3		
1973	Browns Ferry 1	14	33
	Fort Calhoun		
	Indian Point 2		
	Kewaunee		
	Maine Yankee		
	Oconee 1		
	Oconee 2		
	Peach Bottom 2		
	Point Beach 2		
	Surry 2		
	Turkey Point 4		
	Vermont Yankee		
	Zion 1		
	Zion 2		
1974	Arkansas Nuclear 1	14	47
	Browns Ferry 2		
	Brunswick 2		
	Calvert Cliffs 1		
	Cooper		
	D. C. Cook 1		
	Duane Arnold		
1974 *(Continued)*			
	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	2	49
	Trojan		
1976	Beaver Valley 1	7	56
	Browns Ferry 3		
	Brunswick 1		
	Calvert Cliffs 2		
	Indian Point 3		
	Salem 1		
	St. Lucie 1		
1977	Crystal River 3	4	60
	Davis-Besse		
	D. C. Cook 2		
	Joseph M. Farley 1		
1978	Arkansas Nuclear 2	3	63
	Edwin I. Hatch 2		
	North Anna 1		
1980	North Anna 2	2	65
	Sequoyah 1		
1981	Joseph M. Farley 2	4	69
	McGuire 1		
	Salem 2		
	Sequoyah 2		
1982	La Salle County 1	4	73
	San Onofre 2		
	Summer		
	Susquehanna 1		
1983	McGuire 2	3	76
	San Onofre 3		
	St. Lucie 2		
1984	Callaway	6	82
	Diablo Canyon 1		
	Grand Gulf 1		

Year	Reactor Name	Number of Licenses Issued	Total Number of Operating Licenses
1984 *(Continued)*			
	La Salle County 2		
	Susquehanna 2		
	Washington Nuclear 2		
1985	Byron 1	9	91
	Catawba 1		
	Diablo Canyon 2		
	Fermi 2		
	Limerick 1		
	Palo Verde 1		
	River Bend 1		
	Waterford 3		
	Wolf Creek 1		
1986	Catawba 2	5	96
	Hope Creek 1		
	Millstone 3		
	Palo Verde 2		
	Perry 1		
1987	Beaver Valley 2	8	104
	Braidwood 1		
	Byron 2		
1987 *(Continued)*			
	Clinton		
	Nine Mile Point 2		
	Palo Verde 3		
	Shearon Harris 1		
	Vogtle 1		
1988	Braidwood 2	2	106
	South Texas Project 1		
1989	Limerick 2	3	109
	South Texas Project 2		
	Vogtle 2		
1990	Comanche Peak 1	2	111
	Seabrook 1		

Note (Table 11 and Figure 22):

Limited to reactors currently licensed to operate.

Year is based on the date the initial full power operating license was issued.

Source (Table 11 and Figure 22): Nuclear Regulatory Commission

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

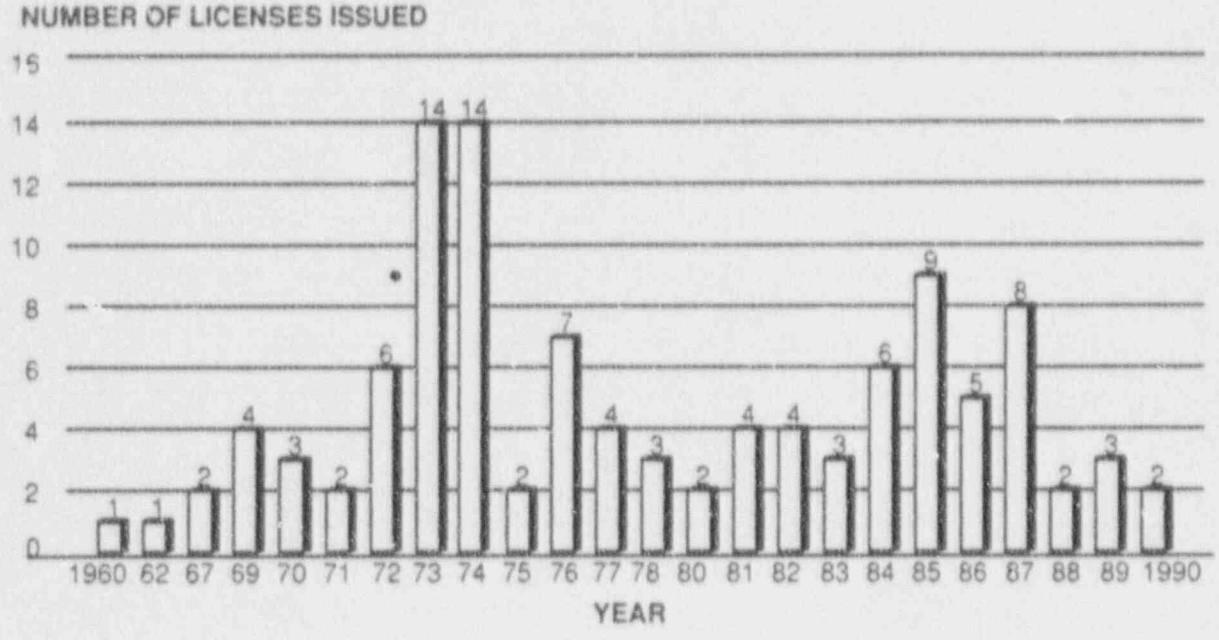
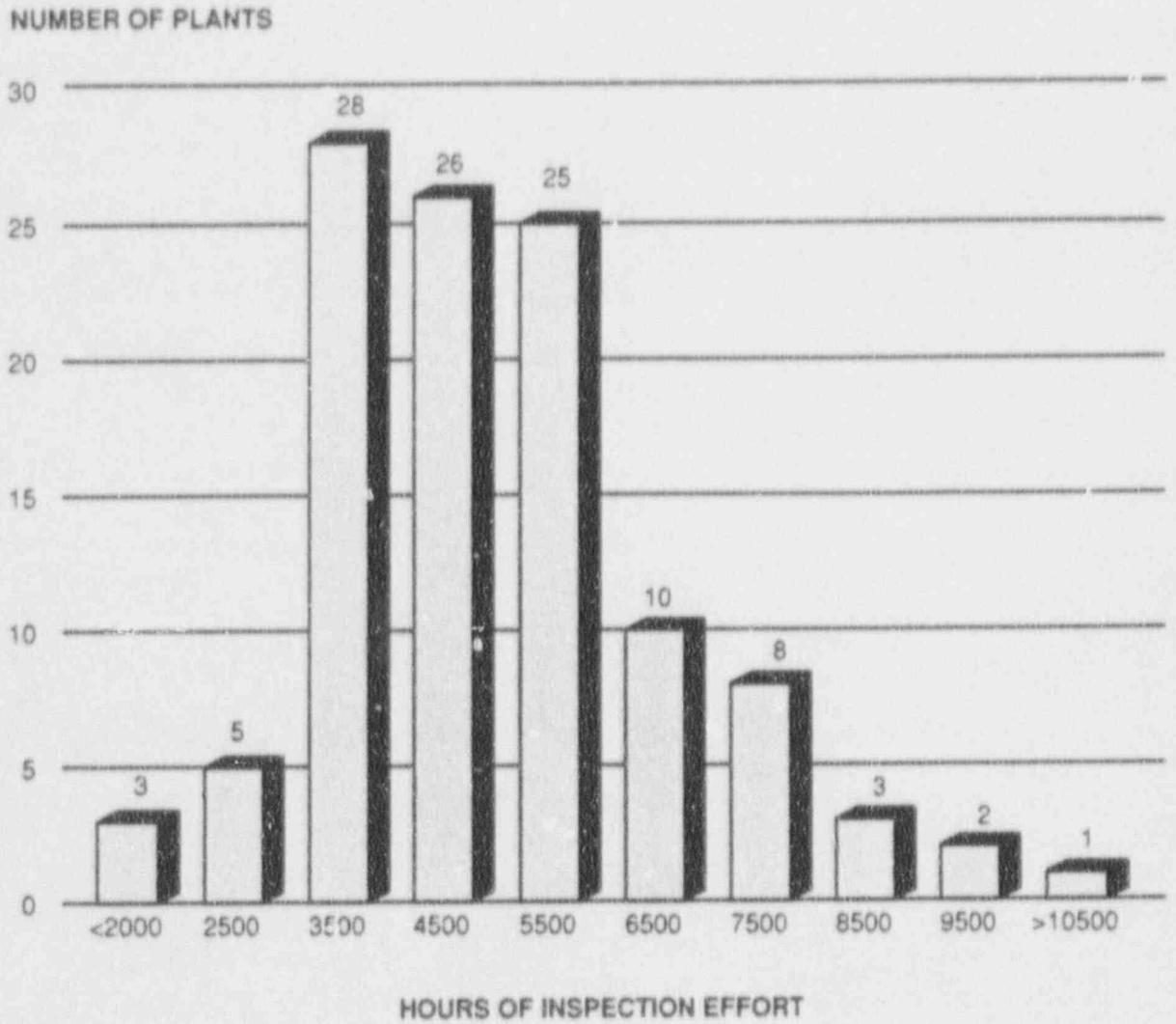


Figure 23. **FY 1991 NRC Inspection Effort at Operating Reactors**



Source: Nuclear Regulatory Commission

Performance at U.S. Commercial Nuclear Power Reactors

Performance Indicator Program:

The Performance Indicator Program is a single, coordinated, overall NRC program that provides an additional view of operational performance and enhances the NRC's ability to recognize areas of changing safety performance of operating plants. When viewed as a set, the performance indicators (PIs) for a given plant provide additional data for determining performance trends. PIs focus attention on the need to assess and understand underlying causes of identified changes by evaluating other available information (see Figure 24).

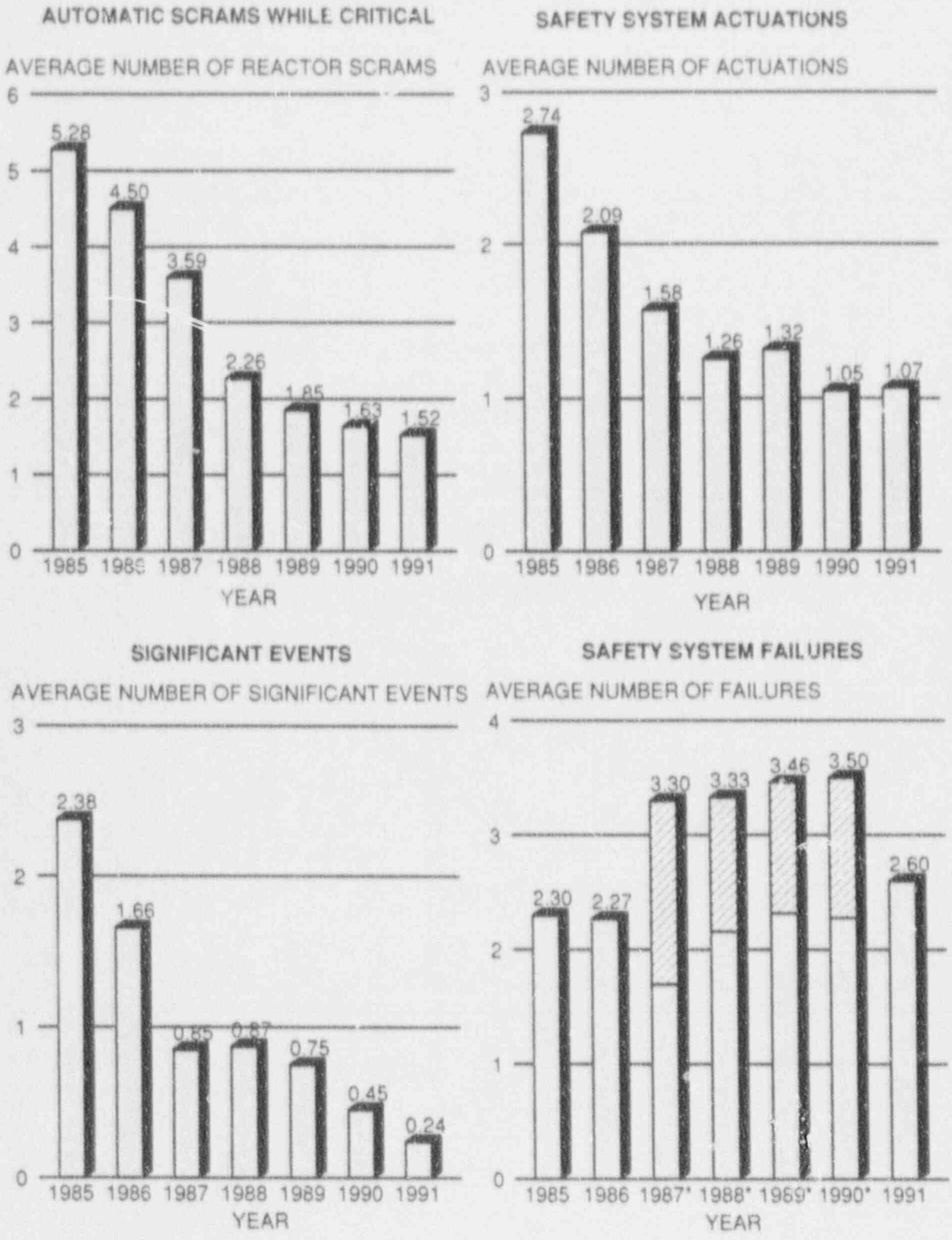
The PI Program is only a tool that must be used in conjunction with other tools, such as the results of routine and special inspections and the Systematic Assessment of Licensee Performance Program, for providing input to NRC management decisions regarding the need to adjust plant-specific regulatory programs. PIs have limitations and are subject to misinterpretation. Therefore, caution is warranted in the interpretation and use of the data. The application of PIs for purposes and in manners other than those stated above will be counter to the NRC's objective of ensuring operational safety.

Systematic Assessment of Licensee Performance:

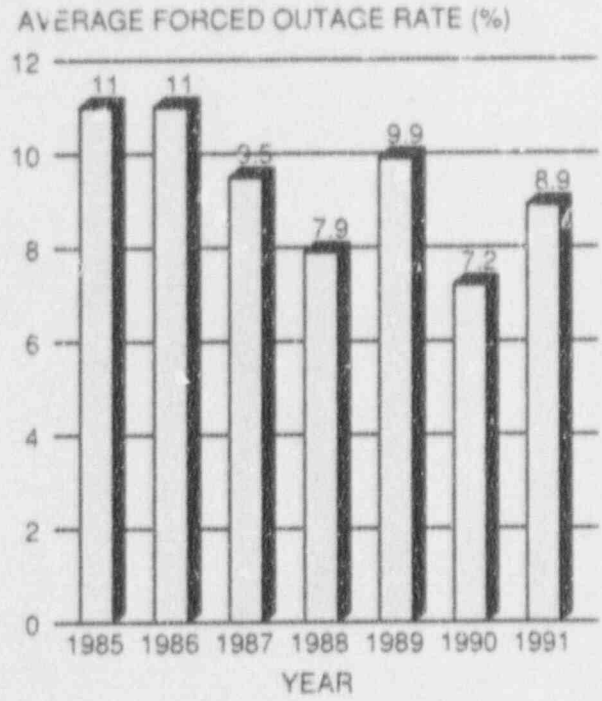
The Systematic Assessment of Licensee Performance, or SALP, Program is an integrated NRC effort to collect and evaluate observations and data in order to assess and better understand the reasons for a licensee's performance. The purpose of the program is to direct both NRC and licensee attention and resources toward those areas that need improvement and that most affect nuclear safety. This involves review of licensee performance over an extended period of time (approximately 15 months) in such areas as (1) plant operations, (2) maintenance and surveillance, (3) radiological controls, (4) emergency preparedness, (5) security, (6) engineering and technical support, and (7) safety assessment/quality verification.

On the basis of a review of the consolidated information, a rating of "one" to "three" is given in each area, with a "one" indicating superior performance and a "three" indicating improvement is required, although performance generally meets minimum levels of NRC acceptance. The SALP evaluations are publicly discussed with the licensee and licensee written comments are obtained before issuing the final SALP evaluation report presenting NRC's considered judgment of overall licensee performance for the SALP evaluation period. For the latest SALP rating by reactor, refer to NUREG–1214, "Historical Data Summary of the Systematic Assessment of Licensee Performance."

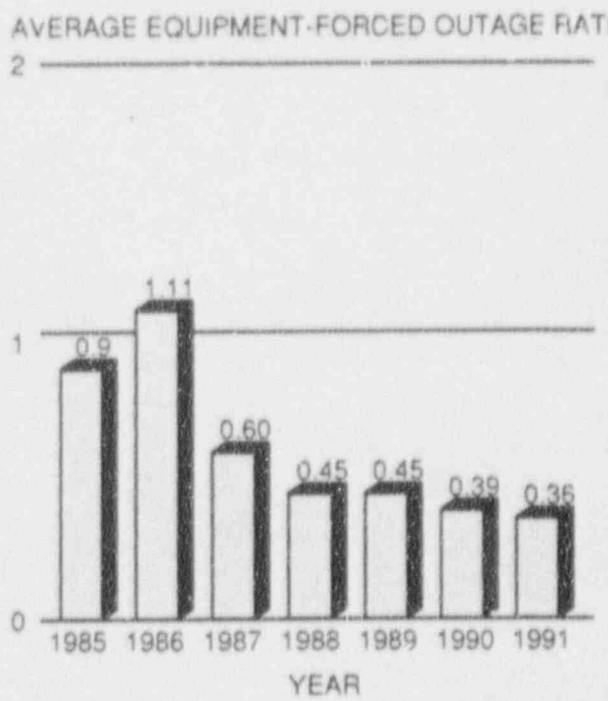
Figure 24. **NRC Performance Indicators; Annual Industry Averages, 1985-1991**



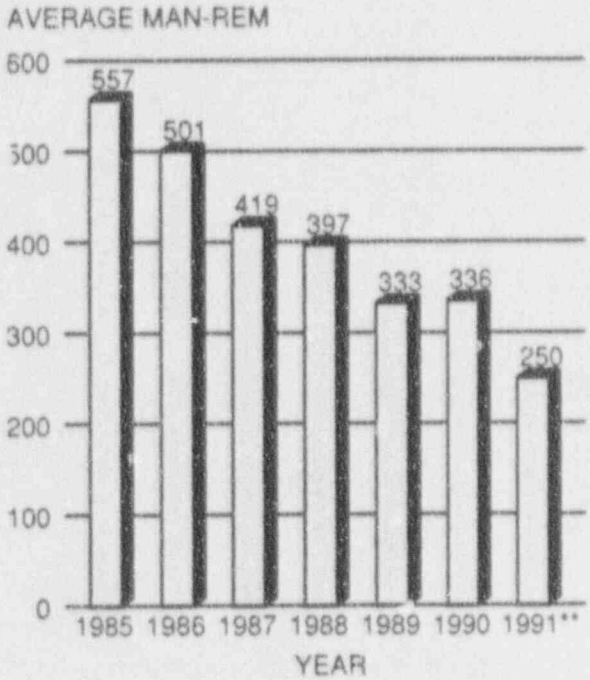
FORCED OUTAGE RATE



EQUIPMENT-FORCED OUTAGES PER 1000 CRITICAL HOURS



COLLECTIVE RADIATION EXPOSURE



*The hatched areas represent additional data that resulted from re-classification of safety system failures.

**Estimated value.

Note: Data represent annual industry averages with plants in extended shut down excluded. These data may differ slightly from previously published data as a result of refinements in data quality. The 1991 data are preliminary.

Source: Licensee data as compiled by the Nuclear Regulatory Commission

Future U.S. Commercial Nuclear Power Reactor Licensing

Reactor Aging and License Renewal:

In 1991, 11 reactors were more than 20 years old. This represents approximately 10 percent of the currently licensed reactors producing approximately 5 percent of net nuclear-generated electricity.

In contrast, by the year 2000, 63 reactors will be more than 20 years old. This represents approximately 57 percent of the currently licensed reactors producing approximately 47 percent of net nuclear-generated electricity.

In 2000, the currently licensed nuclear generating capacity could begin to decrease as reactors begin to reach their 40-year terms, a limit imposed by the Atomic Energy Act of 1954, as amended (see Table 12 and Figures 25 and 26).

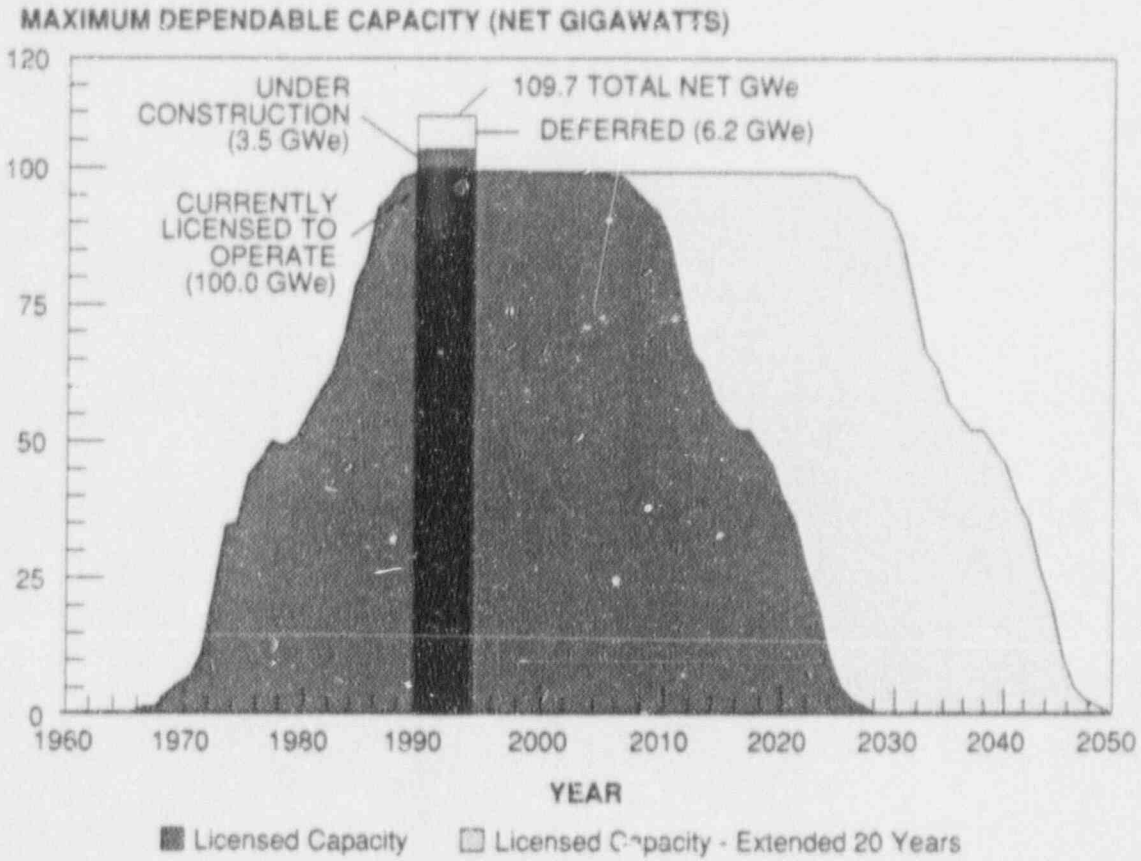
Extending reactor operating licenses beyond their current 40-year terms will provide a viable approach for electric utilities to ensure the adequacy of future electricity generating capacity that offers significant economic benefits when compared to the construction of new reactors.

In December 1991, the final regulation governing the renewal of nuclear power reactor operating licenses was issued by the NRC. The rule and associated documentation describe what a licensee must be able to demonstrate in order for the NRC to make a determination that the plant can continue to be operated safely beyond the expiration of its current 40-year license. Under the rule, reactor operation for up to 20 additional years may be permitted. Applications for license renewal can be submitted 5 to 20 years before the expiration of the current license. Monticello is expected to submit the first application for renewal in 1992.

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

(Continued on page 50)

Figure 25. **U.S. Commercial Nuclear Power Reactor Generating Capacity Assuming Construction Recapture, 1960-2050**



Note: Data assume current expiration dates have been adjusted for construction recapture. See Glossary for definition.

Source: Licensee data as compiled by the Nuclear Regulatory Commission

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

Year	Reactor Name	Number of Licenses Expired	Year Assuming Construction Recapture*
2000	Big Rock Point	2	2002
	Yankee-Rowe		
2004	Oyster Creek 1	2	2009
	San Onofre 1		
2006	Dresden 2	1	2009
2007	Haddam Neck	4	
	Palisades		2011
	Turkey Point 3		2012
	Turkey Point 4		2013
2008	Diablo Canyon 1	5	2024
	Fort Calhoun		2013
	Maine Yankee		2012
	Peach Bottom 2		2013
	Peach Bottom 3		2014
2009	Ginna	3	
	Indian Point 3		2015
	Nine Mile Point 1		
2010	Diablo Canyon 2	5	2025
	H. B. Robinson 2		
	Millstone 1		
	Monticello		
	Point Beach 1		
2011	Dresden 3	2	
	Trojan		2015
2012	Pilgrim 1	5	
	Quad Cities 1		
	Quad Cities 2		
	Surry 1		
	Vermont Yankee		
2013	Browns Ferry 1	12	
	Indian Point 2		
	Kewaunee		
	Oconee 1		
	Oconee 2		
	Point Beach 2		
	Prairie Island 1		
	San Onofre 2		2022
	San Onofre 3		2022
	Surry 2		
	Zion 1		
	Zion 2		
2014	Arkansas Nuclear 1	12	
	Browns Ferry 2		
2014 *(Continued)*			
	Brunswick 2		
	Calvert Cliffs 1		
	Cooper		
	D. C. Cook 1		
	Duane Arnold		
	Edwin I. Hatch 1		
	James A. FitzPatrick		
	Oconee 3		
	Prairie Island 2		
	Three Mile Island 1		
2015	Millstone 2	1	
2016	Beaver Valley 1	7	
	Browns Ferry 3		
	Brunswick 1		
	Calvert Cliffs 2		
	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	Joseph M. Farley 2	3	
	McGuire 2		
	Sequoyah 2		
2022	Grand Gulf 1	4	
	La Salle County 1		
	Summer		
	Susquehanna 1		
2023	La Salle County 2	4	
	McGuire 2		
	St. Lucie 2		
	Washington Nuclear 2		
2024	Byron 1	7	
	Callaway		
	Catawba 1		
	Limerick 1		

Year	Reactor Name	Number of Licenses Expired	Year Assuming Construction Recapture*
2024 *(Continued)*			
	Palo Verde 1		
	Susquehanna 2		
	Waterford 3		
2025	Fermi 2	5	
	Millstone 3		
	Palo Verde 2		
	River Bend 1		
	Wolf Creek 1		
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	

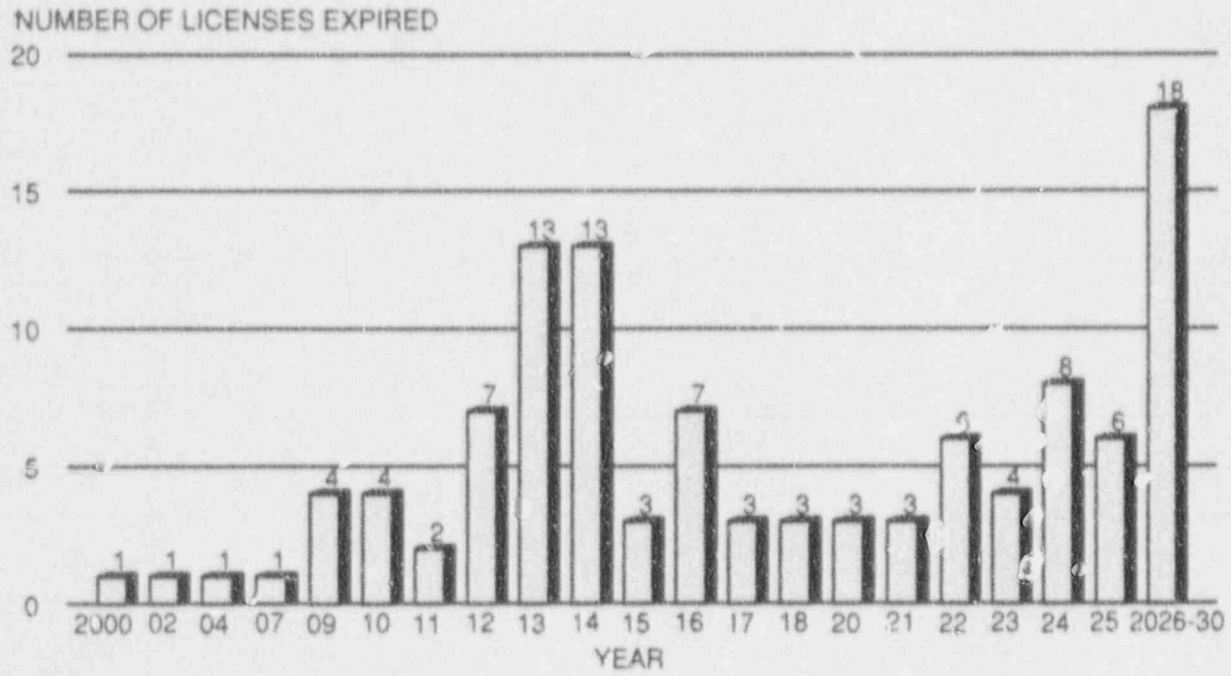
*Year assumes that the maximum number of years for construction recapture has been added to the current expiration date. This column is limited to reactors eligible for construction recapture. See Glossary for definition.

Note (Table 12 and Figure 26):

Limited to reactors currently licensed to operate

Source (Table 12 and Figure 26): Nuclear Regulatory Commission

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



Future U.S. Commercial Nuclear Power Reactor Licensing (Continued)

Standardization of Future Reactor Designs:

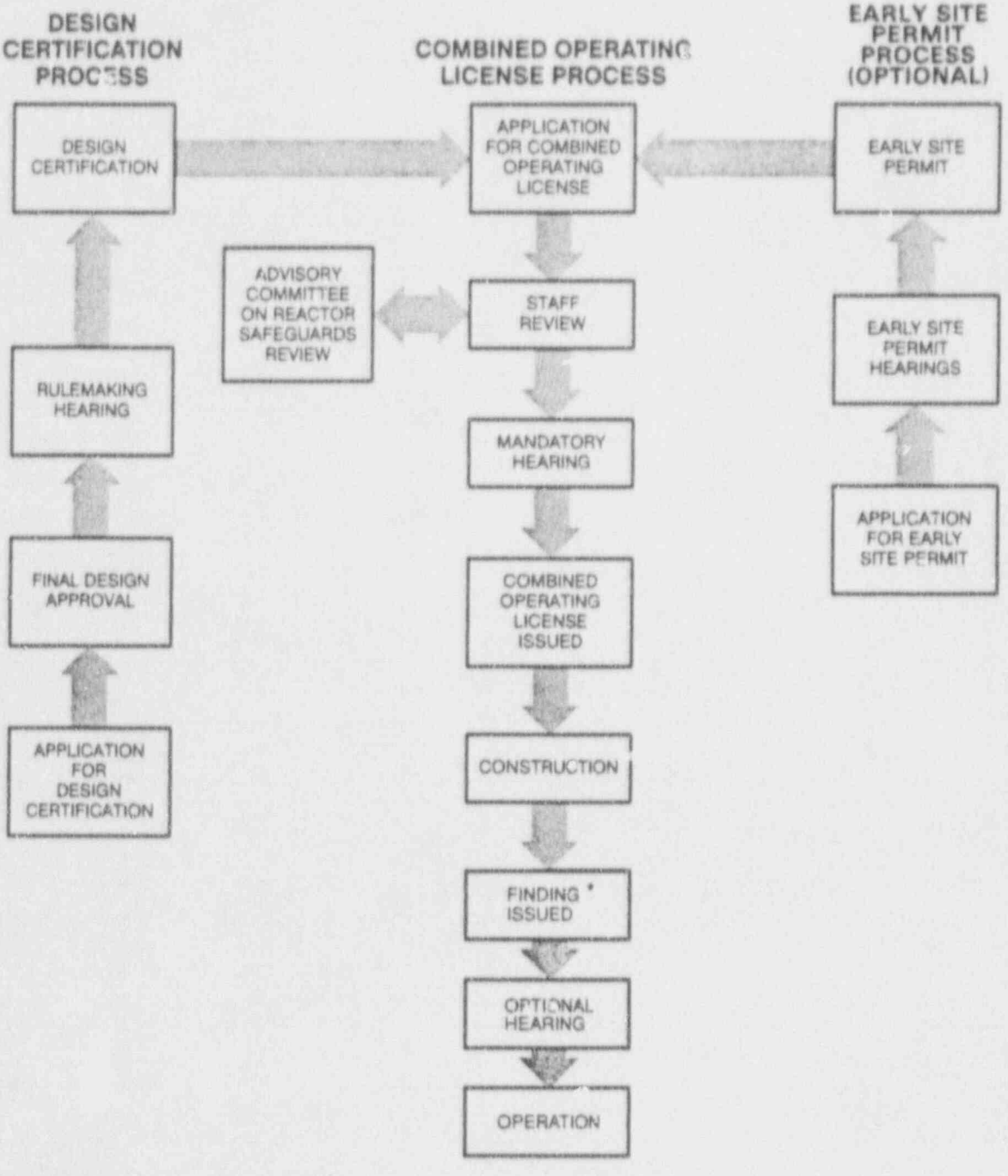
Standardization can minimize excessive diversity in reactor designs and can increase confidence in the safety, reliability, and availability of future nuclear power reactors. The NRC has revised its regulations to streamline the licensing process for future nuclear power reactors. The changes should substantially improve the entire licensing process, with the goal that future nuclear power reactors will use standard designs already certified by the NRC and will be located at preapproved sites (see Figure 27).

The NRC is reviewing the Electric Power Research Institute Evolutionary and Passive Requirements Documents. Each will be a comprehensive statement of utility requirements for the design, construction, and performance of advanced light-water reactors. The development of these common utility requirements and their review and approval by the NRC are important steps toward achieving standardization.

Currently under NRC review are two advanced light-water reactor designs evolved from the currently licensed generation of reactors: the General Electric advanced boiling-water reactor (ABWR) and the ASEA Brown Boveri/Combustion Engineering advanced pressurized-water reactor System 80+. Additionally, the NRC expects to receive two applications for design certification of advanced light-water reactors that employ some passive safety features and modular construction: the Westinghouse Electric advanced passive reactor (AP600) and the General Electric simplified boiling-water reactor (SBWR).

The NRC is also evaluating advanced designs that may be submitted for design certification in the future. These include the CANDU 3 design, an evolutionary form of the existing heavy-water CANDU 6 reactors; the process inherent ultimate safety (PIUS) design, a pressurized water-cooled light-water design; the modular high- temperature gas-cooled reactor (MHTGR) design; and the advanced liquid-metal reactor (ALMR) design (see Table 13 and Figure 28).

Figure 27. **Basic Design Certification and Reactor Licensing Process**



*Finding issued after construction to determine whether conditions of combined operating license were met.

Note: Process as specified under 10 CFR Part 52.

Source: Nuclear Regulatory Commission

Table 13. **Future Reactor Designs**

Design Name Vendor	Design Electrical Rating (MWe)	Design Type	Projected Schedules
ABWR General Electric	1300	Boiling-Water	FDA: December 1992 DC: June 1994
System 80+ ASEA Brown Boveri/ Combustion Engineering	1300	Pressurized-Water	FDA: November 1993 DC: May 1995
AP600 Westinghouse Electric	600	Pressurized-Water	FDA: November 1994 DC: May 1996
SBWR General Electric	600	Boiling-Water	FDA: January 1995 DC: July 1996
CANDU 3 Atomic Energy of Canada Limited	450	Heavy-Water	*
PIUS ASEA Brown Boveri/ Combustion Engineering	640	Pressurized-Water	*
MHTGR General Atomics	135**	Gas-Cooled	*
ALMR General Electric	155**	Liquid-Metal	*

*To be determined

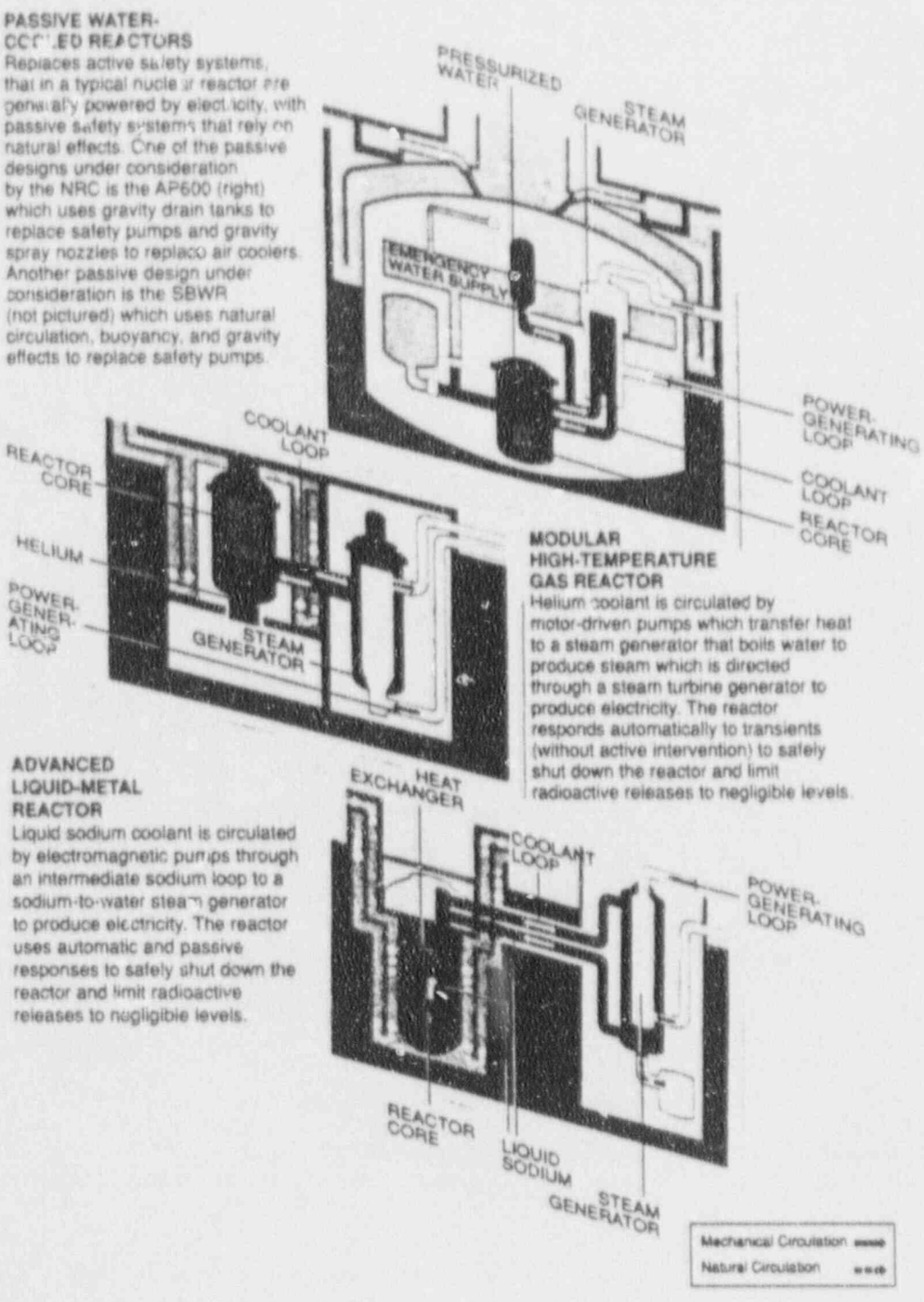
**Represents MWe for individual modules. Actual power plant design is expected to consist of a number of these modules with common support facilities.

FDA – Final Design Approval
DC – Design Certification

Note: Schedules represent projections as of 01/31/92 and depend on NRC receipt of timely, sufficiently detailed information from the designers.

Source: Nuclear Regulatory Commission

Figure 28. **Future Reactor Designs**



Source: Pierre Mion, National Geographic Society©. Reproduced by permission. Further reproduction prohibited.

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 46 nonpower reactors currently licensed to operate in 27 States (see Figure 29):

- 1 construction permit application submitted by Arkansas Tech University is under NRC review.
- Refer to Appendix E for a listing of U.S. nuclear nonpower reactors.

Principal Licensing and Inspection Activities:

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

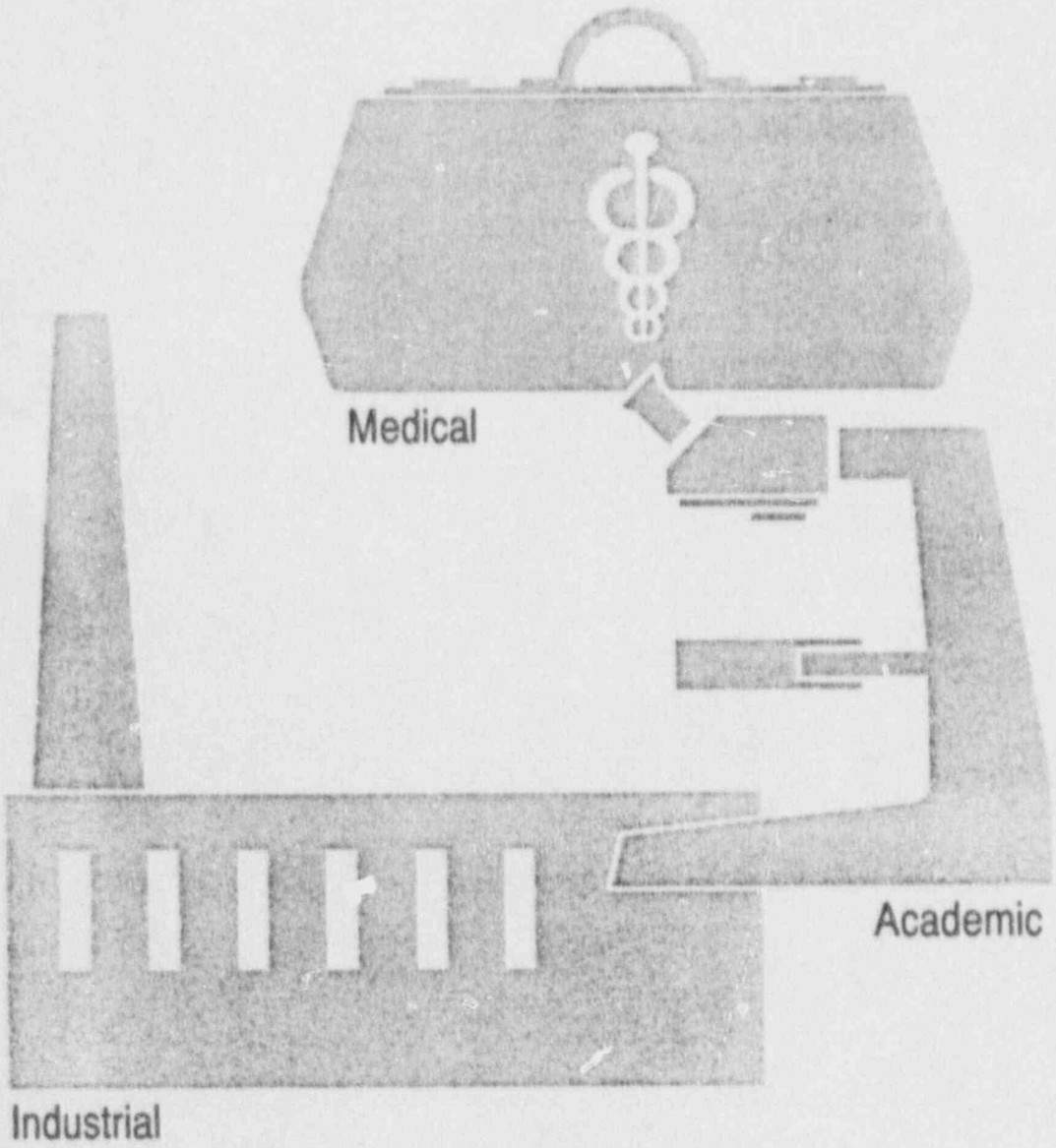
Figure 29. **U.S. Nuclear Nonpower Reactor Sites**

▲ Currently Licensed to Operate (46)
★ Application for Construction Permit (1)

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

Source: Nuclear Regulatory Commission

Nuclear Material 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.

There are 11 major facilities licensed to operate in 10 States (see Figure 30):

- **Uranium Hexafluoride Production Facilities**:
  - Allied-Signal Incorporated (Metropolis, Illinois)
  - Sequoyah Fuels Corporation (Sequoyah, Oklahoma)
- **Uranium Fuel Fabrication Facilities:**
  - General Atomics (San Diego, California)
  - Combustion Engineering (Windsor, Connecticut)
  - Combustion Engineering (Hematite, Missouri)
  - General Electric (Wilmington, North Carolina)
  - Westinghouse Electric (Columbia, South Carolina)
  - Nuclear Fuel Services (Erwin, Tennessee)
  - Babcock & Wilcox Fuel Company (Lynchburg, Virginia)
  - Babcock & Wilcox (Naval) (Lynchburg, Virginia)
  - Siemens Nuclear Power Corporation (Richland, Washington)

In January 1991, the NRC received an application to construct and operate the nation's first privately owned uranium enrichment facility in Homer, Louisiana. The NRC is currently reviewing the application and expects to reach a decision by January 1994.

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

■ Uranium Hexafluoride Production Facility (2)
● Uranium Fuel Fabrication Facility (9)
★ Uranium Enrichment Facility Site (1)

Note: There are no fuel cycle facilities in Alaska or Hawaii.
Source: Nuclear Regulatory Commission

U.S. Material Licenses

Approximately 23,000 licenses are issued for medical, academic, and industrial uses of nuclear material (see Table 14):

- 7,500 licenses are administered by the NRC.
- 15,000 licenses are administered by the 28 States that participate in the NRC Agreement States Program. An Agreement State is one that has signed an agreement with the NRC allowing the State to regulate the use of radioactive material within that State (see Figure 31).

Medical: More than 7 million clinical procedures using radioactive material are performed annually:

- Approximately 7 million for medical diagnosis and therapy
- Approximately 200 thousand for treatment of patients

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 5,400 new, renewal, or license amendments for material licenses annually. The Agreement States issue more than 13,000 such actions annually.
- NRC conducts approximately 3,100 health and safety inspections of nuclear material licensees annually. The Agreement States conduct approximately 4,800 such inspections annually.

Table 14. **U.S. Material Licenses by State**

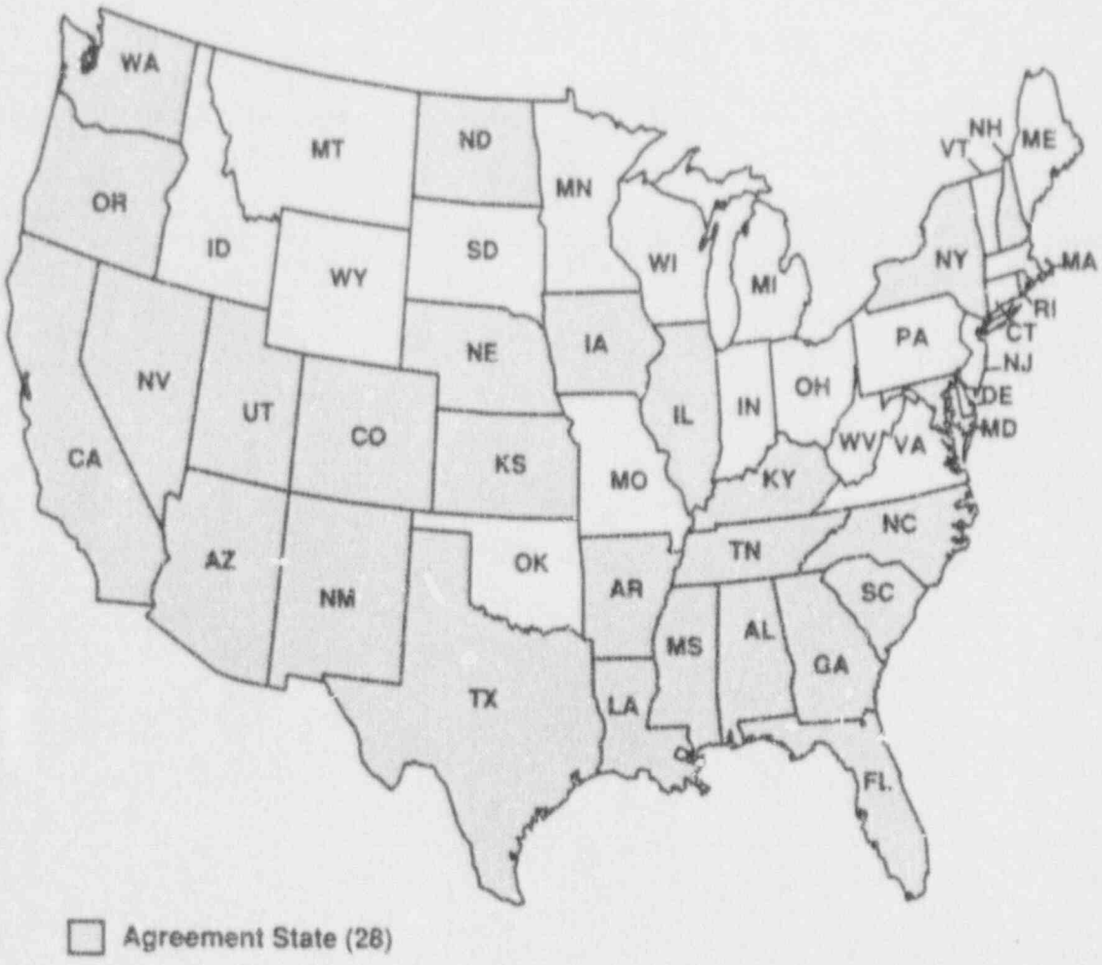
State	Number of Licenses NRC	Number of Licenses Agreement States
Alabama	24	467
Alaska	70	0
Arizona	20	295
Arkansas	11	266
California	84	2,271
Colorado	41	436
Connecticut	257	0
Delaware	70	0
District of Columbia	71	0
Florida	30	1,052
Georgia	22	518
Hawaii	65	0
Idaho	114	0
Illinois	83	900
Indiana	337	0
Iowa	8	219
Kansas	25	341
Kentucky	20	359
Louisiana	15	550
Maine	108	0
Maryland	66	516
Massachusetts	500	0
Michigan	616	0
Minnesota	212	0
Mississippi	11	320
Missouri	370	0
Montana	101	0
Nebraska	5	177
Nevada	5	142
New Hampshire	6	90
New Jersey	641	0
New Mexico	28	253
New York	62	1,872
North Carolina	22	556
North Dakota	6	87
Ohio	715	0
Oklahoma	284	0
Oregon	16	287
Pennsylvania	936	0
Rhode Island	3	63
South Carolina	9	313
South Dakota	48	0
Tennessee	38	537
Texas	72	1,753
Utah	16	230
Vermont	43	0
Virginia	433	0
Washington	27	370
West Virginia	209	0
Wisconsin	294	0
Wyoming	96	0
Others*	178	0
Total	**7,543**	**15,240**

*Others include territories such as Puerto Rico, Virgin Islands, Guam, and American Samoa.

Note: Data as of 12/31/91.

Source: Nuclear Regulatory Commission

Figure 31. **NRC Agreement States**



Note: Data as of 01/31/92. The NRC is currently considering a request from Maine to become an Agreement State. Alaska and Hawaii are not Agreement States.

Source: Nuclear Regulatory Commission

U.S. Nuclear Material Transportation and Safeguards

The NRC conducts transport-related safety inspections; quality assurance inspections of designers, fabricators, and suppliers of approved transportation containers; and safeguards inspections of nuclear material licensees.

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

The NRC institutes newly developed techniques to evaluate security systems through tactical response exercises to evaluate the operational effectiveness of licensees that possess significant quantities of strategic special nuclear material.

Principal Licensing and Inspection Activities:

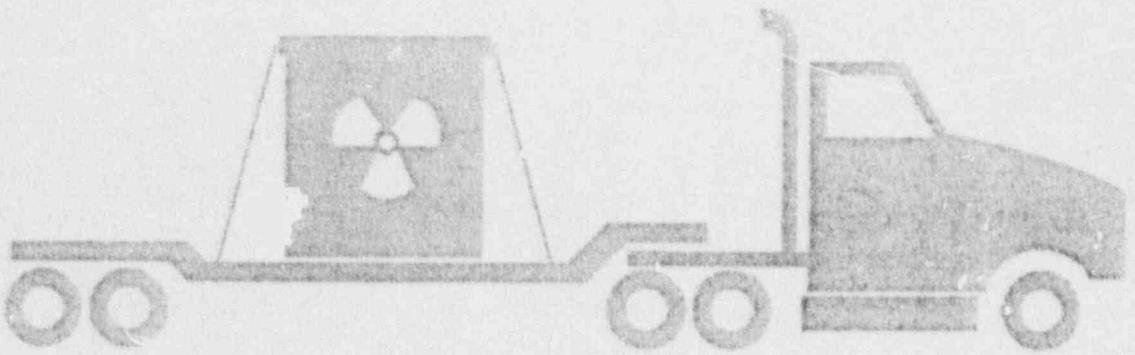
- NRC reviews, evaluates, and certifies approximately 100 container-design applications for the transport of nuclear material annually.
- NRC reviews and evaluates approximately 165 license applications for the export of nuclear material from the United States annually.
- NRC conducts comprehensive physical security and material control and accounting inspections at the major fuel fabrication facilities annually.

International Nuclear Safety

The NRC participates in a broad program of international cooperation related to nuclear safety.

- NRC has formal agreements to exchange technical information with 25 countries and Taiwan. These agreements:
  - Ensure prompt notification of safety problems that warrant action or investigation.
  - Provide bilateral cooperation on nuclear safety, safeguards, waste management, and environmental protection.
  - Partners are Argentina, Belgium, Brazil, Canada, China, Commonwealth of Independent States (formerly the Union of Soviet Socialist Republics, U.S.S.R), Czechoslovakia, Egypt, Finland, France, Germany, Greece, Hungary, Israel, Italy, Japan, Korea, Mexico, Netherlands, Philippines, Spain, Sweden, Switzerland, Taiwan, United Kingdom, and Yugoslavia.
- NRC has worked with the former U.S.S.R and is now working with the Commonwealth of Independent States to encourage improvements in reactor safety, to understand the important technical lessons from the Chernobyl accident, and to obtain information of value for U.S. plant safety. This cooperative effort is carried out primarily through working group meetings, field visits, and document exchanges.
- NRC participates in programs of the International Atomic Energy Agency (113 member countries) and of the Organization for Economic Cooperation and Development's Nuclear Energy Agency (24 member countries) concerned with reactor safety research and regulatory matters, radiation protection, waste management, transportation, standards, training, and technical assistance.
- NRC is involved in approximately 50 joint international safety research arrangements and agreements. Participants share the funding, technical support, and results of specific projects and programs.

Radioactive Waste



U.S. Low-Level Radioactive Waste Disposal

Approximately 1.14 million cubic feet of low-level radioactive waste was generated in 1990 (see Figure 32).

- 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 annual volume of waste has dropped approximately 60 percent since 1985 (see Figure 33).

The radioactivity of wastes varies from year to year based on the types and quantities of waste shipped each year (see Figure 34).

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

- Formation of regional compacts; nine compacts now active
- Exclusion of waste generated outside a compact
- Each compact (or State) to designate at least one active site
- System of milestones, incentives, and penalties to ensure that States and compacts will be responsible for their own waste after January 1, 1993 (see Table 15 and Figure 35).

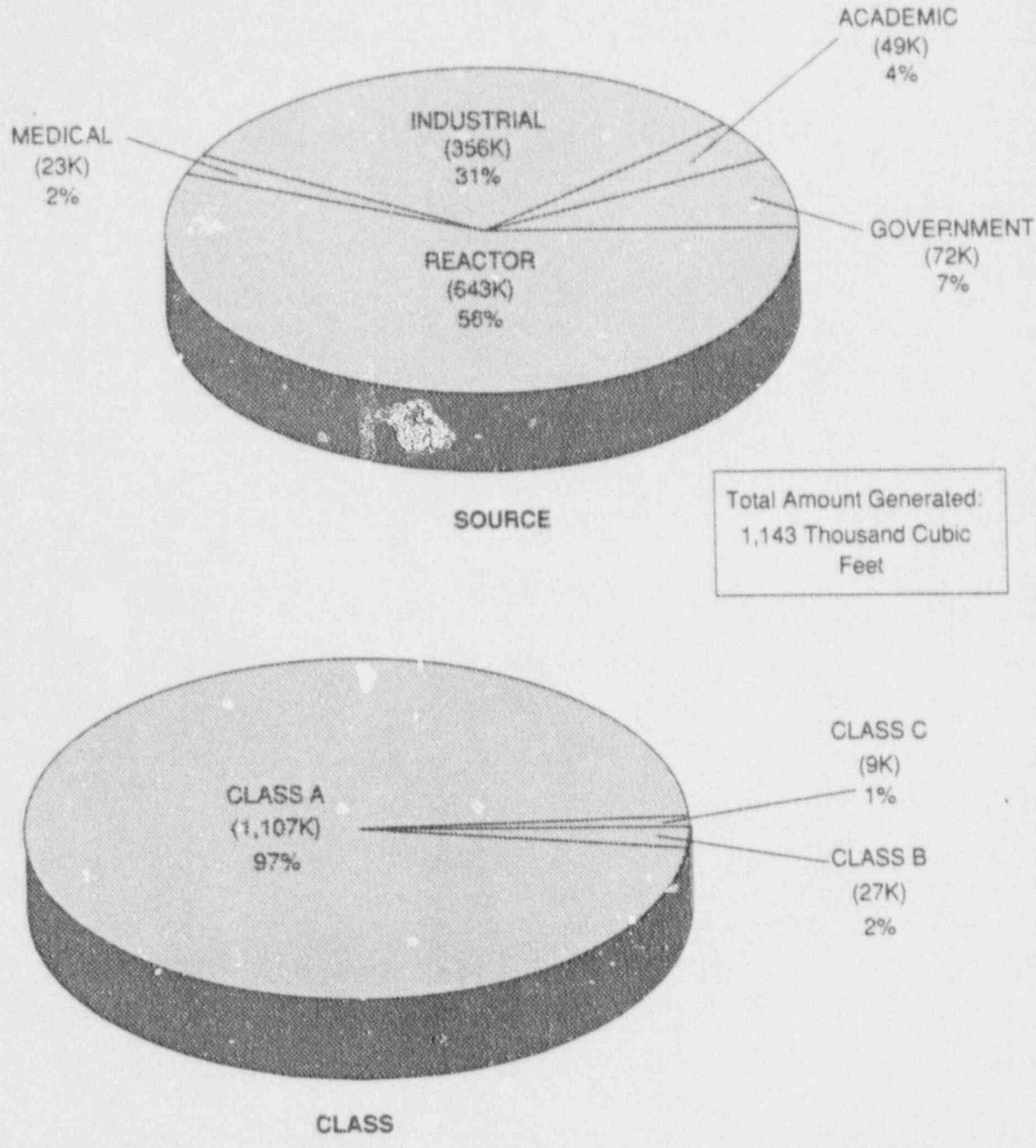
There are three active licensed disposal facilities:

- Barnwell (South Carolina)
- Beatty (Nevada)
- Hanford (Washington)

There are four sites under license review by the Agreement State regulatory authorities:

- Boyd County (Nebraska)
- Clark County (Illinois)
- Hudspeth County (Texas)
- San Bernardino County (California)

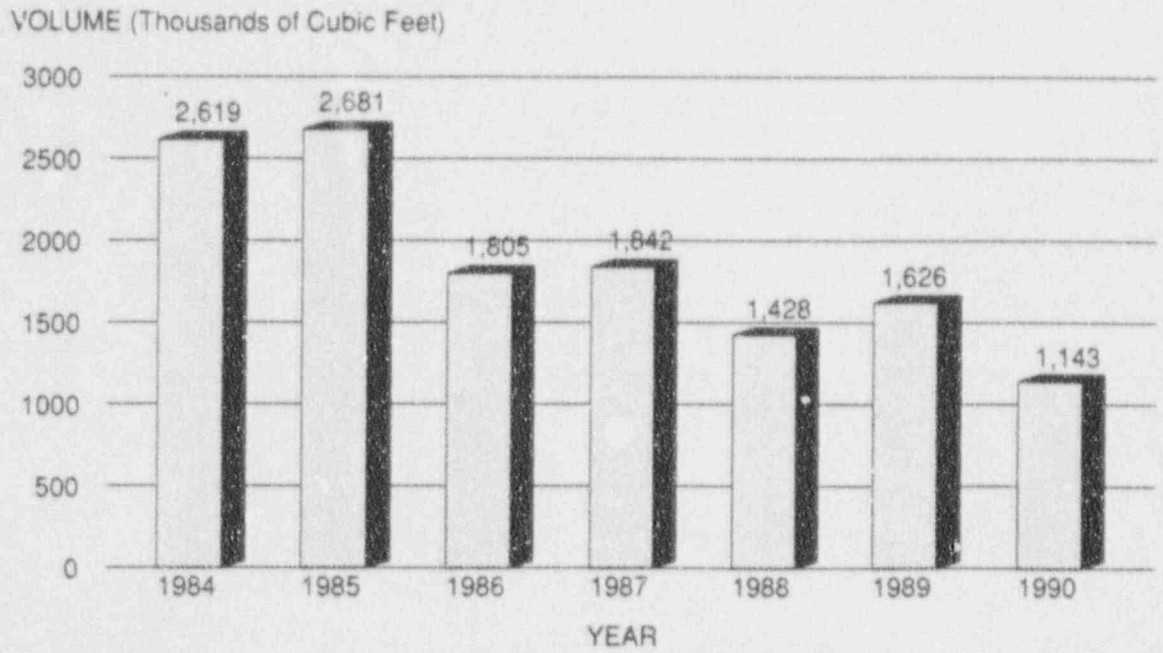
Figure 32. **Volume of Low-Level Radioactive Waste Generated in the United States in 1990 (Cubic Feet)**

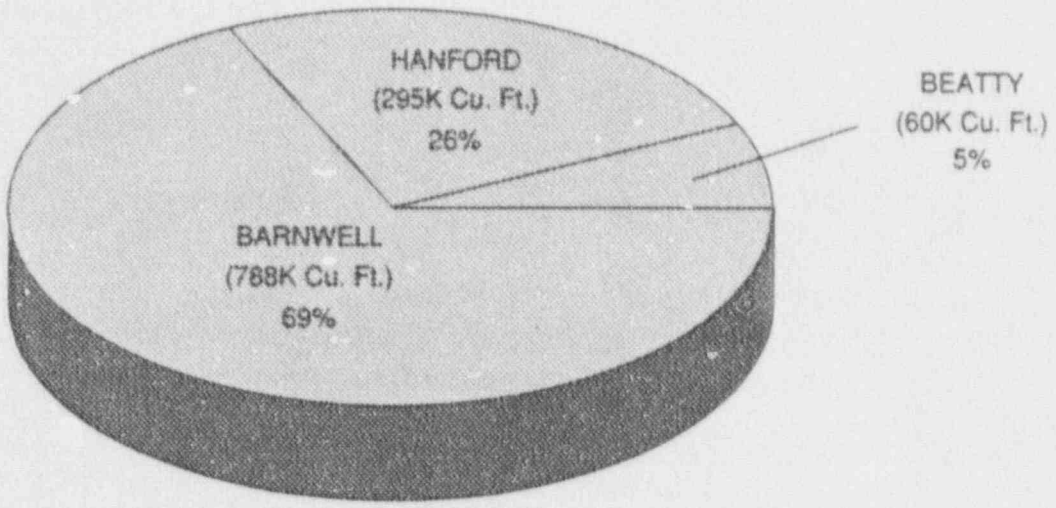


Note: Class A waste contains lower concentrations of radioactive material than Class C waste. Determination of the classification of waste, however, is a complex process. For more information, see 10 CFR Part 61. Percentages are rounded to the nearest whole number.

Source: DOE 1990 State-by-State Assessment of Low-Level Radioactive Wastes Received at Commercial Disposal Sites (DOE/LLW–132)

Figure 33. **Volume of Low-Level Waste Received at Currently Operating U.S. Disposal Facilities, 1984-1990**



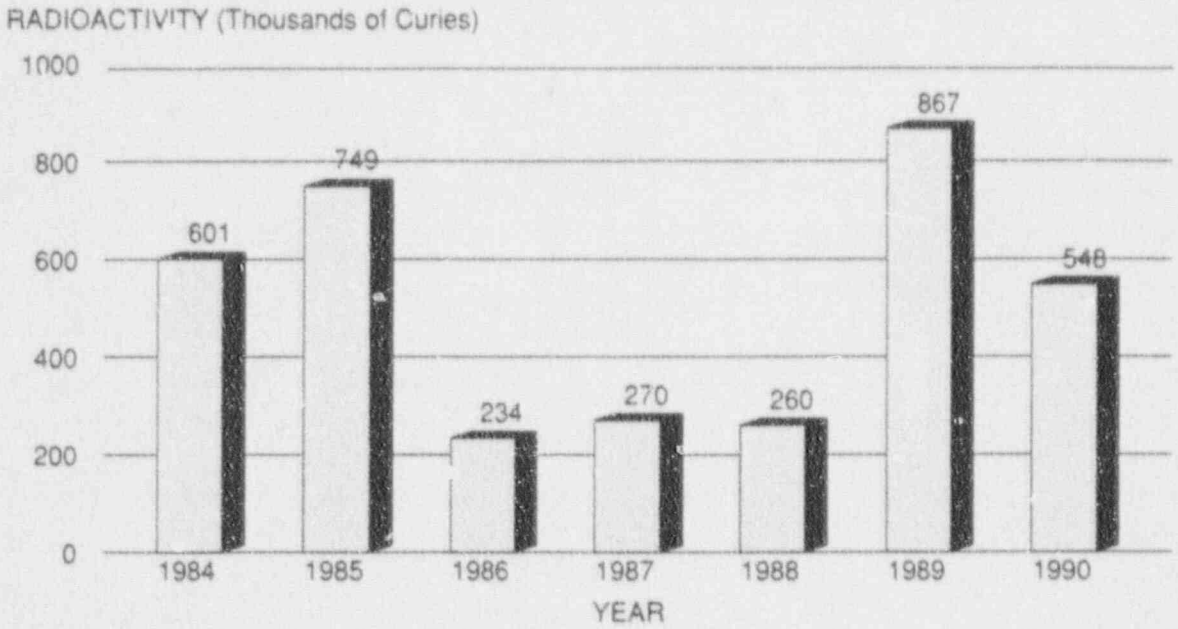


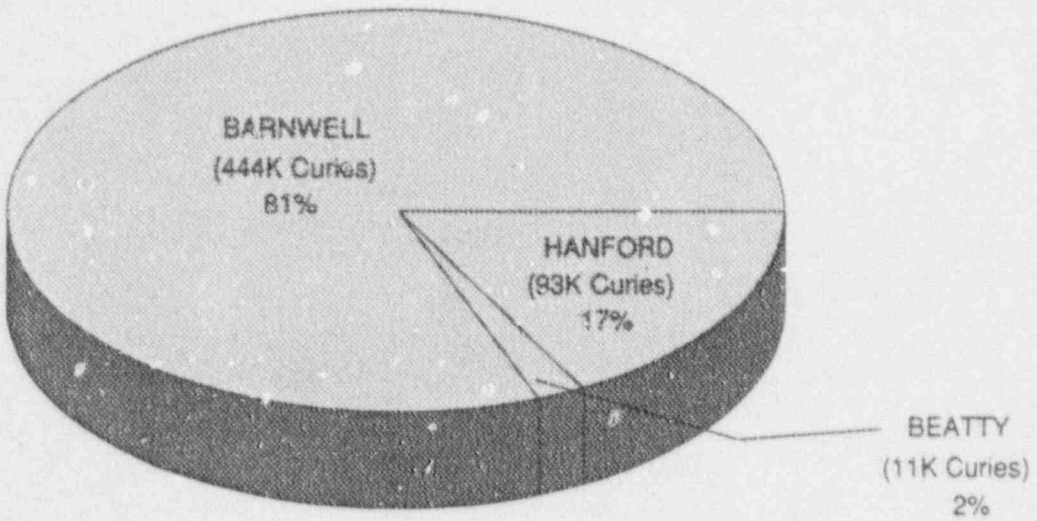
1990 VOLUME BY DISPOSAL FACILITY

Note: Percentages are rounded to the nearest whole number.

Source: DOE 1990 State-by-State Assessment of Low-Level Radioactive Wastes Received at Commercial Disposal Sites (DOE/LLW–132)

Figure 34. **Radioactivity of Low-Level Waste Received at Currently Operating U.S. Disposal Facilities, 1984-1990**





1990 RADIOACTIVITY BY DISPOSAL FACILITY

Note: Percentages are rounded to the nearest whole number.

Source: DOE 1990 State-by-State Assessment of Low-Level Radioactive Wastes Received at Commercial Disposal Sites (DOE/LLW–132)

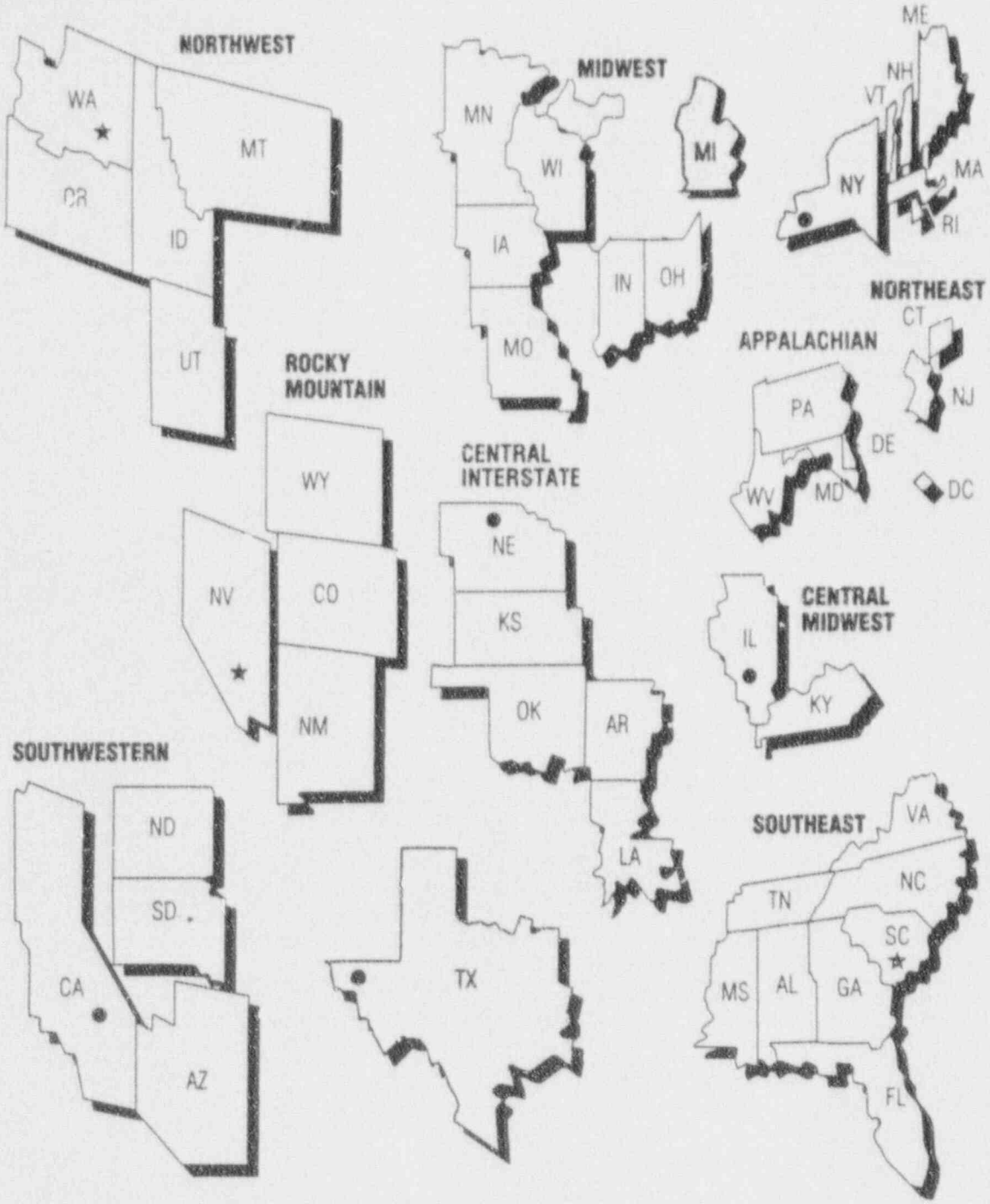
Table 15. **U.S. Low-Level Waste Compacts**

Compact	Percent of Total 1990 Low-Level Waste Generated	Disposal Technology
Northwest	8.4%	
Alaska		
Hawaii		
Idaho		
Montana		
Oregon		
Utah		
Washington*		Shallow land burial
Southwestern	7.4%	
Arizona		
California**		Shallow land burial
North Dakota		
South Dakota		
Rocky Mountain	0.4%	
Colorado**		
Nevada*		Shallow land burial
New Mexico		
Wyoming		
Midwest	7.6%	
Indiana		
Iowa		
Minnesota		
Missouri		
Ohio**		Shallow land burial banned
Wisconsin		
Central Interstate	5.1%	
Arkansas		
Kansas		
Louisiana		
Nebraska**		Shallow land burial banned
Oklahoma		
Central Midwest	9.0%	
Illinois**		Shallow land burial banned
Kentucky		
Appalachian	10.5%	
Delaware		
Maryland		
Pennsylvania**		Shallow land burial banned
West Virginia		
Northeast	7.6%	
Connecticut**		
New Jersey**		Shallow land burial banned
Southeast	29.4%	
Alabama		
Florida		
Georgia		
Mississippi		
North Carolina**		Shallow land burial banned
South Carolina*		Shallow land burial
Tennessee		
Virginia		
Unaffiliated States	14.6%	
District of Columbia	<1%	
Maine**	0.7%	Shallow land burial banned
Massachusetts**	3.6%	Shallow land burial banned
Michigan	3.2%	
New Hampshire	<1%	
New York**	6.2%	Shallow land burial banned
Puerto Rico	0%	
Rhode Island	<1%	
Texas**	0.8%	Shallow land burial banned
Vermont **	0%	Shallow land burial banned

* Current Host State (3)
** Selected Host State (14)

Source: DOE 1990 State-by-State Assessment of Low-Level Radioactive Wastes Received at Commercial Disposal Sites (DOE/LLW–132) and the Nuclear Regulatory Commission

Figure 35. **U.S. Low-Level Waste Compacts**



★ Active Disposal Site (3)

● Disposal Site Under License Review (4)

☐ Approved Compact (9)

☐ Unaffiliated State (10)

Note: Alaska and Hawaii belong to the Northwest Compact. Puerto Rico is an unaffiliated State.

Source: Nuclear Regulatory Commission

U.S. High-Level Radioactive Waste Disposal

Approximately 20,000 metric tons of spent nuclear fuel is stored at commercial nuclear power reactors as of 1990. By the year 2000, this amount is expected to double (see Table 16):

- In 1990, the NRC amended its regulations to authorize licensees to store spent fuel at reactor sites in storage casks approved by the NRC. Four cask designs received certificates of compliance as a result of this rule change (see Tables 17 and 18).

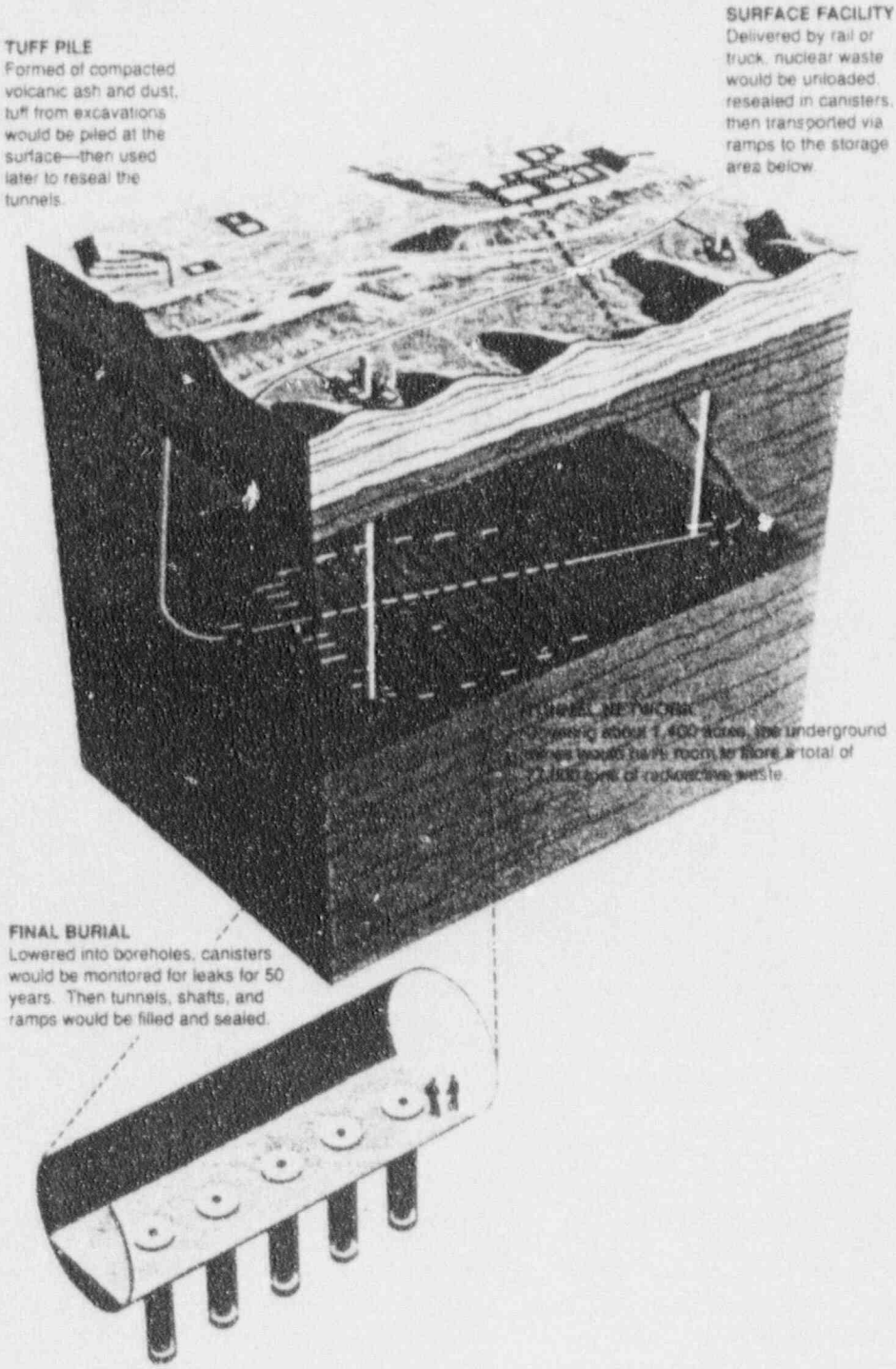
Two offsite (i.e, not at the reactor site) spent fuel storage facilities no longer accept spent fuel for storage:

- West Valley (New York)
- Morris (Illinois)

The Nuclear Waste Policy Act of 1982 and the Nuclear Waste Policy Amendments Act of 1987 specify a detailed approach for high-level radioactive waste disposal, with 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, stable geologic structure (see Figure 36 for a conceptual design of the candidate high-level waste repository).
- The Amendments Act designated a candidate site for a high-level waste repository at Yucca Mountain, Nevada. DOE is determining site suitability.
- Ultimately, any high-level waste repository will require an NRC license.

Figure 36. **Conceptual Design of the U.S. High-Level Waste Repository**



Source: Peter Miller and Pierre Mion, National Geographic Society ©. Reproduced by permission. Further reproduction prohibited.

Figure 36. **Conceptual Design of the U.S. High-Level Waste Repository**

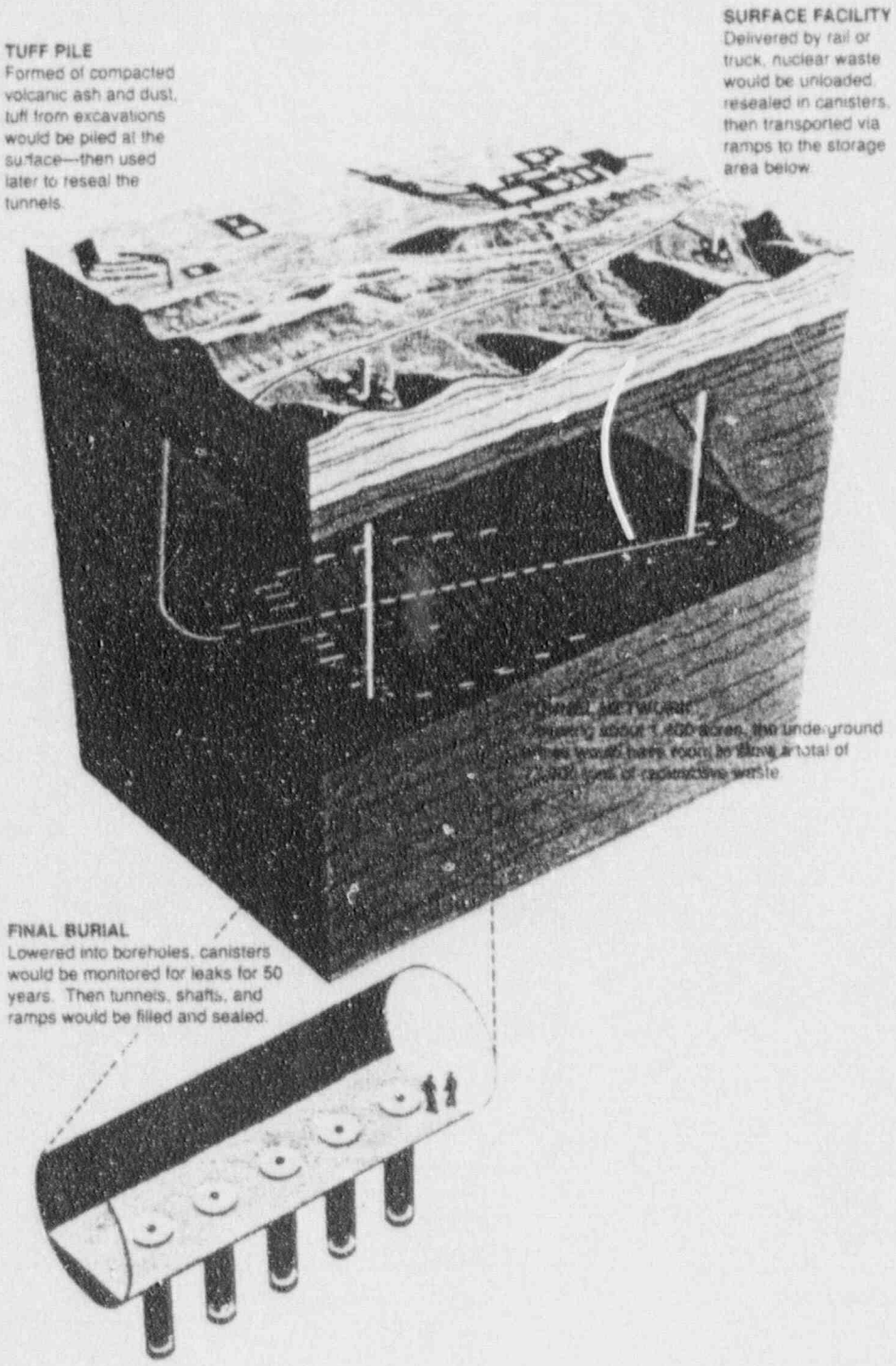


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Table 16. **Spent Nuclear Fuel Stored at U.S. Commercial Nuclear Power Reactors—Total Metric Tons by State**

State	1990	2000	State	1990	2000
Alabama	1,183	2,031	Missouri	162	387
Arizona	203	914	Nebraska	256	499
Arkansas	437	753	New Hampshire	0	179
California	596	1,531	New Jersey	807	1,559
Connecticut	1,003	1,646	New York	1,354	2,217
Florida	1,120	1,789	North Carolina	1,144	1,994
Georgia	644	1,340	Ohio	254	667
Illinois	2,605	4,998	Oregon	246	485
Iowa	194	280	Pennsylvania	1,608	3,356
Kansas	118	307	South Carolina	1,318	2,571
Louisiana	212	681	Tennessee	271	786
Maine	375	529	Texas	65	803
Maryland	509	852	Vermont	320	455
Massachusetts	356	560	Virginia	865	1,477
Michigan	940	1,688	Washington	131	349
Minnesota	492	837	Wisconsin	634	1,002
Mississippi	202	502			
			Total	20,624	40,054

Note: Projection based on 114 reactors.

Source: DOE Spent Fuel Storage Requirements 1991–2040 (DOE/RL–91–54(92/02))

Table 17. **NRC-Approved Dry Spent Fuel Storage Designs**

Vendor	Storage Design Model	Capacity (Assemblies)	Storage Design Approval Date	Certificate of Compliance Approval Date
General Nuclear Systems, Incorporated	Metal Cask CASTOR V/21	21 PWR	09/30/1985	08/17/1990
Pacific Nuclear Fuel Services, Incorporated	Concrete Module NUHOMS - 7	7 PWR	03/28/1986	
Westinghouse Electric	Metal Cask MC - 10	24 PWR	09/30/1987	08/17/1990
Foster Wheeler Energy Applications, Incorporated	Concrete Vault Modular Vault Dry Store	83 PWR or 150 BWR	03/22/1988	
Nuclear Assurance Corporation	Metal Cask NAC - STC	26 PWR	03/29/1988	08/17/1990
Nuclear Assurance Corporation	Metal Cask NAC - C28 S/T	28 Canisters (fuel rods from 56 PWR assemblies)	09/29/1988	08/17/1990
Pacific Nuclear Fuel Services, Incorporated	Concrete Module NUHOMS - 24P	24 PWR	04/21/1989	
Transnuclear, Incorporated	Metal Cask TN - 24	24 PWR	07/05/1989	
Nuclear Assurance Corporation	Metal Cask NAC - I28/ST	28 PWR	02/01/1990	
Pacific Sierra Nuclear Associates	Concrete Cask VSC	24 PWR	03/29/1991	

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

Source: Nuclear Regulatory Commission

Table 18. **NRC Dry Spent Fuel Storage Licensees**

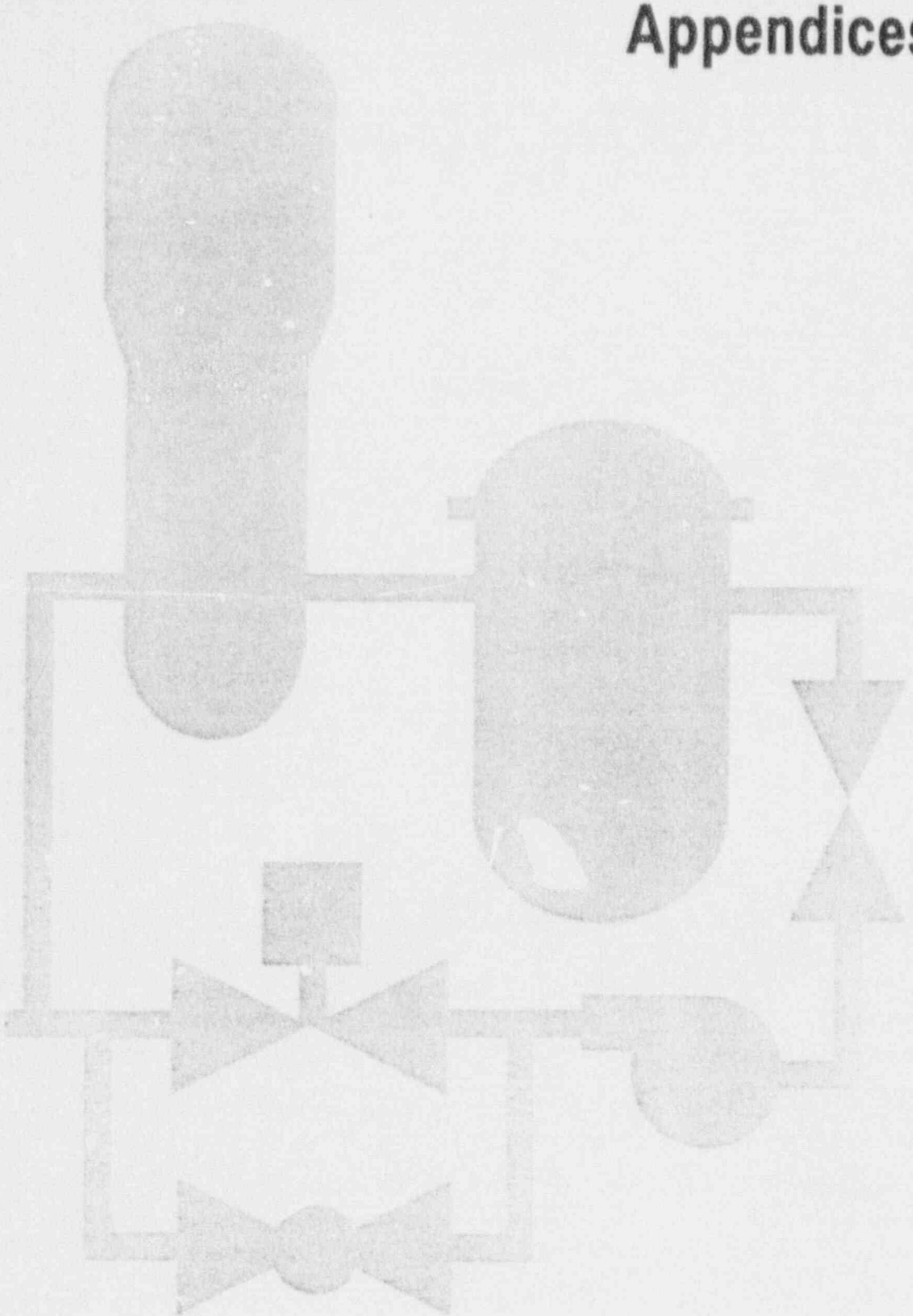
Reactor Name Utility	Date Issued	Vendor	Storage Model
Surry 1, 2 Virginia Electric & Power Company	07/02/1986	General Nuclear Systems, Incorporated	Metal Cask CASTOR V/21
H. B. Robinson 2 Carolina Power & Light Company	08/13/1986	Pacific Nuclear Fuel Services, Incorporated	NUHOMS - 7
Oconee 1, 2, 3 Duke Power Company	01/29/1990	Pacific Nuclear Fuel Services, Incorporated	NUHOMS - 24P
Fort St. Vrain Public Service Company of Colorado	11/04/1991	Foster Wheeler Energy Applications, Incorporated	Modular Vault Dry Store (MVDS)
Brunswick 1, 2 Carolina Power & Light Company	*	Pacific Nuclear Fuel Services, Incorporated	NUHOMS - 7
Calvert Cliffs 1, 2 Baltimore Gas & Electric Company	*	Pacific Nuclear Fuel Services, Incorporated	NUHOMS - 24P
Prairie Island 1, 2 Northern States Power Company	*	Transnuclear, Incorporated	TN - 40
Rancho Seco Sacramento Municipal Utility District	*	**	**

*Application Received.

**To Be Determined.

Source: Nuclear Regulatory Commission

Appendices



Abbreviations Used in Appendices

ACECOWEN:	Belgian Consortium with Westinghouse
AE:	Architect-Engineer
AECL:	Atomic Energy of Canada, Ltd.
AEE:	Atomenergoexport
AEP:	American Electric Power
AGN:	Aerojet-General Nucleonics
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 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
DPR:	Demonstration Power Reactor
DUKE	Duke Power Company
EBSO	Ebasco
EXP. DATE:	Expiration Date of Operating License
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
HWR:	Pressurized Heavy-Water Reactor
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
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 ISSUED:	Date of Latest Full Power Operating License
PG&E:	Pacific Gas & Electric Company
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
TNPG:	The Nuclear Power Group
TOSH:	Toshiba
TR:	Test Reactor
TVA:	Tennessee Valley Authority
UE&C:	United Engineering & Constructors
UTR:	Universal Training Reactor
WDCO:	Westinghouse Development Corporation
WEST:	Westinghouse Electric

U.S. Commercial Nuclear Power Reactors

Unit Operating Utility Location Docket Number	NRC Regi	Con Type NSSS onstructor	Licensed MWt	Net MDC	CP Issued OL Issued Comm. Op Exp. Date	License Type & Number	1991 Average Capacity Factor (Percent)	Note
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	89.3	
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	81.4	
Beaver Valley 1 Duquesne Light Co. 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	52.2	
Beaver Valley 2 Duquesne Light Co. 17 MI W of McCandless, PA 050-00412	I	PWR-DRYSUB WEST 3LP S&W S&W	2652	0820	05/03/1974 08/14/1987 11/17/1987 05/27/2027	OL-FP NPF-73	94.1	
Bellefonte 1 Tennessee Valley Authority 6 MI NE of Scottsboro, AL 050-00438	II	PWR-DRYAMB B&W RLP TVA TVA	0000	1235 (DER)	12/24/1974	CP CPPR-122	–	(1)
Bellefonte 2 Tennessee Valley Authority 6 MI NE of Scottsboro, AL 050-00439	II	PWR-DRYAMB B&W RLP TVA TVA	0000	1235 (DER)	12/24/1974	CP CPPR-123	–	(1)
Big Rock Point Consumers Power Co. 4 MI NE of Charlevoix, MI 050-00155	III	BWR-DRYAMB GE 1 BECH BECH	0240	0067	05/31/1960 05/01/1964 03/29/1963 05/31/2000	OL-FP DPR-6	83.8	
Braidwood 1 Commonwealth Edison Co. 24 MI SSW of Joliet, IL 050-00456	III	PWR-DRYAMB WEST 4LP S&L CWE	3411	1120	12/31/1975 07/02/1987 07/29/1988 10/17/2026	OL-FP NPF-72	50.8	
Braidwood 2 Commonwealth Edison Co. 24 MI SSW of Joliet, IL 050-00457	III	PWR-DRYAMB WEST 4LP S&L CWE	3411	1120	12/31/1975 05/20/1988 10/17/1988 12/18/2027	OL-FP NPF-77	66.6	

(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	1991 Average Capacity Factor (Percent)	Note
Browns Ferry 1 Tennessee Valley Authority 10 MI NW of Decatur, AL 050-00259	II	BWR-MARK1 GE 4 TVA TVA	3293	1065	05/10/1967 12/20/1973 08/01/1974 12/20/2013	OL-FP DPR-33	0	
Browns Ferry 2 Tennessee Valley Authority 10 MI NW of Decatur, AL 050-00260	II	BWR-MARK1 GE 4 TVA TVA	3293	1065	05/10/1967 08/02/1974 03/01/1975 06/28/2014	OL-FP DPR-52	40.3	
Browns Ferry 3 Tennessee Valley Authority 10 MI NW of Decatur, AL 050-00296	II	BWR-MARK1 GE 4 TVA TVA	3293	1065	07/31/1968 08/18/1976 03/01/1977 07/02/2016	OL-FP DPR-68	0	
Brunswick 1 Carolina Power & Light Co. 2 MI N of Southport, NC 050-00325	II	BWR-MARK1 GE 4 UE&C BRRT	2436	0767	02/07/1970 11/12/1976 03/18/1977 09/08/2016	OL-FP DPR-71	65.4	
Brunswick 2 Carolina Power & Light Co. 2 MI N of Southport, NC 050-00324	II	BWR-MARK1 GE 4 UE&C BRRT	2436	0754	02/07/1970 12/27/1974 11/03/1975 12/27/2014	OL-FP DPR-62	55.1	
Byron 1 Commonwealth Edison Co. 17 MI SW of Rockford, IL 050-00454	III	PWR-DRYAMB WEST 4LP S&L CWE	3411	1105	12/31/1975 02/14/1985 09/16/1985 10/31/2024	OL-FP NPF-37	65.2	
Byron 2 Commonwealth Edison Co. 17 MI SW of Rockford, IL 050-00455	III	PWR-DRYAMB WEST 4LP S&L CWE	3411	1105	12/31/1975 01/30/1987 08/21/1987 11/06/2026	OL-FP NPF-66	90.6	
Callaway Union Electric Co. 10 MI SE of Fulton, MO 050-00483	III	PWR-DRYAMB WEST 4LP BECH DANI	3565	1125	04/16/1976 10/18/1984 12/19/1984 10/18/2024	OL-FP NPF-30	101.3	
Calvert Cliffs 1 Baltimore Gas & Electric Co. 40 MI S of Annapolis, MD 050-00317	I	PWR-DRYAMB COMB CE BECH BECH	2700	0825	07/07/1969 07/31/1974 05/08/1975 07/31/2014	OL-FP DPR-53	75.6	
Calvert Cliffs 2 Baltimore Gas & Electric Co. 40 MI S of Annapolis, MD 050-00318	I	PWR-DRYAMB COMB CE BECH BECH	2700	0825	07/07/1969 11/30/1976 04/01/1977 08/31/2036	OL-FP DPR-69	50.3	

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	1991 Average Capacity Factor (Percent)	Note
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	67.4	
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	73.5	
Clinton Illinois Power Co. 6 MI E of Clinton, IL 050-00461	III	BWR-MARK3 GE 6 S&L BALD	2894	0930	02/24/1976 04/17/1987 11/24/1987 09/29/2026	OL-FP NPF-62	74.2	
Comanche Peak 1 Texas Utilities Electric Co. 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	53.2	
Comanche Peak 2 Texas Utilities Electric Co. 4 MI N of Glen Rose, TX 050-00446	IV	PWR-DRYAMB WEST 4LP BECH BRRT	0000	1150 (DER)	12/19/1974	CP CPPR-127	–	(2)
Cooper Nebraska Public Power District 23 MI S of Nebraska City, NE 050-00298	IV	BWR-MARK1 GE 4 B&R B&R	2381	0764	06/04/1968 01/18/1974 07/01/1974 12/18/2014	OL-FP DPR-46	71.8	
Crystal River 3 Florida Power Corp. 7 MI NW of Crystal River, FL 050-00302	II	PWR-DRYAMB B&W LLP GIL JONES	2544	0821	09/25/1968 01/28/1977 03/13/1977 12/03/2016	OL-FP DPR-72	75.9	
Davis-Besse Toledo Edison Co. 21 MI ESE of Toledo, OH 050-00346	III	PWR-DRYAMB B&W LLP BECH BECH	2772	0874	03/24/1971 04/22/1977 07/31/1978 04/22/2017	OL-FP NPF-3	76.3	
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	83.2	
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	85.7	

(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	1991 Average Capacity Factor (Percent)	Note
Diablo Canyon 1 Pacific Gas & Electric Co. 12 MI WSW of San Luis Obispo, CA 050-00275	V	PWR-DRYAMB WEST 4LP PG&E PG&E	3338	1073	04/23/1968 11/02/1984 05/07/1985 04/23/2008	OL-FP DPR-80	78.3	
Diablo Canyon 2 Pacific Gas & Electric Co. 12 MI WSW of San Luis Obispo, CA 050-00323	V	PWR-DRYAMB WEST 4LP PG&E PG&E	3411	1087	12/09/1970 08/26/1985 03/13/1986 12/09/2010	OL-FP DPR-82	81.0	
Dresden 2 Commonwealth Edison Co. 9 MI E of Morris, IL 050-00237	III	BWR-MARK1 GE 3 S&L UE&C	2527	0772	01/10/1966 02/20/1991 06/09/1970 01/10/2006	OL-FP DPR-19	43.9	
Dresden 3 Commonwealth Edison Co. 9 MI E of Morris, IL 050-00249	III	BWR-MARK1 GE 3 S&L UE&C	2527	0773	10/14/1966 03/02/1971 11/16/1971 01/12/2011	OL-FP DPR-25	37.9	
Duane Arnold Iowa Electric Light & Power Co. 8 MI NW of Cedar Rapids, IA 050-00331	III	BWR-MARK1 GE 4 BECH BECH	1658	0515	06/22/1970 02/22/1974 02/01/1975 02/21/2014	OL-FP DPR-49	91.9	
Edwin I. Hatch 1 Georgia Power Co. 11 MI N of Baxley, GA 050-00321	II	BWR-MARK1 GE 4 BECH GPC	2436	0741	09/30/1969 10/13/1974 12/31/1975 08/06/2014	OL-FP DPR-57	72.4	
Edwin I. Hatch 2 Georgia Power Co. 11 MI N of Baxley, GA 050-00366	II	BWR-MARK1 GE 4 BECH GPC	2436	0761	12/27/1972 06/13/1978 09/05/1979 06/13/2018	OL-FP NPF-5	73.8	
Fermi 2 Detroit Edison Co. 25 MI NE of Toledo, OH 050-00341	III	BWR-MARK1 GE 4 S&L DANI	3292	1060	09/26/1972 07/15/1985 01/23/1988 03/20/2025	OL-FP NPF-43	66.7	
Fort Calhoun Omaha Public Power District 19 MI N of Omaha, NE 050-00285	IV	PWR-DRYAMB COMB CE GHDR GHDR	1500	0478	06/07/1968 08/09/1973 06/20/1974 06/07/2008	OL-FP DPR-40	77.6	

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	1991 Average Capacity Factor (Percent)	Note
Ginna Rochester Gas & Electric Corp. 20 MI NE of Rochester, NY 050-00244	I	PWR-DRYAMB WEST 2LP GIL BECH	1520	0470	04/25/1966 12/10/1984 07/01/1970 09/18/2009	OL-FP DPR-18	84.6	
Grand Gulf 1 Entergy Operations, Inc. 25 MI S of Vicksburg, MS 050-00416	II	BWR-MARK3 GE 6 BECH BECH	3833	1143	09/04/1974 11/01/1984 07/01/1985 06/16/2022	OL-FP NPF-29	91.1	
Haddam Neck CT Yankee Atomic Power Co. 13 MI E of Meriden, CT 050-00213	I	PWR-DRYAMB WEST 4LP S&W S&W	1825	0560	05/26/1964 12/27/1974 01/01/1968 06/29/2007	OL-FP DPR-61	74.9	
H. B. Robinson 2 Carolina Power & Light Co. 26 MI from Florence, SC 050-00261	II	PWR-DRYAMB WEST 3LP EBSO EBSO	2300	0683	04/13/1967 09/23/1970 03/07/1971 07/31/2010	OL-FP DPR-23	80.0	
Hope Creek 1 Public Service Electric & Gas Co. 18 MI SE of Wilmington, DE 050-00354	I	BWR-MARK1 GE 4 BECH BECH	3293	1067	11/04/1974 07/25/1986 12/20/1986 04/11/2026	OL-FP NPF-57	81.9	
Indian Point 2 Consolidated Edison Co. 24 MI N of New York City, NY 050-00247	I	PWR-DRYAMB WEST 4LP UE&C WDCO	3071	0939	10/14/1966 09/28/1973 08/01/1974 09/28/2013	OL-FP DPR-26	47.5	
Indian Point 3 Power Authority of the State of New York 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 08/13/2009	OL-FP DPR-64	86.4	
James A. FitzPatrick Power Authority of the State of New York 8 MI NE of Oswego, NY 050-00333	I	BWR-MARK1 GE 4 S&W S&W	2436	0780	05/20/1970 10/17/1974 07/28/1975 10/17/2014	OL-FP DPR-59	49.4	
Joseph M. Farley 1 Southern Nuclear Operating Co. 18 MI SE of Dothan, AL 050-00348	II	PWR-DRYAMB WEST 3LP SSI DANI	2652	0814	08/16/1972 06/25/1977 12/01/1977 06/25/2017	OL-FP NPF-2	75.9	
Joseph M. Farley 2 Southern Nuclear Operating Co. 18 MI SE of Dothan, AL 050-00364	II	PWR-DRYAMB WEST 3LP SSI BECH	2652	0824	08/16/1972 03/31/1981 07/30/1981 03/31/2021	OL-FP NPF-8	93.4	

(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	1991 Average Capacity Factor (Percent)	Note
Kewaunee Wisconsin Public Service Corp. 27 MI E of Green Bay, WI 050-00305	III	PWR-DRYAMB WEST 2LP PSE PSE	1650	0511	08/06/1968 12/21/1973 06/16/1974 12/21/2013	OL-FP DPR-43	82.7	
La Salle County 1 Commonwealth Edison Co. 11 MI SE of Ottawa, IL 050-00373	III	BWR-MARK2 GE 5 S&L CWE	3323	1036	09/10/1973 08/13/1982 01/01/1984 05/17/2022	OL-FP NPF-11	75.2	
La Salle County 2 Commonwealth Edison Co. 11 MI SE of Ottawa, IL 050-00374	III	BWR-MARK2 GE 5 S&L CWE	3323	1036	09/10/1973 03/23/1984 10/19/1984 04/16/2023	OL-FP NPF-18	96.0	
Limerick 1 Philadelphia Electric Co. 21 MI NW of Philadelphia, PA 050-00352	I	BWR-MARK2 GE 4 BECH BECH	3293	1055	06/19/1974 08/08/1985 02/01/1986 10/26/2024	OL-FP NPF-39	88.0	
Limerick 2 Philadelphia Electric Co. 21 MI NW of Philadelphia, PA 050-00353	I	BWR-MARK2 GE 4 BECH BECH	3293	1055	06/19/1974 08/25/1989 01/08/1990 06/22/2029	OL-FP NPF-85	77.3	
Maine Yankee Maine Yankee Atomic Power Co. 10 MI N of Bath, ME 050-00309	I	PWR-DRYAMB COMB CE S&W S&W	2700	0860	10/21/1968 06/29/1973 12/28/1972 10/21/2008	OL-FP DPR-36	85.1	
McGuire 1 Duke Power Co. 17 MI S 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	69.2	
McGuire 2 Duke Power Co. 17 MI S 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	96.2	
Millstone 1 Northeast Nuclear Energy Co. 3.2 MI ENE of New London, CT 050-00245	I	BWR-MARK1 GE 3 EBSO EBSO	2011	0654	05/19/1966 10/31/1986 03/01/1971 10/06/2010	OL-FP DPR-21	30.6	
Millstone 2 Northeast Nuclear Energy Co. 3.2 MI ENE of New London, CT 050-00336	I	PWR-DRYAMB COMB CE BECH BECH	2700	0863	12/11/1970 09/30/1975 12/26/1975 07/31/2015	OL-FP DPR-65	52.2	

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	1991 Average Capacity Factor (Percent)	Note
Millstone 3 Northeast Nuclear Energy Co. 3.2 MI ENE 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	28.5	
Monticello Northern States Power Co. 30 MI NW of Minneapolis, MN 050-00263	III	BWR-MARK1 GE 3 BECH BECH	1670	0536	06/19/1967 01/09/1981 06/30/1971 09/08/2010	OL-FP DPR-22	76.6	
Nine Mile Point 1 Niagara Mohawk Power Corp. 6 MI NE of Oswego, NY 050-00220	I	BWR-MARK1 GE 2 NIAG S&W	1850	0615	04/12/1965 12/26/1974 12/01/1969 08/22/2009	OL-FP DPR-63	71.9	
Nine Mile Point 2 Niagara Mohawk Power Corp. 6 MI NE of Oswego, NY 050-00410	I	BWR-MARK2 GE 5 S&W S&W	3323	1097	06/24/1974 07/02/1987 03/11/1988 10/31/2026	OL-FP NPF-69	68.6	
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	0911	02/19/1971 04/01/1978 06/06/1978 04/01/2018	OL-FP NPF-4	70.5	
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	0909	02/19/1971 08/21/1980 12/14/1980 08/21/2020	OL-FP NPF-7	96.5	
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 02/06/2013	OL-FP DPR-38	81.2	
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 10/06/2013	OL-FP DPR-47	100.2	
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 07/19/2014	OL-FP DPR-55	75.4	
Oyster Creek GPU Nuclear Corp. 9 MI S of Toms River, NJ 050-00219	I	BWR-MARK1 GE 2 B&R B&R	1930	0610	12/15/1964 07/02/1991 12/01/1969 12/15/2004	OL-FP DPR-16	54.7	

(Continued)

Unit Operating Utility Location Docket Number	NRC Region	Cnn Type NSSS AE Constructor	Licensed MWt	Net MDC	CP Issued OL Issued Comm. Op Exp. Date	License Type & Number	1991 Average Capacity Factor (Percent)	Note
Palisades Consumers Power Co. 5 MI S of South Haven, MI 050-00255	III	PWR-DRYAMB COMB CE BECH BECH	2530	0730	03/14/1967 02/21/1991 12/31/1971 03/14/2007	OL-FP DPR-20	76.2	
Palo Verde 1 Arizona Public Service Co. 36 MI W of Phoenix, AZ 050-00528	V	PWR-DRYAMB COMB CE80 BECH BECH	3800	1221	05/25/1976 06/01/1985 01/28/1986 12/31/2024	OL-FP NPF-41	87.1	
Palo Verde 2 Arizona Public Service Co. 36 MI W of Phoenix, AZ 050-00529	V	PWR-DRYAMB COMB CE80 BECH BECH	3800	1221	05/25/1976 04/24/1986 09/19/1986 12/09/2025	OL-FP NPF-51	77.3	
Palo Verde 3 Arizona Public Service Co. 36 MI W of Phoenix, AZ 050-00530	V	PWR-DRYAMB COMB CE80 BECH BECH	3800	1221	05/25/1976 11/25/1987 01/08/1988 03/25/2027	OL-FP NPF-74	70.3	
Peach Bottom 2 Philadelphia Electric Co. 17.9 MI S of Lancaster, PA 050-00277	I	BWR-MARK1 GE 4 BECH BECH	3293	1055	01/31/1968 12/14/1973 07/05/1974 01/31/2008	OL-FP DPR-44	54.8	
Peach Bottom 3 Philadelphia Electric Co. 17.9 MI S of Lancaster, PA 050-00278	I	BWR-MARK1 GE 4 BECH BECH	3293	1035	01/31/1968 07/02/1974 12/23/1974 01/31/2008	OL-FP DPR-56	56.1	
Perry 1 Cleveland Electric Illuminating Co. 7 MI NE of Painesville, OH 050-00440	III	BWR-MARK3 GE 6 GIL KAIS	3579	1166	05/03/1977 11/13/1986 11/18/1987 03/18/2026	OL-FP NPF-58	87.9	
Perry 2 Cleveland Electric Illuminating Co. 7 MI NE of Painesville, OH 050-00441	III	BWR-MARK3 GE 6 GIL KAIS	0000	1205 (DER)	05/03/1977	CP CPPR-149	–	(1)
Pilgrim 1 Boston Edison Co. 4 MI SE of Plymouth, MA 050-00293	I	BWR-MARK1 GE 3 BECH BECH	1998	0670	08/26/1968 09/15/1972 12/01/1972 06/08/2012	OL-FP DPR-35	58.4	
Point Beach 1 Wisconsin Electric Power Co. 13 MI NNW of Manitowoc, WI 050-00266	III	PWR-DRYAMB WEST 2LP BECH BECH	1518	0485	07/19/1967 10/05/1970 12/21/1970 10/05/2010	OL-FP DPR-24	85.4	

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	1991 Average Capacity Factor (Percent)	Note
Point Beach 2 Wisconsin Electric Power Co. 13 MI NNW of Manitowoc, WI 050-00301	III	PWR-DRYAMB WEST 2LP BECH BECH	1518	0485	07/25/1968 03/08/1973 10/01/1972 03/08/2013	OL-FP DPR-27	86.8	
Prairie Island 1 Northern States Power Co. 28 MI SE of Minneapolis, MN 050-00282	III	PWR-DRYAMB WEST 2LP FLUR NSP	1650	0503	06/25/1968 04/05/1974 12/16/1973 08/09/2013	OL-FP DPR-42	90.4	
Prairie Island 2 Northern States Power Co. 28 MI SE of Minneapolis, MN 050-00306	III	PWR-DRYAMB WEST 2LP FLUR NSP	1650	0500	06/25/1968 10/29/1974 12/21/1974 10/29/2014	OL-FP DPR-60	102.3	
Quad Cities 1 Commonwealth Edison Co. 20 MI NE of Moline, IL 050-00254	III	BWR-MARK1 GE 3 S&L UE&C	2511	0769	02/15/1967 12/14/1972 02/18/1973 12/14/2012	OL-FP DPR-29	52.5	
Quad Cities 2 Commonwealth Edison Co. 20 MI NE of Moline, IL 050-00265	III	BWR-MARK1 GE 3 S&L UE&C	2511	0769	02/15/1967 12/14/1972 03/10/1973 12/14/2012	OL-FP DPR-30	78.5	
River Bend 1 Gulf States Utilities Co. 24 MI NNW of Baton Rouge, LA 050-00458	IV	BWR-MARK3 GE 6 S&W S&W	2894	0936	03/25/1977 11/20/1985 06/16/1986 08/29/2025	OL-FP NPF-47	81.6	
Salem 1 Public Service Electric & Gas Co. 18 MI S of Wilmington, DE 050-00272	I	PWR-DRYAMB WEST 4LP PUBS UE&C	3411	1106	09/25/1968 12/01/1976 06/30/1977 08/13/2016	OL-FP DPR-70	70.3	
Salem 2 Public Service Electric & Gas Co. 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	79.1	
San Onofre 1 Southern California Edison Co. & San Diego Gas & Electric Co. 4 MI SE of San Clemente, CA 050-00206	V	PWR-DRYAMB WEST 3LP BECH BECH	1347	0436	03/02/1964 09/26/1991 01/01/1968 03/02/2004	OL-FP DPR-13	53.0	

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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	1991 Average Capacity Factor (Percent)	Note
San Onofre 2 Southern California Edison Co. & San Diego Gas & Electric Co. 4 MI SE of San Clemente, CA 050-00361	V	PWR-DRYAMB COMB CE BECH BECH	3390	1070	10/18/1973 09/07/1982 08/08/1983 10/18/2013	OL-FP NPF-10	61.5	
San Onofre 3 Southern California Edison Co. & San Diego Gas & Electric Co. 4 MI SE of San Clemente, CA 050-00362	V	PWR-DRYAMB COMB CE BECH BECH	3390	1080	10/18/1973 09/16/1983 04/01/1984 10/18/2013	OL-FP NPF-15	91.9	
Seabrook 1 Public Service Co. of NH 13 MI S of Portsmouth, NH 050-00443	I	PWR-DRYAMB WEST 4LP UE&C UE&C	3411	1150	07/07/1976 03/15/1990 08/19/1990 10/17/2026	OL-FP NPF-86	67.6	
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	73.9	
Sequoyah 2 Tennessee Valley Authority 9.5 MI NE of Chattanooga, TN 050-00328	II	PWR-ICECND WEST 4LP TVA TVA	3411	1122	05/27/1970 09/15/1981 06/01/1982 09/15/2021	OL-FP DPR-79	94.8	
Shearon Harris 1 Carolina Power & Light Co. 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	78.6	
South Texas Project 1 Houston Lighting & Power Co. 12 MI SSW of Bay City, TX 050-00498	IV	PWR-DRYAMB WEST 4LP BECH EBSO	3800	1251	12/22/1975 03/22/1988 08/25/1988 08/20/2027	OL-FP NPF-76	65.8	
South Texas Project 2 Houston Lighting & Power Co. 12 MI SSW of Bay City, TX 050-00499	IV	PWR-DRYAMB WEST 4LP BECH EBSO	3800	1251	12/22/1975 03/28/1989 06/19/1989 12/15/2028	OL-FP NPF-80	66.2	
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	78.8	

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	1991 Average Capacity Factor (Percent)	Note
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	101.1	
Summer South Carolina Electric & Gas Co. 26 MI NW of Columbia, SC 050-00395	II	PWR-DRYAMB WEST 3LP GIL DANI	2775	0885	03/21/1973 11/12/1982 01/01/1984 08/06/2022	OL-FP NPF-12	68.9	
Surry 1 Virginia Electric & Power Co. 17 MI NW of Newport News, VA 050-00280	II	PWR-DRYSUB WEST 3LP S&W S&W	2441	0781	06/25/1968 05/25/1972 12/22/1972 05/25/2012	OL-FP DPR-32	96.3	
Surry 2 Virginia Electric & Power Co. 17 MI NW of Newport News, VA 050-00281	II	PWR-DRYSUB WEST 3LP S&W S&W	2441	0781	06/25/1968 01/29/1973 05/01/1973 01/29/2013	OL-FP DPR-37	58.3	
Susquehanna 1 Pennsylvania Power & Light Co. 7 MI NE of Berwick, PA 050-00387	I	BWR-MARK2 GE 4 BECH BECH	3293	1040	11/02/1973 11/12/1982 06/08/1983 07/17/2022	OL-FP NPF-14	96.8	
Susquehanna 2 Pennsylvania Power & Light Co. 7 MI NE of Berwick, PA 050-00388	I	BWR-MARK2 GE 4 BECH BECH	3293	1044	11/02/1973 06/27/1984 02/12/1985 03/23/2024	OL-FP NPF-22	76.9	
Three Mile Island 1 GPU Nuclear Corp. 10 MI SE of Harrisburg, PA 050-00289	I	PWR-DRYAMB B&W LLP GIL UE&C	2568	0808	05/18/1968 04/19/1974 09/02/1974 04/19/2014	OL-FP DPR-50	80.1	
Trojan Portland General Electric Co. 32 MI N of Portland, OR 050-00344	V	PWR-DRYAMB WEST 4LP BECH BECH	3411	1095	02/08/1971 11/21/1975 05/20/1976 02/08/2011	OL-FP NPF-1	15.3	
Turkey Point 3 Florida Power & Light Co. 25 MI S of Miami, FL 050-00250	II	PWR-DRYAMB WEST 3LP BECH BECH	2200	0666	04/27/1967 07/19/1972 12/14/1972 04/27/2007	OL-FP DPR-31	22.5	
Turkey Point 4 Florida Power & Light Co. 25 MI S of Miami, FL 050-00251	II	PWR-DRYAMB WEST 3LP BECH BECH	2200	0666	04/27/1967 04/10/1973 09/07/1973 04/27/2007	OL-FP DPR-41	13.7	

(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	1991 Average Capacity Factor (Percent)	Note
Vermont Yankee VT Yankee Nuclear Power Corp. 5 MI S of Brattleboro, VT 050-00271	I	BWR-MARK1 GE 4 EBSO EBSO	1593	0504	12/11/1967 02/28/1973 11/30/1972 03/21/2012	OL-FP DPR-28	93.1	
Vogtle 1 Georgia Power Co. 26 MI SE of Augusta, GA 050-00424	II	PWR-DRYAMB WEST SBEC GPC	3411	1100	06/28/1974 03/16/1987 06/01/1987 01/16/2027	OL-FP NPF-68	77.8	
Vogtle 2 Georgia Power Co. 26 MI SE of Augusta, GA 050-00425	II	PWR-DRYAMB WEST 4LP SBEC GPC	3411	1097	06/28/1974 03/31/1989 05/20/1989 02/09/2029	OL-FP NPF-81	92.6	
Washington Nuclear 1 Washington Public Power Supply System 12 MI NW of Richland, WA 050-00460	V	PWR-DRYAMB B&W LLP UE&C BECH	0000	1266 (DER)	12/24/1975	CP CPPR-134	–	(1)
Washington Nuclear 2 Washington Public Power Supply System 12 MI NW of Richland, WA 050-00397	V	BWR-MARK2 GE 5 B&R BECH	3323	1085	03/19/1973 04/13/1984 12/13/1984 12/20/2023	OL-FP NPF-21	44.3	
Washington Nuclear 3 Washington Public Power Supply System 26 MI W of Olympia, WA 050-00508	V	PWR-DRYAMB COMB CE80 EBSO EBSO	0000	1242 (DER)	04/11/1978	CP CPPR-154	–	(1)
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	77.3	
Watts Bar 1 Tennessee Valley Authority 10 MI S of Spring City, TN 050-00390	II	PWR-ICECND WEST 4LP TVA TVA	0000	1165 (DER)	01/23/1973	CP CPPR-91	–	(2)
Watts Bar 2 Tennessee Valley Authority 10 MI S of Spring City, TN 050-00391	II	PWR-ICECND WEST 4LP TVA TVA	0000	1165 (DER)	01/23/1973	CP CPPR-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	12/91 Average Capacity Factor (Percent)	Note
Wolf Creek 1 Wolf Creek Nuclear Operating Corp. 3.5 MI NE of Burlington, KS 050-00482	IV	PWR-DRYAMB WEST 4LP BECH DANI	3411	1135	05/31/1977 06/04/1985 09/03/1985 03/11/2025	OL-FP NPF-42	58.9	
Yankee-Rowe Yankee Atomic Electric Co. 21 MI NE of Pittsfield, MA 050-00029	I	PWR-DRYAMB WEST 4LP S&W S&W	0600	0167	11/04/1957 12/24/1963 07/01/1961 07/09/2000	OL-FP DPR-3	67.8	(3)
Zion 1 Commonwealth Edison Co. 40 MI N of Chicago, IL 050-00295	III	PWR-DRYAMB WEST 4LP S&L CWE	3250	1040	12/26/1968 10/19/1973 12/31/1973 04/06/2013	OL-FP DPR-39	46.8	
Zion 2 Commonwealth Edison Co. 40 MI N of Chicago, IL 050-00304	III	PWR-DRYAMB WEST 4LP S&L CWE	3250	1040	12/26/1968 11/14/1973 09/17/1974 11/14/2013	OL-FP DPR-48	56.3	

Note: (1) Deferred Construction
(2) Under Construction
(3) Under 10 CFR 50.82, Yankee Atomic Electric Company applied for termination of their license. Permanent cessation of power operation of the Yankee-Rowe nuclear power reactor was effective on 02/27/92.

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

Appendix B

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

Unit Location	Con Type MWt	OL Issued Shut Down	Decommissioning Alternative Selected Current Status
Bonus *	BWR	04/02/1964	ENTOMB
Punta Higuera, PR	50	06/01/1968	ENTOMB
CVTR **	PHW	11/27/1962	SAFSTOR
Parr, SC	65	01/01/1967	SAFSTOR
Dresden 1	BWR	09/28/1959	SAFSTOR
Morris, IL	700	10/31/1978	SAFSTOR Preparation
Elk River *	BWR	11/06/1962	DECON
Elk River, MN	58	02/01/1968	DECON Completed
Fermi 1	SCF	05/10/1963	SAFSTOR
Lagoona Beach, MI	200	11/29/1972	SAFSTOR
Fort St. Vrain	HTG	12/21/1973	DECON
Platteville, CO	842	08/18/1989	NRC Review
GE VBWR	BWR	08/31/1957	SAFSTOR
Pleasanton, CA	50	12/09/1963	SAFSTOR
Hallam *	SCGM	01/02/1962	ENTOMB
Hallam, NE	256	09/01/1964	ENTOMB
Humboldt Bay	BWR	08/28/1962	SAFSTOR
Eureka, CA	200	07/02/1976	SAFSTOR
Indian Point 1	PWR	03/26/1962	SAFSTOR
Buchanan, NY	615	10/31/1984	NRC Review
La Crosse	BWR	07/03/1967	SAFSTOR
Genoa, WI	165	04/30/1987	SAFSTOR
Pathfinder	BwR	03/12/1964	SAFSTOR
Sioux Falls, SD	190	10/01/1967	DECON in Progress
Peach Bottom 1	HTG	01/24/1966	SAFSTOR
Peach Bottom, PA	115	10/01/1974	SAFSTOR

Unit Location	Con Type MWt	OL Issued Shut Down	Decommissioning Alternative Selected Current Status
Piqua *	OCM	08/23/1962	ENTOMB
Piqua, OH	46	01/01/1966	ENTOMB
Rancho Seco	PWR	08/16/1974	SAFSTOR
Herald, CA	2772	06/07/1989	NRC Review
Shippingport *	PWR	N/A	DECON
Shippingport, PA	236	1982	DECON Completed
Shoreham	BWR	04/21/1989	DECON
Wading River, NY	2436	06/28/1989	NRC Review
Three Mile Island 2	PWR	02/08/1978	***
Londonderry Township, PA	2770	03/28/1979	

* AEC/DOE owned; not regulated by NRC.

** Holds byproduct license from State of South Carolina.

*** Three Mile Island 2 is undergoing decontamination in selected areas. On completion of these activities, the plant will be placed in a monitored storage mode for an indefinite period.

Note:

Includes reactors of 10 MWt capacity or greater.

ENTOMB is defined as the alternative 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.

SAFSTOR is defined as the alternative 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.

DECON is defined as the alternative 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.

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

Appendix C

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
Atlanta 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
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

Unit Utility	Con Type MWe Per Unit	Canceled Date Status
Erie 1 & 2 Ohio Edison Company	PWR 1260	1980 Under CP Review
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 Reiew
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

(Continued)

Unit Utility	Con Type MWe Per Unit	Canceled Date Status
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
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
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

Unit Utility	Con Type MWe Per Unit	Canceled Date Status
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
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 4 Washington Public Power Supply System	PWR 1218	1982 With CP
Washington Nuclear 5 Washington Public Power Supply System	PWR 1242	1982 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: Cancelation is defined as public announcement of cancelation or written notification to NRC.
Only docketed applications are indicated.
Source: DOE/EIA Commercial Nuclear Power 1990 (DOE/EIA-0438 (90)) and Nuclear Regulatory Commission

Appendix D

U.S. Commercial Nuclear Power Reactors by Licensee

Utility	Unit
Arizona Public Service Company	Palo Verde 1, 2, & 3
Baltimore Gas & Electric Company	Calvert Cliffs 1 & 2
Boston Edison Company	Pilgrim 1
Carolina Power & Light Company	Brunswick 1 & 2
Carolina Power & Light Company	H. B. Robinson 2
Carolina Power & Light Company	Shearon Harris 1
Cleveland Electric Illuminating Company	Perry 1 & 2
Commonwealth Edison Company	Braidwood 1 & 2
Commonwealth Edison Company	Byron 1 & 2
Commonwealth Edison Company	Dresden 2 & 3
Commonwealth Edison Company	La Salle County 1 & 2
Commonwealth Edison Company	Quad Cities 1 & 2
Commonwealth Edison Company	Zion 1 & 2
Consolidated Edison Company	Indian Point 2
Consumers Power Company	Big Rock Point
Consumers Power Company	Palisades
CT Yankee Atomic Power Company	Haddam Neck
Detroit Edison Company	Fermi 2
Duke Power Company	Catawba 1 & 2
Duke Power Company	McGuire 1 & 2
Duke Power Company	Oconee 1, 2, & 3
Duquesne Light Company	Beaver Valley 1 & 2
Entergy Operations, Incorporated	Arkansas Nuclear 1 & 2
Entergy Operations, Incorporated	Waterford 3
Entergy Operations, Incorporated	Grand Gulf 1
Florida Power Corporation	Crystal River 3
Florida Power & Light Company	St. Lucie 1 & 2
Florida Power & Light Company	Turkey Point 3 & 4
Georgia Power Company	Edwin I. Hatch 1 & 2
Georgia Power Company	Vogtle 1 & 2
GPU Nuclear Corporation	Oyster Creek
GPU Nuclear Corporation	Three Mile Island 1
Gulf States Utilities Company	River Bend 1
Houston Lighting & Power Company	South Texas Project 1 & 2
Illinois Power Company	Clinton
Indiana/Michigan Power Company	D. C. Cook 1 & 2

Utility	Unit
Iowa Electric Light & Power Company	Duane Arnold
Maine Yankee Atomic Power Company	Maine Yankee
Nebraska Public Power District	Cooper
Niagara Mohawk Power Corporation	Nine Mile Point 1 & 2
Northeast Nuclear Energy Company	Millstone 1, 2, & 3
Northern States Power Company	Monticello
Northern States Power Company	Prairie Island 1 & 2
Omaha Public Power District	Fort Calhoun
Pacific Gas & Electric Company	Diablo Canyon 1 & 2
Pennsylvania Power & Light Company	Susquehanna 1 & 2
Philadelphia Electric Company	Limerick 1 & 2
Philadelphia Electric Company	Peach Bottom 2 & 3
Portland General Electric Company	Trojan
Power Authority of the State of New York	Indian Point 3
Power Authority of the State of New York	James A. FitzPatrick
Public Service Company of New Hampshire	Seabrook 1
Public Service Electric & Gas Company	Hope Creek 1
Public Service Electric & Gas Company	Salem 1 & 2
Rochester Gas & Electric Corporation	Ginna
South Carolina Electric & Gas Company	Summer
Southern California Edison Co. & San Diego Gas & Electric Company	San Onofre 1, 2, & 3
Southern Nuclear Operating Company	Joseph M. Farley 1 & 2
Tennessee Valley Authority	Bellefonte 1 & 2
Tennessee Valley Authority	Browns Ferry 1, 2, & 3
Tennessee Valley Authority	Sequoyah 1 & 2
Tennessee Valley Authority	Watts Bar 1 & 2
Texas Utilities Electric Company	Comanche Peak 1 & 2
Toledo Edison Company	Davis-Besse
Union Electric Company	Callaway
VT Yankee Nuclear Power Corporation	Vermont Yankee
Virginia Electric & Power Company	North Anna 1 & 2
Virginia Electric & Power Company	Surry 1 & 2
Washington Public Power Supply System	Washington Nuclear 1, 2, & 3
Wisconsin Electric Power Company	Point Beach 1 & 2
Wisconsin Public Service Company	Kewaunee
Wolf Creek Nuclear Operating Corporation	Wolf Creek 1
Yankee Atomic Electric Company	Yankee-Rowe

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
Arkansas Tech University Russellville, AR	Trina CP Application Under Review by NRC		
Armed Forces Radiobiology Research Institute Bethesda, MD	Triga 06/26/1962	OL 50-170	R-84
Cornell University Ithaca, NY	Zero Power 12/11/1962	OL 50-97	R-89
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 Atomics Mark I San Diego, CA	Triga Mark I 05/03/1953	OL 50-89	R-38
General Atomics Mark F San Diego, CA	Triga Mark F 07/01/1960	OL 50-163	R-67
General Electric Pleasanton, CA	Nuclear Test 10/31/1957	OL 50-73	R-33
Georgia Institute of Technology Atlanta, GA	Heavy Water 12/29/1964	OL 50-160	R-97
Idaho State University Pocatello, ID	AGN-201 #103 10/11/1967	OL 50-284	R-110
Iowa State University Ames, IA	UTR-10 10/16/1959	OL 50-116	R-59
Kansas State University Manhattan, KS	Triga 10/16/1962	OL 50-188	R-88
Manhattan College Bronx, NY	Tank 03/24/1964	OL 50-199	R-94
Massachusetts Institute of Technology Cambridge, MA	HWR Reflected 06/09/1958	OL 50-20	R-37

Licensee Location	Reactor Type OL Issued	License Type Docket Number	License Number
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
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
State University of New York (Buffalo) Buffalo, NY	Pulstar 03/24/1961	OL 50-57	R-77
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

(Continued)

Licensee Location	Reactor Type OL Issued	License Type Docket Number	License Number
University of Florida Gainesville, FL	Argonaut 05/21/1959	OL 50-83	R-56
University of Illinois Urbana, IL	Triga 07/22/1969	OL 50-151	R-115
University of Illinois Urbana, IL	Lopra 12/27/1971	OL 50-356	R-117
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
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, Triga Salt Lake City, UT	Triga Mark I 09/30/1975	OL 50-407	R-126
University of Virginia Charlottesville, VA	Pool 06/27/1960	OL 50-62	R-66
University of Washington* Seattle, WA	Argonaut 03/31/1961	OL 50-139	R-73
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

Licensee Location	Reactor Type OL Issued	License Type Docket Number	License Number
Worcester Polytechnic Institute Worcester, MA	GE 12/16/*959	OL 50-134	R-61

*The NRC is currently reviewing application to decommission facility.

Source: Nuclear Regulatory Commission

Appendix F

World List of Nuclear Power Reactors

Country	In Operation		Under Construction Or On Order		Total	
	Number of Units	Net MWe	Number of Units	Net MWe	Number of Units	Net MWe
Argentina	2	935	1	692	3	1,627
Belgium	7	5,484	0	0	7	5,484
Brazil	1	626	2	2,458	3	3,084
Bulgaria	6	3,538	2	1,906	8	5,444
Canada	19	12,799	3	2,643	22	15,442
China	0	0	3	2,100	3	2,100
Cuba	0	0	2	834	2	834
Czechoslovakia	8	3,264	6	3,340	14	6,604
Finland	4	2,310	0	0	4	2,310
France	55	55,608	6	8,205	61	63,813
Germany	21	22,408	0	0	21	22,408
Hungary	4	1,695	0	0	4	1,695
India	7	1,394	9	2,480	16	3,874
Japan	42	31,994	13	12,495	55	44,489
Kazakhstan	1	135	0	0	1	135
Korea	9	7,220	5	4,463	14	11,683
Lithuania	2	2,760	0	0	2	2,760
Mexico	1	654	1	654	2	1,308
Netherlands	2	507	0	0	2	507
Pakistan	1	125	1	300	2	425
Philippines	0	0	1	620	1	620
Romania	0	0	5	3,100	5	3,100
Russia	24	17,751	16	14,575	40	32,326
South Africa	2	1,840	0	0	2	1,840
Spain	9	7,071	6	5,747	15	12,818
Sweden	12	9,907	0	0	12	9,907
Switzerland	5	2,936	0	0	5	2,936
Taiwan, China	6	4,884	0	0	6	4,884
Ukraine	15	13,020	6	5,700	21	18,720
United Kingdom	37	11,934	1	1,188	38	13,122
USA	111	99,673	8	9,634	119	109,307
Yugoslavia	1	620	0	0	1	620
Total	**414**	**323,092**	**97**	**83,134**	**511**	**406,226**

Note: Operable, under construction, or on order (30 MWe and over) as of 12/31/91.

Source: Nuclear News (2/92)

Nuclear Power Units by Reactor Type, Worldwide

Reactor Type	In Operation		Total	
	Number of Units	Net MWe	Number of Units	Net MWe
Pressurized light-water reactors	238	206,877	298	263,981
Boiling light-water reactors	88	71,908	100	83,705
Gas-cooled reactors, all varieties	39	12,807	39	12,807
Heavy-water reactors, all varieties	29	15,710	48	25,288
Graphite-moderated light-water reactors	16	14,612	17	15,537
Liquid metal fast-breeder reactors	4	1,178	9	4,908
Total	**414**	**323,092**	**511**	**406,226**

Note: Operable, under construction, or on order (30 MWe and over) as of 12/31/91.
Source: Nuclear News (2/92)

Appendix H

Top 50 Units by Capacity Factor, Worldwide

Country	Unit	Reactor Type	Vendor	1991 Gross Capacity Factor (Percent)	1991 Gross Generation
U.S.	St. Lucie 2	PWR	COMB	101.33	7829
U.S.	Callaway	PWR	WEST	100.09	10452
Canada	Pickering 6	HWR	AECL	99.75	4719
Japan	Fukushima I - 5	BWR	TOSH	99.56	6838
Canada	Pickering 8	HWR	AECL	99.23	4694
Japan	Kashiwazaki - Kariwa 1	BWR	TOSH	97.82	9426
Canada	Point Lepreau	HWR	AECL	97.66	5818
Japan	Fukushima I - 4	BWR	HIT	97.61	6703
U.S.	North Anna 2	PWR	WEST	97.37	8078
U.S.	Oconee 2	PWR	B&W	97.23	7759
U.S.	Prairie Island 2	PWR	WEST	96.61	4739
U.S.	Susquehanna 1	BWR	GE	96.16	9140
U.S.	Surry 1	PWR	WEST	96.12	6938
Spain	Garona	BWR	GE	95.63	3854
Spain	Almaraz 1	PWR	WEST	95.60	7783
Canada	Pickering 7	HWR	AECL	95.06	4497
Finland	Olkiluoto 1	BWR	ASEA	94.70	6097
Japan	Tsuruga 2	PWR	MHI	94.39	9592
Germany	Emsland	PWR	KWU	94.15	10837
Japan	Ikata 1	PWR	MHI	93.35	4628
U.S.	Sequoyah 2	PWR	WEST	93.31	9670
Canada	Bruce 6	HWR	AECL	93.24	7474
U.S.	Joseph M. Farley 2	PWR	WEST	92.82	7090
U.S.	San Onofre 3	PWR	COMB	92.66	9148
Finland	Olkiluoto 2	BWR	ASEA	92.40	5949
Canada	Bruce 8	HWR	AECL	92.29	7398
U.S.	McGuire 2	PWR	WEST	92.27	9902
Argentina	Atucha	HWR	KWU	92.04	2634
U.S.	Vogtle 2	PWR	WEST	92.00	9349
U.S.	Beaver Valley 2	PWR	WEST	91.76	7138
South Korea	Ulchin 1	PWR	KWU	91.72	7633
U.S.	La Salle County 2	BWR	GE	91.63	9006
France	Chinon B3	PWR	FRAM	91.46	7403
U.S.	Vermont Yankee	BWR	GE	91.17	4313
South Korea	Wolsung 1	HWR	AECL	91.11	5417
Germany	Grafenrheinfeld	PWR	KWU	90.26	10279
Hungary	Paks 2	PWR	AEE	90.11	3631

Country	Unit	Reactor Type	Vendor	1991 Gross Capacity Factor (Percent)	1991 Gross Generation
Canada	Bruce 5	HWR	AECL	90.02	7216
South Korea	Kori 1	PWR	WEST	89.88	4622
U.S.	Byron 2	PWR	WEST	89.55	9217
Britain	Hunterston B-2	GCR	TNPG	89.21	5143
Sweden	Barsebaeck 2	BWR	ASEA	89.16	4804
Finland	Loviisa 2	PWR	AEE	89.16	3632
Switzerland	Goesgen	PWR	KWU	89.13	7573
Belgium	Doel 1	PWR	ACECOWEN	89.03	3213
U.S.	Duane Arnold	BWR	GE	88.99	4412
Germany	Isar 1	BWR	KWU	88.87	7061
Sweden	Forsmark 1	BWR	ASEA	88.43	7785
Sweden	Oskarshamn 3	BWR	ASEA	88.33	9324
Hungary	Paks 4	PWR	AEE	88.16	3553

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Appendix I

Top 50 Units by Generation, Worldwide

Country	Unit	Reactor Type	Vendor	1991 Gross Generation	1991 Gross Capacity Factor (Percent)
Germany	Emsland	PWR	KWU	10837	94.15
Germany	Grohnde	PWR	KWU	10518	86.13
U.S.	Callaway	PWR	WEST	10452	100.09
Germany	Philippsburg 2	PWR	KWU	10415	88.07
Germany	Isar 2	PWR	KWU	10314	84.10
Germany	Grafenrheinfeld	PWR	KWU	10279	90.26
France	Cattenom 3	PWR	FRAM	10182	85.34
Germany	Neckar 2	PWR	KWU	10143	88.12
Germany	Brokdorf	PWR	KWU	9988	81.73
France	Paluel 3	PWR	FRAM	9978	84.68
France	Golfech 1	PWR	FRAM	9960	83.42
U.S.	McGuire 2	PWR	WEST	9902	92.27
U.S.	Palo Verde 1	PWR	COMB	9876	86.26
U.S.	Sequoyah 2	PWR	WEST	9670	93.31
Japan	Tsuruga 2	PWR	MHI	9592	94.39
U.S.	Grand Gulf 1	BWR	GE	9507	83.10
Japan	Kashiwazaki - Kariwa 1	BWR	TOSH	9426	97.82
U.S.	Perry	BWR	GE	9410	85.94
U.S.	Vogtle 2	PWR	WEST	9349	92.00
Sweden	Oskarshamn 3	BWR	ASEA	9324	88.33
U.S.	Byron 2	PWR	WEST	9217	89.55
U.S.	San Onofre 3	PWR	COMB	9148	92.66
U.S.	Susquehanna 1	BWR	GE	9140	96.16
France	Belleville 1	PWR	FRAM	9027	77.48
U.S.	La Salle County 2	BWR	GE	9006	91.63
Sweden	Forsmark 3	BWR	ASEA	8998	86.17
France	Penly 1	PWR	FRAM	8818	72.84
U.S.	Palo Verde 2	PWR	COMB	8779	76.67
France	Paluel 4	PWR	FRAM	8689	73.75
France	Nogent 2	PWR	FRAM	8687	74.56
Germany	Gundremmingen C	BWR	KWU	8578	74.75
U.S.	D.C. Cook 2	PWR	WEST	8481	85.45
Germany	Gundremmingen B	BWR	KWU	8472	73.83
U.S.	Limerick 1	BWR	GE	8455	84.67
France	Flamanville 2	PWR	FRAM	8315	70.57
France	St. Alban/St. Maurice 2	PWR	FRAM	8297	70.26
France	St. Alban/St. Maurice 1	PWR	FRAM	8290	70.20

Country	Unit	Reactor Type	Vendor	1991 Gross Generation	1991 Gross Capacity Factor (Percent)
France	Belleville 2	PWR	FRAM	8216	70.52
Germany	Kruemmel	BWR	KWU	8112	70.37
U.S.	Diablo Canyon 2	PWR	WEST	8100	79.44
U.S.	North Anna 2	PWR	WEST	8078	97.37
Belgium	Tihange 3	PWR	ACECOWEN	8043	85.81
Japan	Fukushima II-3	BWR	TOSH	8033	83.37
U.S.	Palo Verde 3	PWR	COMB	8010	69.96
U.S.	Salem 2	PWR	WEST	7995	78.01
France	Cattenom 2	PWR	FRAM	7962	68.39
U.S.	Vogtle 1	PWR	WEST	7878	77.53
Belgium	Doel 4	PWR	ACECOWEN	7851	85.44
U.S.	St. Lucie 2	PWR	COMB	7829	101.33
Spain	Almaraz 1	PWR	WEST	7789	95.60

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 this report. Measured in watts.

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.

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

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

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

GENERATION EXPENSE: Generation expenses include costs associated both with production expenses (operation, maintenance and fuel costs) and with capital expenses (taxes, depreciation, interest, return on equity, etc.). Generation expenses comprise the total cost of producing electricity that is the basis for rates charged to electric utility customers. Production expenses are variable costs that a utility has some short-term control over and may vary

according to the amount of electricity generated in a year. Capital expenses are generally fixed charges that are amortized over a facility's life and must be paid whether or not a facility operates.

GIGAWATT: One billion watts.

GIGAWATTHOUR : One billion watthours.

HIGH-LEVEL WASTE: High-level radioactive waste (HLW) means (I) 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 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.

MAJOR INVESTOR-OWNED ELECTRIC UTILITY: An investor-owned electric utility that has had in the last three consecutive calendar years sales of electricity or transmission service that exceed at least one of the following: (1) 1 million megawatthours of total annual sales of electricity, (2) 100 megawatthours of annual sales of electricity for resale, (3) 500 megawatthours of annual gross exchange of electricity between utilities, or (4) 500 megawatthours of wheeling for others (deliveries plus losses). Investor-owned electric utilities account for about 75 percent of total generation in the United States.

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 due to cooling water temperature variations. 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.

MAXIMUM DEPENDABLE CAPACITY (Net): Gross maximum dependable capacity less the normal station service loads. Measured in watts.

MEGAWATT (MW): One million watts.

MEGAWATTHOUR (MWh): One million watthours.

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.

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.

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.

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.

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.

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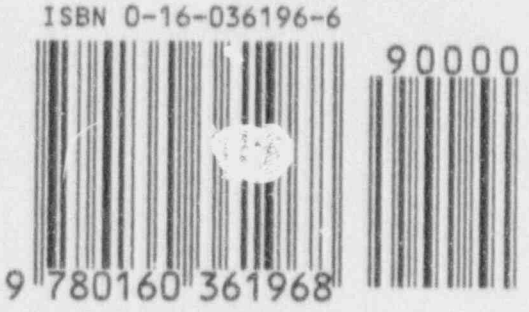

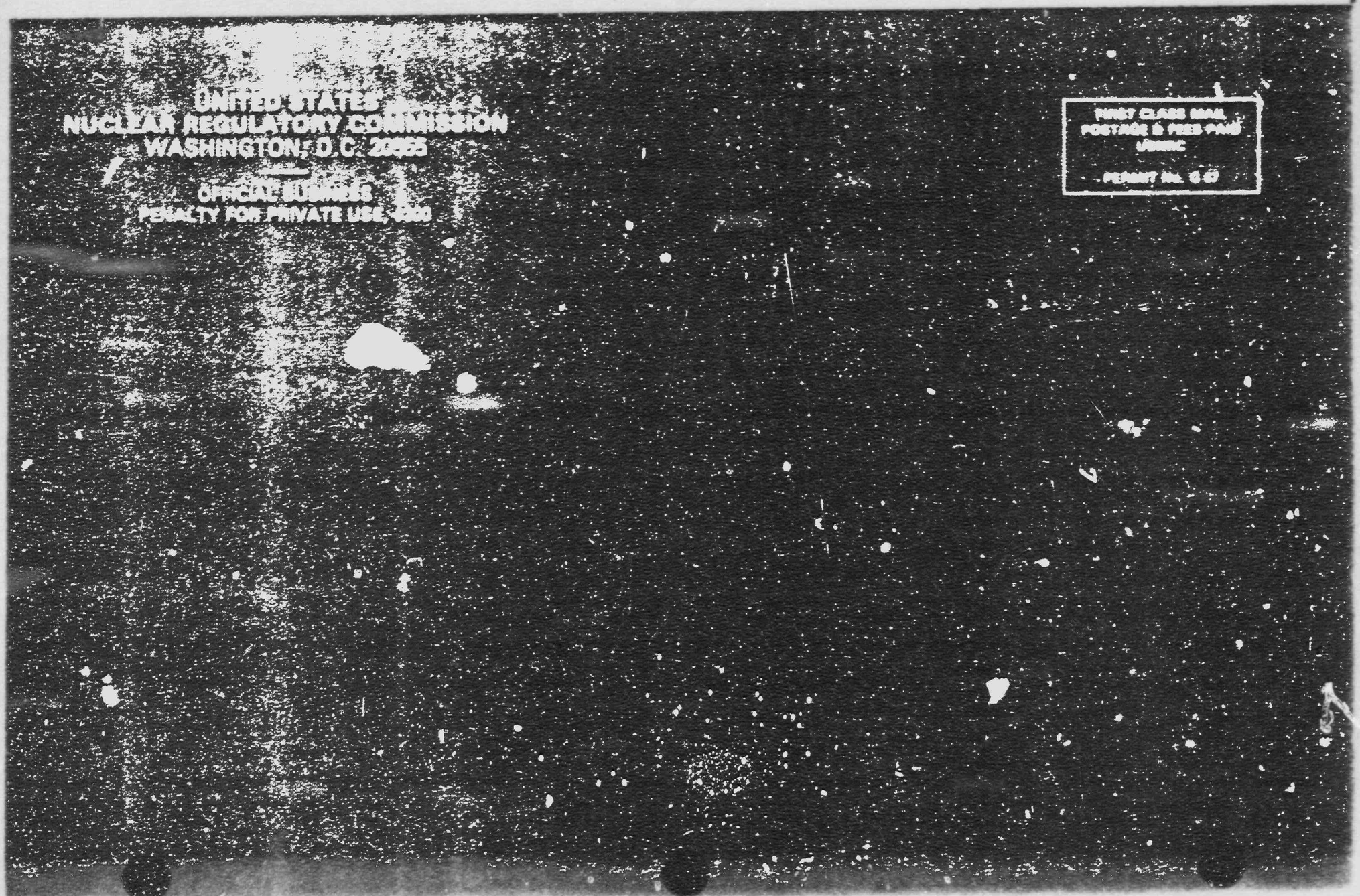
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