U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

2022-2023 Information Digest

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   Washington, DC 20402-0001
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   Telephone: (202) 512-1800
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   5301 Shawnee Road
   Alexandria, VA 22312-0002
   Internet: www.ntis.gov
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The NRC Technical Library
Two White Flint North
11545 Rockville Pike
Rockville, MD 20852-2738

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11 West 42nd Street
New York, NY 10036-8002
Internet: www.ansi.org
(212) 642-4900

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ABSTRACT

The U.S. Nuclear Regulatory Commission (NRC) has published the Information Digest annually since 1989. Beginning with this edition, the Digest will begin a 2-year publication cycle. The Digest provides information about agency activities and licensees from the various industries it regulates. It describes the agency's responsibilities and activities and provides general information on nuclear-related topics. It includes NRC and industry data in an easy-to-read format.

The 2022–2023 Information Digest includes NRC and non-NRC data (e.g., International Atomic Energy Agency, Energy Information Administration, and U.S. Department of Energy), which were updated as of September 30, 2022, including data in maps and graphics. Beginning with this edition, the Digest includes QR codes to direct users to the most current information. The next Information Digest containing updated data will be published in February 2025.

The NRC reviews the information from industry and international sources but does not independently verify it. The NRC is the source of all photographs, graphics, and tables unless otherwise noted. All information is final unless otherwise noted. Any corrections and updates will appear in the digital version on the NRC website at https://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr1350/.

The NRC welcomes comments or suggestions on the Information Digest. To submit comments, write to the Office of Public Affairs at U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or at opa.resource@nrc.gov.

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Mission Statement

The U.S. Nuclear Regulatory Commission (NRC) licenses and regulates the Nation's civilian use of radioactive materials to provide reasonable assurance of adequate protection of public health and safety, and to promote the common defense and security, and to protect the environment.

Commission

Chair Christopher T. Hanson	Term ends June 30, 2024
Commissioner Jeff Baran	Term ends June 30, 2023
Commissioner David A. Wright	Term ends June 30, 2025
Commissioner Annie Caputo	Term ends June 30, 2026
Commissioner Bradley R. Crowell	Term ends June 30, 2027

Locations

Headquarters:

U.S. Nuclear Regulatory Commission Rockville, MD	301-415-7000 800-368-5642

Regional Offices:

Region I—King of Prussia, PA	610-337-5000 800-432-1156
Region II—Atlanta, GA	404-997-4000 800-577-8510
Region III—Lisle, IL	630-829-9500 800-522-3025
Region IV—Arlington, TX	817-200-8100 800-952-9677

Headquarters Operations Center

Rockville, MD 301-816-5100

The NRC staffs a 24-hour Operations Center that coordinates incident response with Federal, State, Tribal, and local agencies.

Training and Professional Development

Technical Training Center Chattanooga, TN	423-855-6500
Professional Development Center Rockville, MD	301-287-0556

Resident Sites

At least two NRC resident inspectors, who report to the appropriate regional office, are assigned at each operating nuclear power plant site.

NRC Fiscal Year 2022 Budget

- *Total budget authority: $905.7 million ($887.7 million enacted budget, $2 million supplemental appropriation, and $16 million authorized carryover)*
- *Total authorized staff: 2,882 full-time equivalents*
- *Estimated fees to be recovered: $756.7 million*
- *Separate appropriation for the Office of the Inspector General: $13.8 million*
- *Total research budget: $81.4 million*
  - *Reactor Program: $56 million*
  - *New/Advanced Reactor Licensing: $20.1 million*
  - *Materials and Waste: $5.3 million*

What Does the NRC Do?

- *Regulation and guidance—rulemaking*
- *Policymaking*
- *Licensing, decommissioning, and certification*
- *Research*
- *Oversight and enforcement*
- *Incident response*
- *Emergency preparedness and response*

Nuclear Governing Legislation

The NRC was established by the Energy Reorganization Act of 1974. The most significant laws that govern the regulatory process of the agency are available on the NRC website at https://www.nrc.gov/about-nrc/governing-laws.html. The NRC's regulations are found in Title 10, "Energy," of the *Code of Federal Regulations* (10 CFR). The text of many laws can be found in NUREG-0980, "Nuclear Regulatory Legislation."

NRC BY THE NUMBERS

U.S. Electricity Generated by Commercial Nuclear Power

NRC-licensed nuclear reactors generate about 19 percent of U.S. gross electricity, or about 778 billion kilowatt-hours.

Nuclear Reactors

- *92 commercial nuclear power reactors operating in 28 States at 54 sites*
  - *Vogtle Unit 3 (Southern Nuclear Operating Co.) plans to enter service in 2023. Unit 4 is still under construction.*
- *61 pressurized-water reactors and 31 boiling-water reactors*
- *Three reactor fuel vendors*
- *21 parent operating companies*
- *About 80 different designs*
- *About 5,960 total inspection and assessment hours at each operating reactor in Fiscal Year (FY) 2021*

Reactor License Renewal

Commercial power reactor operating licenses are valid for 40 years and a renewed license of up to 20-years may be requested.

- *94 reactors have been issued initial renewed licenses, including 11 reactors now permanently shut down.*
- *Eight reactors operate under their original licenses.*

Subsequent License Renewal

This type of licensing allows a plant to operate for an additional 20-year term beyond its initial license renewal, allowing it to operate from 60 to 80 years.

- *Six reactors at three sites have been issued subsequent renewed licenses.*
- *Nine reactors at four sites have subsequent license renewal applications under review.*
- *Four licensees with a total of seven reactors have submitted letters of intent to request subsequent license renewals.*

Early Site Permits for New Reactors

- *Six early site permits have been issued:*
  - *System Energy Resources, Inc., for the Grand Gulf site in Mississippi*
  - *Exelon Generation Co., LLC, for the Clinton site in Illinois*
  - *Dominion Nuclear North Anna, LLC, for the North Anna site in Virginia*
  - *Southern Nuclear Operating Co., for the Vogtle site in Georgia*
  - *PSEG Power, LLC, and PSEG Nuclear, LLC, for a site in New Jersey*
  - *Tennessee Valley Authority for two or more small modular reactors at the Clinch River Nuclear Site in Tennessee*

Combined License—Construction and Operating License for New Reactors

- *Since June 2007, the NRC has received and docketed 18 combined license (COL) applications for 28 new, large light-water reactors. The NRC has received, docketed, and rejected a COL application for the Oklo advanced reactor.*
- *The NRC suspended or canceled 10 COL application reviews at the request of the applicants for Bell Bend, Pennsylvania; Bellefonte, Alabama; Callaway, Missouri; Calvert Cliffs, Maryland; Comanche Peak, Texas; Grand Gulf, Mississippi; Nine Mile Point, New York; River Bend, Louisiana; Shearon Harris, North Carolina; and Victoria County Station, Texas.*
- *The NRC has issued COLs for 14 reactors at Fermi, Michigan; Levy County, Florida; North Anna, Virginia; South Texas Project, Texas; Turkey Point, Florida; V.C. Summer, South Carolina; Vogtle, Georgia; and W.S. Lee, South Carolina.*
- *At the licensee's request, six COLs have been terminated at three sites: Levy County Units 1 and 2 (terminated on April 26, 2018); South Texas Project Units 3 and 4 (terminated on July 12, 2018); and V.C. Summer Units 2 and 3 (terminated on March 6, 2019).*

Reactor Design Certification

- *Seven reactor design certifications (DCs) and one amendment have been issued:*
  - *General Electric-Hitachi Nuclear Energy's Advanced Boiling-Water Reactor (ABWR)*
  - *Westinghouse Electric Company's System 80+*
  - *Westinghouse Electric Company's Advanced Passive 600 (AP600)*
  - *Westinghouse Electric Company's Advanced Passive 1000 (AP1000)*
  - *South Texas Project Nuclear Operating Company's ABWR amendment*
  - *General Electric-Hitachi Nuclear Energy's Economic Simplified Boiling-Water Reactor (ESBWR)*
  - *Korea Electric Power Corporation's Advanced Power Reactor 1400 (APR1400)*
  - *The Commission has directed the staff to issue the design certification for the NuScale small modular reactor.*
- *Two DC applications for the Evolutionary Pressurized-Water Reactor (U.S. EPR) and Advanced Pressurized-Water Reactor (US-APWR) are suspended at the request of the applicants.*

Nonpower Production and Utilization Facilities

- *Research and test reactors*
  - *31 licensed research and test (nonpower) reactors operate in 21 States.*
  - *Two applications are under review for the Kairos Hermes advanced test reactor and for the Abilene Christian University Molten Salt Research Reactor.*
- *Medical radioisotope facilities*
  - *Two construction permits have been issued to SHINE Medical Technologies, LLC, in Janesville, Wisconsin, and Northwest Medical Isotopes, LLC, in Columbia, Missouri. At the company's request, the Northwest Medical Isotopes construction permit was terminated on July 11, 2022.*
  - *One operating license application is under review (SHINE).*

NUCLEAR MATERIALS

Materials Licensing

- *The NRC and the Agreement States have more than 18,000 licensees for medical, academic, industrial, and general users of nuclear materials.*
  - *The NRC regulates more than 2,100 licenses.*
  - *The 39 Agreement States regulate nearly 16,000 licenses.*
- *Connecticut and Indiana submitted letters of intent to become Agreement States and are on track to become Agreement States by 2025 and 2026, respectively.*
- *The agency issues approximately 1,400 new licenses, renewals, or amendments for existing materials licenses annually. The NRC conducts approximately 600 to 800 safety and security inspections of materials licensees each year.*

Nuclear Fuel Cycle

- *Three uranium recovery sites are licensed by the NRC.*
- *The NRC licenses nine active fuel cycle facilities:*
  - *One uranium hexafluoride conversion facility ("ready-idle" status)*
  - *Five uranium fuel fabrication facilities*
  - *Two gas centrifuge uranium enrichment facilities (one operating and one under construction)*
  - *One depleted uranium deconversion facility (construction decision pending)*
- *The NRC issues about 40 fuel cycle facility licensing actions per year, including amendments; renewals; new licenses; and safety, environmental, and safeguards reviews.*

National Source Tracking System

The National Source Tracking System, also known as NSTS, tracks more than 80,000 sources held by about 1,100 NRC and Agreement State licensees. Of those sources, about 53 percent are Category 1 sources and 47 percent are Category 2. The majority are cobalt-60, the most widely used isotope in large sources.

Domestic Safeguards

The NRC and the U.S. Department of Energy (DOE) use the Nuclear Materials Management and Safeguards System (NMMSS) to track transfers and inventories of source and special nuclear material. Licensees must report their inventories, transfers, purchases, and sales (including import and export of these materials) to the NMMSS. More than 300 licensees report to the NMMSS database, verifying their inventories at least annually by reconciling their transactions against the previous year's inventory. The database supports U.S. participation in the Treaty on the Non-Proliferation of Nuclear Weapons.

RADIOACTIVE WASTE

Low-Level Radioactive Waste

- *10 regional compacts*
- *Four State-licensed disposal facilities*

HIGH-LEVEL RADIOACTIVE WASTE MANAGEMENT

Spent Nuclear Fuel Storage

- *The NRC has issued 84 licenses for independent spent fuel storage installations in 36 States:*
  - *16 site-specific licenses (two of these facilities are licensed but were never built or operated)*
  - *68 general licenses*
- *An application is under review for a consolidated interim storage facility for spent fuel in Lea County, New Mexico.*
- *A license was issued on September 13, 2021, for a CISF in Andrews County, Texas*

Transportation—Principal Licensing and Inspection Activities

- *Approximately 1,000 safety inspections of fuel, reactor, and materials licensees are conducted annually.*
- *Annually, 50–70 new, renewed, or amended container-design applications for the transport of nuclear materials are reviewed.*
- *Approximately 150 license applications for the import and export of nuclear materials from the United States are reviewed annually.*
- *More than 3 million packages of radioactive materials are shipped each year in the United States by road, rail, air, or water. This represents less than 1 percent of the Nation's yearly hazardous material shipments.*

Decommissioning

- *Approximately 100 materials licenses are terminated each year. The NRC's materials decommissioning program focuses on the termination of licenses that are not routine and that require complex activities.*
- *26 nuclear power reactors are in various stages of decommissioning (DECON or SAFSTOR).*
- *Four research and test reactors are permanently shut down and in various stages of decommissioning.*
- *Eight complex materials sites are in various stages of decommissioning.*
- *One fuel cycle facility is in partial decommissioning, and one is undergoing decommissioning.*
- *Five NRC-licensed uranium recovery facilities are in various stages of decommissioning.*

SECURITY AND EMERGENCY PREPAREDNESS

- *Every 2 years, each operating nuclear power plant performs a full-scale emergency preparedness exercise inspected by the NRC and evaluated by the Federal Emergency Management Agency.*
- *Plants conduct additional emergency drills between full-scale exercises to maintain their preparedness and proficiency in responding to emergencies.*
- *The NRC spends about 15,000 hours a year scrutinizing security at nuclear power plants, including 8,000 hours of force-on-force inspections. These inspections include simulated terrorist attacks using a mock adversary force, which are conducted at each site every 3 years.*
- *The NRC has implemented a comprehensive cybersecurity oversight program for power reactors, which includes routine inspections and requires licensees to isolate critical systems from the Internet.*

ACCOMPLISHMENTS AND HIGHLIGHTS FY 2022

Power Reactors

- *Found that the acceptance criteria in the combined license for Vogtle Unit 3 in Georgia were met, allowing the licensee to begin operation and marking the first time the NRC authorized a reactor's initial startup through the 10 CFR Part 52 licensing process.*
- *Transitioned Vogtle Unit 3 from construction to the operating reactor oversight process.*
- *Obtained Commission approval to issue a final rule that certifies NuScale's small modular reactor design for use in the United States.*
- *Completed more than 940 licensing actions and other licensing tasks that support operating, new, and advanced reactors, including numerous actions related to the adoption of risk-informed initiatives, topical reports, and the safe transition of operating plants to decommissioning.*
- *Continued to add functionality to MAP-X, a modern web-based portal, which allows licensee submission of proposed alternatives to codes and standards in accordance with 10 CFR 50.55a(z) and the submission of event notification data by licensees.*
- *Completed several key activities related to accident tolerant fuel, including issuance of Research Information Letter 2021-13 on fuel fragmentation, relocation, and dispersal of higher burnup fuel; initiation of an increased enrichment rulemaking effort, per SRM-SECY-21-0109, "Staff Requirements-SECY-21-0109-Rulemaking Plan on Use of Increased Enrichment of Conventional and Accident Tolerant Fuel Designs for Light-Water Reactors" and hosting of several widely attended workshops and conferences on licensing higher burnup and increased enrichment fuel.*
- *Proposed to the Commission a revised policy to review applications for risk-informed digital instrumentation and control (I&C) and endorsed new guidance concerning third-party commercial-grade dedication of digital I&C equipment.*
- *Continued implementation of the Commission's direction to assess how the NRC conducts subsequent license renewal environmental reviews in accordance with the National Environmental Policy Act. The staff began rulemaking to update the license renewal generic environmental impact statement.*
- *Completed 100 percent of calendar year 2021 required inspection and assessment activities of the Reactor Oversight Process (ROP), despite continuing challenges due to COVID-19.*
- *Completed several SECY papers focused on ROP enhancement, including finalizing a change in the periodicity of engineering inspections, a proposed change to incentivize timely closure of white findings and performance indicators, and a recommendation to maintain biennial frequency for Problem Identification and Resolution team inspections.*
- *Issued order approving the transfer of the Palisades license for the purpose of decommissioning.*
- *Approved multiple applications for the adoption of advanced risk management programs, including 10 related to risk-informed completion times (TSTF-505) and 12 related to risk-informed categorization and treatment of structures, systems, and components (10 CFR 50.69), as well as the last application for the risk-informed surveillance frequency program (TSTF-425).*
- *Published for trial use regulatory guidance on probabilistic risk assessment for advanced, non-light water reactors.*
- *Released for discussion in multiple public meetings draft preliminary rule text for the 10 CFR Part 53, "Risk Informed, Technology-Inclusive Regulatory Framework for Commercial Nuclear Plants." This rulemaking would create a rulemaking regulatory framework for commercial nuclear plants, including advanced reactors, and has a proposed rule publication target of October 2024.*
- *Issued a comprehensive technical report on fuel qualification criteria for advanced, non-light water reactors.*

- *Completed 21 force-on-force inspections, testing licensees' abilities to protect against the design-basis threat.*
- *Reviewed and accepted revisions to two industry cybersecurity guidance documents related to the identification and protection of critical digital assets associated with safety, security, and emergency preparedness functions.*
- *Conducted 190 baseline security inspections at operating power reactors and Category I fuel cycle facilities.*

Nonpower Reactors

- *Accepted for review the construction permit application for the Abilene Christian University Molten Salt Research Reactor.*
- *Issued a draft environmental impact statement for the Kairos Hermes advanced test reactor construction permit application in September 2022 and also completed review of several related topical reports.*
- *Issued a special inspection team report for a 2021 event that damaged fuel in the reactor at the National Institute of Standards and Technology Center for Neutron Research.*
- *Issued a renewed license for the University of Massachusetts Lowell research reactor.*
- *Terminated the construction permit for Northwest Medical Isotopes, LLC, on July 11, 2022.*

Nuclear Materials and Waste

- *Completed approximately 1,400 radioactive materials licensing actions.*
- *Completed nearly 800 safety and security inspections of materials licensees and issued 10 updated inspection procedures.*
- *Completed 14 Integrated Materials Performance Evaluation Program reviews of Agreement State licensing and oversight programs.*
- *Issued licensing guidance for Alpha DaRT™ manual brachytherapy sources, which use radium-224 and are inserted into tumors to kill cancer cells.*
- *Issued revisions to 10 State Agreement and State Liaison procedures to support NRC Agreement States and enhance joint oversight of the National Materials Program.*
- *Issued the second revision to NUREG-2155, "Implementation Guidance for 10 CFR Part 37 Physical Protection of Category 1 and Category 2 Quantities of Radioactive Material."*
- *Issued five certificates of compliance for spent fuel storage casks.*
- *Issued Amendment 19 to Centrus Energy Corp./American Centrifuge Operating, extending its authorization for the High-Assay Low-Enriched Uranium Demonstration Program.*
- *Held the first field Commission meeting in more than 40 years for the Discussion of the Ten-Year Plan to Address Impacts of Uranium Contamination on the Navajo Nation and Lessons Learned from the Remediation of Former Uranium Mill Sites, in Gallup, New Mexico, and a community meeting at the Red Water Pond Shade House in April 2022.*
- *Issued reports for the fuel cycle smarter inspection program and the independent spent fuel storage installation oversight enhancement initiatives to ensure safety as well as provide for a comprehensive and consistent inspection program.*
- *Issued NUREG-1757, Volume 2, Revision 2, "Consolidated Decommissioning Guidance: Characterization, Survey, and Determination of Radiological Criteria," in July 2022 to further risk-inform the NRC's guidance and provide alternative approaches to decommissioning strategies.*
- *Terminated the materials license for Sigma Aldrich located in Missouri in November 2021.*
- *Terminated the license for the decommissioned Humboldt Bay nuclear power plant in California in November 2021.*

- *Terminated the General Atomics licenses for the Mark I (R-37) and Mark F (R-67) TRIGA research reactors located in California in December 2021.*
- *Issued the safety evaluation report and environmental assessment for the long-term surveillance plan and the long-term care fee for the transfer of the Western Nuclear Incorporated-Split Rock site to the U.S. Department of Energy, the first of its kind in more than 10 years.*
- *Participated as the U.S. delegation to the 7th Review Meeting of the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management in Vienna, Austria, in June 2022.*
- *Issued a technical evaluation report providing an independent evaluation of the U.S. Department of Energy's draft waste determination that the vitrified low-activity waste at the Hanford Nuclear Reservation could be disposed in the near surface.*
- *Issued the draft environmental impact statement for the Holtec consolidated interim storage facility for spent nuclear fuel in Lea County, New Mexico.*
- *Issued NUREG-2159, "Acceptable Standard Format and Content for the Fundamental Nuclear Material Control Plan Required for Special Nuclear Material of Moderate Strategic Significance," which provides information to facilitate compliance with material control and accounting regulations for such facilities that are authorized to possess special nuclear material of moderate strategic significance, such as some proposed Category II fuel facilities.*
- *Submitted a report to Congress on the Preparedness for High-Assay Low-Enriched Uranium Availability.*
- *Renewed the license for the Westinghouse Columbia Fuel Fabrication Facility for an additional 40 years.*
- *Issued Revision 3 of Regulatory Guide 3.54, "Spent Fuel Heat Generation in an Independent Spent Fuel Storage Installation," which provides revised methodology for determining heat generation rates for both pressurized-water reactor and boiling-water reactor fuel.*
- *Issued a renewed special nuclear material (SNM) license to Oregon State University for an additional 10 years to allow continued research on fuel rods for research and test reactors that contain greater than critical mass amounts of SNM.*
- *Issued the certificate of compliance for the model MAGNATRAN (Amendment 3) transportation package. This was the first time a moderator exclusion was approved pursuant to 10 CFR 71.55(c).*
- *Provided to the Commission the staff's review of the NRC's regulatory readiness for the oversight of large-scale commercial transportation of spent nuclear fuel in the United States.*
- *Issued Enforcement Guidance Memorandum 22-001, "Enforcement Discretion for Noncompliance of Tornado Hazards Protection Requirements at Independent Spent Fuel Storage Installations."*
- *Completed updates to the agency's cost-benefit guidance:*
  - *Completed Revision 5 of NUREG/BR-0058, "Regulatory Analysis Guidelines of the U.S. Nuclear Regulatory Commission," which standardizes methods for agencywide use in preparation and presentation of regulatory and cost-benefit analyses.*
  - *Issued NUREG-2242, "Replacement Energy Cost Estimates for Nuclear Power Plants: 2020–2030—Final Report," which provides current replacement energy cost estimates for both short- and long-term outages and updates information provided in previous evaluations.*
  - *Issued Revision 1 of NUREG-1530, "Reassessment of NRC's Dollar Per Person-Rem Conversion Factor Policy, Final Report," which incorporates updates to the dollar per person-rem conversion factor and establishes a method for keeping this factor up to date.*
- *Supported the agency's Principles of Good Regulation through openness and transparency in the petition for rulemaking process by managing petitions submitted by members of the public in areas such as of licensing, physical protection, and medical use of byproduct materials; promoting public confidence in the agency's rulemaking efforts; and increasing responsiveness to the public.*

Agencywide

- *Continued to oversee the safe and secure operation of nuclear power plants and fuel cycle facilities, as well as the possession and use of radioactive materials.*
- *Made significant progress toward the transformation vision of being a modern, risk-informed regulator, particularly in the areas of innovation; employee retention, recruitment, and development; use of risk insights; and technology adoption.*
- *Used its "innovation platform," called IdeaScale, to collect more than 48 agency innovation success stories and hosted approximately 36 total innovation challenge campaigns, including 11 agencywide campaigns and 25 office-specific campaigns.*
- *Deployed the NRC Ambassador program to support the on-boarding of new hires.*
- *Launched the second cohort of the Nuclear Regulator Apprenticeship Network training program, which supports entry-level hiring, with a diverse group of 25 new staff.*
- *Continued implementing the agency's culture improvement strategy with a focus on coaching and empowerment, recognizing and sharing different viewpoints, taking innovative approaches and discussing risk, showing mutual support and shared responsibility, and bringing one's whole self to work.*
- *Held quarterly Executive Director for Operations Town Hall meetings to broadly share information with staff about emergent topics of wide interest. More than 1,600 staff members participated in each town hall.*
- *Achieved 70 percent participation on the 2022 Federal Employee Viewpoint Survey with an employee engagement index score of 76 percent positive.*
- *Continued implementing innovative solutions via EMBARK Venture Studio to enable and promote a risk-informed mindset within the nuclear reactor safety program and other business lines.*
- *Pursued substantial rulemaking activities on topics including licensing of advanced reactors, alignment of licensing processes and lessons learned from new reactor licensing, categorical exclusions from environmental reviews, American Society of Mechanical Engineers codes and code cases, and petitions for rulemaking submitted by members of the public.*
- *Issued escalated enforcement actions in 68 cases, including 17 notices of violation that involved civil penalties (one of which involved a subsequent order imposing the civil penalty) totaling $427,100; seven enforcement orders without a proposed civil penalty; and 44 escalated notices of violation without a proposed civil penalty.*
- *Published research results on a variety of topics related to operating facility safety, including analysis of high burnup fuel performance, probabilistic flood hazard modeling, risk-informed and performance-based seismic design, risk evaluations for fire events, and design-basis and severe accident analysis for advanced reactor designs.*
- *Continued collaboration with the DOE under the Nuclear Energy Innovation Capabilities Act, including the signing of a technical addendum on technologies for advanced fuels and fuel cycle applications. This collaboration supports technical readiness and facilitates sharing of technical expertise and knowledge on advanced nuclear reactor technologies and nuclear energy innovation related to research, development, and demonstration.*
- *Received 88 educational proposals and 100 research and development proposals under the University Nuclear Leadership Program notice of funding opportunity. Awarded 25 educational grants and 12 research and development grants totaling $14.6 million to 27 academic institutions.* ***>>See Appendix Q for States with NRC grant award recipients in FY 2022.<<***

International Activities

- *Continued international technical leadership through research engagement and technical cooperation, including participation in international experimental safety programs, leadership of technical computer code user groups, leadership of and engagement in Nuclear Energy Agency-sponsored multinational research programs, and bilateral cooperation with countries worldwide on research activities of mutual interest.*
- *Represented the NRC as part of U.S. delegations, negotiating agreements for civil nuclear cooperation (Section 123 agreements) and participating in activities such as meetings of the Nuclear Suppliers Group, International Atomic Energy Agency Board of Governors, and Group of Seven Nuclear Safety and Security Group.*
- *Issued 61 licenses to export nuclear materials and equipment.*
- *Supported the development of enhanced regulatory infrastructure for radiological sources, research reactors, and nuclear power plant safety and security around the world through the provision of technical expertise and assistance funding, reinforcing U.S. Government national security and foreign policy objectives.*
- *Participated in a U.S. Government delegation to international meetings addressing the implementation of treaties and conventions, including the Review Conference of the Parties to the Amendment to the Physical Protection of Nuclear Material (CPPNM), meetings of the Preparatory Committee for the Conference of the Parties to the Amended CPPNM, and the Technical Meeting of Representatives to the CPPNM and Its Amendment.*
- *Participated in numerous virtual, hybrid, and in-person meetings with regulatory counterparts as international travel started to return to normal after being suspended due to COVID-19.*
- *Continued work under a first-of-a-kind memorandum of cooperation with the Canadian Nuclear Safety Commission to increase regulatory effectiveness through collaboration on the technical reviews of advanced reactors and small modular reactors.*
- *Coordinated the NRC's response, in support of broader U.S. Government efforts, to Russia's invasion of Ukraine by leveraging relationships across the U.S. Government and coordinating with international counterparts to facilitate information sharing and address urgent technical nuclear safety and security questions in support of Ukrainian regulatory counterparts.*
- *Signed multiple bilateral agreements for cooperation and assistance with international counterparts to facilitate the agency's engagement to support the NRC's International Strategy goals.*

Administration

- *Processed 219 Freedom of Information Act (FOIA) requests and nine appeals in FY 2022, with 91 FOIA requests and one FOIA appeal pending by the end of FY 2022.*
- *Conducted 104 cases by the Office of Investigations for FY 2022, including 68 investigations, 26 of which were carried over from FY 2021, and 36 assists to staff, eight of which were carried over from FY 2021.*
- *Conducted agency outreach to audiences interested in NRC activities.*
- *Awarded and administered the agency's acquisition portfolio, with obligations estimated over $265 million in FY 2022.*

Public Meetings and Involvement

- *During FY 2022, conducted approximately 775 open public meetings addressing a full range of NRC issues to support transparency with agency stakeholders. Conducted 116 closed meetings to discuss information not publicly available.*
- *Conducted 10 full committee meetings of the Advisory Committee on Reactor Safeguards and 50 subcommittee meetings in FY 2022; all meetings were hybrid to support re-entry to the agency's facilities.*
- *Held three virtual public meetings of the Advisory Committee on the Medical Uses of Isotopes in FY 2022.*
- *Hosted an all-virtual Regulatory Information Conference, bringing together thousands of participants from around the world and featuring 30 technical sessions, plenaries by agency senior leaders, as well as widely-attended special sessions highlighting women in the nuclear field and decommissioning efforts at the Fukushima Dai-ichi nuclear power plant in Japan.*

News and Information

- *Maintained the NRC website and free listserv subscription services at* https://www.nrc.gov/public-involve/listserver.html#lyris *to post and distribute NRC news releases.*
- *Shared information with the public using social media through platforms that address the major categories of social communication, with a focus on social networking and microblogging (Facebook, LinkedIn, and Twitter).*
- *In FY 2022, gained approximately 2,700 followers on Twitter and sent 500 tweets; gained more than 455 page followers and published approximately 270 posts on Facebook; added 4,900+ followers and published approximately 235 posts on LinkedIn; launched a new social media page on Instagram in October 2022.*
- *Issued 134 news releases in FY 2022.*

Scan QR code to see the latest information on the agency's accomplishments on NRC's website

REPORT A CONCERN TO THE NRC

Emergency

Report an emergency involving a nuclear facility or radioactive materials, including the following:

- *any accident involving a nuclear reactor, nuclear fuel facility, or radioactive materials*
- *lost or damaged radioactive materials*
- *any threat, theft, smuggling, vandalism, or terrorist activity involving a nuclear facility or radioactive materials*

The NRC accepts collect calls. The agency records all calls to this number.

Call the NRC's 24-Hour Headquarters Operations Center: 301-816-5100

Non-Emergency

This includes any concern involving a nuclear reactor, nuclear fuel facility, or radioactive materials. You may send an email to allegations@nrc.gov. However, because email transmission may not be completely secure, if you are concerned about protecting your identity, it is preferable that you contact us by telephone or in person. You may contact any NRC employee (including a resident inspector) or call:

The NRC's Toll-Free Safety Hotline: 800-695-7403

Calls to this number are not recorded between the hours of 7 a.m. and 5 p.m. eastern time. However, calls received outside these hours are answered by the Headquarters Operations Center on a recorded line. Some materials and activities are regulated by Agreement States, and concerns should be directed to the appropriate State radiation control program, a list of which can be found on the NRC website at https://scp.nrc.gov/allegations.html.

THE NRC'S OFFICE OF THE INSPECTOR GENERAL

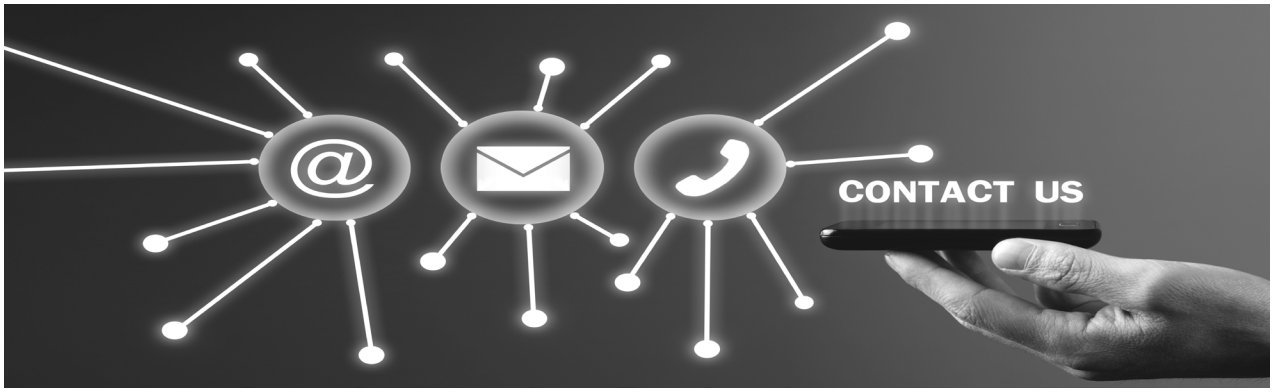
The Office of the Inspector General (OIG) for the U.S. Nuclear Regulatory Commission and the Defense Nuclear Facilities Safety Board established the hotline program to provide agency employees, other government employees, licensee/utility employees, contractors, and the public a way to report questionable activity to the OIG concerning potential fraud, waste, abuse, and employee or management misconduct. You may also report mismanagement of agency programs or danger to public health and safety through the hotline program. You may contact the OIG Hotline program by telephone, through the online form, or by mail.

You may make an allegation anonymously or request that your identity be kept confidential. If you choose to identify yourself, consistent with the terms of the Inspector General Act of 1978, as amended, we will not reveal your identity unless disclosure is unavoidable.

Please be aware, while you may submit complaints anonymously, providing your name, address, and phone number allows us to follow up with you and address your matter more expeditiously. Unless the reporting is knowingly false, no action may be taken against you for having complained or disclosed information to the OIG. Reprisal and retaliation for reporting wrongdoing are prohibited by Federal law and regulations.

OIG HOTLINE
SCAN QR CODE

***Call the OIG Hotline:* 800-233-3497**
7 a.m.–4 p.m. (eastern time)
After hours, please leave a message.



CONTACT US

U.S. Nuclear Regulatory Commission
800-368-5642
301-415-7000

Hearing Impaired Access TTY:
240-428-3217
https://www.nrc.gov

Public Affairs
301-415-8200
fax: 301-415-3716
email: opa.resource@nrc.gov

Public Document Room
800-397-4209
fax: 301-415-3548

Employment
Human Resources: 301-415-7400

Contracting Opportunities
Small Business:
800-903-7227

License Fee Help Desk
301-415-7554
email: fees.resource@nrc.gov

Mailing Address
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

Delivery Address
NRC Storage and Distribution Facility
4934 Boiling Brook Parkway
Rockville, MD 20852

NRC inspectors keep a close eye on construction activities to ensure NRC regulations are being met at Vogtle Units 3 and 4 in Georgia.

NRC Office of Nuclear Security and Incident Response Director Mirela Gavrilas observes new construction activities at Vogtle Units 3 and 4 in Georgia.

PHOTOS: THE NRC ON THE JOB

NRC inspectors (left to right) Katherine Warner, Liz Andrews and Mark Henrion observe workers preparing and pouring concrete for a dry cask storage pad on the Three Mile Island plant site in Pennsylvania.

Region IV Health Physicist Linda Gersey (right) conducts radiological surveys and collects soil samples at the Sequoyah Fuels plant near Gore, Oklahoma. This site is undergoing decommissioning.

NRC Executive Director for Operations Dan Dorman (right), visits Arizona's Palo Verde Nuclear Generating Station and tours an offsite national response center full of equipment that can be rapidly dispatched to nuclear plants during an emergency. Photo courtesy of Arizona Public Service Co.

At the Susquehanna Unit 1 nuclear power plant, Senior Resident Inspector Chris Highley enters the Pennsylvania facility's containment during a refueling and maintenance outage to evaluate material conditions in this protective structure that surrounds the reactor.

The NRC Commission listens to a briefing on the developments of regulatory approaches for fusion energy devices and industry progress in commercializing fusion energy devices.

NRC Senior Instructor Jeff Griffis teaches a virtual class from the agency's Technical Training Center in Chattanooga, Tennessee.

NRC Division Director Chris Miller observes new construction activities at Vogtle Units 3 and 4 in Georgia.

Nuclear Regulator Apprenticeship Network participant Hayden Page visits the plant's condenser containment system at the Sequoyah nuclear power plant in Tennessee.

NRC Commissioner David Wright (purple shirt) tours Arkansas Nuclear One in Russellville, Arkansas, with Entergy and NRC staff before observing a security exercise. Photo courtesy of Entergy.

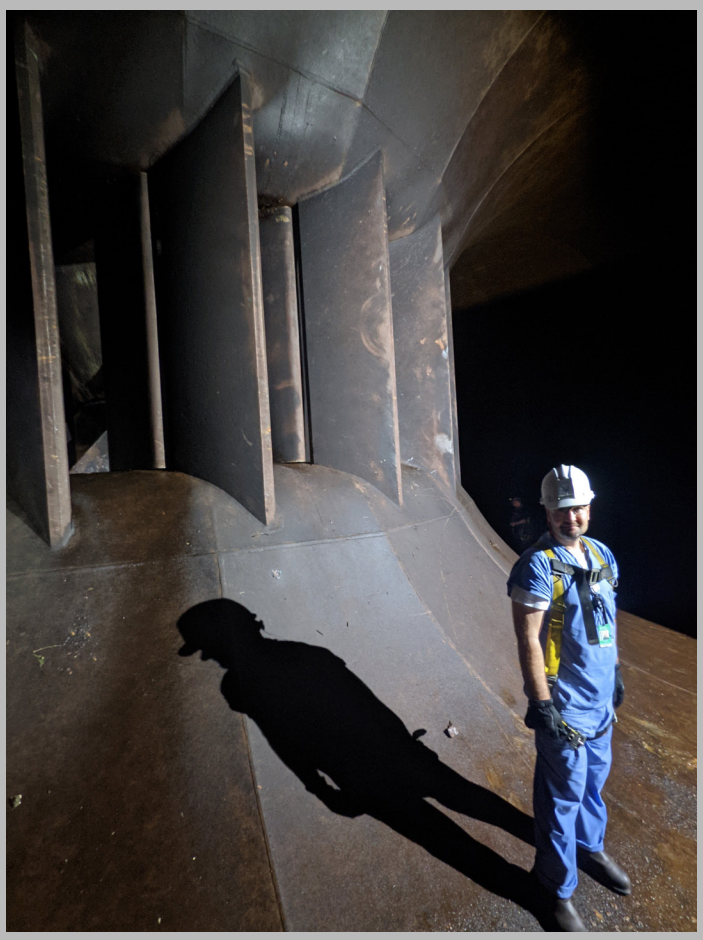
NRC Region I Inspector Juan Ayala in Wilmington, Delaware, conducts an inspection to ensure a nuclear gauge is being properly handled and secured.

Region IV health physicist Rob Evans completes his inspection at the 600-acre site in Gore, Oklahoma, where the Sequoyah Fuels Corporation operated a uranium conversion facility.

Indian Point nuclear power plant control room operators prepare for the final insertion of control rods in the Unit 3 reactor, part of the permanent shutdown of the site in New York. Not pictured: NRC inspectors watching operations.

NRC inspectors James Thompson and Kyle Bischoff take a boat from Prudhoe Bay to Artificial Island to perform an inspection on the use of radioactive materials for various purposes at Hilcorp, which operates an oil and gas facility. Not pictured: Mary Muessle, Director of Region IV's Division of Radiological Safety and Security.

NRC Office of Nuclear Reactor Regulation Director Andrea Veil observes new construction activities at Vogtle Units 3 and 4 in Georgia.



NRC Region II Inspector Nick Peterka pauses for a moment during an inspection of the Keowee Hydro Station near the Oconee Nuclear Station in South Carolina.

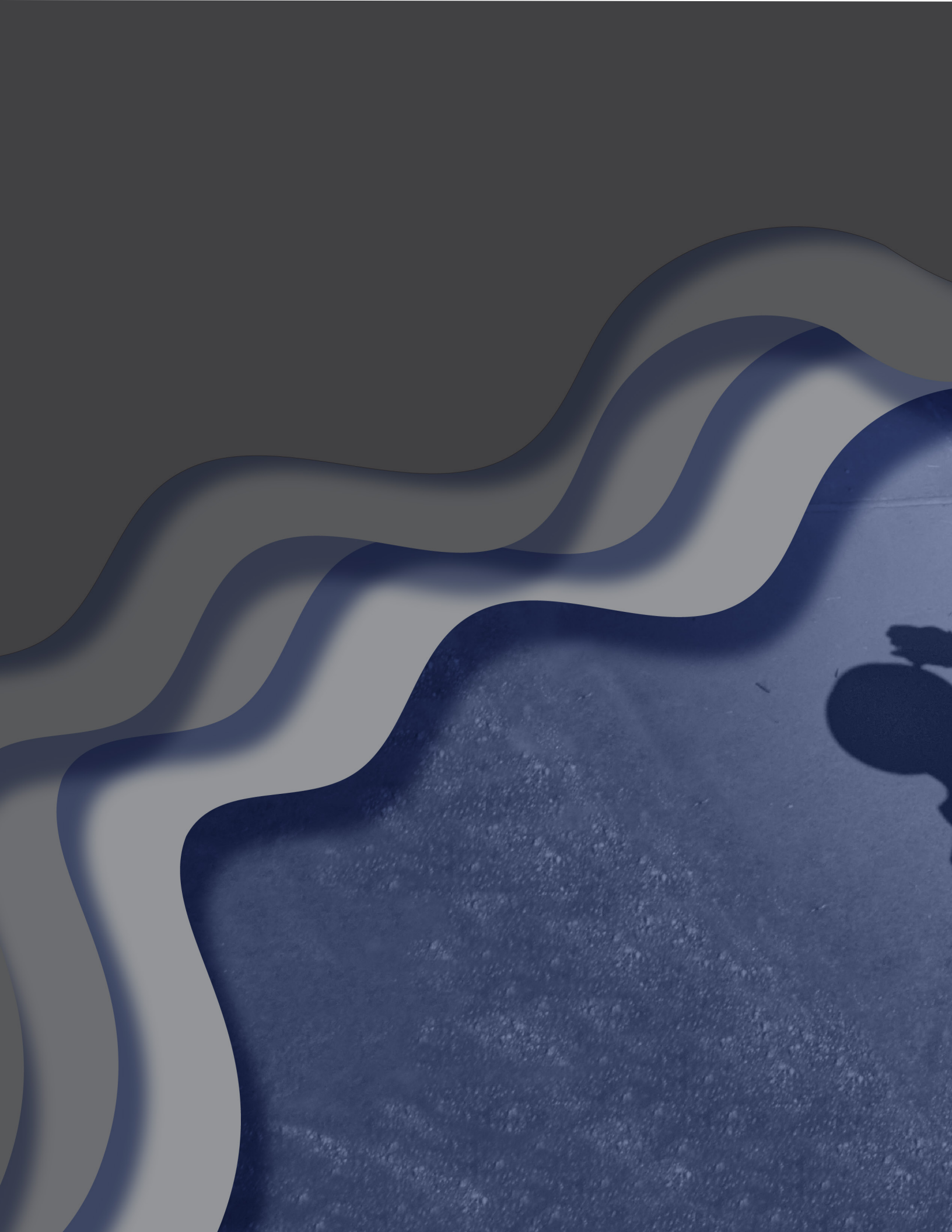
Edison Fernandez (left), a Region III specialist in refueling outage activities and welding, makes an unannounced inspection at the Palisades nuclear power plant to observe some emergent repair work and conduct final examinations on a nozzle weld during a refueling outage. The plant permanently ceased operations in May 2022.

NRC staff members participate in a "hybrid" incident response exercise with some staff online and others working from the Headquarters Operations Center in Rockville, Maryland.

Mary Muessle, Director of Region IV's Division of Radiological Safety and Security, and inspectors James Thompson and Kyle Bischoff at Alaska's North Slope inspect the facilities of five different companies for the use of radioactive materials at or around oil processing plants.

NRC summer and co-op students attend a technical session on emergency planning in the NRC Headquarters Operations Center.

NRC staff members participate in the Purdue University Engineering Industrial Roundtable career fair, sharing information about the agency, their jobs and their experiences working at the NRC.



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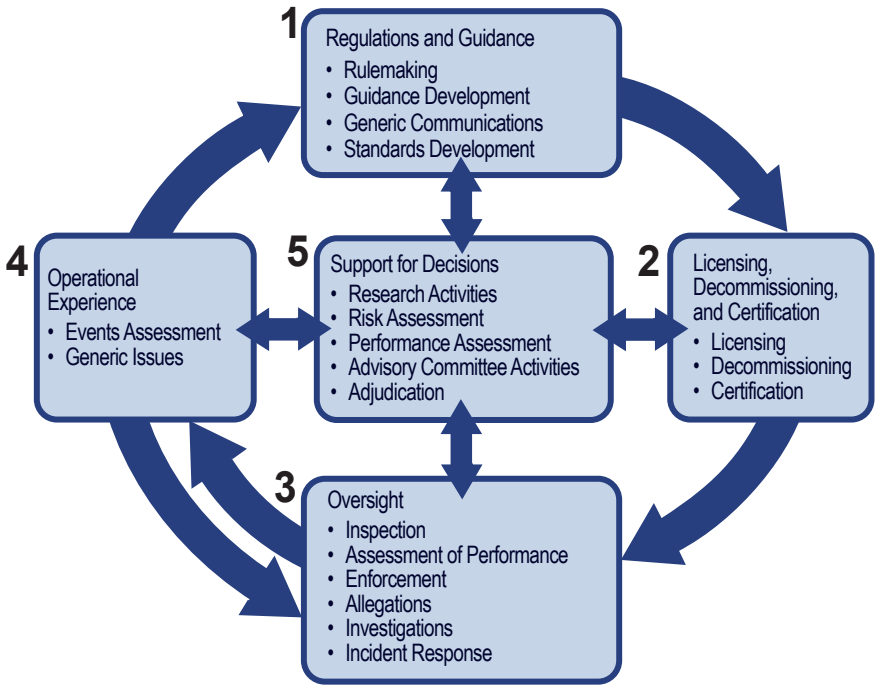
NRC: AN INDEPENDENT REGULATORY AGENCY

ABOUT THE NRC

The U.S. Nuclear Regulatory Commission (NRC) is an independent agency created by Congress. The NRC regulates the Nation's civilian commercial, industrial, academic, and medical uses of nuclear materials.

The NRC's scope of responsibility includes regulating commercial nuclear power plants; nonpower production and utilization facilities including research and test reactors; nuclear fuel cycle facilities; medical, academic, and industrial uses of radioactive materials; the decommissioning of licensed facilities and sites; and the transport, storage, and disposal of radioactive materials and wastes. The agency issues licenses for and oversees the use of radioactive materials and certifies nuclear reactor designs, spent fuel storage casks, and transportation packages. The agency also licenses the import and export of radioactive materials and works closely with its international counterparts to enhance nuclear safety and security worldwide. To fulfill its responsibilities, the NRC performs five principal regulatory functions, as seen in Figure 1. How the NRC Regulates.

Figure 1. How the NRC Regulates



1. Develop regulations and guidance for applicants and licensees.
2. License or certify applicants to use nuclear materials, operate nuclear facilities, and decommission facilities.
3. Inspect and assess licensee operations and facilities to ensure licensees comply with NRC requirements, respond to incidents, investigate allegations of wrongdoing, and take appropriate follow-up or enforcement actions when necessary.
4. Evaluate operational experience of licensed facilities and activities.
5. Conduct research, hold hearings, and obtain independent reviews to support regulatory decisions.

Scan QR code to learn more about how the NRC regulates

MISSION STATEMENT

The NRC licenses and regulates the Nation's civilian use of radioactive materials to provide reasonable assurance of adequate protection of public health and safety, to promote the common defense and security, and to protect the environment.

Vision

Demonstrate the Principles of Good Regulation in performing the agency's mission.

To be successful, the NRC must not only excel in carrying out its mission but must do so in a manner that engenders the trust of the public and stakeholders. The Principles of Good Regulation—independence, openness, efficiency, clarity, and reliability—guide the agency. They affect how the NRC reaches decisions on safety, security, and the environment; how the NRC performs administrative tasks; and how its employees interact with each other as well as with external stakeholders. By adhering to these principles, the NRC maintains its regulatory competence, conveys that competence to stakeholders, and promotes trust in the agency. The agency puts these principles into practice with effective, realistic, and timely actions.

Principles of Good Regulation

Independence: *Nothing but the highest possible standards of ethical performance and professionalism should influence regulation.*

Openness: *Nuclear regulation is the public's business, and it must be transacted publicly and candidly.*

Efficiency: *The highest technical and managerial competence is required and must be a constant agency goal.*

Clarity: *Regulations should be coherent, logical, and practical. Agency positions should be readily understood and easily applied.*

Reliability: *Regulations should be based on the best available knowledge from research and operational experience.*

Strategic Goals

Safety: Ensure the safe use of radioactive materials.

Security: Ensure the secure use of radioactive materials.

Statutory Authority

The Energy Reorganization Act of 1974 created the NRC from a portion of the former Atomic Energy Commission. The new agency was to independently oversee—but not promote—the commercial nuclear industry so the United States could benefit from the use of radioactive materials while also protecting people and the environment. The agency began operations on January 18, 1975. The NRC's regulations can be found in Title 10, *"*Energy,*" of the Code of Federal Regulations* (10 CFR). The principal statutory authorities that govern the NRC's work can be found at the governing legislation web page on the NRC website.

Scan QR code for more information on the topic of NRC's governing legislation

The NRC, its licensees (those licensed by the NRC to use radioactive materials), and the Agreement States (States that assume regulatory authority over certain nuclear materials) share responsibility for protecting public health and safety and the environment. Federal regulations and the NRC's regulatory program play a key role. Ultimately, however, the licensees bear the primary responsibility for safely handling and using radioactive materials.

On September 28, 2018, the Nuclear Energy Innovation Capabilities Act of 2017 was signed into law. The Act requires the U.S. Department of Energy (DOE) and the NRC to enter into a memorandum of understanding (MOU) on certain topics related to advanced reactors and authorizes them to enter into an MOU on additional topics in this area. The NRC and the DOE signed an MOU to implement provisions of the Act in October 2019.

On January 14, 2019, the Nuclear Energy Innovation and Modernization Act (NEIMA) was signed into law. NEIMA's provisions are varied and have impacts across the agency.

NEIMA has three stated objectives:

1. *To provide a revised framework for fee recovery by the NRC "to ensure the availability of resources to meet industry needs without burdening existing licensees unfairly for inaccurate workload projections or premature existing reactor closures."*
2. *To support the development of expertise and regulatory infrastructure necessary to allow innovation and the commercialization of advanced nuclear reactors.*
3. *To foster "more efficient regulation of uranium recovery."*

The NRC is in the process of implementing the various provisions of NEIMA. The agency has already submitted multiple reports to Congress establishing performance metrics and milestone schedules for "requested activities of the Commission." The NRC is also taking actions related to the licensing process for commercial advanced reactors and research and test reactors. The NRC is committed to meeting the requirements of NEIMA and is working diligently to do so.

NRC regulations are contained in Title 10, "Energy," of the Code of Federal Regulations, *Chapter 1, Parts 1 to 199.*

Scan QR code for more information on NRC Regulations Title 10, Code of Federal Regulations

MAJOR ACTIVITIES

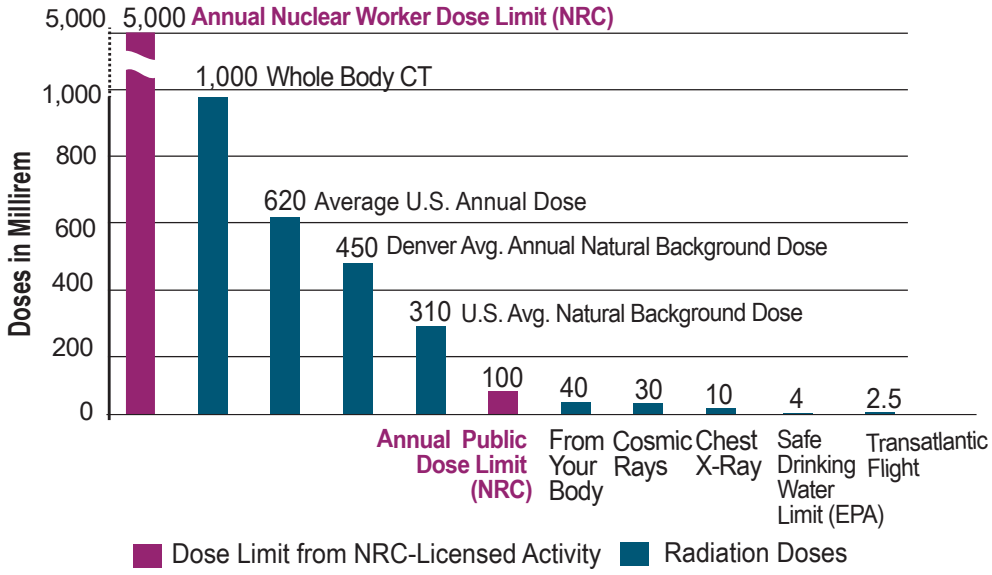
The NRC fulfills its responsibilities by doing the following:

- *licensing the design and overseeing construction, operation, and decommissioning of commercial nuclear power plants and other nuclear facilities*
- *licensing the possession, use, processing, handling, exporting, and importing of nuclear materials*
- *establishing national policy and standards for the safe disposal of low-level radioactive waste*
- *certifying the design and overseeing construction and operation of commercial transportation casks for radioactive materials and waste*
- *licensing the design, and overseeing construction, and operation of spent fuel storage casks and interim storage facilities for spent fuel and high-level radioactive waste*
- *licensing nuclear reactor operators*
- *licensing uranium enrichment facilities*
- *conducting research to support the regulatory framework and to address potential reactor and other nuclear facility safety issues*
- *collecting, analyzing, and disseminating information about the operation of commercial nuclear power reactors and certain nonreactor activities*
- *issuing safety and security regulations, policies, goals, and orders that govern nuclear activities*
- *interacting with other Federal agencies, foreign governments, and international organizations on safety, security, and nonproliferation issues*
- *conducting investigations of alleged violations by NRC licensees that may result in criminal, civil, or administrative penalties*
- *inspecting NRC licensees to ensure adequate performance of safety and security programs*
- *enforcing NRC regulations and the conditions of NRC licenses and imposing, when necessary, civil sanctions and penalties*
- *conducting public hearings on nuclear and radiological safety, security, and environmental concerns*
- *implementing international legal commitments made by the U.S. Government in treaties and conventions*
- *developing working relationships with State and Tribal governments*
- *maintaining an incident response program and overseeing required emergency response activities at NRC-licensed facilities*
- *implementing lessons learned from the March 2011 nuclear accident in Japan to enhance safety at U.S. commercial nuclear facilities*
- *transforming the agency one decision at a time into a modern, risk-informed regulator that promotes and embraces innovative approaches to achieve the agency mission (see Figure 3. Transforming the NRC)*
- *involving the public in the regulatory process through meetings, conferences, and workshops; providing opportunities for commenting on proposed new regulations, petitions, guidance documents, and technical reports; offering multiple ways to report safety concerns; and providing documents under the Freedom of Information Act and through the NRC's website (see Figure 4. A Typical Rulemaking Process)*
- *engaging and informing the public through social media platforms and by providing interactive, high-value datasets (data in a form that allows members of the public to search, filter, or repackage information)*

Radiation Protection

Although radiation is naturally present in our environment, it can have either beneficial or harmful effects, depending on its use and control. For that reason, Congress charged the NRC with protecting people and the environment from unnecessary exposure to radiation as a result of civilian uses of nuclear materials. Toward that end, the NRC requires nuclear power plants; research reactors; and other medical, industrial, and academic licensees to use and store radioactive materials in a way that eliminates unnecessary exposure and protects radiation workers and the public. See Figure 2. Radiation Doses and Regulator Limits to learn the dose limits from NRC-licensed activities.

Figure 2. Radiation Doses and Regulatory Limits



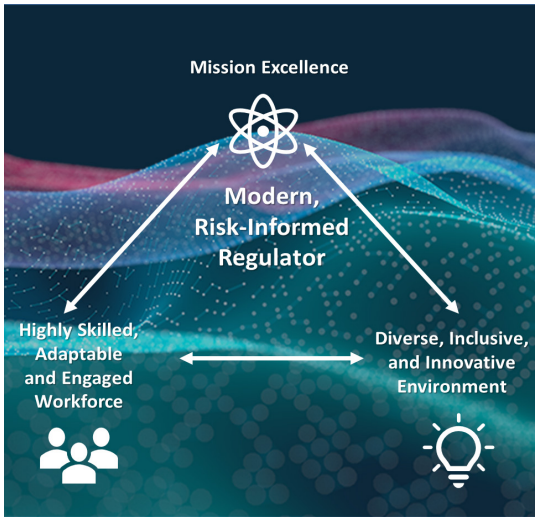
NRC Region IV Administrator Scott Morris (right) and Senior Resident Inspector Andrew Siwy (left), dressed in protective gear, examine the plant's drywell during a refueling outage at the Cooper nuclear power plant in Brownville, Nebraska. Photo courtesy of Nebraska Public Power District.

TRANSFORMING THE NRC

Figure 3. Transforming the NRC

How is the NRC transforming into a modern, risk-informed regulator?

- *Be riskSMART—making sound decisions while accepting well-managed risks in decisionmaking.*
- *Focus on Our People—maintaining an engaged and highly skilled workforce now and in the future.*
- *Innovate—making timely decisions that take into account different viewpoints and fully explored options.*
- *Use Technology—working smarter, including using data analytics to highlight areas for regulatory attention and improvement.*



The NRC's Transformation Journey

Over the past several years, the NRC has been transforming to realize its vision of becoming a modern, risk-informed regulator and be in the best position to continue meeting its important safety and security mission well into the future. As a modern, risk-informed regulator, the agency will achieve mission excellence in a diverse, inclusive, and innovative environment with a highly skilled, adaptable, and engaged workforce. Transformation will thus help the agency keep pace with the highly dynamic, interconnected environment in which it operates and regulate an innovative industry that has new technologies. Transforming also provides the NRC an opportunity to re-evaluate the way it conducts business to streamline processes and procedures and maximize efficiencies to better serve the American public.

The NRC's transformation vision is supported by the four focus areas outlined above. Each of the four focus areas is supported by initiatives aimed at streamlining work processes, advancing the use of new information technology, developing a framework that considers well-managed risk in decision making and encouraging innovative solutions to agency challenges.

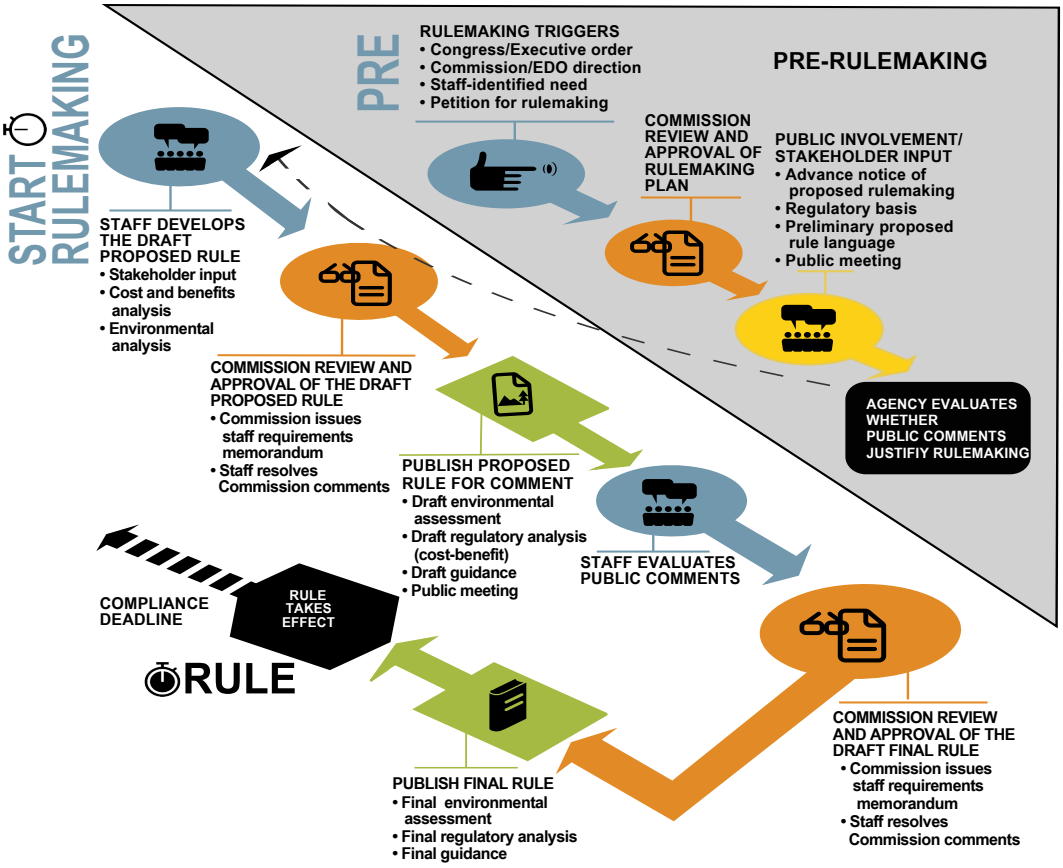
The NRC anticipates that the efficiencies gained by transformation will allow the staff to make more timely and better quality decisions vital to accomplishing the agency's safety and security mission. As the agency continues its transformation journey, stakeholder engagement is important, and the agency is communicating its progress through public meetings and conferences, as well as through the NRC website.

Scan QR code to learn more about the NRC's transformation journey

NRC RULEMAKING PROCESS

The process of developing regulations is called "rulemaking." The NRC initiates a new rule or a change to an existing rule when there is a need to do so to protect public health and safety. Additionally, any member of the public may petition the NRC to develop, change, or rescind a rule. The Commission directs the staff to begin work and obtain public input on a new rulemaking activity through approval of a staff rulemaking plan. The process is informally divided into two phases—pre-rulemaking and rulemaking—with a goal of maximizing public participation.

Figure 4. NRC Rulemaking Process



Pre-Rulemaking

The pre-rulemaking phase enlists the public in the early stages of rulemaking. The NRC staff tailors this phase to the complexity and potential impact of the rulemaking as well as the needs of licensees and the public. Public views and comments received during pre-rulemaking outreach can influence the agency's decision on whether to continue a rulemaking. The NRC may hold one or more public meetings as part of its pre-rulemaking outreach.

Advance Notice of Proposed Rulemaking

For especially important or complex rules, the NRC may engage the public at the beginning of the pre-rulemaking phase to define the scope and content of the rule. An advance notice of proposed rulemaking describes the need for the proposed action but discusses only broad concepts.

Regulatory Basis

A regulatory basis describes the technical, legal, and policy information that supports changes to the NRC's regulations. It describes why the current regulation needs to be updated, explains how a change in the regulations will resolve the problem, and discusses other regulatory options to potentially address the problem. It provides a high-level discussion of the costs and benefits of each option and identifies any backfitting and forward-fitting considerations. The NRC determines whether a regulatory basis is necessary based on the regulatory issues involved. If development of a regulatory basis is warranted, it is generally published for public comment.

Preliminary Proposed Rule Language

The agency will sometimes issue preliminary proposed rule language to provide the public opportunity to comment on the NRC staff's proposal and to prepare for detailed discussions during a public meeting.

Rulemaking

Proposed Rules

In this phase, the NRC staff drafts the actual regulation. Each proposed rule involving significant matters of policy is sent to the NRC Commission for approval. Less significant rules may, with Commission approval, be signed by an NRC staff manager. If approved, the proposed rule is published in the *Federal Register* and usually contains the following items:

- *the background information about the proposed rule*
- *an address for submitting comments*
- *the date by which comments must be submitted to ensure consideration by the NRC*
- *an explanation indicating why the rule change is thought to be needed*
- *the proposed text to be changed*

Usually, the public is given 30 to 90 days to provide written comments, although not all rules are issued for public comment. Generally, the agency does not collect comments on rules that concern agency organization, procedure, or practice, or rules for which delaying their publication to receive comments would be contrary to the public interest and not practical.

Final Rules

Once the public comment period has closed for the proposed rule, the staff analyzes the comments, makes any needed changes, and prepares a final rule for approval by the Commission or delegated NRC manager. Upon approval, the final rule is published in the *Federal Register* and usually becomes effective 30 days later.

Direct Final Rulemakings

When appropriate, the NRC can shorten the traditional rulemaking process by using a direct final rulemaking process. This process is used only for regulatory changes that the NRC believes are noncontroversial. In a direct final rule, a companion proposed rule is published at the same time as the direct final rule. If there are no significant and adverse comments on the proposed rule, the direct final rule becomes effective. If there are significant and adverse comments, the direct final rule is withdrawn and the rulemaking proceeds with the preparation of a typical final rule addressing public comment.

Rulemaking Information

The public can access a centralized, web-based tracking and reporting system, which provides near-real-time updates on all NRC rulemaking activities on the NRC website.

Scan QR code for more information on NRC rulemaking activities

ORGANIZATIONS AND FUNCTIONS

The NRC's Commission has five members nominated by the President of the United States and confirmed by the U.S. Senate for 5-year terms. The members' terms are staggered so one Commissioner's term expires on June 30 of each year. The President designates one member to serve as Chair. The Chair is the principal executive officer and spokesperson of the agency. No more than three Commissioners can belong to the same political party. The Commission as a whole formulates policies and regulations governing the safety and security of nuclear reactors and materials, issues orders to licensees, and adjudicates legal matters brought before it. The Executive Director for Operations carries out the policies and decisions of the Commission and directs the activities of the program and regional offices (see Figure 5. NRC Organizational Chart).

*Commissioner Term Expiration**

Christopher T. Hanson
Chair
June 30, 2024

Jeff Baran
June 30, 2023

David A. Wright
June 30, 2025

Annie Caputo
June 30, 2026

Bradley R. Crowell
June 30, 2027

* Commissioners listed by seniority.

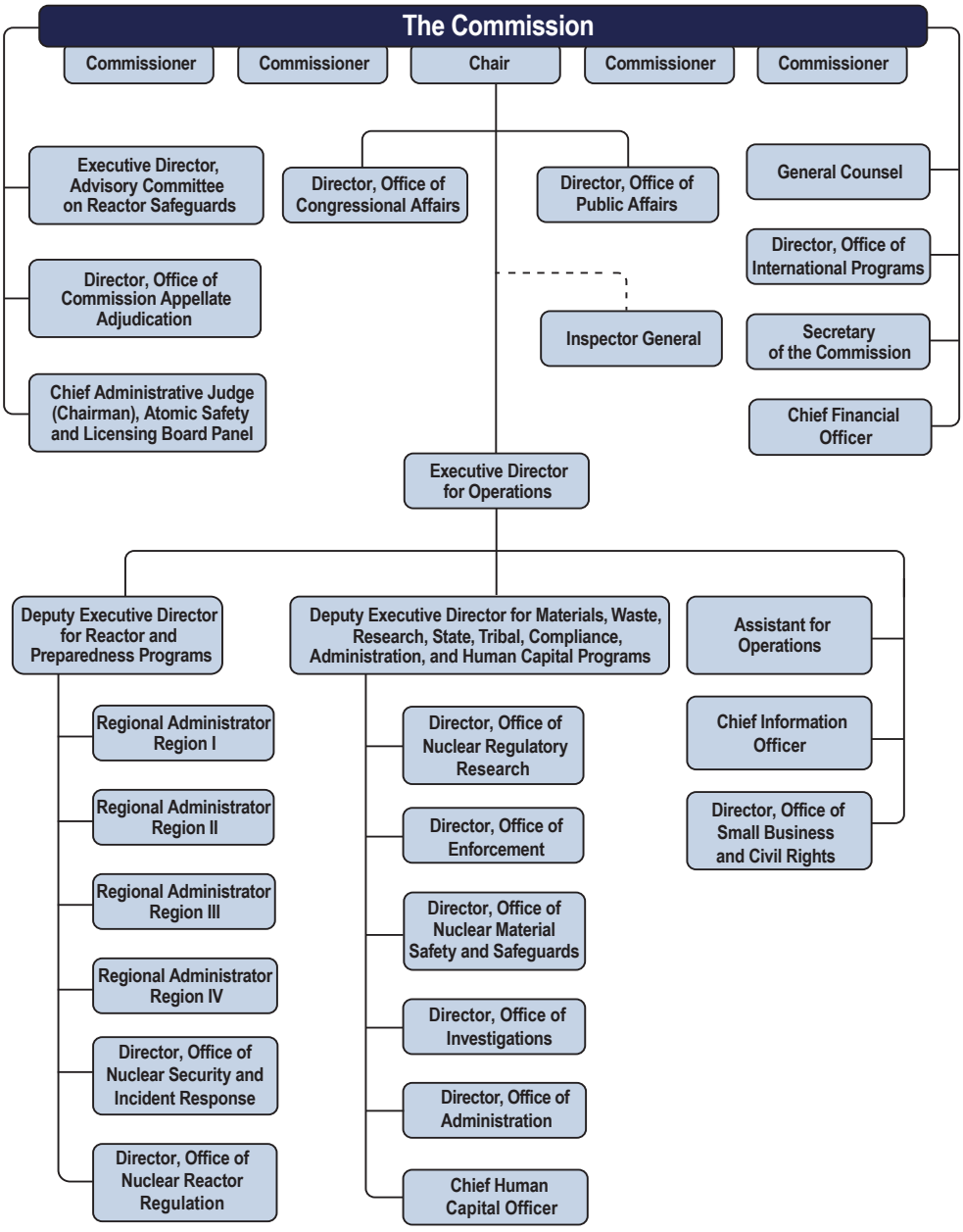
The NRC is headquartered in Rockville, Maryland, and has four regional offices. They are located in King of Prussia, Pennsylvania; Atlanta, Georgia; Lisle, Illinois; and Arlington, Texas.

The NRC's corporate offices provide centrally managed activities necessary for agency programs to operate and achieve goals. Corporate support is needed for a successful regulatory program and includes the Office Administration, Office of the General Council and Office of the Chief Information Officer. The NRC has the following major program offices:

- *The **Office of Nuclear Reactor Regulation** handles all licensing and inspection activities for existing nuclear power reactors and research and test reactors. It also oversees the design, siting, licensing, and construction of new commercial nuclear power reactors.*
- *The **Office of Nuclear Regulatory Research** provides independent expertise and information for making timely regulatory judgments, anticipating potentially significant safety problems, and resolving safety issues. It helps develop technical regulations and standards and collects, analyzes, and disseminates information about the safety of commercial nuclear power plants and certain nuclear materials activities.*
- *The **Office of Nuclear Material Safety and Safeguards** regulates the production of commercial nuclear fuel; uranium recovery activities; decommissioning of nuclear facilities; and the use of radioactive materials in medical, industrial, academic, and commercial applications. It regulates safe storage, transportation, and disposal of low- and high-level radioactive waste and spent nuclear fuel. The office also works with other Federal agencies, States, and Tribal and local governments on regulatory matters.*
- *The **Office of Nuclear Security and Incident Response** initiates and oversees the implementation of agency security policy for nuclear facilities and users of radioactive material and coordinates with other Federal agencies and international organizations on security issues. This office also maintains the NRC's emergency preparedness and incident response programs.*

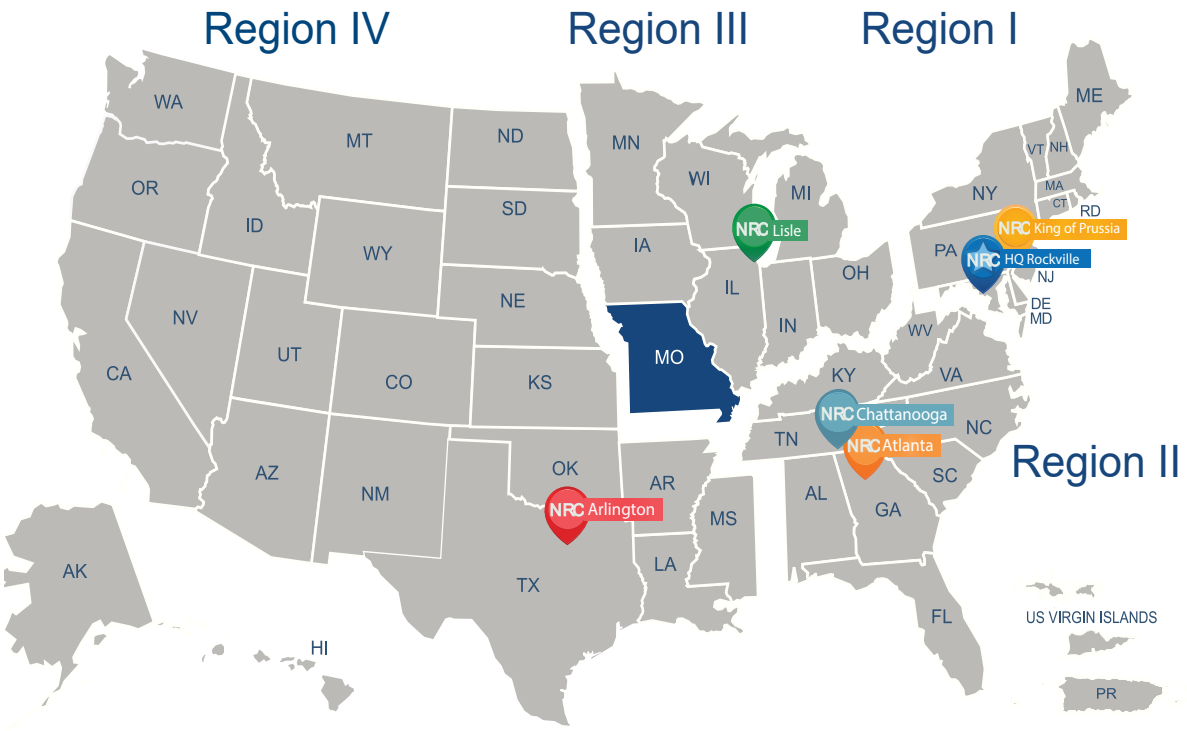
- *The NRC **regional offices** conduct inspections and investigations; take enforcement actions (in coordination with the Office of Enforcement); and maintain incident response programs for nuclear reactors, fuel facilities, and materials licensees. In addition, the regional offices carry out licensing for certain materials licensees (see Figure 6. NRC Regions).*
- *The agency has two **advisory committees**, the Advisory Committee on Reactor Safeguards (ACRS) and the Advisory Committee on the Medical Uses of Isotopes (ACMUI), which are independent of the NRC staff. The ACRS reports directly to the Commission, which appoints its members. The advisory committees are structured to provide a forum where experts representing many technical perspectives can provide independent advice that is factored into the Commission's decision-making process. Most committee meetings are open to the public, and any member of the public may request an opportunity to make an oral statement during committee meetings.*

Figure 5. NRC Organizational Chart



Note: For the most recent information, go to the NRC organization chart at https://www.nrc.gov/about-nrc/organization.html.

Figure 6. NRC Regions



Region I
King of Prussia, PA

Region II
Atlanta, GA

Region III
Lisle, IL

Region IV
Arlington, TX

Technical Training Ctr.
Chattanooga, TN

Nuclear Power Plants

- Each regional office oversees the plants in its region—except for the Callaway plant in Missouri, which Region IV oversees.

Materials Licensees

- Region I oversees licensees and Federal facilities located in Region I and Region II.
- Region III oversees licensees and Federal facilities located in Region III.
- Region IV oversees licensees and Federal facilities located in Region IV.

Nuclear Fuel Processing Facilities

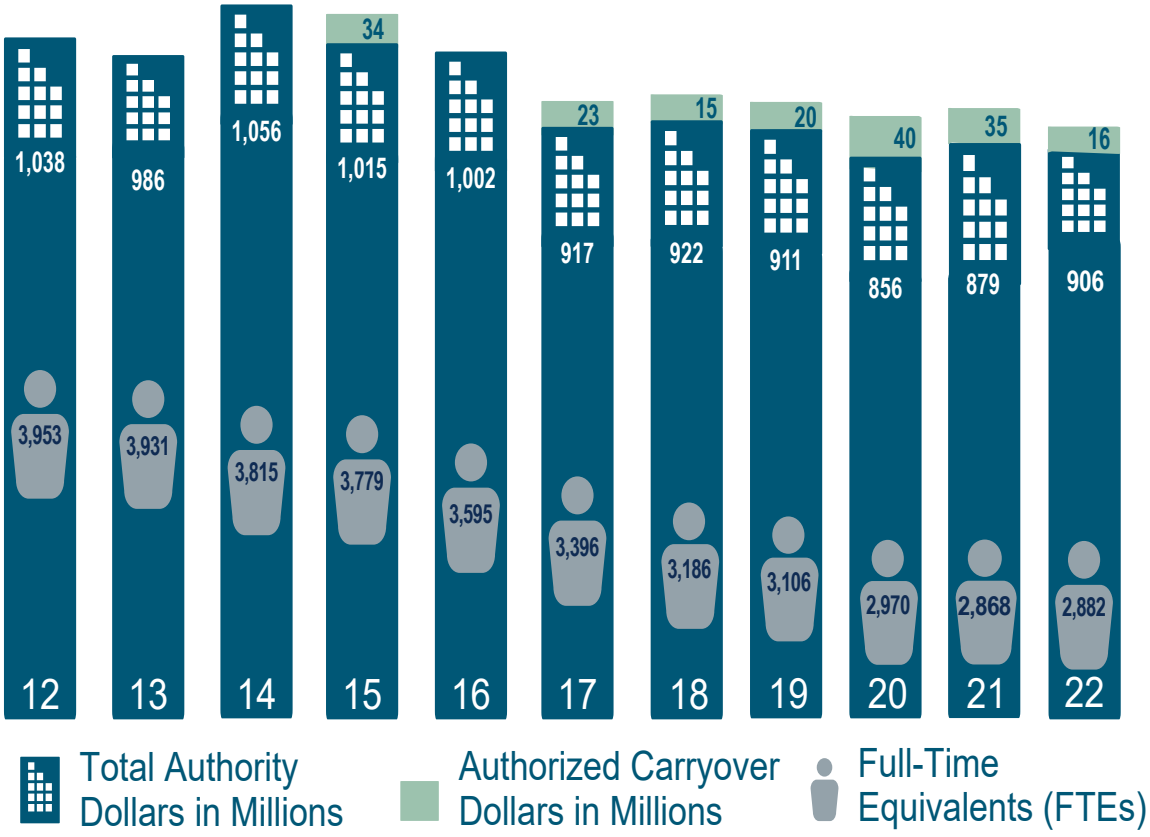
- Region II oversees all the fuel processing facilities in all regions.
- Region II also handles all construction inspection activities for new nuclear power plants and fuel cycle facilities in all regions.

FISCAL YEAR 2022 BUDGET

For fiscal year (FY) 2022 (October 1, 2021, through September 30, 2022), the NRC's budget is $905.7 million. The NRC has 2,882 full-time equivalents (FTEs) in FY 2022, including the Office of the Inspector General (see Figure 7. NRC Total Budget Authority, FYs 2012–2022). The Office of the Inspector General received its own appropriation of $13.8 million, which is included in the total NRC budget.

The breakdown of the budget is shown in Figure 8. NRC FY 2022 Distribution of Budget Authority; Recovery of Enacted NRC Budget. The Nuclear Energy Innovation and Modernization Act, known as NEIMA (Public Law 115-439), requires the NRC to recover, to the maximum extent practicable, approximately 100 percent of its total budget authority for a fiscal year, less the budget authority for "excluded activities." The NRC collects fees each year by $756.7 million in fees in FY 2022.

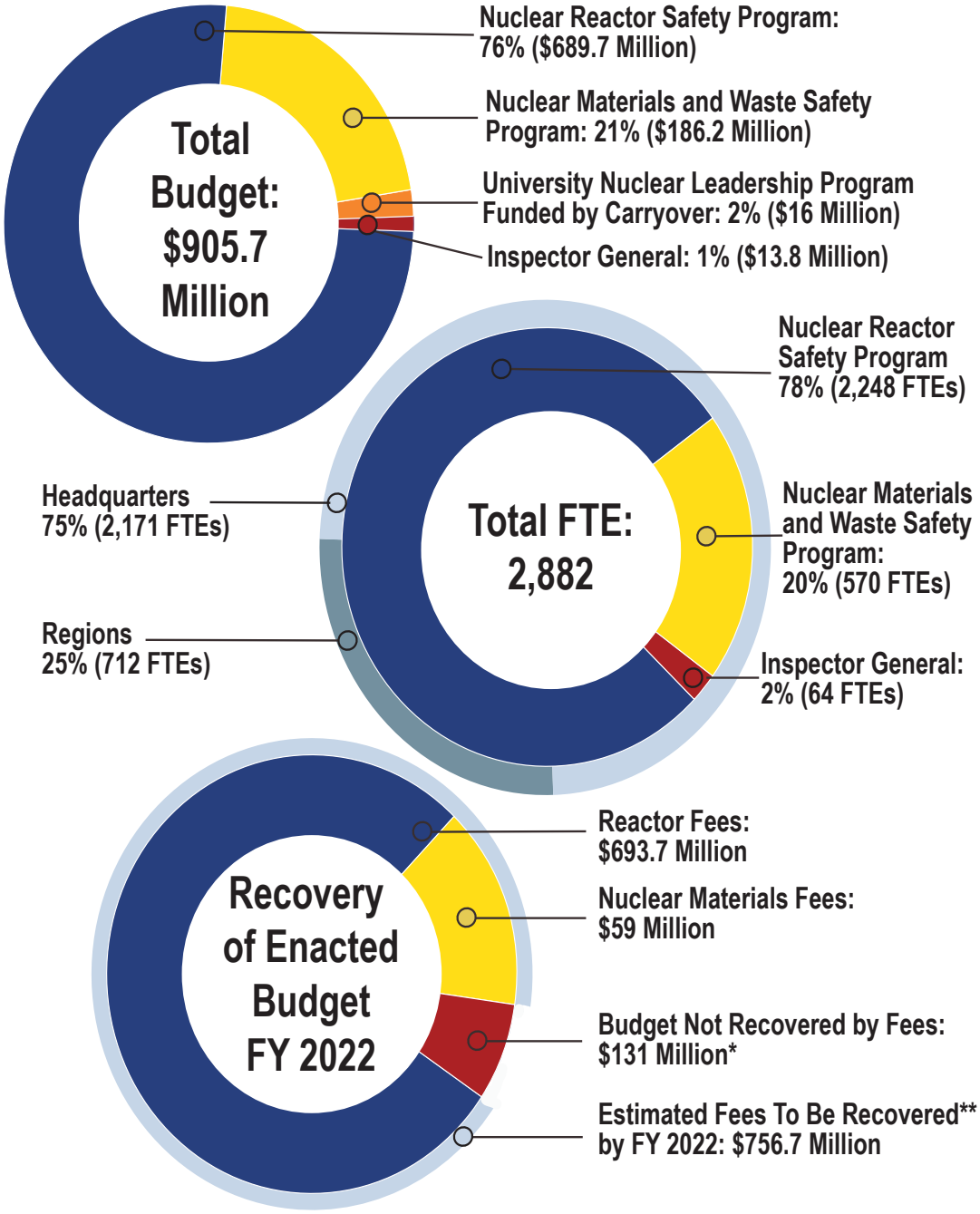
Figure 7. NRC Total Budget Authority, FYs 2012–2022



Note: Dollars are rounded to the nearest million. Numbers may not add up due to rounding.

Scan QR code for more budget information available in the Congressional Budget Justification

Figure 8. NRC FY 2022 Distribution of Budget Authority; Recovery of Enacted Budget



* The NRC also received a $2 Million Supplemental Appropriation to provide regulatory and technical support for Ukraine, which is not recovered by fees

** Recovered fees do not include the use of prior-year carryover where fees were previously collected. After Part 171 billing adjustments the amount to be recovered is $752.7.

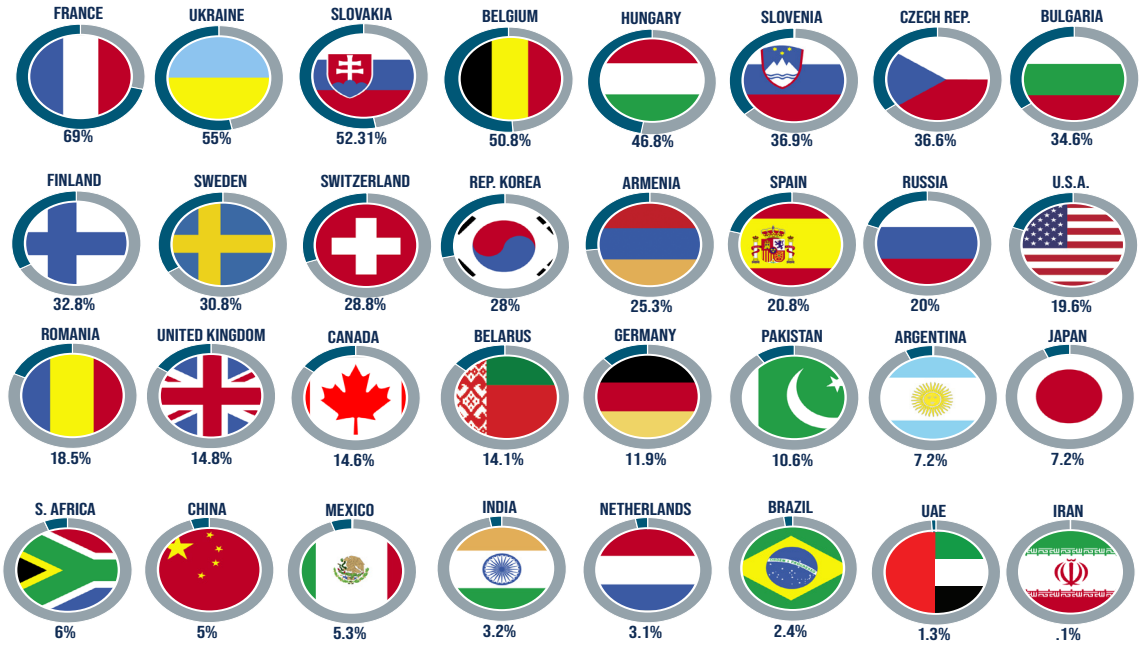
Notes: The NRC incorporates corporate and administrative costs proportionately within programs. Also, the spread of corporate FTE is included in Reactor and Material fees. Numbers may not add up due to rounding. Enacted budget for FY 2022.

WORLDWIDE ELECTRICITY GENERATED BY COMMERCIAL NUCLEAR POWER

Nuclear reactor technology was first developed in the 1940s, initially for producing weapons, but President Dwight D. Eisenhower's Atoms for Peace program shifted the focus to power generation, scientific research, and the production of medical and industrial isotopes. Today, nuclear technology is global, and nuclear-generated power is a part of the worldwide energy portfolio.

As of October 2022, there were 427 operating reactors in 32 countries with a total net capacity of 382,796 megawatts electric. (See Figure 9. Nuclear Share of Electricity Generated by Country to learn percentage by country.) In addition, 56 reactors were under construction. Based on data from 2021, France had the highest portion (69 percent) of total domestic energy generated by nuclear power.

Figure 9. Nuclear Share of Electricity Generated by Country



Note: Each country's short-form name is used.
Source: IAEA, Power Reactor Information System database, as of November 3, 2022, for 2021
https://pris.iaea.org/PRIS/WorldStatistics/OperationalReactorsByCountry.aspx

In addition to generating electricity, nuclear materials and technology are used worldwide for many other peaceful purposes, such as the following:

- *Radioactive isotopes help diagnose and treat medical conditions.*
- *Irradiation makes food safer and last longer, and assists in making pest-resistant seed varieties with higher yields.*
- *Nuclear gauges maintain quality control in industry.*
- *Radioactive isotopes date objects and identify elements.*

The NRC engages in international activities to exchange regulatory information to enhance the safe and secure civilian use of nuclear materials and technologies.

Scan QR code for more information on the NRC's International Program

INTERNATIONAL STRATEGY 2021–2025

The NRC is well-respected internationally in nuclear safety and security regulation. The agency's International Strategy builds directly on the Commission's 2014 International Policy Statement and has two primary aims:

- *Leverage this reputation to positively influence the development of new, and maintenance of existing, nuclear safety and security regimes around the world.*
- *Target the staff's international engagement to opportunities that will directly inform the agency's domestic mission objectives.*

The strategy consists of five objectives to guide the agency's international engagement and ensure that the agency's activities positively influence global nuclear safety and security, align with U.S. Government policy priorities, and promote strong cooperation with international regulatory partners. The objectives are as follows:

EXCEL

Maintain excellence in executing the NRC's statutory and legally mandated activities.

- *Successfully execute the U.S. Government's export and import mandate for nuclear equipment, components, and materials and contribute to meeting U.S. obligations under nuclear safety, security, and nonproliferation conventions, treaties, and U.S. Government commitments.*

INTEGRATE

Integrate the agency's international activities with broader U.S. Government foreign policy and national security objectives.

- *Frequent engagement with the executive branch about how the NRC can complement U.S. foreign policy or national security objectives, recognizing the NRC's nonpromotional status and independence and areas where policy restrictions may influence the direction of the agency's work.*

PARTNER

Build and maintain partnerships in specific regions of strategic importance to the United States that will support government-wide objectives and enable the agency to learn from its counterparts and advance its domestic mission.

- *Establish and maintain strategic global partnerships in all regions in targeted ways, promote domestic and global nuclear safety and security by creating and taking advantage of opportunities to increase cooperation, and gain valuable information to use as a benchmark for the agency's domestic activities.*

LEAD

Demonstrate leadership in the international community through involvement in key bilateral and multilateral forums in areas of strategic importance to the NRC and the U.S. Government.

- *Positively influence the global nuclear safety and security regime to develop regulatory frameworks that emphasize safety and security as a foremost objective, in a manner that promotes or is consistent with the NRC's domestic regulatory approach.*

ASSIST

Advance nuclear safety and security worldwide by providing regulatory assistance to countries with emerging regulatory programs, with a focus on countries of strategic importance to the broader U.S. Government.

- *Countries receiving NRC capacity-building support will make advances in developing a sound, independent, technically competent, adequately resourced nuclear safety and security regulatory infrastructure that mirrors key tenets of the NRC's regulatory infrastructure and approach.*

INTERNATIONAL ACTIVITIES

The NRC's international activities support the agency's domestic mission, as well as broader U.S. domestic and international interests. The wide-ranging activities include the following:

- *convention and treaty implementation*
- *nuclear nonproliferation*
- *export and import licensing for nuclear materials and equipment*
- *international nuclear safety, security, and safeguards cooperation and assistance*
- *cooperative safety research*

The NRC works with multinational organizations, such as the International Atomic Energy Agency (IAEA) and the Nuclear Energy Agency of the Organisation for Economic Co-operation and Development (OECD/NEA), and bilaterally with regulators in other countries through cooperation and research agreements. These interactions allow the NRC to share and acquire regulatory safety and security best practices. In addition, joint research projects give the NRC access to research facilities not available in the United States.

Conventions and Treaties

All countries that ratify nuclear-related conventions and treaties must take actions to implement them. Their actions help ensure high levels of safety and security. For example, the NRC actively participates in and provides leadership for the implementation of the Convention on Nuclear Safety. The objectives of the Convention are to maintain a high level of nuclear safety worldwide, to prevent accidents with radiological consequences, and to mitigate such consequences should they occur.

In addition, the NRC's international cooperation and assistance activities, as well as import and export licensing of nuclear materials and equipment, fulfill U.S. obligations undertaken under the treaty on the Non-Proliferation of Nuclear Weapons, which says that all parties to the Treaty have the right to participate in the fullest possible exchange of equipment, materials, and scientific and technological information for the peaceful uses of nuclear energy, provided that they meet their nonproliferation obligations. The NRC therefore participates in review meetings and associated activities under this treaty.

The NRC also actively participates in meetings and activities for the following conventions:

- *Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management*
- *Convention on the Physical Protection of Nuclear Material and Its Amendment*
- *Convention on Early Notification of a Nuclear Accident*
- *Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency*

Export and Import Licensing

The NRC reviews applications to license exports and imports of nuclear materials and equipment to ensure that such exports and imports will not be inimical to the safety and security of the United States and will be consistent with applicable agreements for the peaceful use of nuclear materials. The NRC's export and import regulations are found in 10 CFR Part 110, "Export and Import of Nuclear Equipment and Material."

The NRC participates in meetings of the Nuclear Suppliers Group and the Code of Conduct on the Safety and Security of Radioactive Sources to ensure that U.S. export and import controls are appropriate. ***>>See Appendix S for a listing of import and export licenses in FY 2022<<***

Bilateral Cooperation and Assistance

The NRC has information-sharing agreements with more than 45 countries, as well as Taiwan and the European Atomic Energy Community.

Cooperation

The NRC participates in a wide range of programs that enhance the safety and security of peaceful nuclear activities worldwide. With countries that have mature nuclear power or radioactive materials programs, the NRC focuses on sharing information and best practices.

Some of the benefits of consulting with mature regulatory programs include the following:

- *awareness of reactor construction activities that could apply to new reactors being built in the United States*
- *prompt notification to foreign partners of U.S. safety issues and vice versa*
- *sharing of safety and security information*

Assistance

The NRC provides bilateral and regional capacity-building support, training, workshops, and peer reviews to assist countries as they develop or enhance their national nuclear regulatory infrastructures and programs.

International Assignee Program

The NRC provides long-term, on-the-job assignments to foreign regulators at the NRC through its International Assignee Program. This helps both organizations better understand each other's regulatory programs, capabilities, and commitments. It also helps to enhance the expertise of both foreign assignees and the NRC staff. The program also fosters relationships between the NRC and key officials in other countries. Since the program's inception in 1975, the NRC has hosted more than 400 foreign assignees.

International Trainee Program

The NRC provides opportunities for engineers, scientists, and regulatory personnel from other countries to attend NRC training courses at the Technical Training Center and Professional Development Center.

Multilateral Cooperation and Assistance

The NRC plays an active role in the different programs and committee work of multilateral organizations. The agency works with multiple regulatory counterparts through the IAEA, OECD/NEA, and other multilateral organizations on issues related to the following

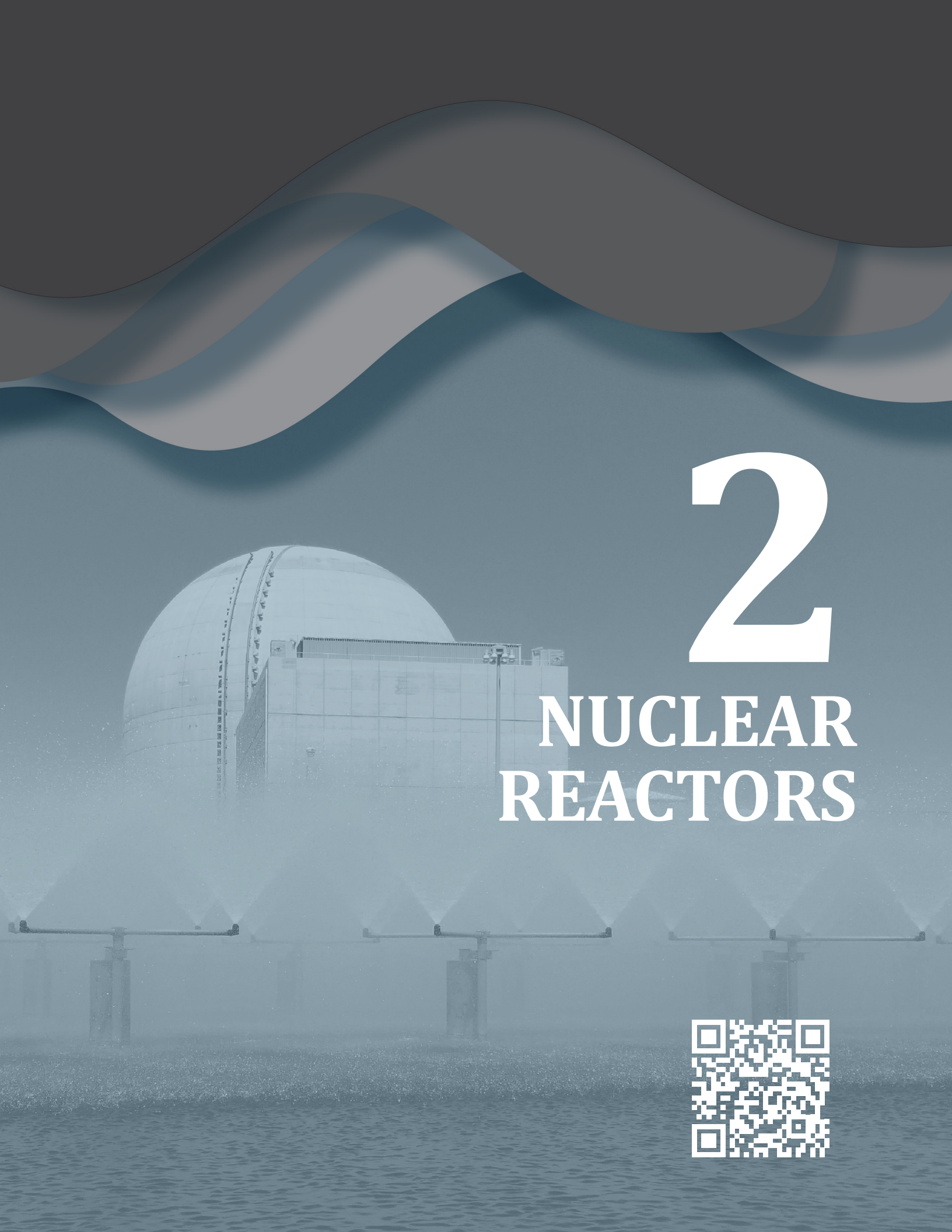
- *development of standards*
- *radiation protection*
- *risk assessment*
- *emergency preparedness*
- *waste management*
- *transportation*
- *safeguards, physical protection, and security*
- *communications and public outreach*

International Cooperative Research

The NRC participates in international cooperative research programs to share U.S. operating experience and to learn from the experiences of other countries. This helps leverage access to foreign research data and test facilities otherwise unavailable to the United States.

NRC Commissioners Annie Caputo and Bradley Crowell take a moment together while attending the IAEA International Ministerial Conference on Nuclear Power in the 21st Century, held in Washington, DC.

NRC Chair Christopher Hanson (left) and Alejandro Nunez-Carrera, Director General of Mexico's National Nuclear Safety and Safeguards Commission, meet to renew the bilateral arrangement between the NRC and the Mexican regulator, and discuss nuclear safety and security issues of mutual interest.



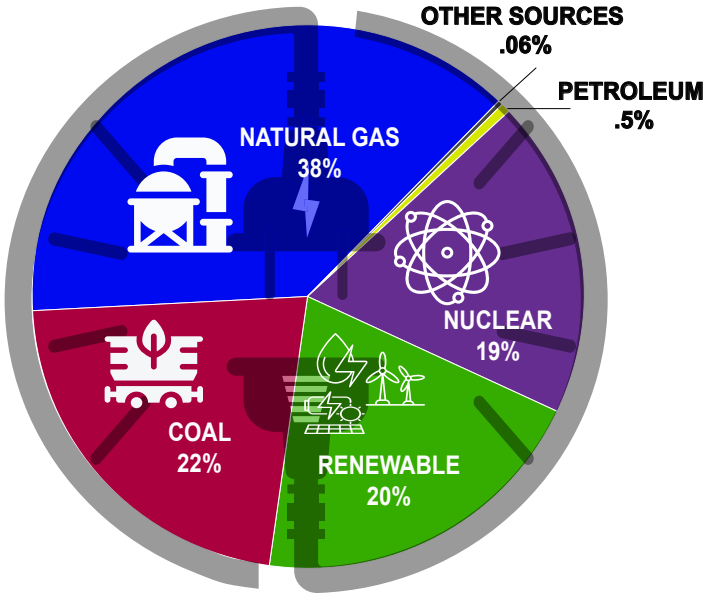
2

NUCLEAR REACTORS

U.S. ELECTRICITY GENERATED BY COMMERCIAL NUCLEAR POWER

According to the U.S. Energy Information Administration (EIA), in 2021, preliminary estimates show that 4.12 trillion kilowatt hours of electricity were generated in the United States. About 38 percent of this electricity generation was from natural gas, 22 percent from coal, 20 percent from renewable energy sources, 19 percent from nuclear energy, 0.5 percent from petroleum and 0.6 percent from other gases and sources. (see Figure 10. U.S. Gross Electricity Share by Energy Source, 2021)

Figure 10. U.S. Gross Electricity Share by Energy Source, 2021



Since the 1970s, the Nation's utilities have asked permission to generate more electricity from existing nuclear plants. The NRC regulates how much heat a commercial nuclear reactor may generate. This heat, or power level, is used with other data in many analyses that demonstrate the safety of the nuclear power plant. Because this power level is included in the plant's license and technical specifications, the NRC must review and approve any licensee's requested change to it, as it would for any license or technical specification change. Increasing a commercial nuclear power plant's maximum operational power level is called a "power uprate." The NRC has approved power uprates that have collectively added the equivalent of seven new reactors' worth of electrical generation to the power grid. ***>>See glossary on the NRC's website for information on the electric power grid at https://www.nrc.gov/reading-rm/basic-ref/glossary.html.<<***

According to the EIA, in 2021, each of the following States generated more than 40,000 megawatt-hours of electricity from nuclear power: Illinois, Pennsylvania, South Carolina, New York, Alabama, North Carolina, and Texas. Illinois ranked first in the Nation in both generating capacity and net electricity generation from nuclear power. Illinois nuclear power plants accounted for 12 percent of the Nation's nuclear power generation.

Scan QR code to access the EIA's historical state data for electricity generated in each state by nuclear power.

A photograph of Callaway nuclear power plant in Fulton, Missouri, at sunrise.

U.S. COMMERCIAL NUCLEAR POWER REACTORS

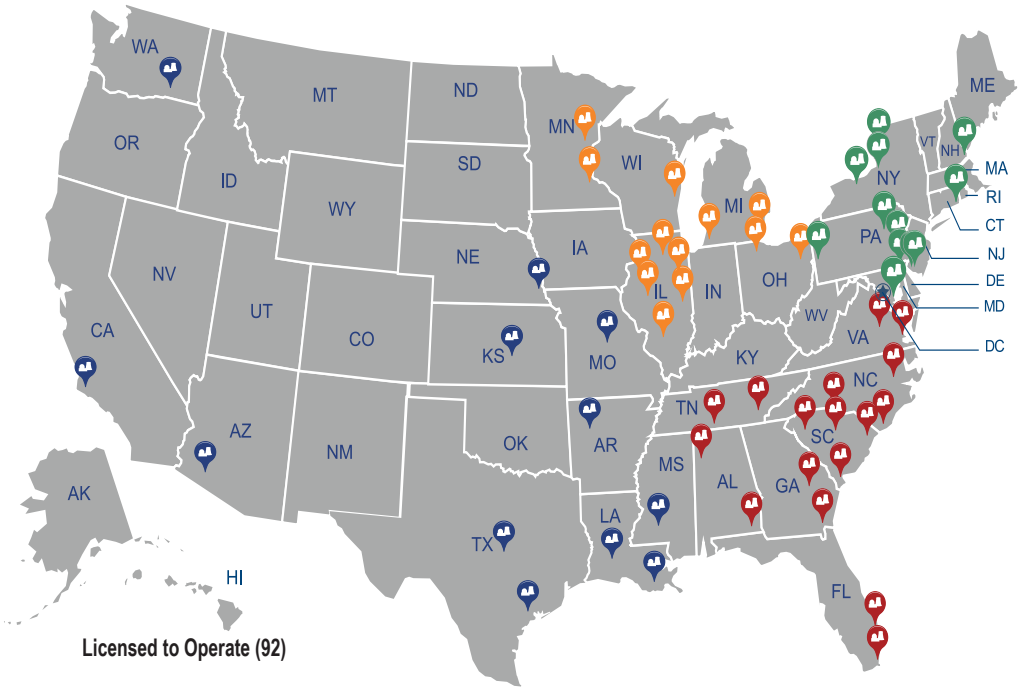
Power plants convert heat into electricity using steam. At nuclear power plants, the heat to boil water into steam is created when atoms split apart in a process called “fission.” When the process is repeated over and over, it is called a chain reaction. The reaction’s heat creates steam to turn a turbine. As the turbine spins, the generator turns, and its magnetic field produces electricity.

Nuclear power plants are very complex. There are many buildings at the site and many different systems. Some of the systems work directly to make electricity, while others keep the plant working correctly and safely. All nuclear power plants have a containment structure with reinforced concrete about 4 feet (1.2 meters) thick that houses the reactor. To keep reactors performing efficiently, operators remove about one-third of the fuel every year or two and replace it with fresh fuel. Used fuel is stored and cooled in deep pools of water located on site. The process of removing used fuel and adding fresh fuel is known as refueling.

The United States has two types of commercial nuclear reactors. Pressurized-water reactors are known as PWRs. They keep water in the reactor under pressure, so it heats to over 500 degrees Fahrenheit (260 degrees Celsius) but does not boil. Water from the reactor and the water that is turned into steam are in separate pipes and never mix. In boiling-water reactors, called BWRs, the water heated in the reactor actually boils and turns into steam, which then turns a turbine generator to produce electricity. In both types of plants, the steam is turned back into water and reused.

The NRC regulates commercial nuclear power plants that generate electricity. There are several operating companies and vendors and many different types of reactor designs. Of these designs, only PWRs and BWRs are currently in commercial operation in the United States. << Although commercial U.S. reactors have many similarities, each one is considered unique (see Figure 11. U.S. Operating Commercial Nuclear Power Reactors). >***>See glossary on the NRC’s website for information on the typical PWR and BWR designs <<***

Figure 11. U.S. Operating Commercial Nuclear Power Reactors



REGION I

CONNECTICUT
Millstone 2 and 3

MARYLAND
Calvert Cliffs 1 and 2

NEW HAMPSHIRE
Seabrook

NEW JERSEY
Hope Creek
Salem 1 and 2

NEW YORK
FitzPatrick
Ginna
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

REGION II

ALABAMA
Browns Ferry 1, 2, and 3
Farley 1 and 2

FLORIDA
St. Lucie 1 and 2
Turkey Point 3 and 4

GEORGIA
Hatch 1 and 2
Vogtle 1, 2 and 3*

NORTH CAROLINA
Brunswick 1 and 2
McGuire 1 and 2
Harris 1

SOUTH CAROLINA
Catawba 1 and 2
Oconee 1, 2, and 3
Robinson 2
Summer

TENNESSEE
Sequoyah 1 and 2
Watts Bar 1 and 2

VIRGINIA
North Anna 1 and 2
Surry 1 and 2

REGION III

ILLINOIS
Braidwood 1 and 2
Byron 1 and 2
Clinton
Dresden 2 and 3
LaSalle 1 and 2
Quad Cities 1 and 2

MICHIGAN
Cook 1 and 2
Fermi 2

MINNESOTA
Monticello
Prairie Island 1 and 2

OHIO
Davis-Besse
Perry

WISCONSIN
Point Beach 1 and 2

REGION IV

ARKANSAS
Arkansas Nuclear 1 and 2

ARIZONA
Palo Verde 1, 2, and 3

CALIFORNIA
Diablo Canyon 1 and 2

KANSAS
Wolf Creek

LOUISIANA
River Bend 1
Waterford 3

MISSISSIPPI
Grand Gulf

MISSOURI
Callaway

NEBRASKA
Cooper

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

WASHINGTON
Columbia

* Vogtle Unit 3 (Southern Nuclear Operating Co.) plans to enter service in 2023.
Note: NRC-abbreviated reactor names are listed. Data are current as of October 2022. For the most recent information, go to the NRC facility locator page at https://www.nrc.gov/info-finder/reactors/index.html.

>>See Appendix A for a list of commercial nuclear power reactors and their general licensing information and Appendix P for Native American reservations and trust lands near nuclear power plants.<<

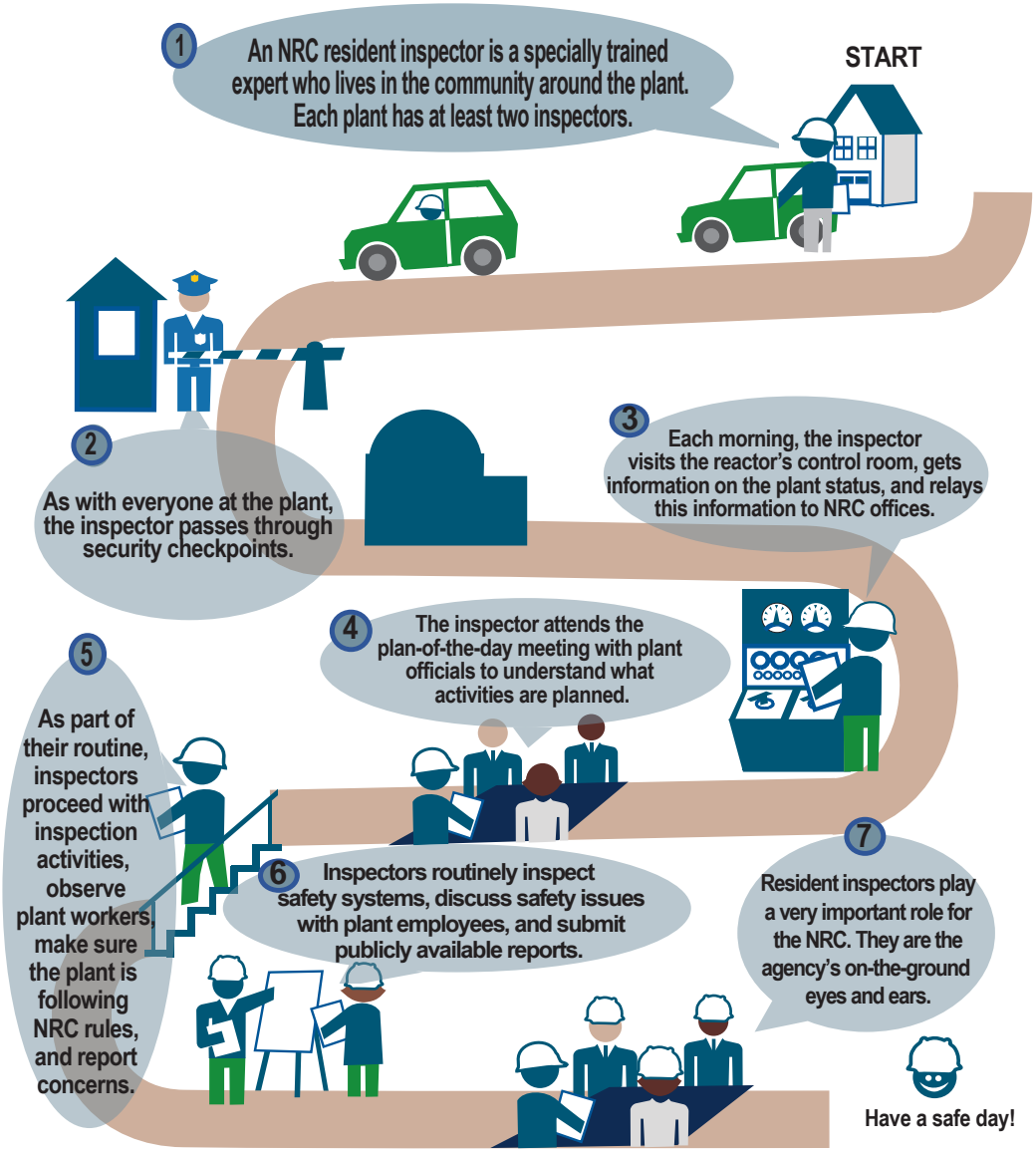
Scan QR code for more information on the NRC-licensed operating reactors

Resident Inspectors

Since the late 1970s, the NRC has maintained its own sets of eyes and ears at the Nation's nuclear power plants. These onsite NRC personnel are referred to as "resident inspectors." Each plant has at least two resident inspectors, and their work is at the core of the agency's reactor inspection program. These highly trained and qualified professionals scrutinize activities at the plants and verify adherence to Federal safety requirements. The inspectors visit the control room and review operator logbook entries, visually assess areas of the plant, observe tests of (or repairs to) important systems or components, interact with plant employees, and check corrective action documents to ensure that problems have been identified and appropriate fixes implemented.

Resident inspectors promptly notify plant operators of any safety-significant issues they find so they are corrected, if necessary, and communicated to NRC management. If problems are significant enough, the NRC will consider whether enforcement action is warranted. More information about the NRC's Reactor Oversight Process and the resident inspector program is available on the agency's website (see Figure 12. Day in the Life of an NRC Resident Inspector).

Figure 12. Day in the Life of an NRC Resident Inspector



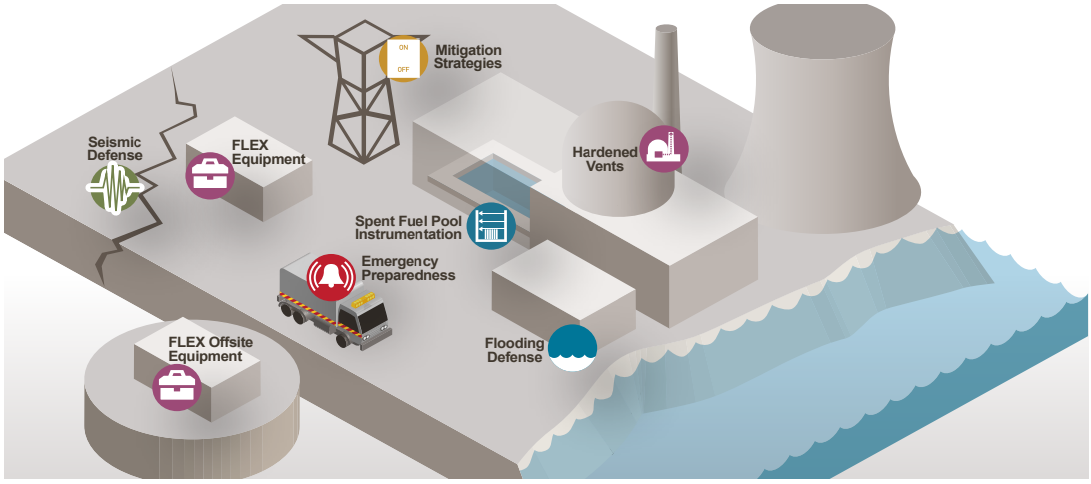
YouTube Learn more about resident inspectors. Watch the videos on the NRC YouTube channel at https://www.youtube.com/user/NRCgov.

Post-Fukushima Safety Enhancements

On March 11, 2011, a 9.0-magnitude earthquake, followed by a 45-foot (13.7-meter) tsunami, heavily damaged the nuclear power reactors at Japan's Fukushima Dai-ichi facility. Following this accident, the NRC required significant enhancements to U.S. commercial nuclear power plants. At the front lines of this effort were the agency's resident inspectors and regional staff. They inspected and monitored U.S. reactors as the plants worked on these enhancements.

The enhancements included adding capabilities to maintain key plant safety functions following any kind of severe event, updating evaluations of potential impacts from seismic and flooding events, installing new equipment to better handle potential reactor core damage events, and strengthening emergency preparedness capabilities. These actions ensure the nuclear industry and the NRC are prepared for the unexpected. The NRC continues to inspect plants' efforts to ensure the plants have the required resources, plans, and training (see Figure 13. NRC Post-Fukushima Safety Enhancements).

Figure 13. NRC Post-Fukushima Safety Enhancements



Principal Licensing, Inspection, and Enforcement Activities

The NRC's commercial reactor licensing and inspection activities include the following:

- *reviewing separate license change requests, called "amendments," from power reactor licensees*
- *performing inspections at each operating reactor site*
- *conducting initial reactor operator licensing examinations*
- *ensuring NRC-licensed reactor operators maintain their knowledge and skills current by passing rigorous requalification exams every 2 years and obtaining an NRC license renewal every 6 years*
- *reviewing applications for proposed new reactors*
- *inspecting construction activities*
- *reviewing operating experience items each year and sharing lessons learned that could help licensed facilities operate more effectively*
- *issuing notices of violation, civil penalties, or orders to operating reactors for significant violations of NRC safety and security regulations*
- *investigating allegations of inadequacy or impropriety associated with NRC-regulated activities*
- *incorporating independent advice from the Advisory Committee on Reactor Safeguards, which holds both full committee meetings and subcommittee meetings each year to examine potential safety issues for existing or proposed reactors*

NRC Commissioner Jeff Baran observes the reactor vessel head inside Unit 4 containment, currently under construction at the Vogtle site in Georgia.

OVERSIGHT OF U.S. COMMERCIAL NUCLEAR POWER REACTORS

The NRC establishes requirements for the design, construction, operation, and security of U.S. commercial nuclear power plants. The agency ensures plants operate safely and securely within these requirements by licensing the plants to operate, licensing control room operators, establishing technical specifications for operating each plant, and inspecting plants daily.

Reactor Oversight Process

The NRC's Reactor Oversight Process (ROP) verifies that U.S. reactors are operating in accordance with NRC rules, regulations, and license requirements. If reactor performance declines, the NRC increases its oversight to protect public health and the environment. This can range from conducting additional inspections to shutting a reactor down.

The NRC staff uses the ROP to evaluate NRC inspection findings and performance records for each reactor and applies this information to assess the reactor's safety performance and security measures. The NRC places each reactor in one of five categories. The top category is "fully meeting all safety cornerstone objectives," while the bottom is "unacceptable performance."

NRC inspections start with detailed baseline-level activities for every reactor. As the number of issues at a reactor increases, the scope of the NRC's inspections increases. The agency's supplemental inspections and other actions (if needed) ensure licensees promptly address significant performance issues. The latest reactor-specific inspection findings and historical performance information can be found on the NRC's website.

The ROP is informed by 50 years of improvements in nuclear industry performance. The process continues to improve approaches to inspecting and evaluating the safety and security performance of NRC-licensed nuclear plants. More ROP information is available on the NRC's website and in NUREG-1649, Revision 6, "Reactor Oversight Process," issued July 2016 (see Figure 14. Reactor Oversight Framework, and Figure 15. Reactor Oversight Action Matrix Performance Indicators).

Figure 14. Reactor Oversight Framework

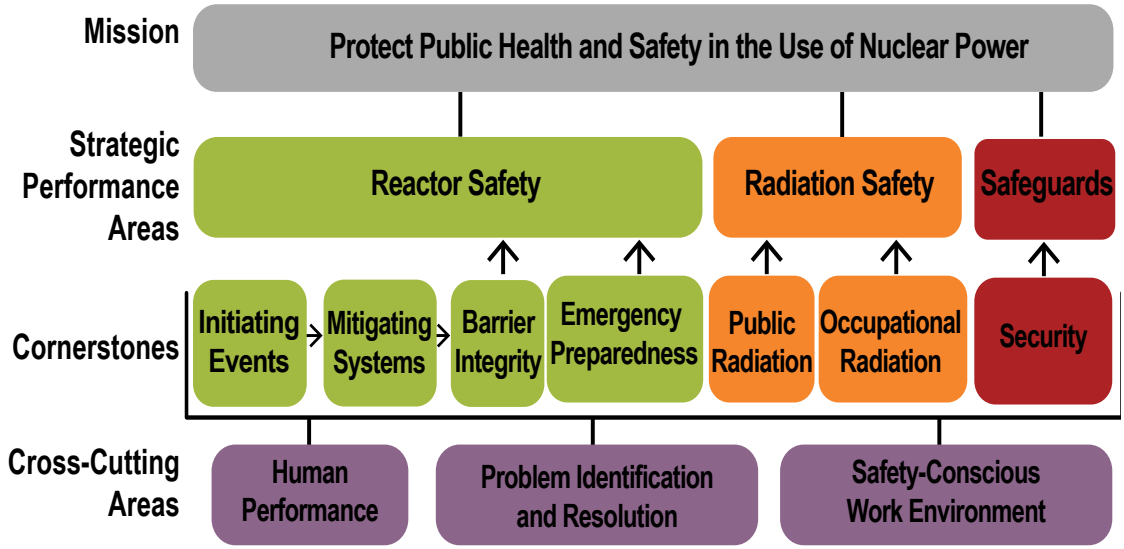


Figure 15. Reactor Oversight Action Matrix Performance Indicators

>>See Appendix C for a list of commercial nuclear power reactors undergoing decommissioning and permanently shut down, Appendix R for list of significant enforcement actions, and Appendices E and F for power reactor operating licenses issued and expiring by year.<<

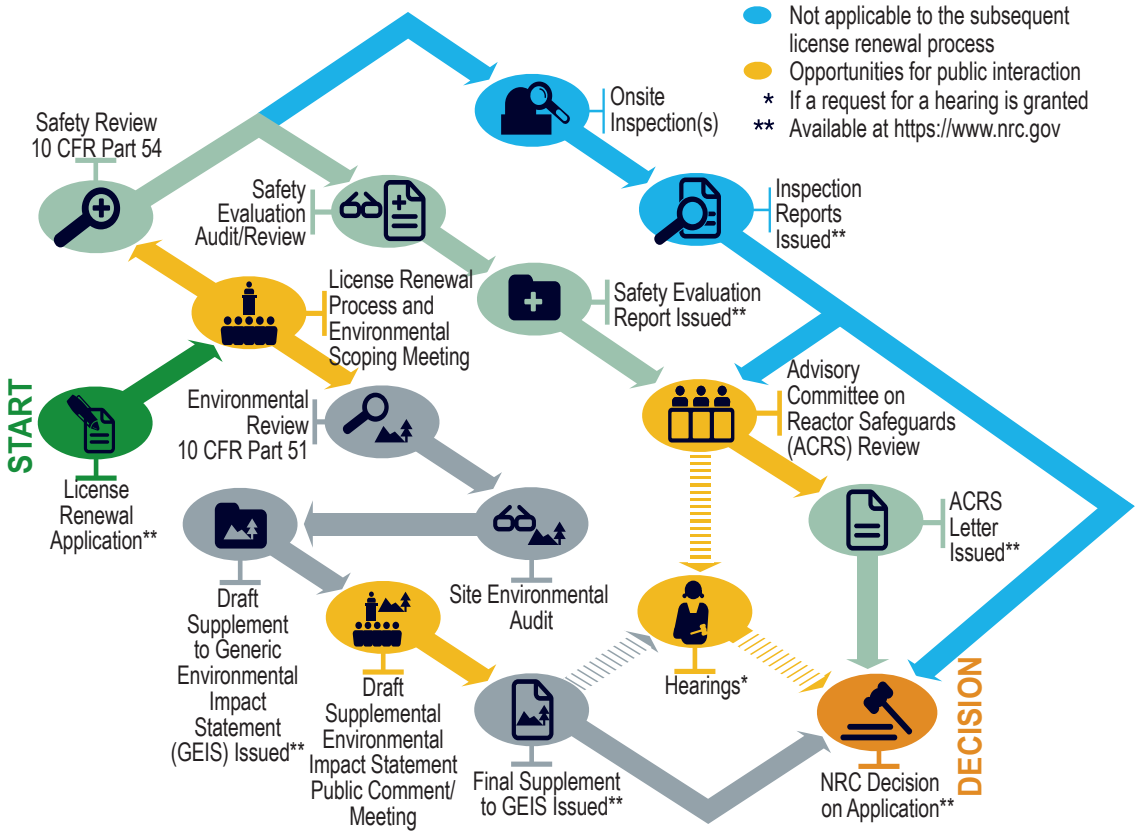
Scan QR code to see the latest reactor-specific inspection findings and historical performance information on website

REACTOR LICENSE RENEWAL

The Atomic Energy Act of 1954, as amended, authorizes the NRC to issue 40-year initial licenses for commercial power reactors. The Act also allows the NRC to renew licenses. Under the NRC's current regulations, the agency can renew reactor licenses for 20 years at a time. Nuclear power plant owners typically seek license renewal based on a plant's economic situation and on whether it can continue to meet NRC requirements in the future (see Figure 16. License Renewal Process). Congress set the original 40-year term after considering economic and antitrust issues, as opposed to nuclear technology issues. There can be systems, structures, and components for which the licensee used "time-limited" aging analyses. To receive a renewed license, NRC regulations provide options on how to address these time-limited analyses, including that the applicant show that the analyses remain valid for the period of extended operation.(see Figure 17. License Renewals Granted for Operating Nuclear Power Reactors). For current reactors grouped by how long they have operated, see Figure 18. U.S. Commercial Nuclear Power Reactors—Years of Operation by the End of 2022.

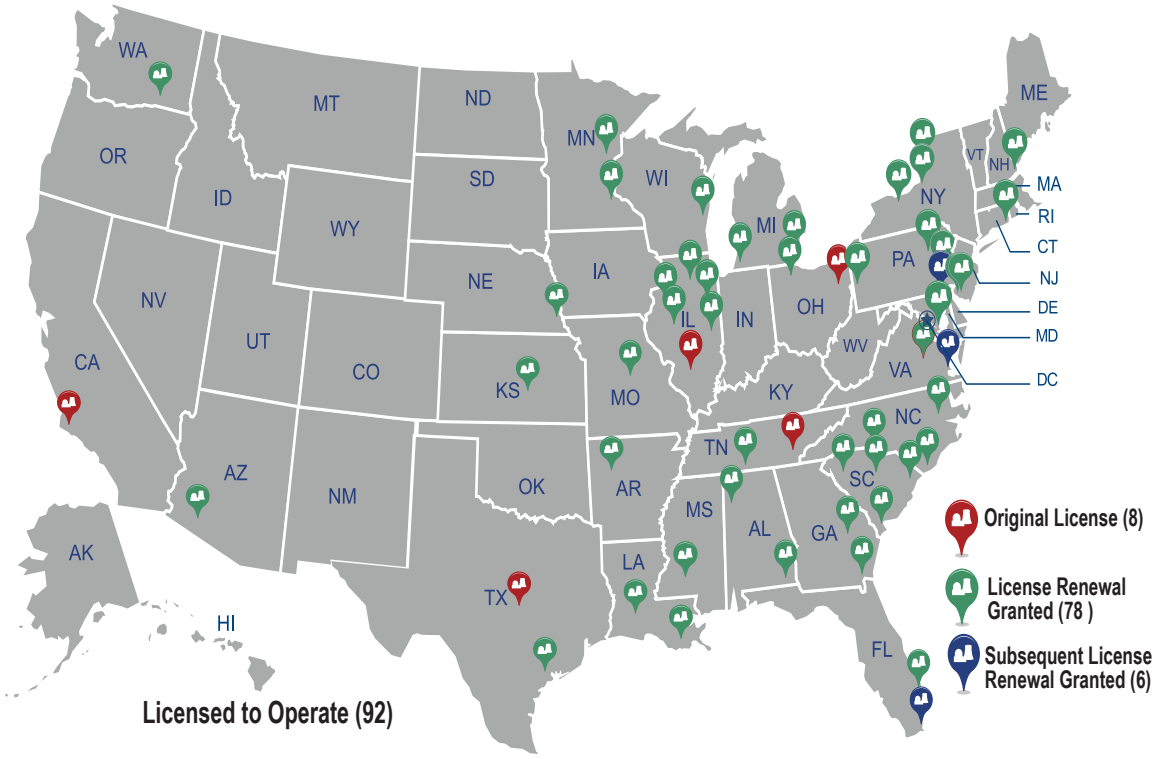
The license renewal process proceeds along two tracks—one for review of safety issues and another for environmental issues. The safety review evaluates the licensee's plans for managing aging plant systems during the renewal period. For the environmental review, the agency uses the NUREG-1437, Revision 1, "Generic Environmental Impact Statement for License Renewal of Nuclear Plants" issued June 2013, to evaluate impacts common to all nuclear power plants, then prepares a supplemental environmental impact statement for each individual plant. The supplement examines impacts unique to the plant's site. The public has two opportunities to contribute to the environmental review—at the beginning and when the draft report is published.

Figure 16. License Renewal Process



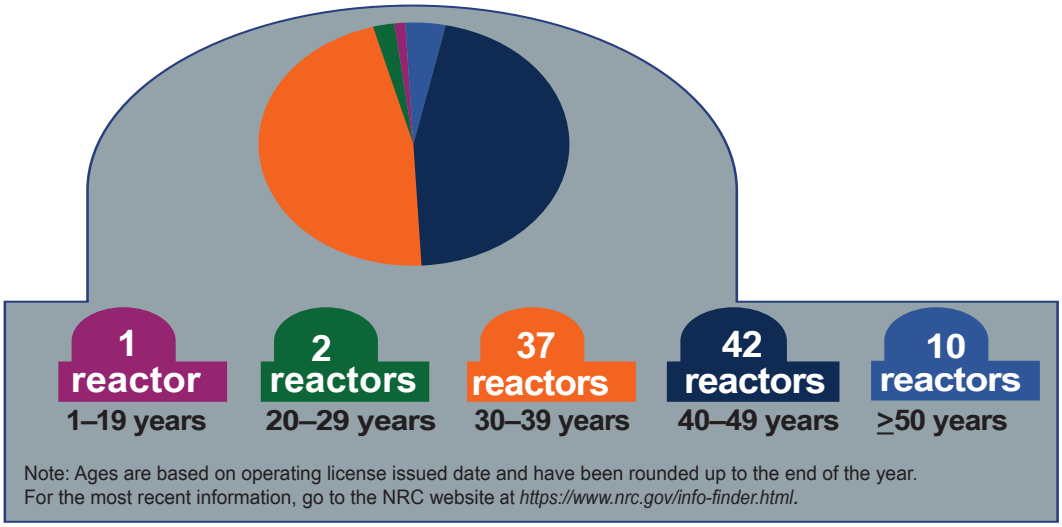
The NRC considered the environmental impacts of the continued storage of spent nuclear fuel during rulemaking activities and published its final continued storage rule and supporting generic environmental impact statement in 2014. The rule addresses the environmental impacts of the continued storage of spent nuclear fuel beyond a reactor's licensed operating life before ultimate disposal. The environmental impacts of continued storage of spent nuclear fuel are incorporated into each environmental review for license renewal.

Figure 17. License Renewals Granted for Operating Nuclear Power Reactors



Note: The NRC has issued a total of 95 initial license renewals; 10 of these units have permanently shut down.
Data are as of October 2022. For the most recent information, go to the NRC Web page at *https://www.nrc.gov/info-finder.html*.

Figure 18. U.S. Commercial Nuclear Power Reactors— Years of Operation by the End of 2022



Note: Ages are based on operating license issued date and have been rounded up to the end of the year.
For the most recent information, go to the NRC website at *https://www.nrc.gov/info-finder.html*.

Subsequent License Renewal

The NRC staff developed guidance and a standard review plan for "subsequent license renewals" that would allow plants to operate for more than 60 years (the 40 years of the original license plus the 20 years in the initial license renewal).

The Commission determined that the agency's existing regulations are adequate for subsequent license renewals. Nevertheless, the Commission asked the staff to develop new guidance to better help licensees develop aging management programs for the 60-year to 80-year period. The staff issued this guidance (NUREG-2191 and NUREG-2192) in July 2017.

Public Involvement

The public plays an important role in the license renewal process. Members of the public have several opportunities to contribute to the environmental review. The NRC shares information provided by the applicant, holds public meetings, and publicly documents the results of its technical and environmental reviews. In addition, the ACRS reviews license renewal applications and discusses them at its meetings.

Individuals or groups can challenge a license renewal application in an NRC adjudicatory proceeding if they would be affected by the renewal and meet basic requirements for requesting a hearing.

Turkey Point nuclear power plant in Florida was the first U.S. plant to be approved by the NRC for subsequent license renewal, or an additional 20 years of operation, for a total lifespan of 80 years.

Scan QR code for more information on the NRC-licensed reactor license renewal

NUCLEAR RESEARCH AND TEST REACTORS

Nuclear research and test reactors (RTRs), also called "nonpower" reactors, are a type of Nonpower Production and Utilization Facility, also referred to as NPUF. RTRs are primarily used for research, training, and development to support science and education in nuclear engineering, physics, chemistry, biology, anthropology, medicine, materials science, and related fields. These reactors do not produce electricity. Most U.S. RTRs are at universities or colleges.

The largest U.S. RTR (which operates at 20 megawatts thermal (MWt) is approximately 80 times smaller than the smallest U.S. commercial power nuclear reactor (which operates at 1,677 MWt). The NRC regulates a wide variety of RTRs located across the country (see Figure 19. Size Comparison of Commercial and Research Reactors, and Figure 20. U.S. Nuclear Research and Test Reactors). The DOE also uses nonpower nuclear research reactors, but they are not regulated by the NRC.

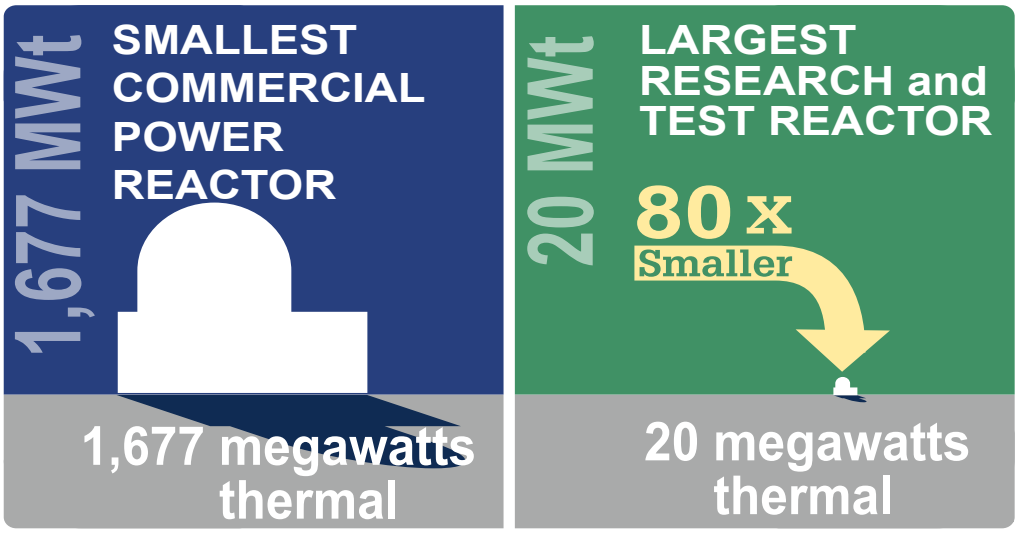
NRC inspectors visit each RTR facility about once a year to provide varying levels of oversight. RTRs licensed to operate at 2 MWt or more receive a full NRC inspection every year. Those licensed to operate at less than 2 MWt receive a full inspection every 2 years.

Principal Licensing and Inspection Activities

The NRC's RTR licensing and inspection activities include the following:

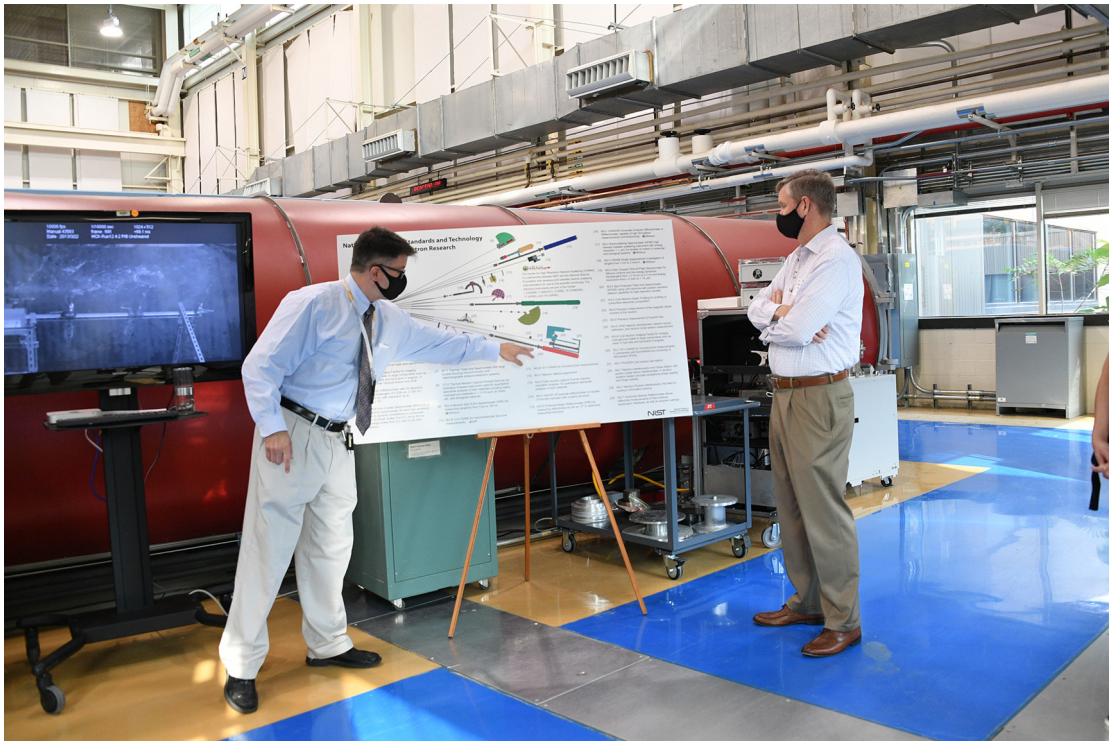
- *licensing new and currently operating sites, including license renewals and license amendments*
- *overseeing decommissioning*
- *licensing operators*
- *overseeing operator relicensing programs*
- *conducting inspections each year, based on inspection frequency and procedures for operating RTRs*
- *overseeing facility security and emergency preparedness programs*

Figure 19. Size Comparison of Commercial and Research Reactors



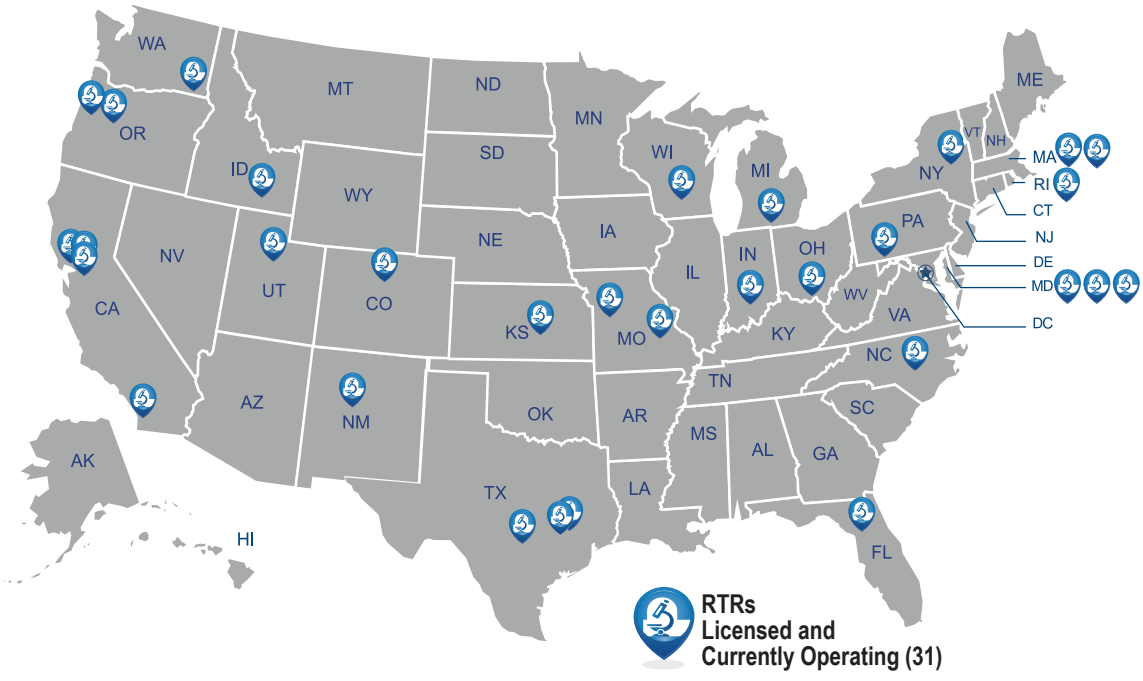
For the most recent information, go to NRC website at *https://www.nrc.gov/info-finder.html.*

Scan QR code for more information on the NRC-licensed nonpower production and utilization facility



NRC Chair Christopher T. Hanson tours the National Institute of Standards and Technology's Center for Neutron Research in Maryland, learning about some of the research conducted using the largest NRC-regulated nonpower reactor in the United States.

Figure 20. U.S. Nuclear Research and Test Reactors



Note: RTRs are also referred to as "nonpower facilities." For the most recent information, go to NRC webpage at *https://www.nrc.gov/info-finder.html.*

NEW COMMERCIAL NUCLEAR POWER REACTOR LICENSING

New reactors are any reactors proposed in addition to the current fleet of operating reactors (see Figure 21. The Different NRC Classifications for Types of Reactors).

The NRC's current review of new power reactor license applications improves on the process used through the 1990s (see Figure 22. New Reactor Licensing Process). In 2012, the NRC issued the first combined construction permit and operating license (called a "combined license," or COL) under the new licensing process. The NRC continues to review applications submitted by prospective licensees and (when appropriate) issues standard design approvals, standard design certifications, early site permits (ESPs), limited work authorizations, construction permits, operating licenses, and COLs for facilities in a variety of projected locations throughout the United States. The NRC has implemented the Commission's policies on new reactor safety through rules, guidance, staff reviews, and inspection.

The NRC's ongoing design certification, COL, and ESP reviews are incorporating lessons learned from the Fukushima accident. The environmental impacts of continued storage of spent nuclear fuel are incorporated into each environmental review for new reactor licensing. The NRC considered these impacts in a rulemaking and published its final continued storage rule and supporting generic environmental impact statement in September 2014. Section 4 discusses the continued storage rule in more detail.

>>See Appendices G and H for a list of RTRs regulated by the NRC that are operating or are in the process of decommissioning, and Appendix B for a list of new nuclear power plant licensing applications in the United States.<<

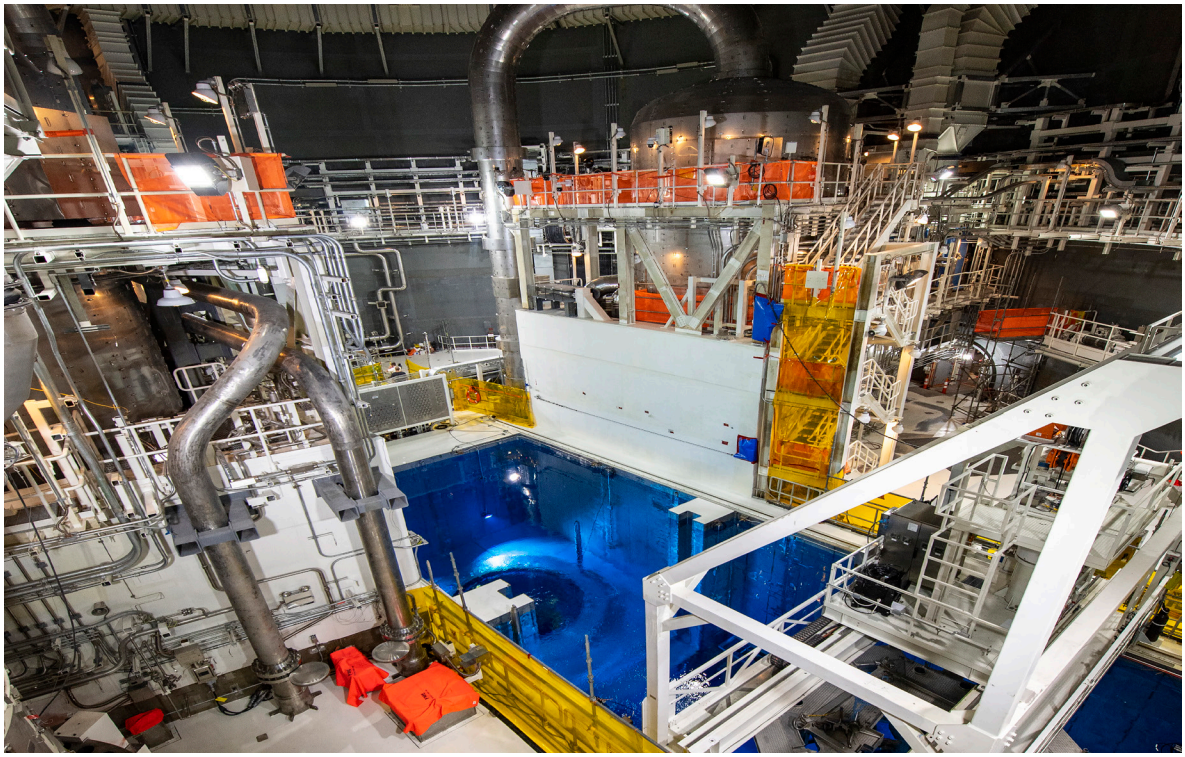
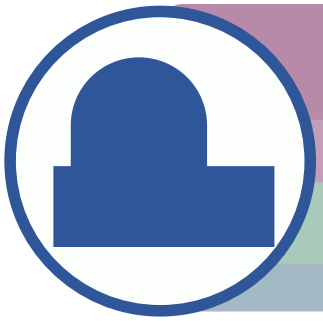


Photo of the Vogtle Unit 3 reactor cavity area.
Photo courtesy of Georgia Power Company.

Figure 21. The Different NRC Classifications for Types of Reactors

Operating Reactors



Design: The U.S. fleet consists mainly of large reactors that use regular water ("light" water, as opposed to "heavy" water that has a different type of hydrogen than commonly found in nature) for both cooling the core and facilitating the nuclear reaction.

Capacity: The generation base load of these plants is 1,677 MWt (approximately 570 MWe) or higher.

Safety: These reactors have "active" safety systems powered by alternating current (ac) and require an operator to reach a safe-shutdown state.

Fuel: These reactors require enriched uranium.

Advanced Reactors

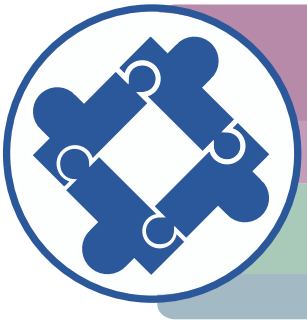
Design: Advanced reactors are a new generation of non-light-water reactors.They use coolants such as molten salts, liquid metals, and even gases like helium.

Capacity: These plants range in power from very small reactors to a power level comparable to existing operating reactors.

Safety: These reactors are expected to provide enhanced margins of safety and use simplified, inherent, and passive means to ensure safety. They may not require an operator to shut down.

Fuel: These reactors could use enriched uranium, thorium, or used nuclear fuel.

Small Modular Reactors



Design: Small modular reactors (SMRs) are similar to large light-water reactors but are smaller, compact designs. These factory-fabricated reactors can be transported by truck or rail to a nuclear power site. Additional SMRs can be installed on site to scale or to meet increased energy needs.

Capacity: These reactors are about one-third the size of typical reactors, with a generation base load of 1,000 MWt (300 MWe) or less.

Safety: These reactors can be installed underground, providing more safety and security. They are built with passive safety systems and can be shut down without an operator.

Fuel: These reactors require enriched uranium.

Research and Test Reactors

Design: Research and test reactors—also called "nonpower" reactors—are primarily used for research, training, and development. They are classified by their moderator, the material used to slow down the neutrons, in the nuclear reaction. Typical moderators include water (H_2O), heavy water (D_2O), polyethylene, and graphite.

Capacity: Currently licensed RTRs range in size from 5 watts (less than a night light) to 20 MWt (equivalent to 20 standard medical x-ray machines).

Safety: All NRC-licensed research and test reactors have a built-in safety feature that reduces reactor power during potential accidents before an unacceptable power level or temperature can be reached.

Fuel: Reactors may also be classified by the type of fuel used, such as MTR (plate-type fuel) or TRIGA fuel. TRIGA fuel is unique in that a moderator (hydrogen) is chemically bonded to the fuel.

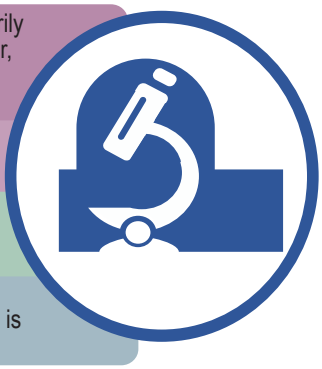
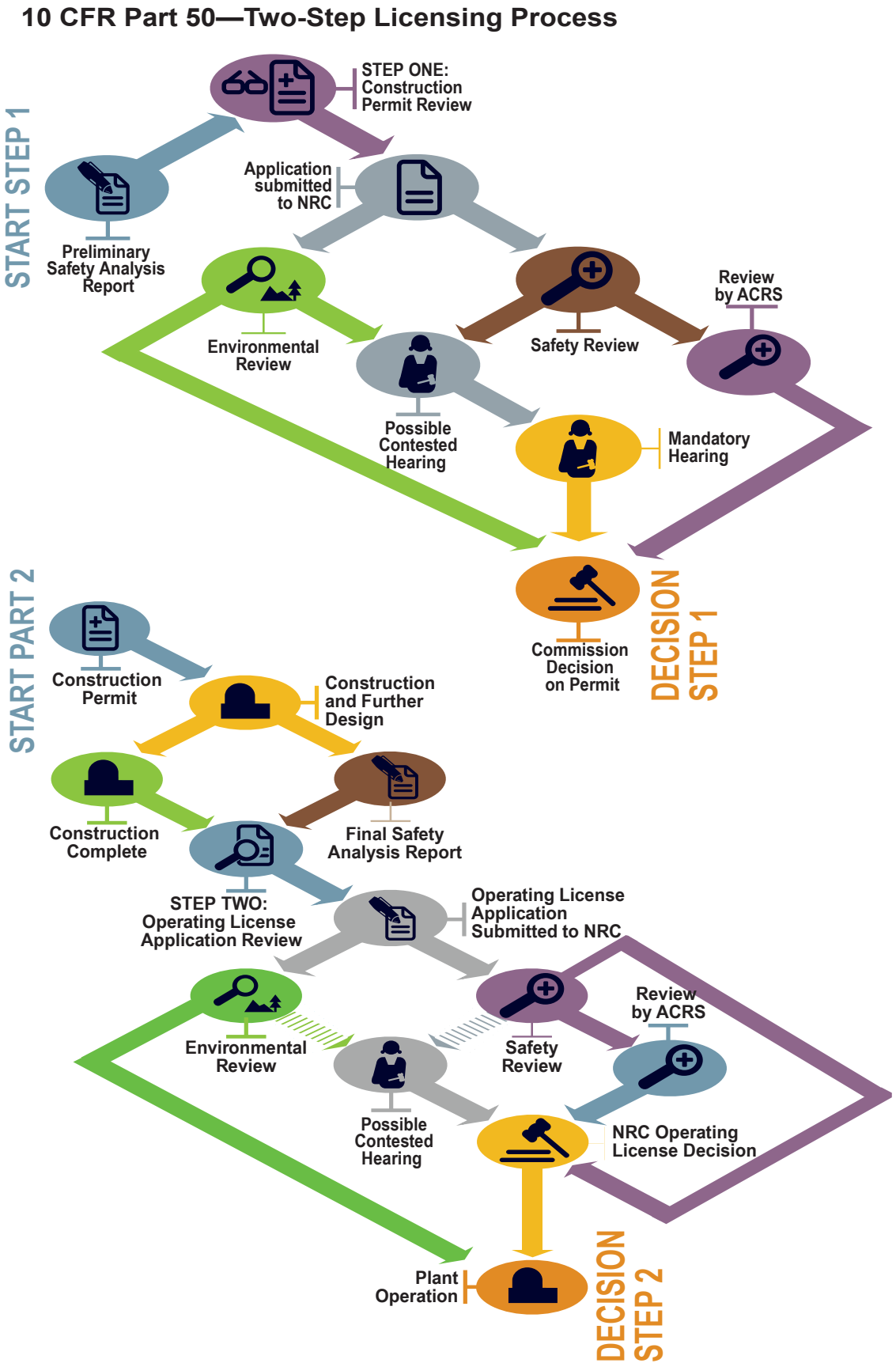


Figure 22. New Reactor Licensing Process



10 CFR Part 52—Combined License Application Review Process

Combined License Applications—Construction and Operating

By issuing a COL, the NRC authorizes the licensee to construct and (with specified conditions) operate a nuclear power plant at a specific site, in accordance with established laws and regulations. If the Commission finds that the acceptance criteria are met, a COL is valid for 40 years. A COL can be renewed for additional 20-year terms (see Figure 23. Locations of New Nuclear Power Reactors with Active Applications and Approved Licenses).

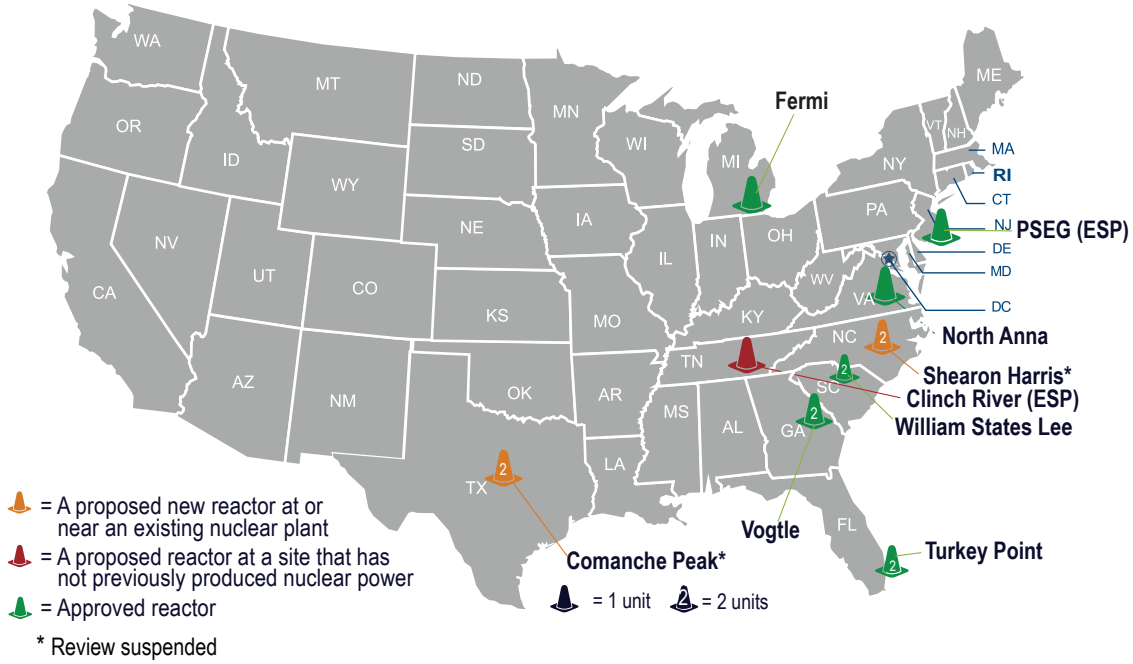
Public Involvement

Even before the NRC receives an application, the agency holds a public meeting to talk to the community near the proposed reactor location. The agency explains the review process and outlines how the public can participate. After the application is submitted, the NRC asks the public to comment on which factors the agency should consider in its environmental review under the National Environmental Policy Act.

The NRC later posts a draft environmental evaluation on its website and asks for public input. There is no formal opportunity for public comment on the staff's safety evaluation, but members of the public are welcome to attend public meetings and make comments. Individuals or groups can raise legal arguments against a new reactor application in an Atomic Safety and Licensing Board hearing if they would be affected by the new reactor and meet basic requirements for requesting a hearing. The NRC announces opportunities to request these hearings in news releases, in the *Federal Register,* and on its website.

Scan QR code for more information on new reactor licensing activities

Figure 23. Locations of New Nuclear Power Reactors with Active Applications and Approved Licenses



Note: Alaska and Hawaii are not pictured but have no sites. On July 31, 2017, South Carolina Electric and Gas announced its decision to cease construction on V.C. Summer Units 2 and 3, and the licensee has requested that the COLs be withdrawn. As of October 2017, Duke Energy has announced plans to cancel reactors at Levy County, Florida, and William States Lee, South Carolina. Applications were withdrawn for Calvert Cliffs, Grand Gulf, Nine Mile Point, Victoria County, and Callaway (COL and ESP). In June 2018, Nuclear Innovation North America submitted a letter requesting that the COLs for South Texas Project Units 3 and 4 be withdrawn. NRC-abbreviated reactor names are listed.
Data are current as of September 2022. For the most recent information, go to the NRC website at https://www.nrc.gov.

Early Site Permits

An ESP review examines whether a piece of land is suitable for a nuclear power plant. The review covers site safety, environmental protection, and emergency preparedness. The ACRS reviews safety-related portions of an ESP application. As with COL reviews, the public participates in the environmental portion of the NRC's ESP review, and the public can challenge an application in a hearing.

Design Certifications

The NRC issues standard design certifications through rulemaking for reactor designs that meet basic requirements for ensuring safe operation. Utilities can cite a certified design when applying for a nuclear power plant construction permit, COL, ESP, or manufacturing license. The certification is valid for 15 years from the date issued and can be renewed for an additional 15 years. The NRC staff has also issued standard design approvals upon completion of the final safety evaluation report for the design. Standard design approvals may be referenced by a construction permit, COL, or manufacturing license. The new reactor designs under review incorporate new elements such as passive safety systems and simplified system designs. The seven certified designs are—

- *GE-Hitachi Nuclear Energy's Advanced Boiling-Water Reactor (ABWR)*
- *Westinghouse Electric Company's System 80+*
- *Westinghouse Electric Company's AP600*
- *Westinghouse Electric Company's AP1000*
- *GE-Hitachi Economic Simplified Boiling-Water Reactor (ESBWR)*
- *Korean Electric Power Corporation APR 1400 (Advanced Power Reactor)*
- *NuScale Small Modular Reactor*

Design Certification Renewals

The NRC staff has completed its review of GE-Hitachi's application to renew the ABWR design certification. The direct final rule renewing this design certification was published on July 1, 2021, and was effective September 29, 2021.

Advanced Reactor Designs

Several companies are considering advanced reactor designs and technologies and are conducting preapplication activities with the NRC. These reactors are cooled by liquid metals, molten salt mixtures, or inert gases. Advanced reactors can also consider fuel materials and designs that differ radically from today's enriched uranium dioxide (UO_2) pellets with zirconium cladding. While developing the regulatory framework for advanced reactor licensing, the NRC is examining policy issues in areas such as security and emergency preparedness.

Small Modular Reactors

Small modular reactors (SMRs) use water to cool the reactor core in the same way as today's large light-water reactors. SMR designs also use the same enriched uranium fuel as today's reactors. However, SMR designs are considerably smaller. Each SMR module generates 300 megawatts electric (MWe) (1,000 MWt) or less, compared to today's large designs that can generate 1,000 MWe (3,300 MWt) or more per reactor. The NRC's discussions to date with SMR designers involve modules generating less than 200 MWe (660 MWt).

New Reactor Construction Inspections

NRC inspectors based in the agency's Region II office in Atlanta, Georgia, monitor reactor construction activities. These expert staff members ensure licensees carry out construction according to NRC license specifications and related regulations.

The NRC staff examines the licensee's operational programs in areas such as security, radiation protection, and operator training and qualification. Inspections at a construction site verify that a licensee has completed required inspections, tests, and analyses and has met associated acceptance criteria. The NRC's onsite resident construction inspectors oversee day-to-day licensee and contractor activities.

In addition, specialists in NRC Region II's Division of Construction Oversight periodically visit the sites to ensure the facilities are being constructed using the approved design.

The NRC's Construction Reactor Oversight Process assesses all of these activities. Before the agency will allow a new reactor to start up, NRC inspectors must confirm that the licensee has met all the acceptance criteria in its COL.

The agency also inspects domestic and overseas factories and other vendor facilities. This ensures new U.S. reactors receive high-quality products and services that meet the NRC's regulatory requirements.

NRC senior leaders observe new construction activities to ensure NRC regulations are being met at Vogtle Units 3 and 4 in Georgia.

NEW LICENSING OF NONPOWER PRODUCTION AND UTILIZATION FACILITIES

Research reactors, testing facilities, and other nonpower facilities can be used to produce medical radioisotopes and demonstrate advanced reactor technologies. These research and test reactors are used to demonstrate new reactor technologies to meet future energy needs, promote training and education, and support needed medical care. To support these efforts, the NRC staff conducts safety and environmental reviews of construction permit and operating license applications, which are also subject to regulatory requirements for hearings and an independent review by the ACRS.

Doctors worldwide rely on a steady supply of molybdenum-99 (Mo-99) to produce technetium-99m, which is used in a radiopharmaceutical applied in approximately 50,000 medical diagnostic procedures daily in the United States. The NRC supports the national policy objective of establishing a reliable, domestically available supply of this medical radioisotope by reviewing license applications for these facilities submitted in accordance with the provisions of 10 CFR Part 50, "Domestic Licensing of Production and Utilization Facilities." Since 2013, the NRC staff has received two construction permit applications and one operating license application for these facilities. The proposed facilities would irradiate low-enriched uranium targets in utilization facilities, then separate Mo-99 from other fission products in hot cells contained within a production facility. The NRC approved the construction permits for SHINE Medical Technologies, LLC (SHINE), in February 2016 and for Northwest Medical Isotopes, LLC, in May 2018. The staff is reviewing SHINE's application for a license to operate its facility.

The NRC is reviewing construction permit applications from Kairos Power and Abilene Christian University for an advanced test reactor and an advanced research reactor, respectively. The NRC is also engaged in pre-application topical report reviews for Atomic Alchemy, which proposes to construct a nonpower reactor for radioisotope production.

The NRC anticipates receiving additional topical reports, construction permit applications, operating license applications, materials license applications, and license amendment requests in the coming years from other potential Mo-99 producers and advanced nonpower reactor applicants.

The NRC continues to develop the necessary infrastructure programs for these facilities, including inspection procedures for construction and operation. The agency provides updates on the status of these licensing reviews through NRC-hosted public meetings, Commission meetings, and interagency interactions.

Technetium-99m is produced by the decay of molybdenum-99 and is used in diagnostic nuclear medical imaging procedures.

NUCLEAR REGULATORY RESEARCH

The NRC's Office of Nuclear Regulatory Research supports the agency's mission by providing technical advice, tools, methods, data, and information. This research can identify, explore, and resolve safety issues, as well as provide information supporting licensing decisions and new regulations and guidance. The NRC's research includes the following:

- *independently confirming other parties' work through experiments and analyses*
- *developing technical support for agency safety decisions*
- *preparing for the future by evaluating the safety implications of new technologies and designs for nuclear reactors, materials, waste, and security*

The research program reflects the challenges of an evolving industry. The NRC's research covers the light-water reactor technology developed in the 1960s and 1970s, today's advanced light-water reactor designs, and fuel cycle facilities. The agency has longer term research plans for more advance reactor concepts, such as those cooled by high-temperature gases or molten salts. The NRC's research programs examine a broad range of subjects, such as the following:

- *material performance (for example, environmentally assisted degradation and cracking of metallic alloys, aging management of reactor components and materials, boric-acid corrosion, radiation effects on concrete, and embrittlement of reactor pressure vessel steels)*
- *events disrupting heat transfer from a reactor core, criticality safety, severe reactor accidents, how radioactive material moves through the environment, and how that material could affect human health (sometimes using NRC-developed computer codes for realistic simulations)*
- *computer codes used to analyze fire conditions in nuclear facilities, to examine how reactor fuel performs, and to assess nuclear power plant risk*
- *new and evolving technologies such as additive manufacturing, accident tolerant fuel, and advanced control and automation*
- *experience gained from operating reactors*
- *digital instrumentation and controls, including analyzing digital system components, security aspects of digital systems, and probabilistic assessment of digital system performance*
- *enhanced risk-assessment methods, tools, and models to support the increased use of probabilistic risk assessment in regulatory applications*
- *earthquake, flooding, and high-wind hazards*
- *ultrasonic testing and other nondestructive means of inspecting reactor components and dry cask storage systems and developing and accessing ultrasonic testing simulation tools to optimize examination procedure variables*
- *the human side of reactor operations, including safety culture, and computerization and automation of control rooms*

The Office of Nuclear Regulatory Research also plans, develops, and manages research on fire safety and risk, including modeling, and evaluates potential security vulnerabilities and possible solutions.

Scan QR code for more information on NRC research projects and activities

NRC Research Funding

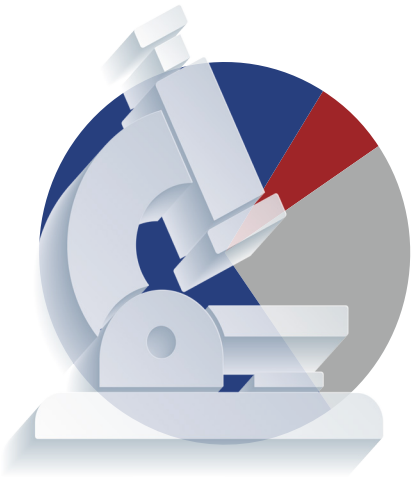
The NRC's research program involves about 6 percent of the agency's personnel and uses about 15 percent of its contracting funds. The NRC's $81.4 million research budget for FY 2022 includes contracts with national laboratories, universities, research organizations, and other Federal agencies (e.g., the National Institute of Standards and Technology, the U.S. Army Corps of Engineers, and the U.S. Geological Survey). NRC research funds support access to a broader group of experts and international research facilities. Figure 24. NRC Research Funding, FY 2022, illustrates the primary areas of research.

The majority of the NRC's research budget supports maintaining operating reactor safety and security, while the remainder supports regulatory activities for new and advanced reactors, industrial and medical use of nuclear materials, and nuclear fuel cycle and radioactive waste programs. The NRC cooperates with universities and nonprofit organizations on research for the agency's specific interests.

The NRC's international cooperation in research areas leverages agency resources, facilitates work on advancing existing technologies, and determines any safety implications of new technologies. The agency's leadership role in international organizations such as the IAEA and the OECD/NEA helps guide the agency's collaborations.

The NRC maintains international cooperative research agreements with more than two dozen foreign governments. This work covers technical areas from severe accident research and computer code development to materials degradation, nondestructive examination, fire risk, and human-factors research. Cooperation under these agreements is more efficient than conducting research independently.

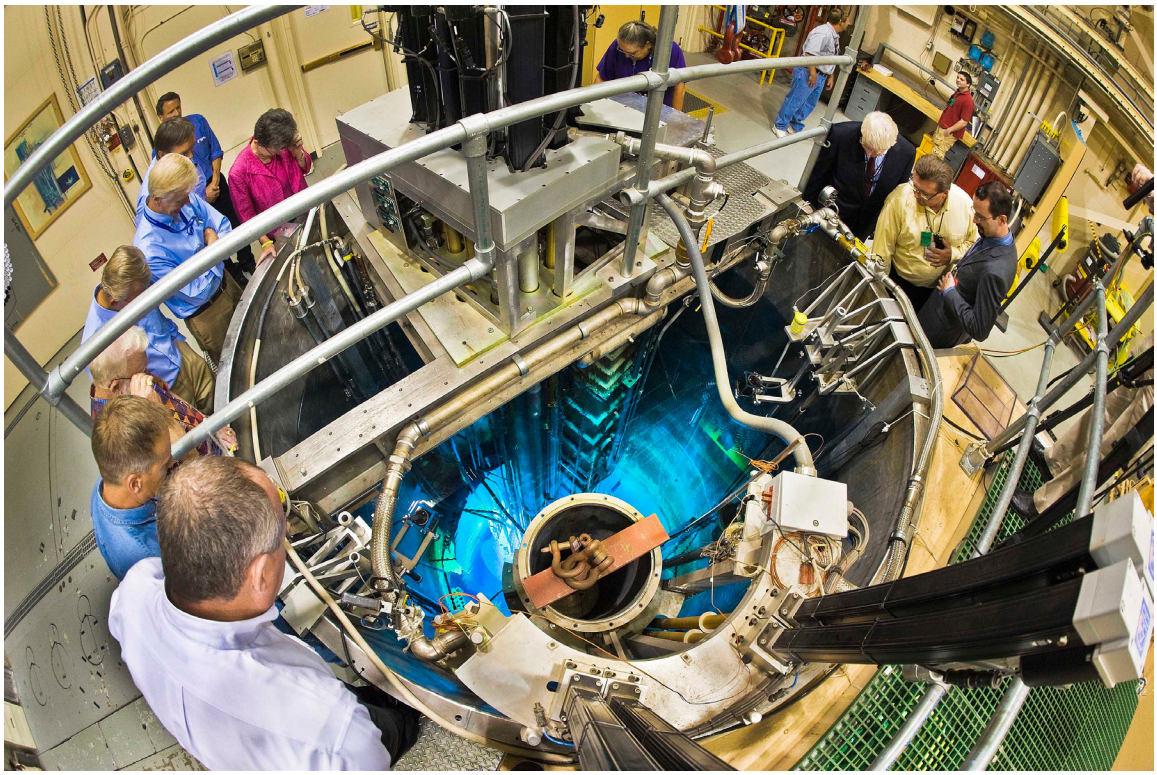
Figure 24. NRC Research Funding, FY 2022



TOTAL $81.4 MILLION

- **Reactor Program—$56 Million**
- **New/Advanced Reactor Licensing—$20.1 Million**
- **Materials and Waste—$5.3 Million**

Note: Totals may not equal sum of components because of rounding.



A group observes the Annular Core Research Reactor. The reactor has been in operation since 1979 at Sandia National Laboratories in New Mexico.

Todd Smith, senior advisor in the NRC Office of Nuclear Security and Incident Response, serves as a team mentor for the Purdue University School of Nuclear Engineering senior design team, which won the annual senior design project showcase with its NRC-sponsored project titled "Design and Application Machine Learning System for Predictive Emergency Response."

3

NUCLEAR MATERIALS

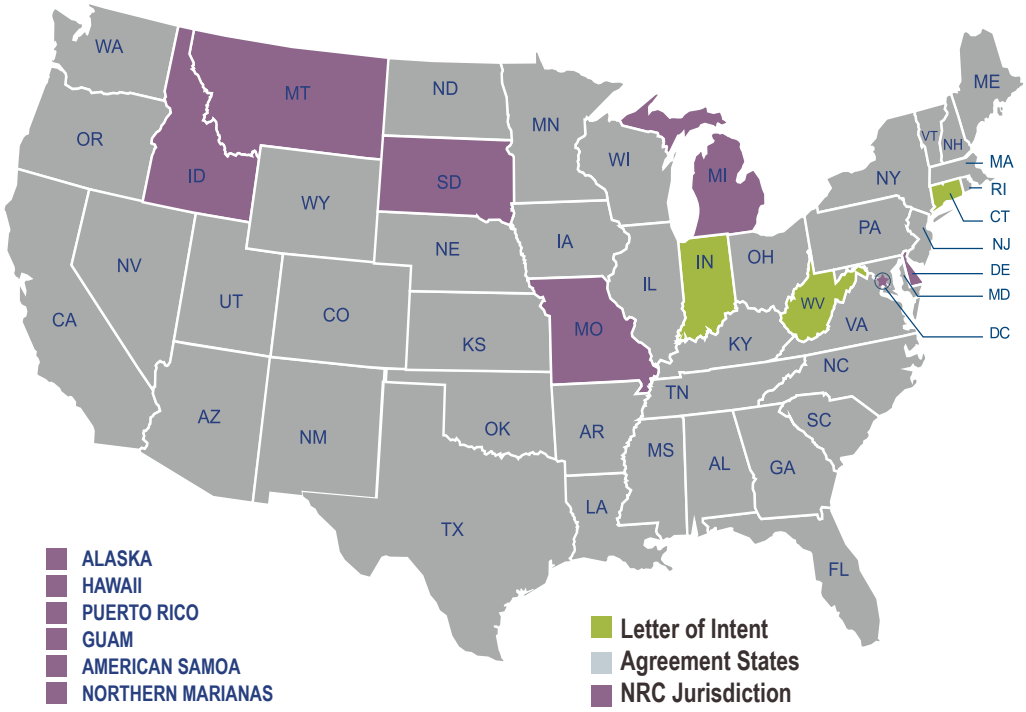
The NRC regulates each phase of the nuclear fuel cycle—the steps needed to turn uranium ore into fuel for nuclear power plants—as well as the storing and disposing of the fuel after it is used in a reactor. In some States, the NRC also regulates nuclear materials used for medical, industrial, and academic purposes. Work includes reviewing applications for and issuing new licenses, license renewals, and amendments to existing licenses. The NRC also regularly conducts safety and security inspections.

MATERIALS LICENSES

States have the option to regulate certain radioactive materials under agreements with the NRC. Those that do are called "Agreement States" (see Figure 25. U.S. Agreement States). These Agreement States then develop regulations consistent with the NRC's and appoint officials to ensure nuclear materials are used safely and securely. Only the NRC regulates nuclear reactors, fuel fabrication facilities, consumer product distribution, and certain amounts of what is called "special nuclear material"—that is, radioactive material that can fission or split apart.

Radioactive materials, or radionuclides, are used for many purposes. They are used in civilian and military industrial applications; basic and applied research; the manufacture of consumer products; academic studies; and medical diagnosis, treatment, and research. They can be produced in a reactor or an accelerator—a machine that propels charged particles. The NRC does not regulate accelerators but does license the use of radioactive materials produced in accelerators. ***>>See Appendix J for the number of materials licenses by State.<<***

Figure 25. U.S. Agreement States



Note: Data are current as of February 2023. For the most recent information, go to the Agreement State page at https://www.nrc.gov/agreement-states.html. In February 2023, the State of West Virginia submitted a letter of intent to the NRC to become an agreement state.

MEDICAL AND ACADEMIC

The NRC and Agreement States review the facilities, personnel, program controls, and equipment involved in using radioactive materials in medical and academic settings. These reviews ensure the safety of the public, patients, and workers who might be exposed to radiation from those materials. The NRC regulates only the use of radioactive material, which is why it does not regulate x-ray machines or other devices that produce radiation without using radioactive materials.

Medical

The NRC and Agreement States license hospitals, physicians, veterinarians, health physicists, and radiopharmacists to use radioactive materials in medical treatments and diagnoses. The NRC also develops guidance and regulations for licensees.

These regulations require licensees to have experience and special training, focusing on operating equipment safely, controlling the radioactive material, and keeping accurate records. To help the NRC stay current, the Advisory Committee on the Medical Uses of Isotopes advises the NRC staff on policy and technical issues that arise in the regulation of the medical uses of radioactive material in diagnosis and therapy. This expert committee includes scientists, physicians, and other health care professionals who have experience with medical radionuclides.

Nuclear Medicine

Doctors use radioactive materials to diagnose or treat about one-third of all patients admitted to hospitals. This branch of medicine is known as nuclear medicine, and the radioactive materials are called “radiopharmaceuticals.”

Two types of radiopharmaceutical tests can diagnose medical problems. In vivo tests (within the living) administer radiopharmaceuticals directly to patients. In vitro tests (within the glass) add radioactive materials to lab samples taken from patients.

Radiation Therapy

Doctors also use radioactive materials and radiation-producing devices to treat medical conditions. They can treat hyperthyroidism and some cancers, for example, and can also ease the pain caused by bone cancer. Radiation therapy aims to deliver an accurate radiation dose to a target site while protecting surrounding healthy tissue. To be most effective, treatments often require several exposures over a period of time. When used to treat malignant cancers, radiation therapy is often combined with surgery or chemotherapy.

There are three main categories of radiation therapy:

- *External beam therapy (also called “teletherapy”) is a beam of radiation directed to the target tissue. Several different types of machines are used in external beam therapy. Treatment machines regulated by the NRC contain high-activity radioactive sources (usually cobalt-60) that emit photons to treat the target site.*
- *Brachytherapy treatments use sealed radioactive sources placed near or even directly in cancerous tissue. The radiation dose is delivered at a distance of up to an inch (2.54 centimeters) from the target area.*
- *Therapeutic radiopharmaceuticals deliver a large radiation dose inside the body. A variety of radioactive materials can be given to patients and will concentrate in different regions or organ systems.*

Academic

The NRC and the Agreement States issue licenses to academic institutions for education and research. For example, qualified instructors may use radioactive materials in classroom demonstrations. Scientists in many disciplines use radioactive materials for laboratory research.

INDUSTRIAL

The NRC and Agreement States issue licenses that specify the type, quantity, and location of radioactive materials to be used. Radionuclides can be used in industrial radiography, gauges, well logging, and manufacturing. Radiography uses radiation sources to find structural defects in metal and welds. Gas chromatography uses low-energy radiation sources to identify the chemical elements in an unknown substance. For example, gas chromatography devices are used to analyze air pollutants, blood alcohol content, essential oils, and food products. They are also used in biological and medical research to identify the parts that make up complex proteins and enzymes. Well-logging devices use radioactive sources and detection equipment to make a record of geological formations from within a well. This process is used extensively for oil, gas, coal, and mineral exploration.

Nuclear Gauges

Nuclear gauges are used to measure the physical properties of products and industrial processes nondestructively as a part of quality control. Gauges use radiation sources to determine the thickness of paper products, fluid levels in oil and chemical tanks, and the moisture and density of soils and materials at construction sites. Gauges may be fixed or portable.

A gauge has shielding to protect the operator while the radioactive source is exposed. When the measuring process is completed, the source is retracted or a shutter closes, minimizing exposure from the source. A fixed gauge has a radioactive source shielded in a container. When the user opens the container's shutter, a beam of radiation hits the material or product being processed or controlled. A detector mounted opposite the source measures the radiation passing through the product. The gauge readout or computer monitor shows the measurement. The material and process being monitored dictate the type, energy, and strength of radiation used.

Fixed fluid gauges are used by the beverage, food, plastics, and chemical industries. Installed on a pipe or the side of a tank, these gauges measure the density, flow rate, level, thickness, and weights of a variety of materials and surfaces. A portable gauge uses both a shielded radioactive source and a detector. The gauge is placed on the object to be measured. Some gauges rely on radiation from the source to reflect back to the gauge. Other gauges insert the source into the object. The detector in the gauge measures the radiation either directly from the inserted source or from the reflected radiation.

The moisture density gauge is a portable device that places a gamma source under the surface of the ground through a tube. Radiation is transmitted directly to the detector on the bottom of the gauge, allowing accurate measurements of compaction. Industry uses such gauges to monitor the structural integrity of roads, buildings, and bridges. Airport security uses nuclear gauges to detect explosives in luggage.

Commercial Irradiators

The U.S. Food and Drug Administration and other agencies have approved the irradiation of food. Commercial irradiators expose food and spices, as well as products such as medical supplies, blood, and wood flooring, to gamma radiation. This process can be used to eliminate harmful germs and insects or for hardening or other purposes. The gamma radiation does not leave radioactive residue or make the treated products radioactive. The radiation can come from radioactive materials (e.g., cobalt-60), an x-ray, or an electron beam.

The NRC and Agreement States license about 50 commercial irradiators. Up to 10 million curies of radioactive material can be used in these types of irradiators. NRC regulations protect workers and the public from this radiation.

Two main types of commercial irradiators are used in the United States: underwater and wet-source-storage panoramic models. Underwater irradiators use sealed sources (radioactive material encased inside a capsule) that remain in the water at all times, providing shielding for workers and the public. The product to be irradiated is placed in a watertight container, lowered into the pool, irradiated, and then removed.

Wet-source-storage panoramic irradiators also store radioactive sealed sources in water. However, the sources are raised into the air to irradiate products that are automatically moved in and out of the room on a conveyor system. Sources are then lowered back into the pool when not in use. For this type of irradiator, thick concrete walls and ceilings or steel barriers protect workers and the public when the sources are lifted from the pool.

TRANSPORTATION

More than 3 million packages of radioactive materials are shipped each year in the United States by road, rail, air, or water. This represents less than 1 percent of the Nation's yearly hazardous material shipments. The NRC and the U.S. Department of Transportation (DOT) share responsibility for regulating the safety of radioactive material shipments. The vast majority of these shipments consist of small amounts of radioactive materials used in industry, research, and medicine. The NRC requires such materials to be shipped in accordance with the DOT's safety regulations.

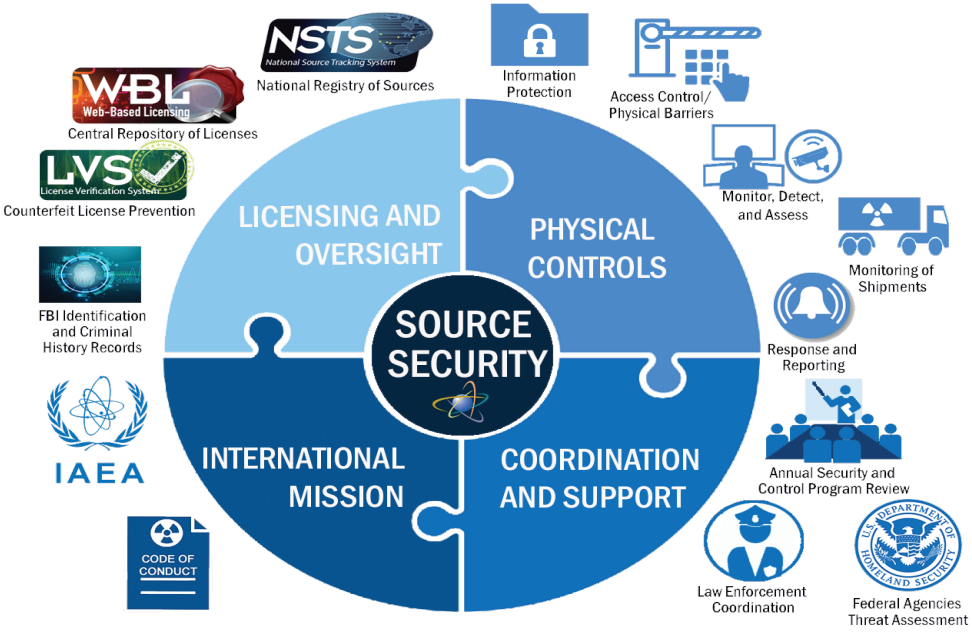
MATERIALS SECURITY

To monitor the manufacture, distribution, and possession of the most high-risk sources, the NRC set up the National Source Tracking System in January 2009. Sources tracked in the system are known as Category 1 and Category 2 sources. They have the potential to cause permanent injury and even death if they are not handled safely and securely, in compliance with NRC requirements. The majority of these sources are cobalt-60.

Licensees use this secure web-based system to enter information on the receipt or transfer of tracked radioactive sources (see Figure 26. NRC Approach to Source Security). The NRC and the Agreement States use the system to monitor where high-risk sources are made, shipped, and used.

The NRC and the Agreement States have increased controls on the most safety-significant radioactive materials. Stronger physical security requirements and stricter limits on who can access the materials give the NRC and the Agreement States added confidence in their security. The NRC has also joined with other Federal agencies, such as the U.S. Department of Homeland Security (DHS) and the DOE's National Nuclear Security Administration, to set up an additional layer of voluntary protection. Together, these activities help make potentially dangerous radioactive sources even more secure and less vulnerable to malevolent uses.

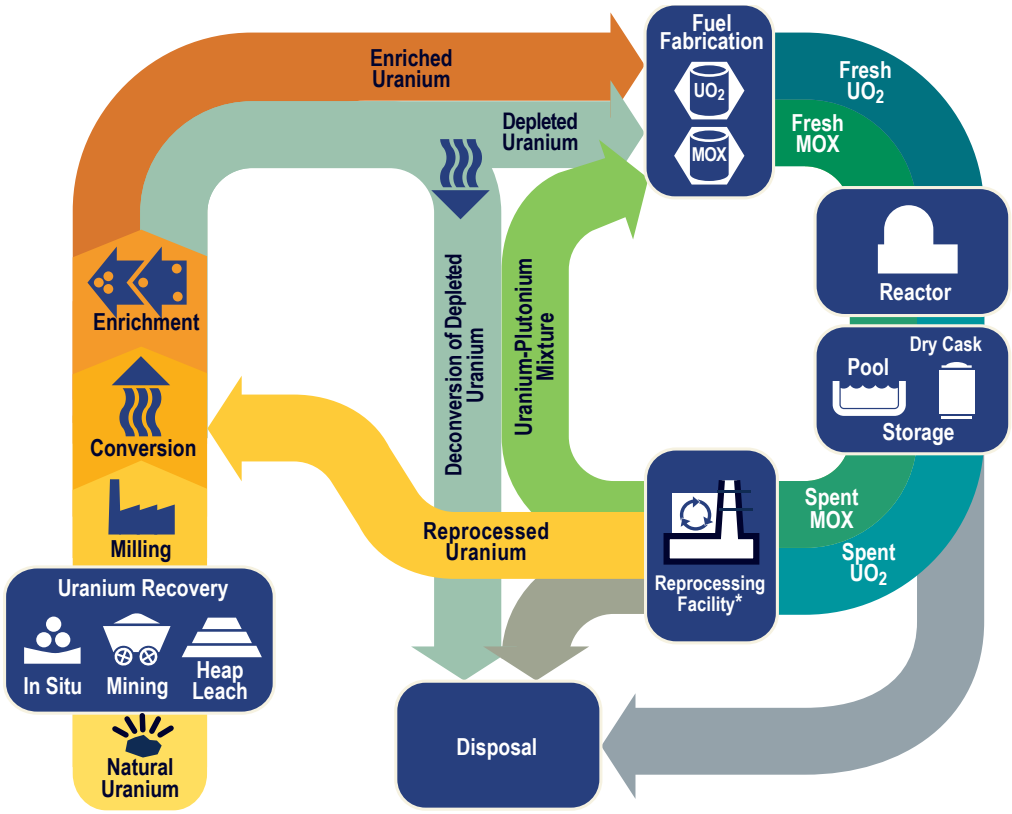
Figure 26. NRC Approach to Source Security



NUCLEAR FUEL CYCLE

The typical nuclear fuel cycle uses uranium in different chemical and physical forms. Figure 27. The Nuclear Fuel Cycle illustrates the stages, which include uranium recovery, conversion, enrichment, and fabrication, to produce fuel for nuclear reactors. Uranium is recovered or extracted from ore, converted, and enriched. Then the enriched uranium is manufactured into pellets, which are placed into fuel assemblies to power nuclear reactors.

Figure 27. The Nuclear Fuel Cycle



*** Reprocessing of spent nuclear fuel, including mixed-oxide (MOX) fuel, is not practiced in the United States.**
Note: The NRC has no regulatory role in mining uranium.

Uranium Recovery

The NRC does not regulate conventional mining but does regulate the processing of uranium ore, known as milling. This processing can be done at three types of uranium recovery facilities: conventional mills, in situ recovery facilities, and heap leach facilities. Once the milling is completed, the uranium is in a powder form known as yellowcake, which is packed into 55-gallon (208-liter) drums and transported to a fuel cycle facility for further processing. The NRC has an established regulatory framework for uranium recovery facilities. This framework ensures they are licensed, operated, decommissioned, and monitored to protect the public and the environment.

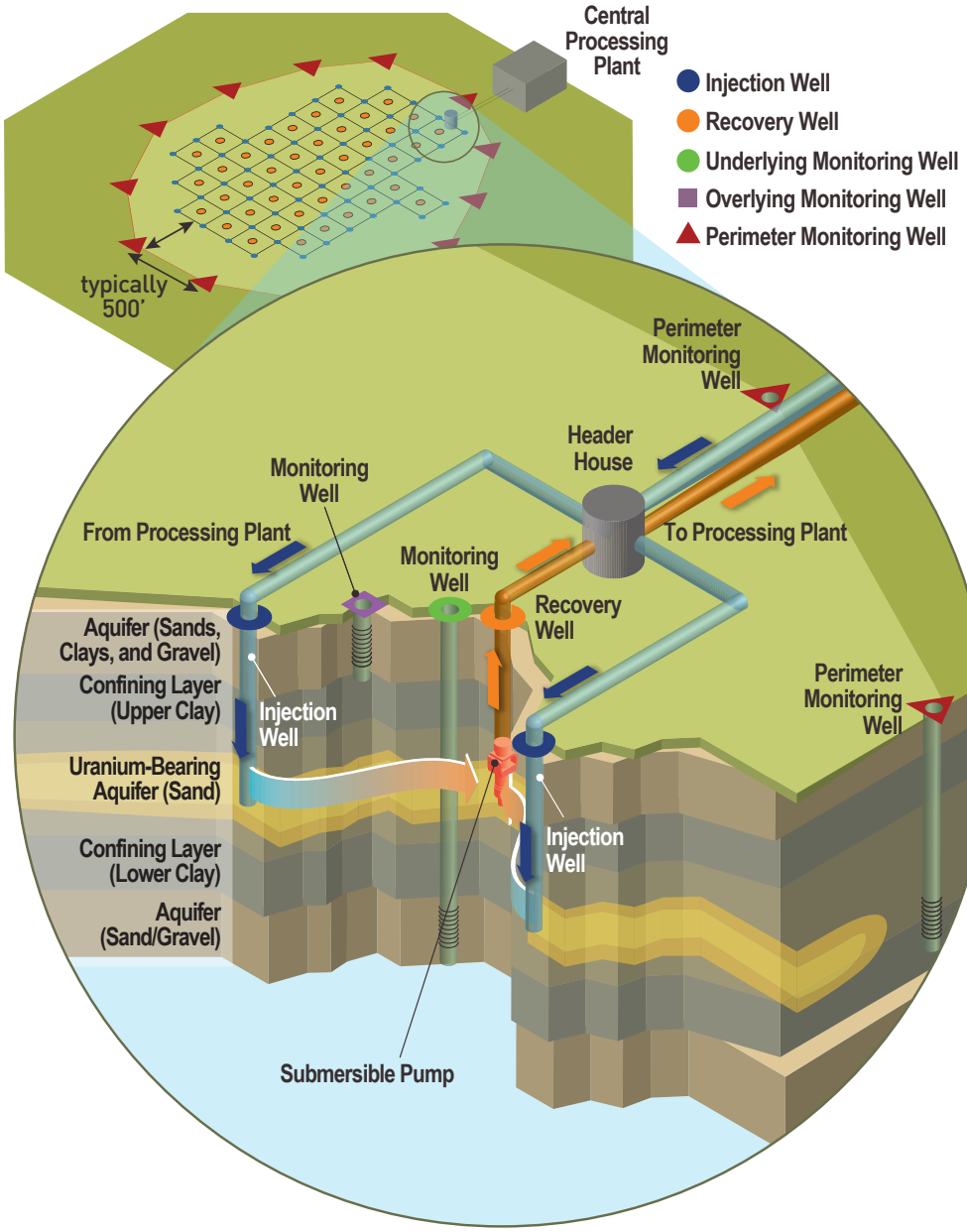
Conventional Uranium Mill

A conventional uranium mill is a chemical plant that extracts uranium from ore. Most conventional mills are located away from population centers and within about 30 miles (50 kilometers) of a uranium mine. In a conventional mill, the process of uranium extraction from ore begins when ore is hauled to the mill and crushed. Sulfuric acid dissolves and removes 90 to 95 percent of the uranium from the ore. The uranium is then separated from the solution, concentrated, and dried to form yellowcake.

In Situ Recovery

In situ recovery is another way to extract uranium—in this case, directly from underground ore. In this process, a solution of ground water, typically mixed with oxygen or hydrogen peroxide and sodium bicarbonate or carbon dioxide, is injected into the ore to dissolve the uranium. The solution is then pumped out of the rock and the uranium separated to form yellowcake (see Figure 28. The In Situ Uranium Recovery Process).

Figure 28. The In Situ Uranium Recovery Process



Injection wells pump a solution of native ground water, typically mixed with oxygen or hydrogen peroxide and sodium bicarbonate or carbon dioxide, into the aquifer (ground water) containing uranium ore. The solution dissolves the uranium from the deposit in the ground and is then pumped back to the surface through recovery wells, all controlled by the header house. From there, the solution is sent to the processing plant. Monitoring wells are checked regularly to ensure the injection solution is not escaping from the wellfield. Confining layers keep ground water from moving from one aquifer to another.

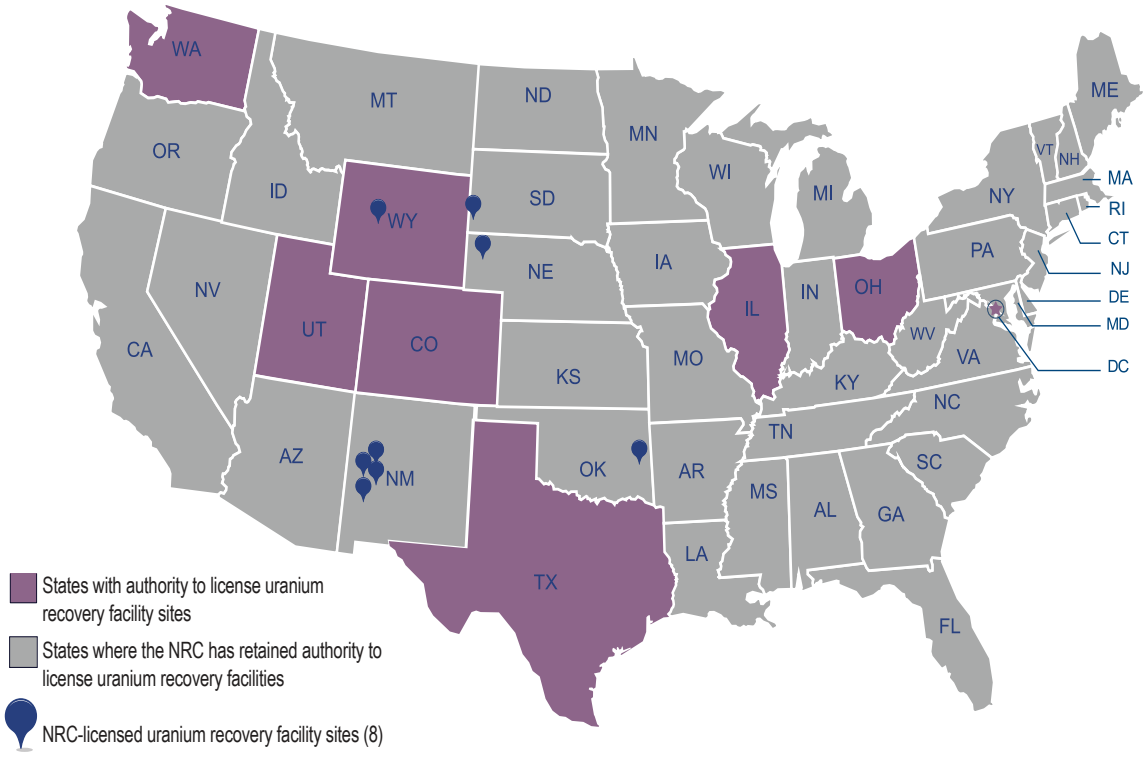
Heap Leach Facility

Heap leach facilities also extract uranium from ore. At these facilities, the ore is placed in piles or heaps on top of liners. The liners prevent uranium and other chemicals from moving into the ground. Sulfuric acid is dripped onto the heap and dissolves uranium as it moves through the ore. The uranium solution drains into collection basins, where it is piped to a processing plant. At the plant, uranium is extracted, concentrated, and dried to form yellowcake. There are no licensed uranium heap leach facilities in operation in the United States.

Licensing Uranium Recovery Facilities

The NRC currently regulates an in situ uranium recovery facility in Nebraska, which suspended operations in 2016. Two in situ recovery facilities, one in South Dakota and another in New Mexico, have been licensed but not constructed. Nine in situ recovery facilities are operating in Wyoming under State regulations, as Wyoming became an NRC Agreement State in 2018. The NRC considers the views of stakeholders, including Native American Tribal governments, to address their concerns with licensing new uranium recovery facilities. The NRC is also overseeing the decommissioning of five uranium recovery facilities: three in New Mexico, one in Oklahoma, and another in Wyoming that was not transferred to the State under its agreement with the NRC (see Figure 29. Locations of NRC-Licensed Uranium Recovery Facility Sites). ***>>See the glossary on the NRC's website for a definition of mill tailings.<<***

Figure 29. Locations of NRC-Licensed Uranium Recovery Facility Sites



Note: Alaska and Hawaii are not pictured here and do not have sites.
For the most recent information, go to the NRC facility locator page at https://www.nrc.gov/info-finder.html.

Scan QR code for more information on uranium recovery and Agreement States

The NRC is also responsible for the following actions:

- *inspecting and overseeing both active and inactive uranium recovery facilities*
- *ensuring the safe management of mill tailings (waste) at facilities that the NRC requires to be located and designed to minimize radon release and disturbance by weather or seismic activity*
- *enforcing requirements to ensure cleanup of active and closed uranium recovery facilities*
- *applying stringent financial requirements to ensure funds are available for decommissioning*
- *ensuring licensees monitor ground water for contamination*
- *providing oversight of decommissioned uranium recovery facilities*

FUEL CYCLE FACILITIES

The NRC licenses all commercial fuel cycle facilities involved in conversion, enrichment, and fuel fabrication (see Figure 30. Locations of NRC-Licensed Fuel Cycle Facilities, and Figure 31. Simplified Fuel Fabrication Process).

The NRC reviews applications for licenses, license amendments, and renewals. The agency also routinely inspects licensees' safety, safeguards, security, and environmental protection programs.

These facilities turn the uranium that has been removed from ore and made into yellowcake into fuel for nuclear reactors. In this process, the conversion facility converts yellowcake into uranium hexafluoride (UF_6). Next, an enrichment facility heats the solid UF_6 enough to turn it into a gas, which is "enriched," or processed to increase the concentration of the isotope uranium-235. The UF_6 gas is then cooled back into solid UF_6 for shipment to a fuel fabrication facility.

Once at a fuel fabrication facility, the UF_6 is mechanically and chemically processed back into a solid UO_2 powder. The powder is blended, milled, pressed, and fused into ceramic fuel pellets about the size of a fingertip. The pellets are stacked into tubes or rods that are about 14 feet (4.3 meters) long and made of material such as zirconium alloys; this material is referred to as "cladding." These fuel rods are made to maintain both their chemical and physical properties under the extreme conditions of heat and radiation present inside an operating reactor.

The fuel rods are bundled into fuel assemblies for use in reactors. The assemblies are washed, inspected, and stored in a special rack until ready for shipment to a nuclear power plant. The NRC inspects these operations to ensure they are conducted safely.

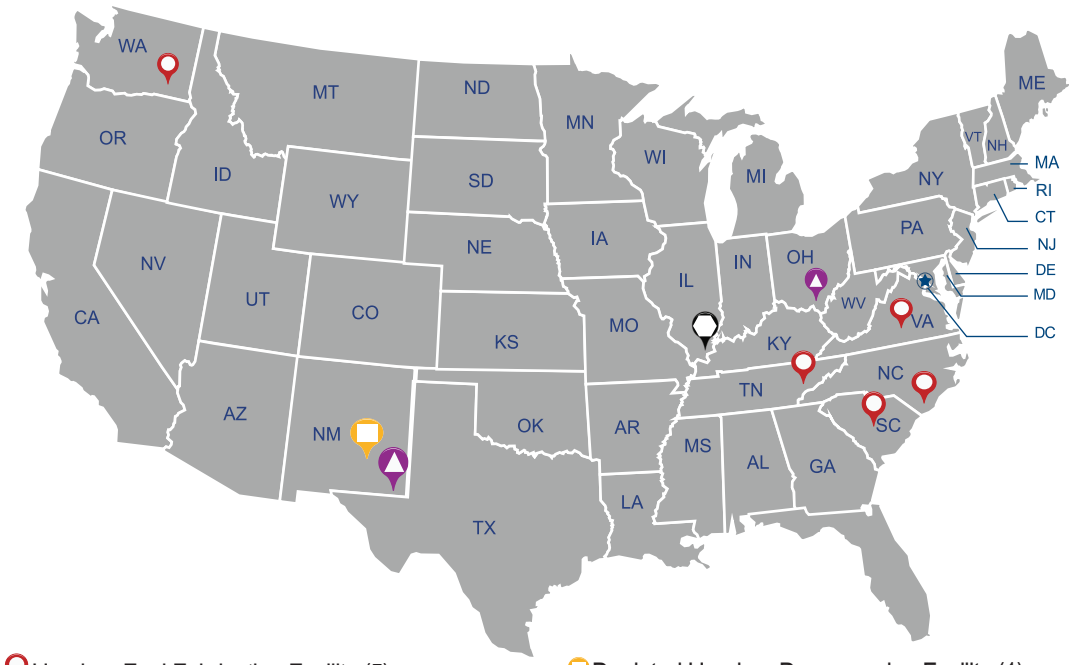
Domestic Safeguards Program

The NRC's domestic safeguards program for fuel cycle facilities and transportation is aimed at ensuring that special nuclear material (such as plutonium or enriched uranium) is not stolen and does not pose a risk to the public from sabotage or terrorism. Through licensing and inspections, the NRC verifies that licensees apply safeguards to protect special nuclear material.

The NRC and the DOE developed the Nuclear Materials Management and Safeguards System (NMMSS) to track transfers and inventories of special nuclear material, source material from abroad, and other material. Material licensees verify and document their inventories in the NMMSS database. The NRC and Agreement States have licensed several hundred additional sites that possess special nuclear material in smaller quantities. Licensees possessing small amounts of special nuclear material must confirm their inventories annually in the NMMSS database. ***>>See Appendix K for major U.S. fuel cycle facility sites and go to the glossary on the NRC's website for a definition on the enrichment process.<<***

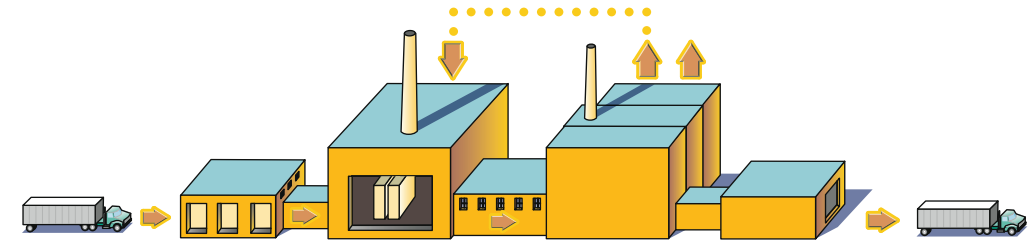
Scan QR code for more to access the online NRC Glossary

Figure 30. Locations of NRC-Licensed Fuel Cycle Facilities



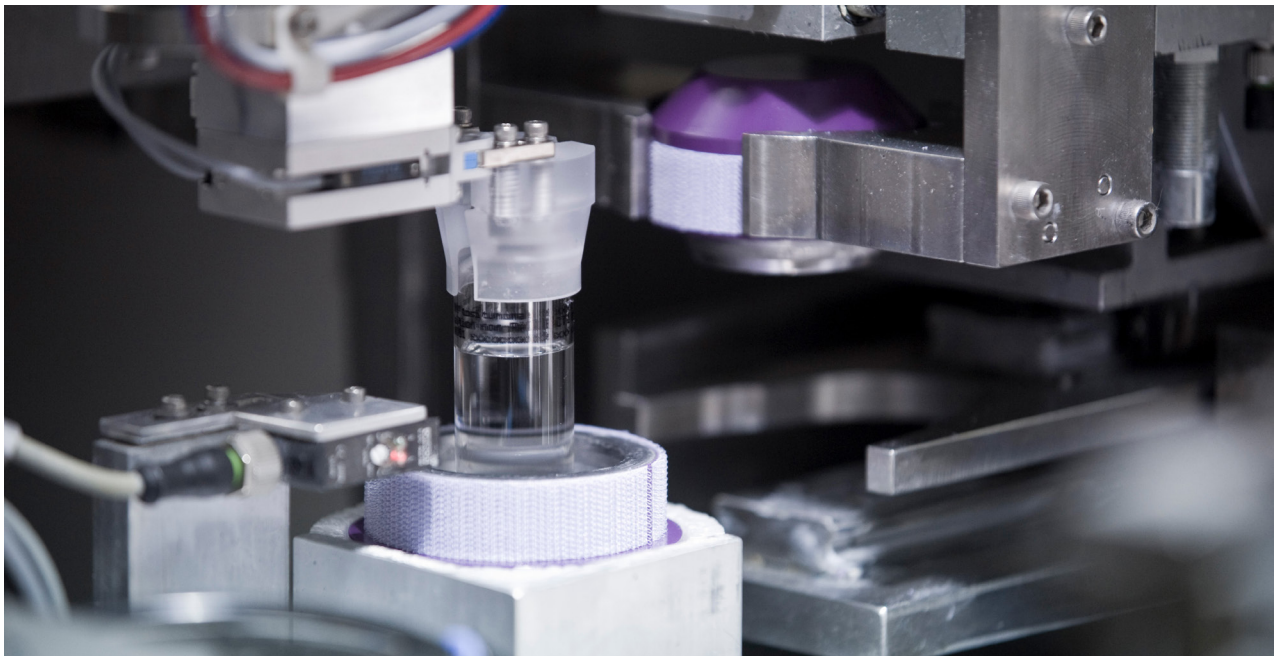
Note: Alaska and Hawaii are not pictured here and do not have sites. On September 30, 2022, the NRC issued a letter terminating the license for the GLE Laser Separation Enrichment Facility. For the most recent information, go to the NRC facility locator page at https://www.nrc.gov/info-finder.html.

Figure 31. Simplified Fuel Fabrication Process



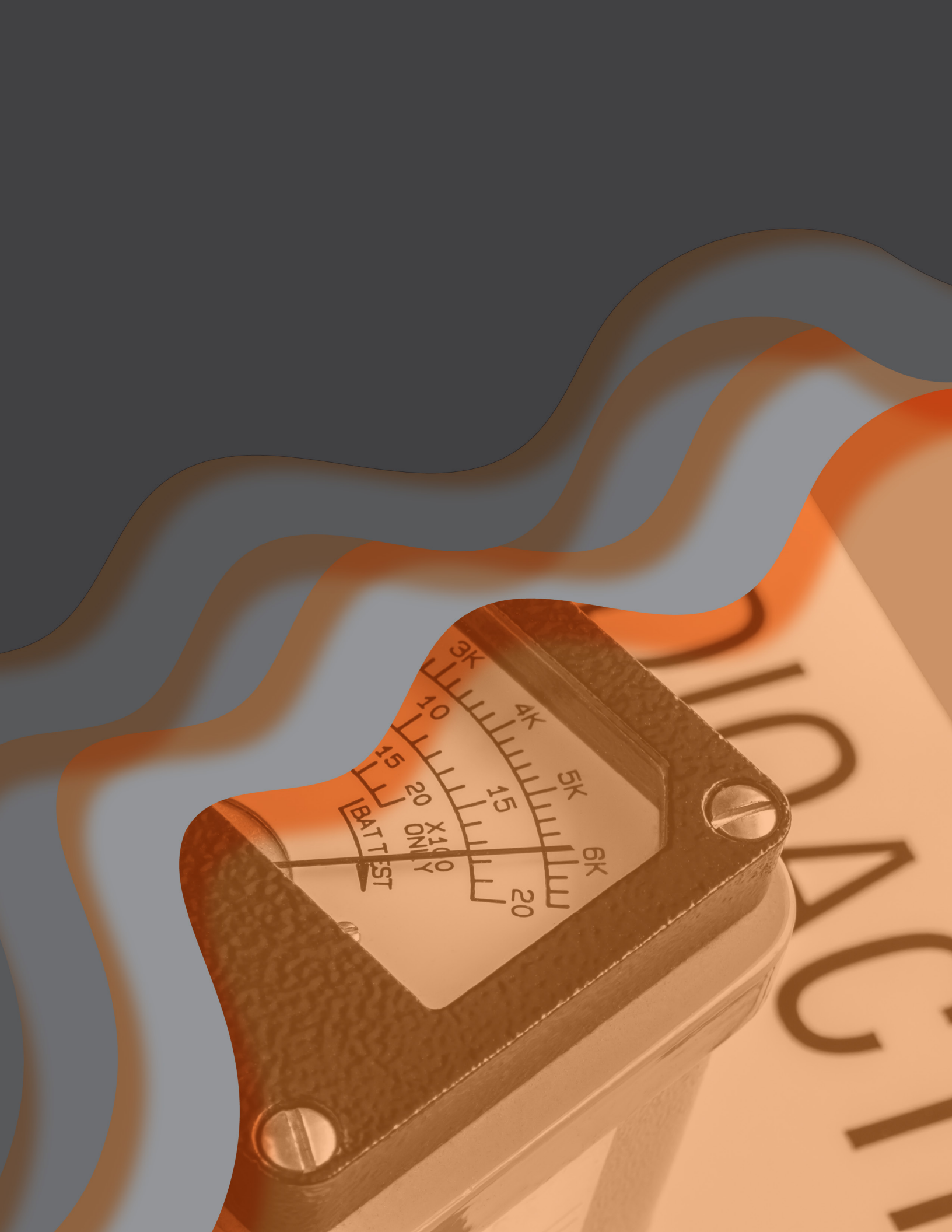
Fabrication of commercial light-water reactor fuel consists of the following three basic steps:

1. **the chemical conversion of UF_6 to UO_2 powder**
2. **a ceramic process that converts UO_2 powder to small ceramic pellets**
3. **a mechanical process that loads the fuel pellets into rods and constructs finished fuel assemblies**



A Bexxar Automated-Inspection unit placing a vial containing radiopharmaceutical into a lead pot. Photo courtesy of the Noridan Corporation.

A moisture density gauge indicates whether a foundation is suitable for constructing a building or roadway. Photo courtesy of the American Portable Nuclear Gauge Association.


3K
4K
5K
6K
10
15
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15
20
X10
ONLY
BAT TEST

4

RADIOACTIVE WASTE

LOW-LEVEL RADIOACTIVE WASTE DISPOSAL

Low-level radioactive waste (LLW) includes items contaminated with radioactive material or exposed to neutron radiation. This waste typically consists of contaminated protective shoe covers and clothing, wiping rags, mops, filters, reactor water treatment residues, equipment and tools, medical waste, and laboratory animal carcasses and tissue. Some LLW is quite low in radioactivity—even as low as just above background levels found in nature. Some licensees, notably hospitals, store such waste on site until radioactive decay has occurred and the waste has lost most of its radioactivity. Then it can be disposed of as ordinary trash. Other LLW, such as parts of a reactor vessel from a nuclear power plant, is more radioactive and requires special handling.

Waste that does not decay fairly quickly is stored until amounts are large enough for shipment to an LLW disposal site in containers approved by the DOT and the NRC. Commercial LLW can be disposed of in facilities licensed by either the NRC or Agreement States. The facilities are designed, constructed, and operated to meet NRC and State safety standards. The facility operator analyzes how the facility will perform in the future based on the environmental characteristics of the site. Current LLW disposal uses shallow land disposal sites with or without concrete vaults (see Figure 32. Low-Level Radioactive Waste Disposal). ***>>See Appendix N for regional compacts and closed LLW sites, Appendices L and M for information about dry spent fuel storage and licensees, and the glossary on the NRC website for a definition on fuel reprocessing (recycling).<<***

Determining the classification of waste can be a complex process. The NRC classifies LLW based on its potential hazards. The NRC has specified disposal and waste requirements for three classes of waste—Class A, B, and C—with progressively higher concentrations of radioactive material. Class A waste, the least radioactive, accounts for approximately 96 percent of the total volume of LLW in the United States. A fourth class of LLW, called “greater-than-Class-C waste,” must be disposed of in a geological repository licensed by the NRC unless the Commission approves an alternative proposal. Under the Low-Level Radioactive Waste Policy Amendments Act of 1985, the DOE is responsible for disposal of greater-than-Class-C waste.

The volume and radioactivity of waste vary from year to year. Waste volumes currently include several million cubic feet each year from operating and decommissioning reactor facilities and from cleanup of contaminated sites.

The Low-Level Radioactive Waste Policy Amendments Act gave the States responsibility for LLW disposal. The Act authorized States to do the following:

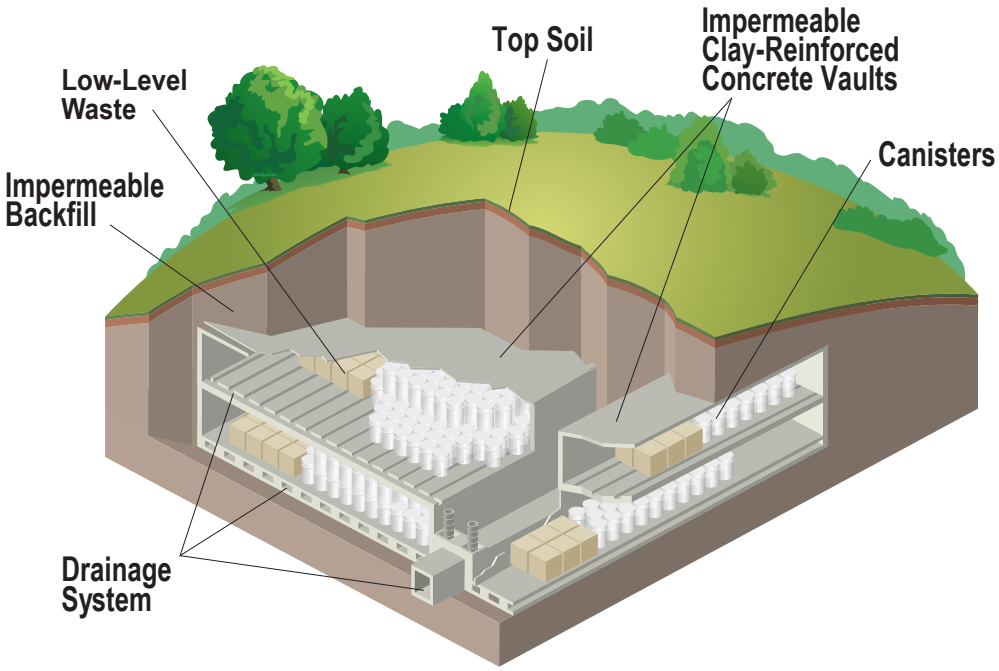
- *form regional compacts, with each compact to provide for LLW disposal site access*
- *manage LLW imported to, and exported from, a compact*
- *exclude waste generated outside a compact*

The States have licensed four active LLW disposal facilities:

- *EnergySolutions’ Barnwell facility, located in Barnwell, South Carolina—Previously, Barnwell accepted LLW from all U.S. generators of LLW. Barnwell now accepts waste only from the Atlantic Compact States (Connecticut, New Jersey, and South Carolina). The State of South Carolina licensed Barnwell to receive Class A, B, and C waste.*
- *EnergySolutions’ Clive facility, located in Clive, Utah—Clive accepts waste from all States of the United States. The State of Utah licensed Clive for Class A waste only.*
- *US Ecology’s Richland facility, located in Richland, Washington, on the Hanford Site—Richland accepts waste from the Northwest Compact States (Alaska, Hawaii, Idaho, Montana, Oregon, Utah, Washington, and Wyoming) and the Rocky Mountain Compact States (Colorado, Nevada, and New Mexico). The State of Washington licensed Richland to receive Class A, B, and C waste.*

- *Waste Control Specialists' Andrews facility, located in Andrews County, Texas—Andrews accepts waste from the Texas Compact States (Texas and Vermont). It also accepts waste from out-of-compact generators on a case-by-case basis. The State of Texas licensed Andrews to receive Class A, B, and C waste.*

Figure 32. Low-Level Radioactive Waste Disposal



The LLW disposal site accepts waste from States participating in a regional disposal agreement.

HIGH-LEVEL RADIOACTIVE WASTE MANAGEMENT

Spent Nuclear Fuel Storage

Commercial spent nuclear fuel, although highly radioactive, is stored safely and securely throughout the United States. Spent fuel is stored in pools and in dry casks at sites with operating nuclear power reactors, decommissioning or decommissioned reactors, and some other sites. Waste can be stored safely in pools or casks for 100 years or more. The NRC licenses and regulates the storage of spent fuel, both at commercial nuclear power plants and at separate storage facilities.

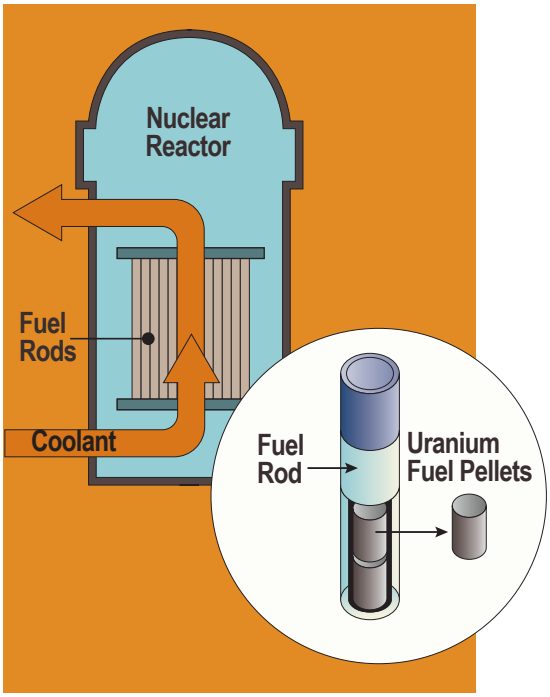
Most reactor facilities were not designed to store the full amount of spent fuel that the reactors would generate during their operational licenses. The original plan was to store spent fuel temporarily in deep pools of continuously circulating water, which cools the spent fuel assemblies. After a few years, the spent fuel would be sent to a reprocessing plant. However, in 1977, the U.S. Government declared a moratorium on reprocessing spent fuel. Although the Government later lifted the restriction, reprocessing has not resumed in the United States.

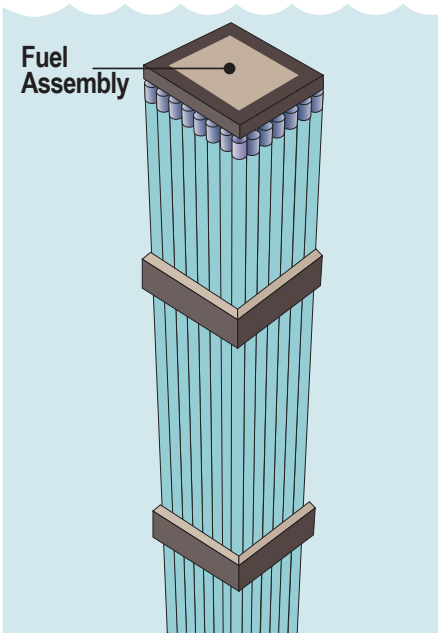
Facilities then expanded their storage capacity by using high-density storage racks in their spent fuel pools. For additional storage, some fuel assemblies are stored in dry casks on site (see Figure 33. Spent Fuel Generation and Storage after Use) in independent spent fuel storage installations (ISFSIs). These large casks are licensed by the NRC and are typically made of leak-tight, welded, and bolted steel and concrete surrounded by another layer of steel or concrete.

The spent fuel sits in the center of the cask in an inert gas. Dry cask storage shields people and the environment from radiation and keeps the spent fuel inside dry and nonreactive (see Figure 34. Dry Storage of Spent Nuclear Fuel). Another type of ISFSI is called a consolidated interim storage facility, which would store spent fuel from multiple commercial reactors, including those that have ceased operation, on an interim basis until a permanent disposal option is available.

Figure 33. Spent Fuel Generation and Storage after Use

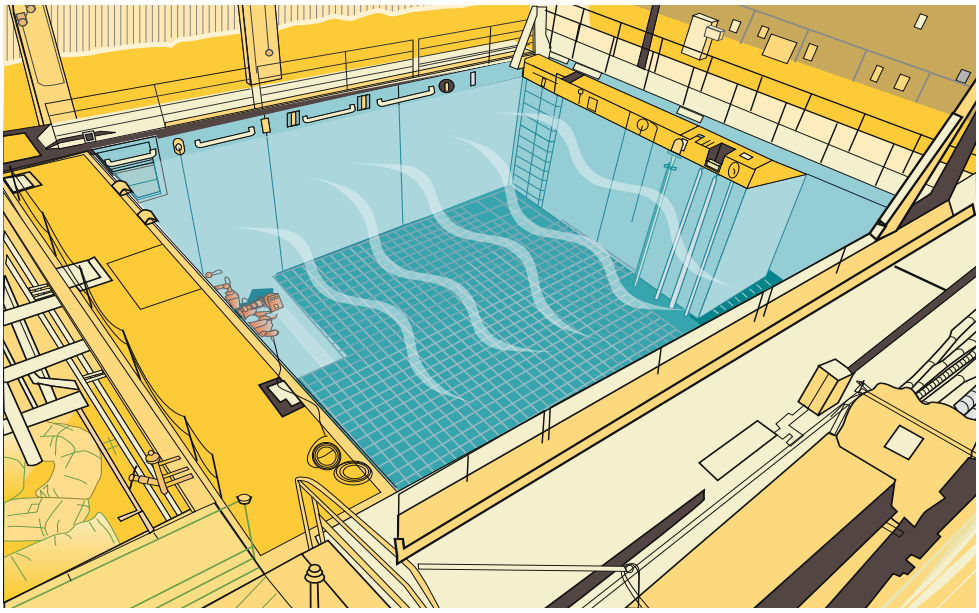
1 **A nuclear reactor is powered by enriched uranium-235 fuel. Fission (splitting of atoms) generates heat, which produces steam that turns turbines to produce electricity. A reactor rated at several hundred megawatts may contain 100 or more tons of fuel in the form of bullet-sized pellets loaded into long metal rods that are bundled together into fuel assemblies. Pressurized-water reactors (PWRs) contain between 120 and 200 fuel assemblies. Boiling-water reactors (BWRs) contain between 370 and 800 fuel assemblies.**

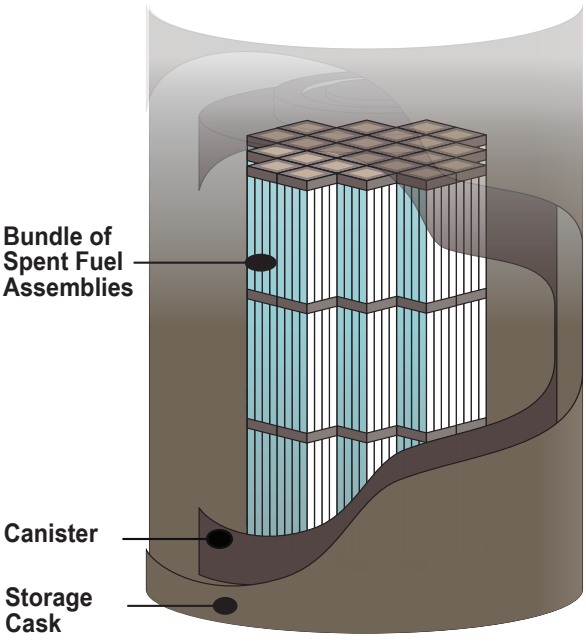




2 **After 5–6 years, spent fuel assemblies (which are typically 14 feet [4.3 meters] long and which contain nearly 200 fuel rods for PWRs and 80–100 fuel rods for BWRs) are removed from the reactor and allowed to cool in storage pools. At this point, the 900-pound (409-kilogram) assemblies contain only about one-fifth the original amount of uranium-235.**

Scan QR code for more information on consolidated interim storage





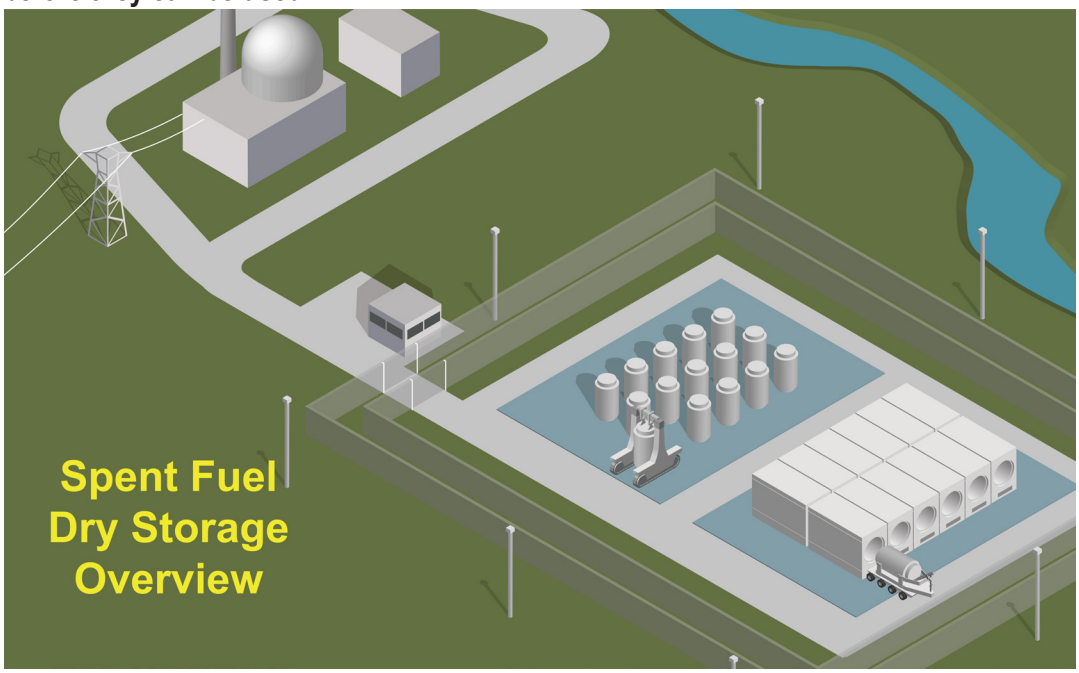
3 **Commercial light-water nuclear reactors store spent radioactive fuel in a steel-lined, seismically designed concrete pool under about 40 feet (12.2 meters) of water that provides shielding from radiation. Pumps supply continuously flowing water to cool the spent fuel. Extra water for the pool is provided by other pumps that can be powered from an onsite emergency diesel generator. Support features, such as water-level monitors and radiation detectors, are also in the pool. Spent fuel is stored in the pool until it is transferred to dry casks on site or transported off site for interim storage or disposal.**

The NRC regulates facilities that store spent fuel in two different ways, either through a specific or a general license. Site-specific licenses are issued after a safety review of the technical requirements and operating conditions for an ISFSI.

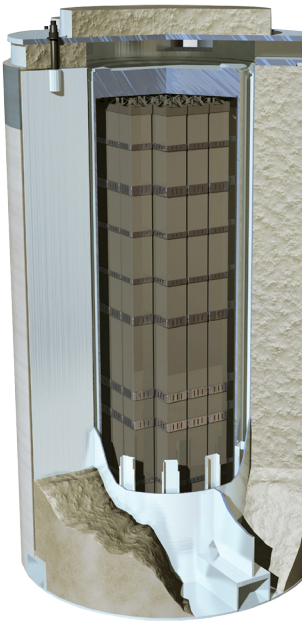
The agency has issued a general license authorizing nuclear power reactor licensees to store spent fuel on site in dry storage casks that the NRC has certified. Following a similar safety review, the NRC may issue a certificate of compliance and add the cask to a list of approved systems through a rulemaking. The agency issues licenses and certificates for terms not to exceed 40 years, but they can be renewed for up to an additional 40 years (see Figure 35. Licensed and Operating Independent Spent Fuel Storage Installations by State).

Figure 34. Dry Storage of Spent Nuclear Fuel

At nuclear reactors across the country, spent fuel is kept on site, typically above ground, in systems basically similar to the ones shown here. The NRC reviews and approves the designs of these spent fuel storage systems before they can be used.



1 **Once the spent fuel has sufficiently cooled, it is loaded into special canisters that are designed to hold nuclear fuel assemblies. Water and air are removed. The canister is filled with inert gas, welded shut, and rigorously tested for leaks. It is then placed in a cask for storage or transportation. The dry casks are then loaded onto concrete pads.**



2 **The canisters can also be stored in aboveground concrete bunkers, each of which is about the size of a one-car garage.**

Scan QR Code for more information on ISFSIs

Public Involvement

The public can participate in decisions about spent nuclear fuel storage, as it can in many licensing and rulemaking decisions. The Atomic Energy Act of 1954, as amended, and the NRC's own regulations call for public meetings about site-specific licensing actions and allow the public to comment on certificate of compliance rulemakings. Members of the public may also file petitions for rulemaking.

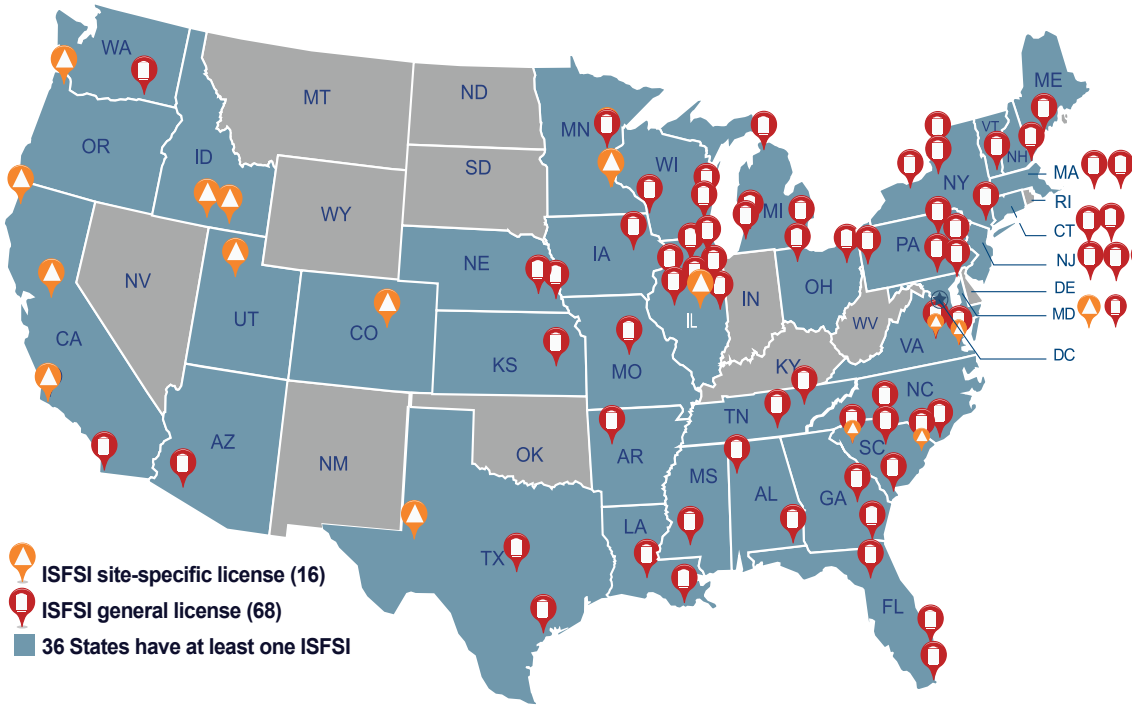
Spent Nuclear Fuel Disposal

The current U.S. policy governing permanent disposal of high-level radioactive waste is defined by the Nuclear Waste Policy Act of 1982, as amended, and the Energy Policy Act of 1992. These acts specify that high-level radioactive waste will be disposed of underground in a deep geologic repository licensed by the NRC. Because the timing of repository availability is uncertain, the NRC looked at potential environmental impacts of storing spent fuel over three possible timeframes: the short term, which includes 60 years of continued storage after a reactor's operating license has expired; the medium term, or 160 years after license expiration; and indefinite, which assumes a repository never becomes available. The NRC's findings—that any environmental impacts can be managed—appear in the 2014 report NUREG-2157, "Generic Environmental Impact Statement for Continued Storage of Spent Nuclear Fuel."

The NRC adopted those findings into NRC regulations in a continued storage rule. This rule provides an important basis for issuing new or renewed licenses for nuclear power plants and spent fuel storage facilities.

Massive containers hold spent nuclear fuel at safe and secure dry storage facilities. This photo shows, at right, a dry cask recently loaded with spent fuel being lifted from a horizontal transporter to be placed vertically on a specially designed storage pad. Photo courtesy of Sandia National Laboratories.

Figure 35. Licensed and Operating Independent Spent Fuel Storage Installations by State



ALABAMA
- Browns Ferry
- Farley

ARIZONA
- Palo Verde

ARKANSAS
- Arkansas Nuclear

CALIFORNIA
- Diablo Canyon
- Humboldt Bay
- Rancho Seco
- San Onofre

COLORADO
- Fort St. Vrain

CONNECTICUT
- Haddam Neck
- Millstone

FLORIDA
- Crystal River
- St. Lucie
- Turkey Point

GEORGIA
- Hatch
- Vogtle

IDAHO
- DOE: Three Mile Island 2 (Fuel Debris)
- DOE: Idaho Spent Fuel Facility *

ILLINOIS
- Braidwood
- Byron
- Clinton
- Dresden
- GEH Morris (Wet)
- LaSalle
- Quad Cities
- Zion

IOWA
- Duane Arnold

KANSAS
- Wolf Creek

LOUISIANA
- River Bend
- Waterford

MAINE
- Maine Yankee

MARYLAND
- Calvert Cliffs

MASSACHUSETTS
- Pilgrim
- Yankee Rowe

MICHIGAN
- Big Rock Point
- Cook
- Fermi 2
- Palisades

MINNESOTA
- Monticello
- Prairie Island

MISSISSIPPI
- Grand Gulf

MISSOURI
- Callaway

NEBRASKA
- Cooper
- Ft. Calhoun

NEW HAMPSHIRE
- Seabrook

NEW JERSEY
- Hope Creek
- Oyster Creek
- Salem

NEW YORK
- FitzPatrick
- Ginna
- Indian Point
- Nine Mile Point

NORTH CAROLINA
- Brunswick
- McGuire

OHIO
- Davis-Besse
- Perry

OREGON
- Trojan

PENNSYLVANIA
- Beaver Valley
- Limerick
- Peach Bottom
- Susquehanna
- Three Mile Island

SOUTH CAROLINA
- Catawba
- Oconee
- Robinson
- Summer

TENNESSEE
- Sequoyah
- Watts Bar

TEXAS
- WCS Consolidated Interim Storage Facility (CISF)*
- Comanche Peak
- South Texas Project

UTAH
- Private Fuel Storage*

VERMONT
- Vermont Yankee

VIRGINIA
- North Anna
- Surry

WASHINGTON
- Columbia

WISCONSIN
- Kewaunee
- La Crosse
- Point Beach

* Facility licensed only, never built or operated.

Note: Alaska and Hawaii are not pictured and have no sites. NRC-abbreviated reactor names are listed. Data are current as of September 30, 2022. For the most recent information, go to the NRC facility locator page at https://www.nrc.gov/info-finder.html.

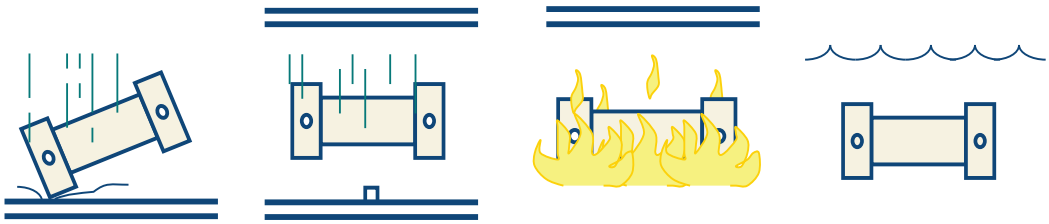
TRANSPORTATION

The NRC regulates the transportation of spent nuclear fuel. The NRC establishes safety and security requirements in collaboration with the DOT, certifies transportation cask designs, and conducts inspections to ensure that requirements are being met. Spent nuclear fuel transportation casks are designed to meet the following safety criteria under both normal and accident conditions:

- *prevents the loss or dispersion of radioactive contents*
- *shields everything outside the cask from the radioactivity of the contents*
- *dissipates the heat from the contents*
- *prevents nuclear criticality (a self-sustaining nuclear chain reaction) from occurring inside the cask*

Transportation casks must be designed to survive a sequence of tests, including a 30-foot (9.14-meter) drop onto an unyielding surface, a puncture test, a fully engulfing fire at 1,475 degrees Fahrenheit (800 degrees Celsius) for 30 minutes, and immersion under water. This very severe test sequence, akin to the cask striking a concrete pillar along a highway at high speed and being engulfed in a severe and long-lasting fire and then falling into a river, simulates conditions more severe than 99 percent of vehicle accidents (see Figure 36. Ensuring Safe Spent Fuel Shipping Containers).

Figure 36. Ensuring Safe Spent Fuel Shipping Containers



The impact (free drop and puncture), fire, and water immersion tests are considered in sequence to determine their cumulative effects on a given package.

To ensure the safe transportation of spent nuclear fuel and other nuclear materials, each year the NRC takes the following actions:

- *conducts transportation safety inspections of fuel, reactor, and materials licensees*
- *reviews, evaluates, and certifies new, renewed, or amended transportation package design applications*
- *inspects cask vendors and manufacturers to ensure the quality of dry cask design and fabrication*

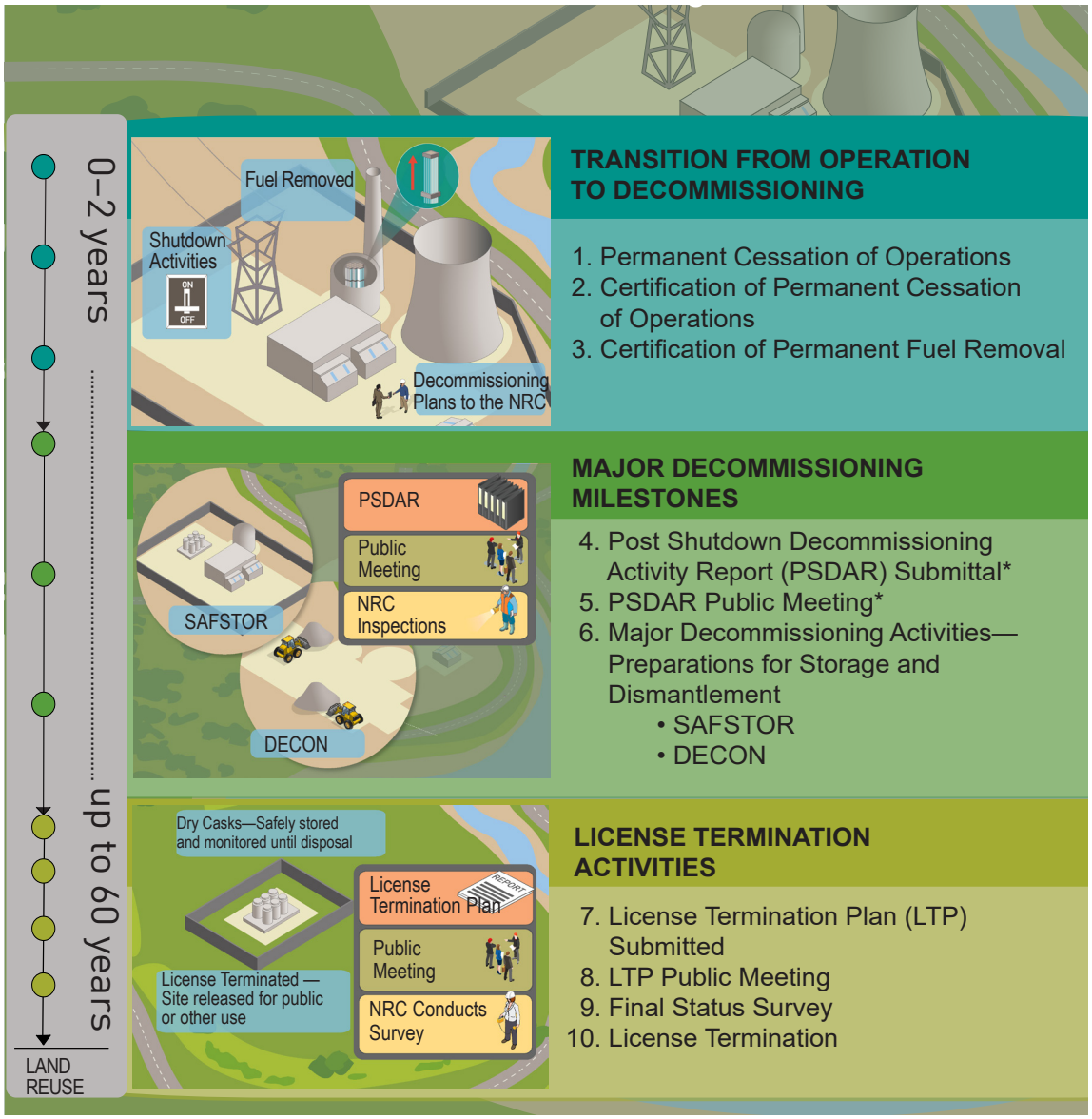
Scan QR code for more information on materials transportation

DECOMMISSIONING

Decommissioning is the safe removal of a nuclear facility from service and the reduction of residual radioactivity to a level that permits release of the property and termination of the license. NRC rules establish site-release criteria and provide for unrestricted and, under certain conditions, restricted release of a site. The NRC also requires licensees to maintain financial assurance that funds will be available when needed for decommissioning.

The NRC regulates the decontamination and decommissioning of nuclear power plants, materials and fuel cycle facilities, RTRs, and uranium recovery facilities, with the ultimate goal of license termination (see Figure 37. Reactor Phases of Decommissioning, and Figure 38. Power Reactor Decommissioning Status).

Figure 37. Reactor Phases of Decommissioning

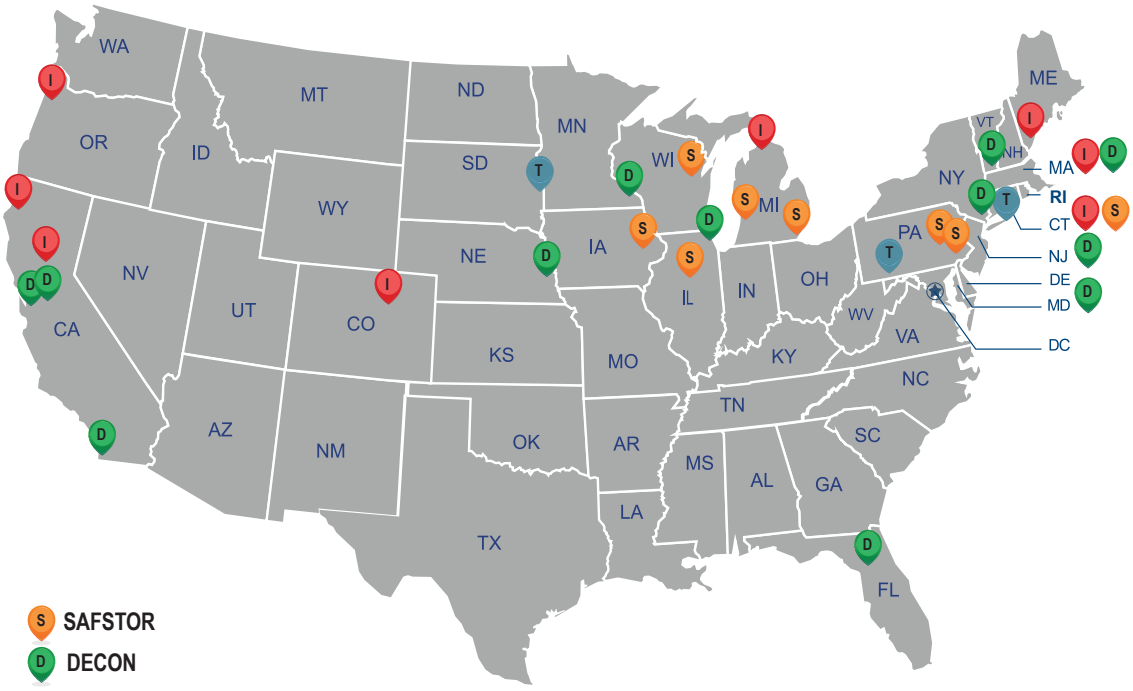


SAFSTOR Under SAFSTOR, a nuclear power plant is maintained and monitored in a condition that allows the radioactivity to decay; afterwards, the plant shifts to DECON as the facility is dismantled and the property decontaminated.

DECON Under DECON, equipment, structures, and portions of the facility containing radioactive contaminants are removed or decontaminated to a level that permits release of the property and termination of the NRC license.

*Under DECON, some licensees have submitted the PSDAR before shutdown.

Figure 38. Power Reactor Decommissioning Status



S SAFSTOR
D DECON

Decommissioning Completed
I Only ISFSI (independent spent fuel storage installation)
T License Terminated (no fuel on site)

CALIFORNIA
- D GE EVESR
- D GE VBWR
- I Humboldt Bay 3*
- I Rancho Seco
- D San Onofre 1, 2, and 3

COLORADO
- I Fort St. Vrain

CONNECTICUT
- I CT Yankee (Haddam Neck)
- S Millstone

FLORIDA
- D Crystal River

ILLINOIS
- S Dresden 1
- D Zion 1 and 2*

IOWA
- S Duane Arnold

MAINE
- I Maine Yankee

MARYLAND
- D N.S. Savannah

MASSACHUSETTS
- D Pilgrim
- I Yankee Rowe

MICHIGAN
- I Big Rock Point
- S Fermi 2
- S Palisades

NEBRASKA
- D Ft. Calhoun

NEW JERSEY
- D Oyster Creek

NEW YORK
- D Indian Point 1, 2, and 3
- T Shoreham

OREGON
- I Trojan

PENNSYLVANIA
- S Peach Bottom
- T Saxton
- S Three Mile Island 1 and 2

SOUTH DAKOTA
- T Pathfinder

VERMONT
- D Vermont Yankee

WISCONSIN
- S Kewaunee
- D La Crosse*

* The NRC is in the final stages of the license termination process with the reviews of the final status survey reports at Zion 1 and 2, La Crosse, and Humboldt Bay.

Notes: Fort St. Vrain ISFSI NRC SNM-2504 license was transferred to the DOE on June 4, 1999. ISFSIs are also located at all sites undergoing decommissioning or in SAFSTOR. GE Bonus, Hallam, and Piqua decommissioned reactor sites are part of the DOE nuclear legacy. For more information, visit the DOE's Office of Legacy Management Sites web page at https://www.energy.gov/lm/sites/. Carolinas Virginia Tube Reactor (CVTR), Elk River, and Shippingport decommissioned reactor sites were either decommissioned before the formation of the NRC or were not licensed by the NRC. NRC-abbreviated reactor names are listed. Alaska and Hawaii are not pictured and have no sites. For the most recent information, go to the NRC facility locator page at https://www.nrc.gov/info-finder.html. Data are current as of October 2022.

Scan QR code for more information on NRC decommissioning activities

Reactor Decommissioning

When a nuclear power plant operator decides to cease operations, it must submit to the NRC a post-shutdown decommissioning activities report (PSDAR). This may be submitted before shutting down, or no later than 2 years following permanent cessation of operations. It includes detailed plans for decommissioning the facility, as well as a cost estimate.

The first stage of decommissioning for a nuclear power plant is to transition from operating status to a permanently shutdown condition. The licensee must certify to the NRC that it has permanently ceased operation and that it has permanently removed the fuel from the reactor. At this point, the license no longer authorizes the plant to operate or load fuel in the reactor.

Licensees typically then apply for several exemptions from NRC requirements that apply to operating reactors but are no longer appropriate after permanent shutdown because a reactor accident can no longer occur. The exemptions are implemented through license amendments that change the plant's licensing basis to reflect its decommissioning status. These changes are in areas such as personnel, spent fuel management, physical and cybersecurity, emergency preparedness, and incident response. The NRC is developing new regulations to make this transition from operations to decommissioning more efficient.

The NRC allows a licensee up to 60 years to decommission a nuclear power plant. This may include extended periods of inactivity (called SAFSTOR), during which residual radioactivity is allowed to decay, making eventual cleanup easier and more efficient. A facility is said to be in DECON when active demolition and decontamination are underway. Active decommissioning of a nuclear power plant takes about 10 years on average.

NRC oversight and inspection continue throughout the entire process. Two years before cleanup is completed, the plant operator must submit a license termination plan, detailing procedures for the final steps. The NRC inspects and verifies that the site is sufficiently decontaminated before terminating the license and releasing the site for another use. ***>>See Appendices C, H and O for licensees undergoing decommissioning. <<***

Public Involvement

NEIMA required the NRC to provide a report to Congress identifying best practices for establishing and operating local community advisory boards, including lessons learned from existing boards. These boards try to foster communication and information exchange between NRC licensees and members of the communities around decommissioning nuclear power plants.

In developing the report, the NRC hosted 11 public meetings in the vicinity of reactors and two webinars to consult with host States, local government organizations, communities within the emergency planning zone of a nuclear power reactor, existing local community advisory boards associated with decommissioning nuclear power plants, and similar external stakeholders. The public meeting locations were selected to ensure geographic diversity across the United States, with priority given to States that have a nuclear power reactor undergoing the decommissioning process.

The report, issued to Congress in July 2020, includes a discussion of the composition of local community advisory boards and best practices, such as logistical considerations, frequency of meetings, and the selection of board members.

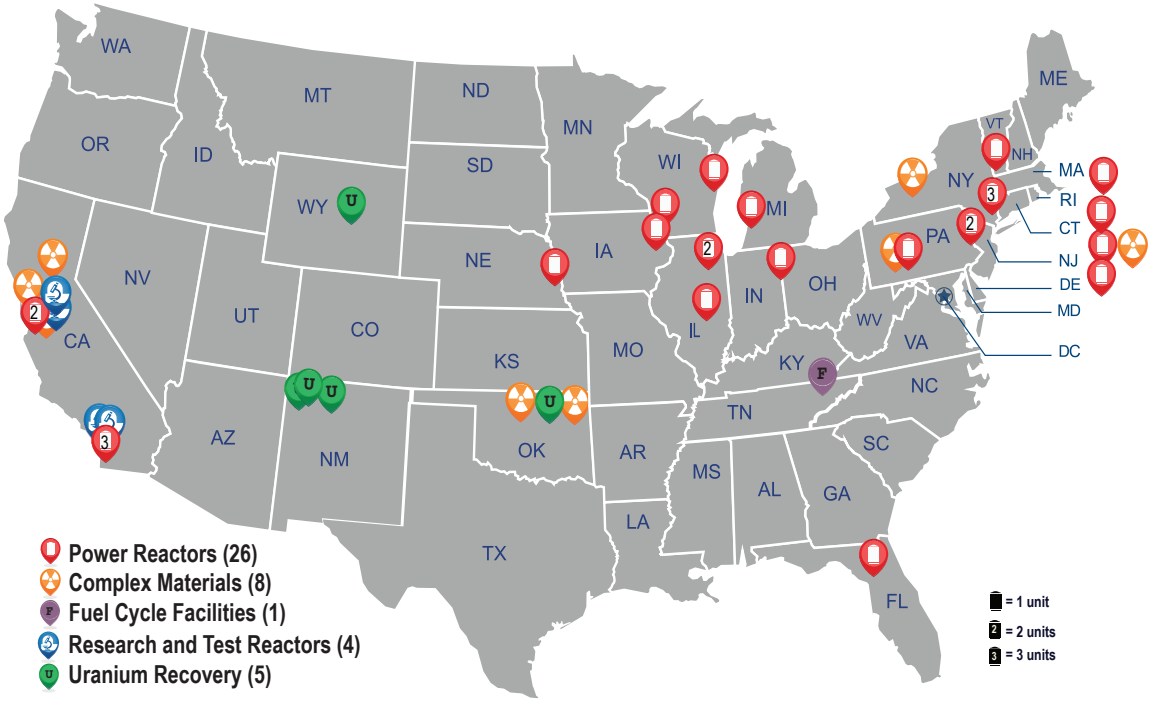
Decommissioning of Materials Licenses

The NRC terminates approximately 100 materials licenses each year. Most of these license terminations are routine, and the sites require little or no cleanup to meet the NRC's criteria for unrestricted access. The decommissioning program focuses on the termination of licenses for RTRs, uranium recovery facilities, fuel cycle facilities, and sites involving more complex decommissioning activities.

These facilities typically were manufacturing or industrial sites that processed uranium, radium, or thorium or were military bases. They are required to begin decommissioning within 2 years of ending operations, unless the NRC approves an alternative schedule. (See Figure 39. Locations of NRC-Regulated Sites Undergoing Decommissioning.)

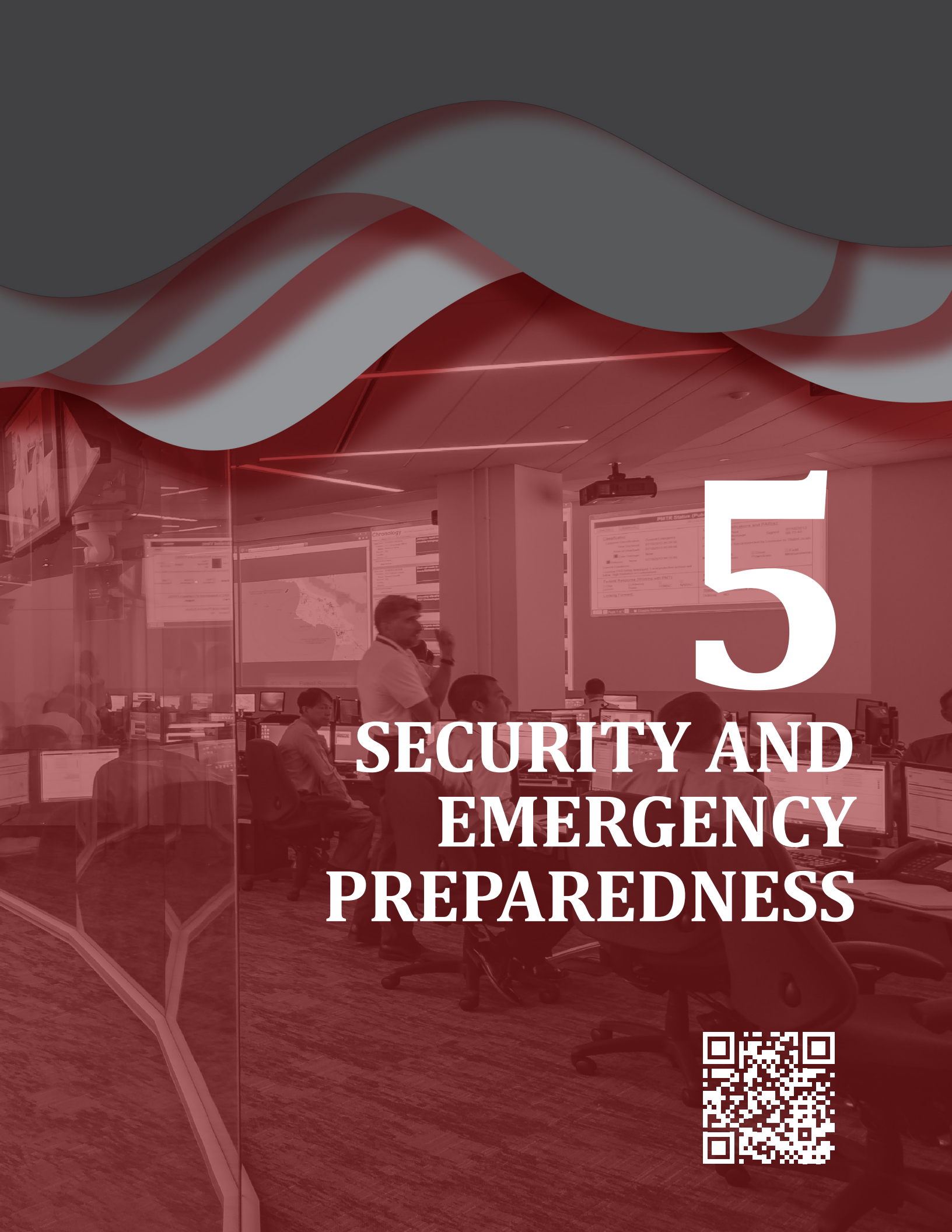
SECY-21-0100, "Status of the Decommissioning Program—2021 Annual Report," dated November 30, 2021, contains additional information on the decommissioning programs of the NRC and Agreement States.

Figure 39. Locations of NRC-Regulated Sites Undergoing Decommissioning



Note: Alaska and Hawaii are not pictured and have no sites.
Data are current as of October 2022. For the most recent information, go to the NRC facility locator page at https://www.nrc.gov/info-finder.html.

Scan QR code for more information on the sites undergoing decommissioning



5

SECURITY AND EMERGENCY PREPAREDNESS

Nuclear security and emergency preparedness and response are high priorities for the NRC. For decades, effective NRC regulation and strong partnerships with Federal, State, Tribal, and local authorities have ensured effective implementation of security programs at nuclear facilities and radioactive materials sites across the country. In fact, nuclear power plants are likely the best protected and prepared private sector facilities in the United States. However, given today's threat environment, the agency recognizes the need for continued vigilance and high levels of security (see Figure 40. Security Components).

Since the terrorist attacks of September 11, 2001, the NRC has required many enhancements to the security of nuclear power plants. Because those plants are inherently robust structures, these additional security upgrades largely focus on the following:

- *well-trained and armed security officers*
- *high-tech equipment and physical barriers*
- *greater standoff distances for vehicle checks*
- *intrusion detection and surveillance systems*
- *tested emergency preparedness and response plans*
- *restrictive site-access control, including background checks and fingerprinting of workers*
- *controls to protect physical security, emergency preparedness, and safety systems from a cyber attack*

The NRC also coordinates and shares threat information with the U.S. Department of Defense, DHS, the FBI, intelligence agencies, and local law enforcement.

The NRC is moving toward a risk-informed, performance-based, technology-inclusive regulatory framework for emergency preparedness. As with security, the NRC's approach to emergency preparedness is graded, using a risk-informed process in which the safety requirements and criteria are matched to the risk to the facility. This approach provides an appropriate level of protection to public health and safety without creating undue regulatory burden.

In 2020, the NRC published a proposed rule for emergency preparedness for small modular reactors and other new technologies. Major provisions of the proposed rule include the following:

- *an alternative performance-based framework for emergency preparedness*
- *a required hazard analysis of nearby facilities that would adversely impact emergency preparedness*
- *a scalable approach for determining the size of the emergency planning zone*
- *a requirement to describe ingestion response capabilities and resources*

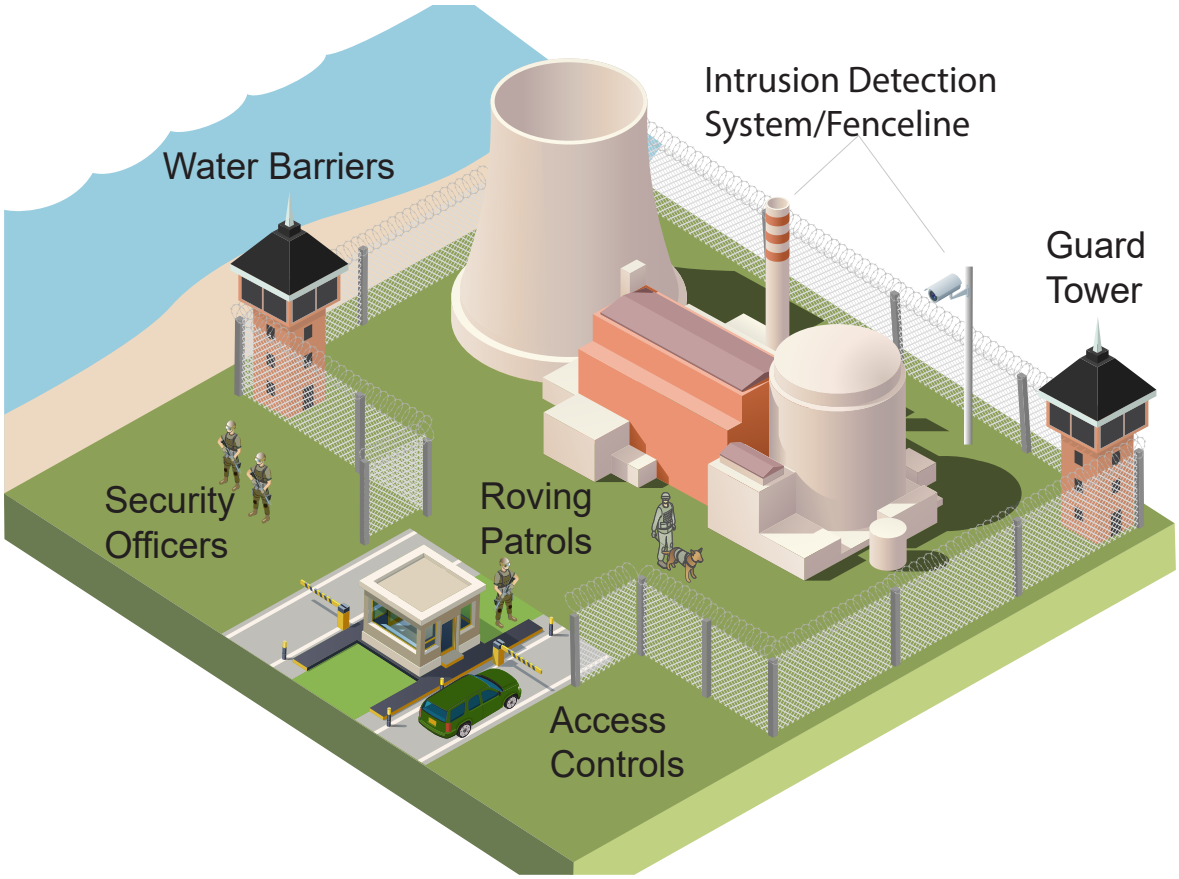
FACILITY SECURITY

Under NRC regulations, nuclear power plants and fuel facilities that handle highly enriched uranium must be able to defend successfully against a set of threats the agency calls the "design-basis threat" (DBT). Details of the DBT are not public because of security concerns, but it includes threats to a facility's physical security, personnel security, and cybersecurity and is based on realistic assessments of the tactics, techniques, and procedures used by terrorist groups. The NRC continually evaluates the threat environment and assesses the need to change the DBT.

The NRC verifies that licensees are complying with security requirements through its baseline inspection program. This includes force-on-force inspections designed to test a facility's defenses against the DBT. Force-on-force inspections are held at each nuclear power plant once every 3 years, employing a highly trained mock adversary force to "attack" a nuclear facility.

Publicly available portions of security-related inspection reports are on the NRC's website. For security reasons, inspection reports are not available for the NRC-licensed fuel facilities that handle highly enriched uranium.

Figure 40. Security Components



CYBERSECURITY

Nuclear facilities use digital and analog systems to monitor and operate various types of equipment, as well as to obtain and store vital information. Protecting these systems and the information they contain from sabotage or malicious use is called “cybersecurity.” All nuclear power plants licensed by the NRC must have an approved cybersecurity plan to guard against malevolent cyber acts against these facilities. For this reason, computer systems at nuclear power plants that monitor and operate safety and security systems are isolated from external communications, including the internet.

The NRC’s inspections of nuclear power plants’ cybersecurity programs provide reasonable assurance that the facilities adequately protect digital computers, communication systems, and networks associated with safety, security, and emergency preparedness. The experience that the NRC gained in developing the cybersecurity requirements for the current fleet of nuclear power plants provided a basis for developing cybersecurity requirements for nonreactor licensees and future advanced reactor licensees.

The NRC’s cybersecurity oversight team includes technology and threat experts who evaluate and identify emerging cyber-related issues that could endanger plant systems. The team also makes recommendations to other NRC offices and programs on cybersecurity oversight issues. The NRC has established working relationships with Federal agencies such as the DHS’s U.S. Cybersecurity and Infrastructure Security Agency; the DOE’s Office of Cybersecurity, Energy Security, and Emergency Response; and the FBI; as well as with international organizations such as the IAEA and the International Electrotechnical Commission. Such relationships are intended not only to share information but also to ensure effective coordination among Federal agencies if a cyber incident were to occur at a nuclear facility.

MATERIALS SECURITY

Radioactive materials must be secured to prevent terrorists from using them to make a radiological dispersal device, sometimes called an "RDD" or "dirty bomb." The NRC requires the physical protection of certain types and quantities of radioactive material. The NRC also works with the Agreement States, other Federal agencies, the IAEA, and licensees to protect radioactive materials from theft and malicious use.

In 2009, the NRC deployed the National Source Tracking System, designed to track the most risk-sensitive radioactive materials. Other improvements allow U.S. Customs and Border Protection agents to promptly validate whether radioactive materials coming into the United States are properly licensed by the NRC or an Agreement State. In addition, the NRC improved and upgraded the joint NRC-DOE database tracking the movement and location of certain forms and quantities of special nuclear material.

EMERGENCY PREPAREDNESS

Operators of nuclear facilities are required to develop and maintain effective emergency plans and procedures to protect the public in the unlikely event of an emergency. Emergency preparedness plans include public information, preparations for evacuation, instructions for sheltering, and other actions to protect the residents near nuclear power plants in the event of a serious incident.

The NRC conducts inspections and monitors performance indicators associated with emergency preparedness programs. At least once every 2 years, nuclear power plant operators must conduct full-scale exercises in coordination with State and local officials, under evaluation by the NRC and the Federal Emergency Management Agency. Once during every 8-year exercise cycle, these exercises include hostile-action-based scenarios. These exercises test and maintain the skills of the emergency responders and identify areas that need to be addressed. Nuclear power plant operators also conduct their own emergency response drills.

Emergency Planning Zones

The NRC defines two emergency planning zones (EPZs) around each nuclear power plant. The exact size and configuration of the zones vary from plant to plant, based on local emergency response needs and capabilities, population, land characteristics, access routes, and jurisdictional boundaries. The zone boundaries are flexible, and emergency response actions may be expanded during an emergency if circumstances warrant.

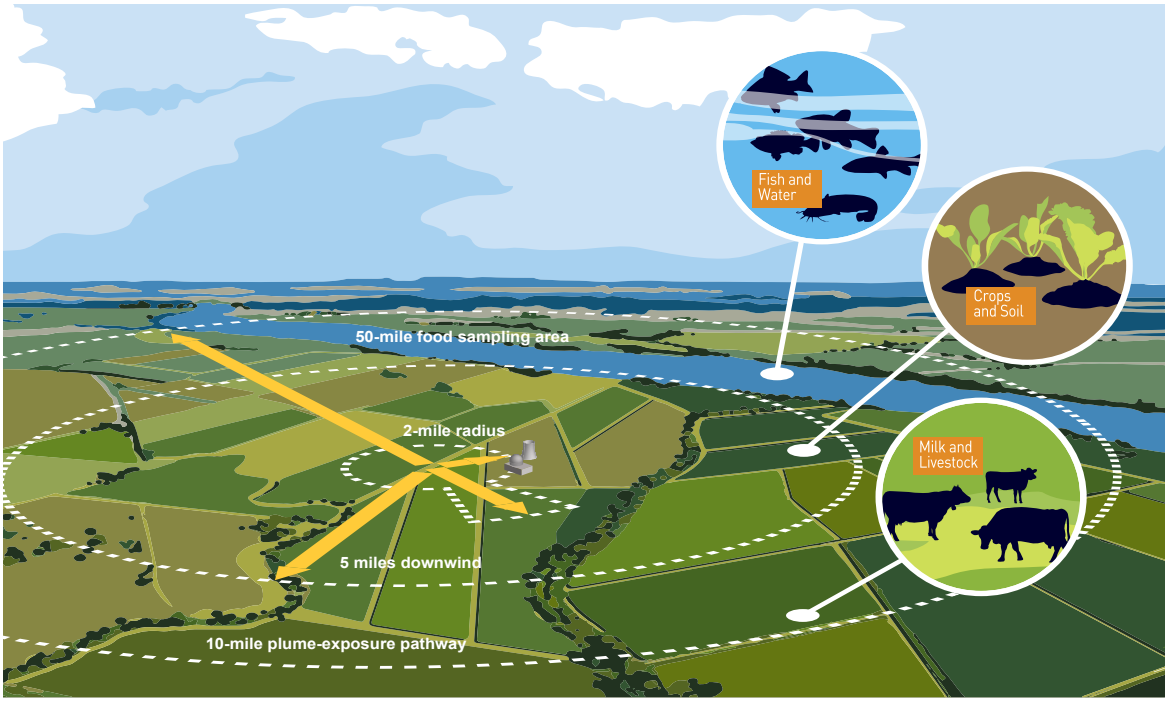
Figure 41. Emergency Planning Zones depicts a typical EPZ around a nuclear plant. The two types of EPZs are the plume-exposure pathway and the ingestion pathway.

- *The plume-exposure pathway covers a radius of about 10 miles (16 kilometers) from the plant and is the area of greatest concern for the public's exposure to and inhalation of airborne radioactive contamination. Research has shown the most significant impacts of an accident would be expected in the immediate vicinity of a plant, and any initial protective actions, such as evacuations or sheltering in place, should be focused there.*
- *The ingestion pathway, or food safety sampling area, extends to a radius of about 50 miles (80 kilometers) from the plant and is the area of greatest concern for the ingestion of food and liquid that may be contaminated by radioactive material.*

Protective Actions

During an actual nuclear power plant accident, the NRC would use radiation dose projection models to predict the nature and extent of a radiation release. The dose calculations would account for weather conditions to project the extent of radiation exposure to the nearby population. The NRC would confer with appropriate State and local governments on its assessment results. Plant personnel would also provide assessments. State and local officials in communities within the EPZ have detailed plans to protect the public during a radiation release. These officials make their protective action decisions, including whether to order evacuations, based on these and other assessments.

Figure 41. Emergency Planning Zones



Note: A 2-mile (3.2-kilometer) ring around the plant is identified for evacuation, along with a 5-mile (8-kilometer) zone downwind of the projected release path.

Evacuation, Sheltering, and the Use of Potassium Iodide

Protective actions considered for a radiological emergency include evacuation, sheltering, and the preventive use of potassium iodide (KI) supplements to protect the thyroid from radioactive iodine, which can cause thyroid cancer.

Under certain conditions, it may be advisable to evacuate the public away from further exposure to radioactive material. However, a complete evacuation of the 10-mile (16-kilometer) zone around a nuclear power plant is not likely to be needed in most cases. The release of radioactive material from a plant during a major incident would move with the wind, not in all directions surrounding the plant. The release would also expand and become less concentrated as it traveled away from a plant. For these reasons, evacuations can be planned based on the anticipated path of the release.

Under some conditions, people may be instructed to “shelter in place” in their homes, schools, or office buildings. Depending on the type of structure, sheltering can significantly reduce someone’s dose when compared to staying outside. It may be appropriate to shelter when the release of radioactive material is known to be short term or is controlled by the nuclear power plant operator. In certain situations, KI may be used as a supplement to either sheltering in place or evacuation.

The risk of an offsite radiological release is significantly lower and the types of possible accidents significantly fewer at a nuclear power reactor that has permanently ceased operations and removed fuel from the reactor vessel. Nuclear power plants that have begun decommissioning may therefore apply for exemptions from certain NRC emergency planning requirements. If the exemptions are granted, State and local agencies may apply their comprehensive emergency plans—known as “all-hazards plans”—to respond to incidents at the plant.

Scan QR code for more information on emergency preparedness

INCIDENT RESPONSE

Quick and accurate communication among the NRC, other Federal and State agencies, and the nuclear industry is critical when responding to any incident. The NRC Headquarters Operations Center, located in the agency's headquarters in Rockville, Maryland, is staffed around the clock to disseminate information and coordinate response activities. The NRC also reviews intelligence reports and assesses suspicious activity to keep licensees and other agencies up to date on current threats.

The NRC works within the National Response Framework to respond to events. The framework guides the Nation in its response to complex events that might involve a variety of agencies and hazards. Under this framework, the NRC retains its independent authority and ability to respond to emergencies involving NRC-licensed facilities or materials. The NRC may request support from the DHS in responding to an emergency at an NRC-licensed facility or involving NRC-licensed materials.

In response to an incident involving possible radiation releases, the NRC activates its incident response program at its Headquarters Operations Center and one of its regional Incident Response Centers. Teams of specialists at these centers evaluate event information, independently assess the potential impact on public health and safety, and evaluate possible recovery strategies.

The NRC response staff provides expert consultation, support, and assistance to State and local public safety officials and keeps the public informed of agency actions. Meanwhile, other NRC experts evaluate the effectiveness of protective actions the licensee has recommended to State and local officials. If needed, the NRC will dispatch a team of technical experts from the responsible regional office to the site. This team would assist the NRC's resident inspectors who work at the plant and provide licensee event information to the technical experts at the NRC region and headquarters.

EMERGENCY CLASSIFICATIONS

Emergencies at nuclear facilities are classified according to the risk posed to the public. These classifications help guide first responders on the actions necessary to protect the population near the site. Nuclear power plants use these four emergency classifications:

1. **Notification of Unusual Event:** *Events that indicate a potential degradation in the level of safety or indicate a security threat to the plant are in progress or have occurred. No release of radioactive material requiring offsite response or monitoring is expected unless further degradation occurs.*
2. **Alert:** *Events that involve an actual or potential substantial degradation in the level of plant safety or security events that involve probable life-threatening risk to site personnel or damage to site equipment are in progress or have occurred. Any releases of radioactive material are expected to be limited to a small fraction of the limits set forth by the U.S. Environmental Protection Agency (EPA).*
3. **Site Area Emergency:** *Events that may result in actual or likely major failures of plant functions needed to protect the public or hostile actions that result in intentional damage or malicious acts are in progress or have occurred. Any releases of radioactive material are not expected to exceed the limits set by the EPA except near the site boundary.*
4. **General Emergency:** *Events that involve actual or imminent substantial core damage or melting of reactor fuel with the potential for loss of containment integrity or hostile actions that result in an actual loss of physical control of the facility are in progress or have occurred. Radioactive releases can be expected to exceed the limits set forth by the EPA for more than the immediate site area.*

Nuclear materials and fuel cycle facility licensees use these emergency classifications:

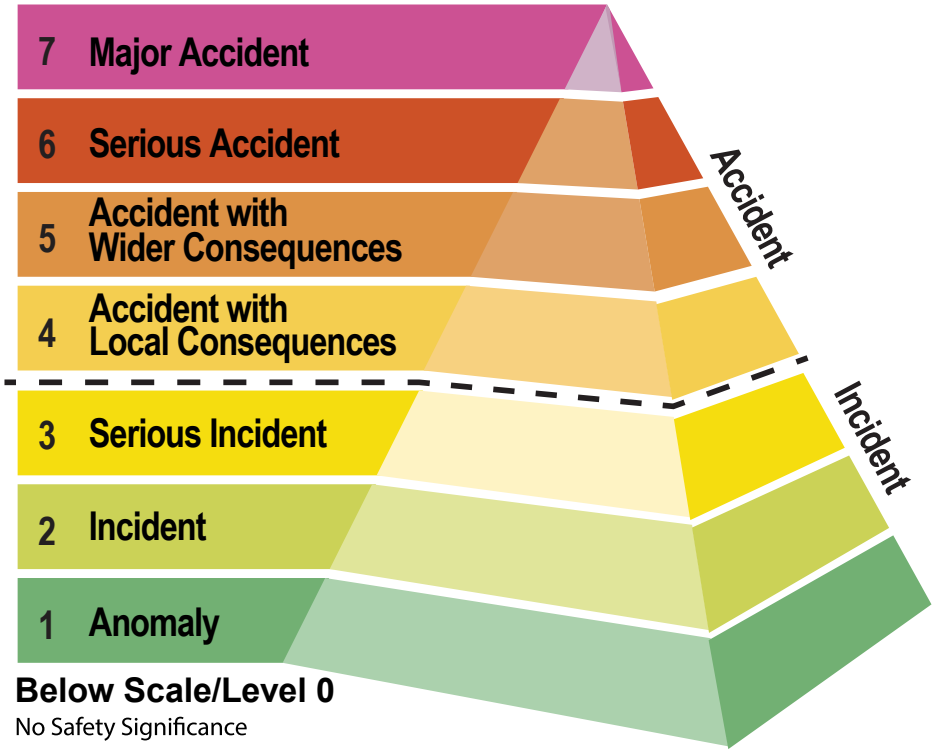
1. **Alert:** *Events that could lead to a release of radioactive materials are in progress or have occurred. The release is not expected to require a response by an offsite response organization to protect residents near the site.*
2. **Site Area Emergency:** *Events that could lead to a significant release of radioactive materials are in progress or have occurred. The release could require a response by offsite response organizations to protect residents near the site.*

INTERNATIONAL EMERGENCY CLASSIFICATIONS

The IAEA uses the International Nuclear and Radiological Event Scale (INES) as a tool for promptly and consistently communicating to the public the safety significance of reported nuclear and radiological incidents and accidents worldwide (see Figure 42.The International Nuclear and Radiological Event Scale).

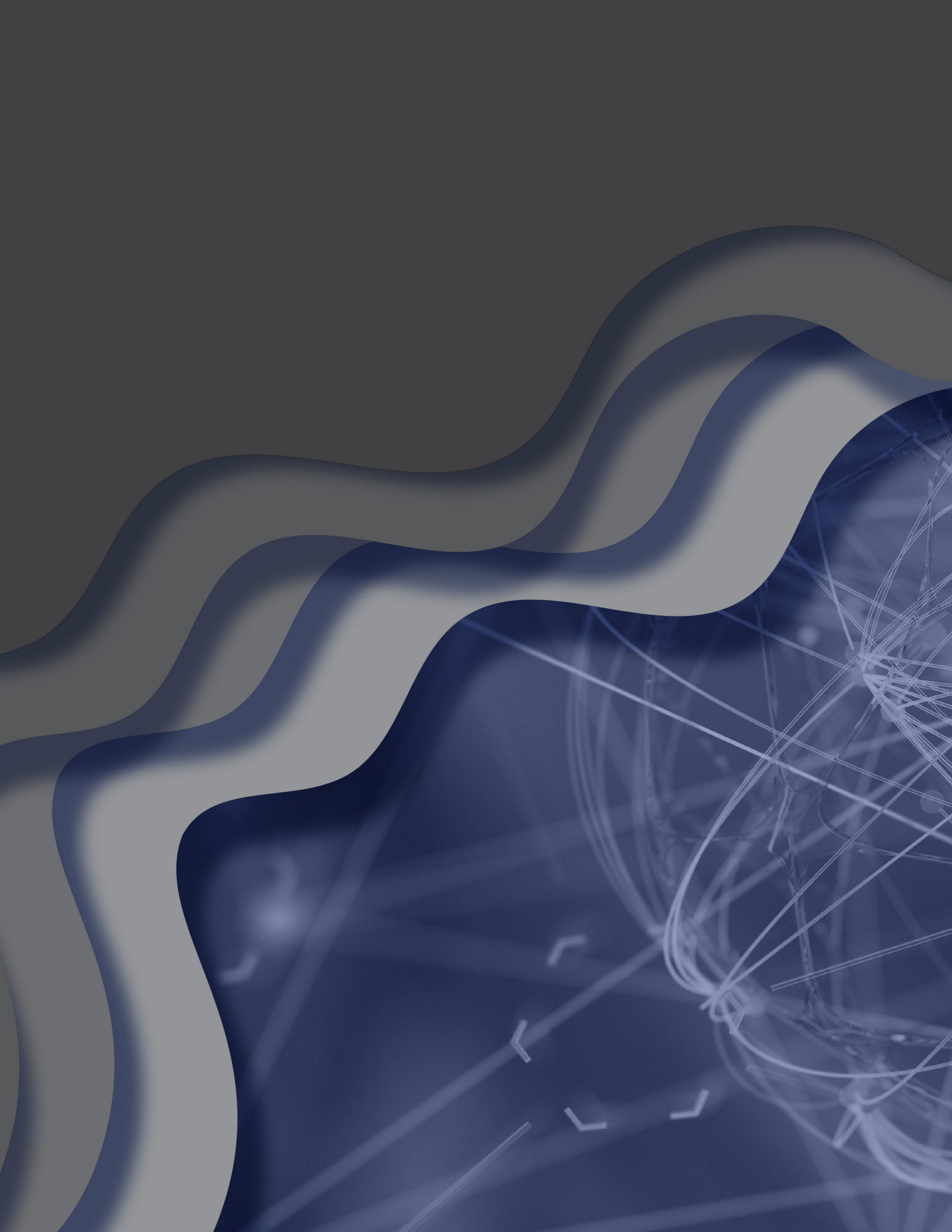
The scale can be applied to any event associated with nuclear facilities, as well as to the transport, storage, and use of radioactive material and radiation sources. Licensees are not required to classify events or provide offsite notifications using the INES. However, the NRC has a commitment to transmit to the IAEA an INES-based rating for an applicable U.S. event rated at Level 2 or above, or for events attracting international public interest.

Figure 42. The International Nuclear and Radiological Event Scale



INES events are classified on the scale at seven levels. Levels 1–3 are called "incidents," and Levels 4–7 are called "accidents." The scale is designed so that the severity of an event is about 10 times greater for each increase in level on the scale. Events without safety significance are called "deviations" and are classified as Below Scale or at Level 0.

Source: https://www.iaea.org/topics/emergency-preparedness-and-response-epr/international-nuclear-radiological-event-scale-ines



6
APPENDICES

Abbreviations

ABWR	Advanced Boiling-Water Reactor
ac	alternating current
ACMUI	Advisory Committee on the Medical Uses of Isotopes
ACRS	Advisory Committee on Reactor Safeguards
ADAMS	Agencywide Documents Access and Management System
ADR	alternative dispute resolution
AEC	Atomic Energy Commission (U.S.)
AEP	American Electric Power Company
AGN	Aerojet-General Nucleonics
AP1000	Advanced Passive 1000 Megawatt (Westinghouse pressurized-water reactor)
AP600	Advanced Passive 600 Megawatt (Westinghouse pressurized-water reactor)
APR1400	Advanced Power Reactor
ASLB	Atomic Safety and Licensing Board
AFT	accident tolerant fuel
B&W	Babcock & Wilcox
BALD	Baldwin Associates
BECH	Bechtel
BRRT	Brown & Root
BWR	boiling-water reactor
CE	Combustion Engineering
CFR	*Code of Federal Regulations*
COL	combined license
Comm. Op.	date of commercial operation
Con Type	containment type
	DRYAMB dry, ambient pressure
	DRYSUB dry, subatmospheric
	ICECND wet, ice condenser
	MARK 1 wet, MARK I
	MARK 2 wet, MARK II
	MARK 3 wet, MARK III
CP	construction permit
CP	civil penalty
CP Issued	date of construction permit issuance
CT	computerized tomography
CVTR	Carolinas Virginia Tube Reactor
CWE	Commonwealth Edison Company
DANI	Daniel International
DBDB	Duke & Bechtel
DBT	design-basis threat
DC	design certification
DECON	decontamination
DHS	Department of Homeland Security (U.S.)
DI&C	digital instrumentation and control
DOE	Department of Energy (U.S.)
DOT	Department of Transportation (U.S.)
DUKE	Duke Power Company
EDO	Executive Director for Operations
EBSO	Ebasco
EIA	Energy Information Administration (DOE)
EPA	Environmental Protection Agency (U.S.)
EPZ	emergency planning zone
ESBWR	Economic Simplified Boiling-Water Reactor
ESP	early site permit
EVESR	ESADA (Empire States Atomic Development Associates) Vallecitos Experimental Superheat Reactor
Exp. Date	expiration date of operating license
FDA	Food and Drug Administration
FEMA	Federal Emergency Management Agency
FERC	Federal Energy Regulatory Commission
FLEX	divers and flexible coping strategies
FLUR	Fluor Pioneer
FOIA	Freedom of Information Act
FR	*Federal Register*
FTE	full-time equivalent
FW	Foster Wheeler
FY	fiscal year
G&H	Gibbs & Hill
GA	General Atomics
GE	General Electric
GEH	General Electric-Hitachi Nuclear Energy
GEIS	generic environmental impact statement
GETR	General Electric Test Reactor
GIL	Gilbert Associates
GL	general license
GPC	Georgia Power Company
HLW	high-level radioactive waste
HTG	high-temperature gas (reactor)
HWR	heavy-water reactor
IAEA	International Atomic Energy Agency
INES	International Nuclear Event Scale
ISFSI	independent spent fuel storage installation
KAIS	Kaiser Engineers
KI	potassium iodide

Abbreviations (continued)

kW	kilowatt(s)
kWh	kilowatt-hour(s)
LLP	B&W lowered loop
LLW	low-level radioactive waste
LM	Legacy Management
LMFB	liquid metal fast breeder (reactor)
LOCA	loss-of-coolant accident
LR Issued	license renewal issued
LSN	Licensing Support Network
LTP	license termination plan
Mo-99	molybdenum-99
MOU	memorandum of understanding
MOX	mixed oxide
MWe	megawatt(s) electric
MWt	megawatt(s) thermal
NARM	naturally occurring or accelerator-produced radioactive material
NEA	Nuclear Energy Agency
NEIMA	Nuclear Energy Innovation and Modernization Act
NEPA	National Environmental Policy Act
NINA	Nuclear Innovation North America
NMMSS	Nuclear Materials Management and Safeguards System
NNSA	National Nuclear Security Administration
NOV	notice of violation
NPUF	nonpower production and utilization facility
NRC	Nuclear Regulatory Commission (U.S.)
NS	Nuclear Ship
NSP	Northern States Power Company
NSSS	nuclear steam system supplier and design type **GE 2** GE Type 2 **GE 3** GE Type 3 **GE 4** GE Type 4 **GE 5** GE Type 5 **GE 6** GE Type 6 **WEST 2LP** Westinghouse Two-Loop **WEST 3LP** Westinghouse Three-Loop **WEST 4LP** Westinghouse Four-Loop
NSTS	National Source Tracking System
OECD	Organisation for Economic Co-operation and Development
OIG	Office of the Inspector General
OL	operating license
OL Issued	date of latest full-power operating license
PG&E	Pacific Gas & Electric Company
PRA	probabilistic risk assessment
PRIS	Power Reactor Information System
PSDAR	post-shutdown decommissioning activities report
PSEG	Public Service Electric and Gas Company
PWR	pressurized-water reactor
rad	radiation absorbed dose
RDD	radiological dispersal device
RLP	B&W raised loop
ROP	Reactor Oversight Process
RSS	Really Simple Syndication
RTR	research and test reactor
S&L	Sargent & Lundy
S&W	Stone & Webster
SAFSTOR	safe storage
SCF	sodium-cooled fast (reactor)
SHINE	SHINE Medical Technologies, LLC
SL	severity level
SL	site-specific license
SMR	small modular reactor
SR	subsequent license renewal
SSI	Southern Services Incorporated
STP	South Texas Project
TMI-2	Three Mile Island, Unit 2
TRIGA	Training Reactor and Isotopes Production, General Atomics
TVA	Tennessee Valley Authority
UE&C	United Engineers & Constructors
UF_6	uranium hexafluoride
U-235	uranium-235
UO_2	uranium dioxide
US-APWR	U.S. [version of] Advanced Pressurized-Water Reactor
U.S. EPR	U.S. [version of] Evolutionary Pressurized-Water Reactor
VBWR	Vallecitos Boiling-Water Reactor
WEST	Westinghouse Electric
WNA	World Nuclear Association
Y-90	yttrium-90

State and Territory Abbreviations

Alabama	AL	Maine	ME	Puerto Rico	PR
Alaska	AK	Maryland	MD	Rhode Island	RI
American Samoa	AS	Massachusetts	MA	South Carolina	SC
Arizona	AZ	Michigan	MI	South Dakota	SD
Arkansas	AR	Minnesota	MN	Tennessee	TN
California	CA	Mississippi	MS	Texas	TX
Colorado	CO	Missouri	MO	Utah	UT
Connecticut	CT	Montana	MT	Vermont	VT
Delaware	DE	Nebraska	NE	Virgin Islands	VI
District of Columbia	DC	Nevada	NV	Virginia	VA
Florida	FL	New Hampshire	NH	Washington	WA
Georgia	GA	New Jersey	NJ	West Virginia	WV
Guam	GU	New Mexico	NM	Wisconsin	WI
Hawaii	HI	New York	NY	Wyoming	WY
Idaho	ID	North Carolina	NC		
Illinois	IL	North Dakota	ND		
Indiana	IN	Northern Mariana Islands	MP		
Iowa	IA	Ohio	OH		
Kansas	KS	Oklahoma	OK		
Kentucky	KY	Oregon	OR		
Louisiana	LA	Pennsylvania	PA		

APPENDIX A
Commercial Nuclear Power Reactors
Operating Reactors

Plant Name, Unit Number Licensee Location Docket Number NRC Web page Address	NRC Region	Con Type NSSS Architect Engineer Constructor	Licensed MWt MWe License Number	CP Issued OL Issued Comm. Op LR Issued SR Issued Exp. Date
Arkansas Nuclear One, Unit 1 Entergy Operations, Inc. London, AR (6 miles WNW of Russellville, AR) 05000313 https://www.nrc.gov/info-finder/reactors/ano1.html	IV	PWR-DRYAMB B&W LLP BECH BECH	2,568 833 DPR-51	12/06/1968 05/21/1974 12/19/1974 06/20/2001 N/A 05/20/2034
Arkansas Nuclear One, Unit 2 Entergy Operations, Inc. London, AR (6 miles WNW of Russellville, AR) 05000368 https://www.nrc.gov/info-finder/reactors/ano2.html	IV	PWR-DRYAMB CE BECH BECH	3,026 985 NPF-6	12/06/1972 09/01/1978 03/26/1980 06/30/2005 N/A 07/17/2038
Beaver Valley Power Station, Unit 1 Energy Harbor Nuclear Generation LLC/ Energy Harbor Nuclear Corp. Shippingport, PA (17 miles W of McCandless, PA) 05000334 https://www.nrc.gov/info-finder/reactors/bv1.html	I	PWR-DRYAMB WEST 3LP S&W S&W	2,900 907 DPR-66	06/26/1970 07/02/1976 10/01/1976 11/05/2009 N/A 01/29/2036
Beaver Valley Power Station, Unit 2 Energy Harbor Nuclear Generation LLC/ Energy Harbor Nuclear Corp. Shippingport, PA (17 miles W of McCandless, PA) 05000412 https://www.nrc.gov/info-finder/reactors/bv2.html	I	PWR-DRYAMB WEST 3LP S&W S&W	2,900 901 NPF-73	05/03/1974 08/14/1987 11/17/1987 11/05/2009 N/A 05/27/2047
Braidwood Station, Unit 1 Constellation Energy Generation Co., LLC Braceville, IL (20 miles SSW of Joliet, IL) 05000456 https://www.nrc.gov/info-finder/reactors/brai1.html	III	PWR-DRYAMB WEST 4LP S&L CWE	3,645 1,183 NPF-72	12/31/1975 07/02/1987 07/29/1988 01/27/2016 N/A 10/17/2046
Braidwood Station, Unit 2 Constellation Energy Generation Co., LLC Braceville, IL (20 miles SSW of Joliet, IL) 05000457 https://www.nrc.gov/info-finder/reactors/brai2.html	III	PWR-DRYAMB WEST 4LP S&L CWE	3,645 1,154 NPF-77	12/31/1975 05/20/1988 10/17/1988 01/27/2016 N/A 12/18/2047

APPENDIX A
Commercial Nuclear Power Reactors
Operating Reactors (continued)

Plant Name, Unit Number Licensee Location Docket Number NRC Web page Address	NRC Region	Con Type NSSS Architect Engineer Constructor	Licensed MWt MWe License Number	CP Issued OL Issued Comm. Op LR Issued SR Issued Exp. Date
Browns Ferry Nuclear Plant, Unit 1 Tennessee Valley Authority Limestone County, AL (10 miles S of Athens, AL) 05000259 https://www.nrc.gov/info-finder/reactors/bf1.html	II	BWR-MARK 1 GE 4 TVA TVA	3,952 1,256 DPR-33	05/10/1967 12/20/1973 08/01/1974 05/04/2006 N/A 12/20/2033
Browns Ferry Nuclear Plant, Unit 2 Tennessee Valley Authority Limestone County, AL (10 miles S of Athens, AL) 05000260 https://www.nrc.gov/info-finder/reactors/bf2.html	II	BWR-MARK 1 GE 4 TVA TVA	3,952 1,259 DPR-52	05/10/1967 06/28/1974 03/01/1975 05/04/2006 N/A 06/28/2034
Browns Ferry Nuclear Plant, Unit 3 Tennessee Valley Authority Limestone County, AL (10 miles S of Athens, AL) 05000296 https://www.nrc.gov/info-finder/reactors/bf3.html	II	BWR-MARK 1 GE 4 TVA TVA	3,952 1,260 DPR-68	07/31/1968 07/02/1976 03/01/1977 05/04/2006 N/A 07/02/2036
Brunswick Steam Electric Plant, Unit 1 Duke Energy Progress, LLC Southport, NC (20 miles S of Wilmington, NC) 05000325 https://www.nrc.gov/info-finder/reactors/bru1.html	II	BWR-MARK 1 GE 4 UE&C BRRT	2,923 938 DPR-71	02/07/1970 09/08/1976 03/18/1977 06/26/2006 N/A 09/08/2036
Brunswick Steam Electric Plant, Unit 2 Duke Energy Progress, LLC Southport, NC (20 miles S of Wilmington, NC) 05000324 https://www.nrc.gov/info-finder/reactors/bru2.html	II	BWR-MARK 1 GE 4 UE&C BRRT	2,923 932 DPR-62	02/07/1970 12/27/1974 11/03/1975 06/26/2006 N/A 12/27/2034
Byron Station, Unit 1 Constellation Energy Generation Co., LLC Byron, IL (17 miles SW of Rockford, IL) 05000454 https://www.nrc.gov/info-finder/reactors/byro1.html	III	PWR-DRYAMB WEST 4LP S&L CWE	3,645 1,164 NPF-37	12/31/1975 02/14/1985 09/16/1985 11/19/2015 N/A 10/31/2044
Byron Station, Unit 2 Constellation Energy Generation Co., LLC Byron, IL (17 miles SW of Rockford, IL) 05000455 https://www.nrc.gov/info-finder/reactors/byro2.html	III	PWR-DRYAMB WEST 4LP S&L CWE	3,645 1,136 NPF-66	12/31/1975 01/30/1987 08/02/1987 11/19/2015 N/A 11/06/2046

APPENDIX A
Commercial Nuclear Power Reactors
Operating Reactors (continued)

Plant Name, Unit Number Licensee Location Docket Number NRC Web page Address	NRC Region	Con Type NSSS Architect Engineer Constructor	Licensed MWt MWe License Number	CP Issued OL Issued Comm. Op LR Issued SR Issued Exp. Date
Callaway Plant, Unit 1 Union Electric Co. Fulton, MO (25 miles ENE of Jefferson City, MO) 05000483 https://www.nrc.gov/info-finder/reactors/call.html	IV	PWR-DRYAMB WEST 4LP BECH DANI	3,565 1190 NPF-30	04/16/1976 10/18/1984 12/19/1984 03/06/2015 N/A 10/18/2044
Calvert Cliffs Nuclear Power Plant, Unit 1 Calvert Cliffs Nuclear Power Plant, LLC Constellation Energy Generation Co., LLC Lusby, MD (40 miles S of Annapolis, MD) 05000317 https://www.nrc.gov/info-finder/reactors/calv1.html	I	PWR-DRYAMB CE BECH BECH	2,737 866 DPR-53	07/07/1969 07/31/1974 05/08/1975 03/23/2000 N/A 07/31/2034
Calvert Cliffs Nuclear Power Plant, Unit 2 Calvert Cliffs Nuclear Power Plant, LLC Constellation Energy Generation Co., LLC Lusby, MD (40 miles S of Annapolis, MD) 05000318 https://www.nrc.gov/info-finder/reactors/calv2.html	I	PWR-DRYAMB CE BECH BECH	2,737 842 DPR-69	07/07/1969 08/13/1976 04/01/1977 03/23/2000 N/A 08/13/2036
Catawba Nuclear Station, Unit 1 Duke Energy Carolinas, LLC York, SC (18 miles S of Charlotte, NC) 05000413 https://www.nrc.gov/info-finder/reactors/cat1.html	II	PWR-ICECND WEST 4LP DUKE DUKE	3,469 1,160 NPF-35	08/07/1975 01/17/1985 06/29/1985 12/05/2003 N/A 12/05/2043
Catawba Nuclear Station, Unit 2 Duke Energy Carolinas, LLC York, SC (18 miles S of Charlotte, NC) 05000414 https://www.nrc.gov/info-finder/reactors/cat2.html	II	PWR-ICECND WEST 4LP DUKE DUKE	3,411 1,150 NPF-52	08/07/1975 05/15/1986 08/19/1986 12/05/2003 N/A 12/05/2043
Clinton Power Station, Unit 1 Constellation Energy Generation Co., LLC Clinton, IL (23 miles SSE of Bloomington, IL) 05000461 https://www.nrc.gov/info-finder/reactors/clin.html	III	BWR-MARK 3 GE 6 S&L BALD	3,473 1,065 NPF-62	02/24/1976 04/17/1987 11/24/1987 N/A N/A 09/29/2026

APPENDIX A
Commercial Nuclear Power Reactors
Operating Reactors (continued)

Plant Name, Unit Number Licensee Location Docket Number NRC Web page Address	NRC Region	Con Type NSSS Architect Engineer Constructor	Licensed MWt MWe License Number	CP Issued OL Issued Comm. Op LR Issued SR Issued Exp. Date
Columbia Generating Station Energy Northwest Hanford Reservation in Benton County, WA (15 miles NNW of Richland, WA) 05000397 https://www.nrc.gov/info-finder/reactors/wash2.html	IV	BWR-MARK 2 GE 5 B&R BECH	3,544 1,163 NPF-21	03/19/1973 04/13/1984 12/13/1984 05/22/2012 N/A 12/20/2043
Comanche Peak Nuclear Power Plant, Unit 1 Comanche Peak Power Co., LLC. Vistra Operating Co., LLC Glen Rose, TX (40 miles SW of Fort Worth, TX) 05000445 https://www.nrc.gov/info-finder/reactors/cp1.html	IV	PWR-DRYAMB WEST 4LP G&H BRRT	3,612 1,205 NPF-87	12/19/1974 04/17/1990 08/13/1990 N/A N/A 02/08/2030
Comanche Peak Nuclear Power Plant, Unit 2 Comanche Peak Power Co., LLC. Vistra Operating Co., LLC Glen Rose, TX (40 miles SW of Fort Worth, TX) 05000446 https://www.nrc.gov/info-finder/reactors/cp2.html	IV	PWR-DRYAMB WEST 4LP BECH BRRT	3,612 1,195 NPF-89	12/19/1974 04/06/1993 08/03/1993 N/A N/A 02/02/2033
Cooper Nuclear Station Nebraska Public Power District Brownville, NE (23 miles S of Nebraska City, NE) 05000298 https://www.nrc.gov/info-finder/reactors/cns.html	IV	BWR-MARK 1 GE 4 B&R B&R	2,419 770 DPR-46	06/04/1968 01/18/1974 07/01/1974 11/29/2010 N/A 01/18/2034
Davis-Besse Nuclear Power Station, Unit 1 Energy Harbor Nuclear Generation LLC Energy Harbor Nuclear Corp. Oak Harbor, OH (21 miles ESE of Toledo, OH) 05000346 https://www.nrc.gov/info-finder/reactors/davi.html	III	PWR-DRYAMB B&W RLP BECH B&W	2,817 894 NPF-3	03/24/1971 04/22/1977 07/31/1978 12/08/2015 N/A 04/22/2037
Diablo Canyon Power Plant, Unit 1 Pacific Gas & Electric Co. Avila Beach, CA (12 miles WSW of San Luis Obispo, CA) 05000275 https://www.nrc.gov/info-finder/reactors/diab1.html	IV	PWR-DRYAMB WEST 4LP PG&E PG&E	3,411 1,122 DPR-80	4/23/1968 11/02/1984 05/07/1985 Withdrawn N/A 11/02/2024

APPENDIX A
Commercial Nuclear Power Reactors
Operating Reactors (continued)

Plant Name, Unit Number Licensee Location Docket Number NRC Web page Address	NRC Region	Con Type NSSS Architect Engineer Constructor	Licensed MWt MWe License Number	CP Issued OL Issued Comm. Op LR Issued SR Issued Exp. Date
Diablo Canyon Power Plant, Unit 2 Pacific Gas & Electric Co. Avila Beach, CA (12 miles WSW of San Luis Obispo, CA) 05000323 https://www.nrc.gov/info-finder/reactors/diab2.html	IV	PWR-DRYAMB WEST 4LP PG&E PG&E	3,411 1,118 DPR-82	12/09/1970 08/26/1985 03/13/1986 Withdrawn N/A 08/26/2025
Donald C. Cook Nuclear Plant, Unit 1 Indiana Michigan Power Co. Bridgman, MI (13 miles S of Benton Harbor, MI) 05000315 https://www.nrc.gov/info-finder/reactors/cook1.html	III	PWR-ICECND WEST 4LP AEP AEP	3,304 1,009 DPR-58	03/25/1969 10/25/1974 08/28/1975 08/30/2005 N/A 10/25/2034
Donald C. Cook Nuclear Plant, Unit 2 Indiana Michigan Power Co. Bridgman, MI (13 miles S of Benton Harbor, MI) 05000316 https://www.nrc.gov/info-finder/reactors/cook2.html	III	PWR-ICECND WEST 4LP AEP AEP	3,468 1,168 DPR-74	03/25/1969 12/23/1977 07/01/1978 08/30/2005 N/A 12/23/2037
Dresden Nuclear Power Station, Unit 2 Constellation Energy Generation Co., LLC Morris (Grundy County), IL (25 miles SW of Joliet, IL) 05000237 https://www.nrc.gov/info-finder/reactors/dres2.html	III	BWR-MARK 1 GE 3 S&L UE&C	2,957 902 DPR-19	01/10/1966 02/20/1991[A] 06/09/1970 10/28/2004 N/A 12/22/2029
Dresden Nuclear Power Station, Unit 3 Constellation Energy Generation Co., LLC Morris (Grundy County), IL (25 miles SW of Joliet, IL) 05000249 https://www.nrc.gov/info-finder/reactors/dres3.html	III	BWR-MARK 1 GE 3 S&L UE&C	2,957 895 DPR-25	10/14/1966 01/12/1971 11/16/1971 10/28/2004 N/A 01/12/2031
Edwin I. Hatch Nuclear Plant, Unit 1 Southern Nuclear Operating Co., Inc. Baxley, GA (20 miles S of Vidalia, GA) 05000321 https://www.nrc.gov/info-finder/reactors/hat1.html	II	BWR-MARK 1 GE 4 BECH GPC	2,804 876 DPR-57	09/30/1969 10/13/1974 12/31/1975 01/15/2002 N/A 08/06/2034

A: The Atomic Energy Commission (AEC) issued a provisional operating license (OL) on 12/22/1969, allowing commercial operation. The NRC issued a full-term OL on 02/20/1991.

APPENDIX A
Commercial Nuclear Power Reactors
Operating Reactors (continued)

Plant Name, Unit Number Licensee Location Docket Number NRC Web page Address	NRC Region	Con Type NSSS Architect Engineer Constructor	Licensed MWt MWe License Number	CP Issued OL Issued Comm. Op LR Issued SR Issued Exp. Date
Edwin I. Hatch Nuclear Plant, Unit 2 Southern Nuclear Operating Co., Inc. Baxley, GA (20 miles S of Vidalia, GA) 05000366 https://www.nrc.gov/info-finder/reactors/hat2.html	II	BWR-MARK 1 GE 4 BECH GPC	2,804 883 NPF-5	12/27/1972 06/13/1978 09/05/1979 01/15/2002 N/A 06/13/2038
Fermi, Unit 2 DTE Electric Company Newport, MI (25 miles NE of Toledo, OH) 05000341 https://www.nrc.gov/info-finder/reactors/ferm2.html	III	BWR-MARK 1 GE 4 S&L DANI	3,486 1,141 NPF-43	09/26/1972 03/20/1985 01/23/1988 12/15/2016 N/A 03/20/2045
Grand Gulf Nuclear Station, Unit 1 Entergy Operations, Inc. Port Gibson, MS (20 miles S of Vicksburg, MS) 05000416 https://www.nrc.gov/info-finder/reactors/gg1.html	IV	BWR-MARK 3 GE 6 BECH BECH	4,408 1,401 NPF-29	09/04/1974 11/01/1984 07/01/1985 12/01/2016 N/A 11/01/2044
H.B. Robinson Steam Electric Plant, Unit 2 Duke Energy Progress, LLC Hartsville, SC (26 miles NW of Florence, SC) 05000261 https://www.nrc.gov/info-finder/reactors/rob2.html	II	PWR-DRYAMB WEST 3LP EBSO EBSO	2,339 759 DPR-23	04/13/1967 07/31/1970 03/07/1971 04/19/2004 N/A 07/31/2030
Hope Creek Generating Station, Unit 1 PSEG Nuclear, LLC Hancocks Bridge, NJ (18 miles SE of Wilmington, DE) 05000354 https://www.nrc.gov/info-finder/reactors/hope.html	I	BWR-MARK 1 GE 4 BECH BECH	3,902 1,172 NPF-57	11/04/1974 07/25/1986 12/20/1986 07/20/2011 N/A 04/11/2046
James A. FitzPatrick Nuclear Power Plant Constellation Energy Generation Co., LLC Scriba, NY (6 miles NE of Oswego, NY) 05000333 https://www.nrc.gov/info-finder/reactors/fitz.html	I	BWR-MARK 1 GE 4 S&W S&W	2,536 848 DPR-59	05/20/1970 10/17/1974 07/28/1975 09/08/2008 N/A 10/17/2034

APPENDIX A
Commercial Nuclear Power Reactors
Operating Reactors (continued)

Plant Name, Unit Number Licensee Location Docket Number NRC Web page Address	NRC Region	Con Type NSSS Architect Engineer Constructor	Licensed MWt MWe License Number	CP Issued OL Issued Comm. Op LR Issued SR Issued Exp. Date
Joseph M. Farley Nuclear Plant, Unit 1 Southern Nuclear Operating Co., Inc. Columbia, AL (18 miles E of Dothan, AL) 05000348 https://www.nrc.gov/info-finder/reactors/far1.html	II	PWR-DRYAMB WEST 3LP SSI DANI	2,775 874 NPF-2	08/16/1972 06/25/1977 12/01/1977 05/12/2005 N/A 06/25/2037
Joseph M. Farley Nuclear Plant, Unit 2 Southern Nuclear Operating Co., Inc. Columbia, AL (18 miles E of Dothan, AL) 05000364 https://www.nrc.gov/info-finder/reactors/far2.html	II	PWR-DRYAMB WEST 3LP SSI BECH	2,775 877 NPF-8	08/16/1972 03/31/1981 07/30/1981 05/12/2005 N/A 03/31/2041
LaSalle County Station, Unit 1 Constellation Energy Generation Co., LLC Marseilles, IL (11 miles SE of Ottawa, IL) 05000373 https://www.nrc.gov/info-finder/reactors/lasa1.html	III	BWR-MARK 2 GE 5 S&L CWE	3,546 1,131 NPF-11	09/10/1973 04/17/1982 01/01/1984 10/19/2016 N/A 04/17/2042
LaSalle County Station, Unit 2 Constellation Energy Generation Co., LLC Marseilles, IL (11 miles SE of Ottawa, IL) 05000374 https://www.nrc.gov/info-finder/reactors/lasa2.html	III	BWR-MARK 2 GE 5 S&L CWE	3,546 1,134 NPF-18	09/10/1973 12/16/1983 10/19/1984 10/19/2016 N/A 12/16/2043
Limerick Generating Station, Unit 1 Constellation Energy Generation Co., LLC Limerick, PA (21 miles NW of Philadelphia, PA) 05000352 https://www.nrc.gov/info-finder/reactors/lim1.html	I	BWR-MARK 2 GE 4 BECH BECH	3,515 1,120 NPF-39	06/19/1974 08/08/1985 02/01/1986 10/20/2014 N/A 10/26/2044
Limerick Generating Station, Unit 2 Constellation Energy Generation Co., LLC Limerick, PA (21 miles NW of Philadelphia, PA) 05000353 https://www.nrc.gov/info-finder/reactors/lim2.html	I	BWR-MARK 2 GE 4 BECH BECH	3,515 1,122 NPF-85	06/19/1974 08/25/1989 01/08/1990 10/20/2014 N/A 06/22/2049

APPENDIX A
Commercial Nuclear Power Reactors
Operating Reactors (continued)

Plant Name, Unit Number Licensee Location Docket Number NRC Web page Address	NRC Region	Con Type NSSS Architect Engineer Constructor	Licensed MWt MWe License Number	CP Issued OL Issued Comm. Op LR Issued SR Issued Exp. Date
McGuire Nuclear Station, Unit 1 Duke Energy Carolinas, LLC Huntersville, NC (17 miles N of Charlotte, NC) 05000369 https://www.nrc.gov/info-finder/reactors/mcg1.html	II	PWR-ICECND WEST 4LP DUKE DUKE	3,411 1,158 NPF-9	02/23/1973 05/27/1981 12/01/1981 12/05/2003 N/A 06/12/204
McGuire Nuclear Station, Unit 2 Duke Energy Carolinas, LLC Huntersville, NC (17 miles N of Charlotte, NC) 05000370 https://www.nrc.gov/info-finder/reactors/mcg2.html	II	PWR-ICECND WEST 4LP DUKE DUKE	3,411 1,158 NPF-17	02/23/1973 05/27/1983 03/01/1984 12/05/2003 N/A 03/03/2043
Millstone Power Station, Unit 2 Dominion Energy Nuclear Connecticut, Inc. Waterford, CT (3.2 miles WSW of New London, CT) 05000336 https://www.nrc.gov/info-finder/reactors/mill2.html	I	PWR-DRYAMB CE BECH BECH	2,700 853 DPR-65	12/11/1970 09/26/1975 12/26/1975 11/28/2005 N/A 07/31/2035
Millstone Power Station, Unit 3 Dominion Energy Nuclear Connecticut, Inc. Waterford, CT (3.2 miles WSW of New London, CT) 05000423 https://www.nrc.gov/info-finder/reactors/mill3.html	I	PWR-DRYSUB WEST 4LP S&W S&W	3,650 1,220 NPF-49	08/09/1974 01/31/1986 04/23/1986 11/28/2005 N/A 11/25/2045
Monticello Nuclear Generating Plant, Unit 1 Northern States Power Company-Minnesota Monticello, MN (30 miles NW of Minneapolis, MN) 05000263 https://www.nrc.gov/info-finder/reactors/mont.html	III	BWR-MARK 1 GE 3 BECH BECH	2,004 617 DPR-22	06/19/1967 01/09/1981[B] 06/30/1971 11/08/2006 N/A 09/08/2030
Nine Mile Point Nuclear Station, Unit 1 Nine Mile Point Nuclear Station, LLC Scriba, NY (6 miles NE of Oswego, NY) 05000220 https://www.nrc.gov/info-finder/reactors/nmp1.html	I	BWR-MARK 1 GE 2 NIAG S&W	1,850 621 DPR-63	04/12/1965 12/26/1974[C] 12/01/1969 10/31/2006 N/A 08/22/2029

B: The AEC issued a provisional OL on 09/08/1970, allowing commercial operation. The NRC issued a full-term OL on 01/09/1981.
C: The AEC issued a provisional OL on 08/22/1969, allowing commercial operation. The NRC issued a full-term OL on 12/26/1974.

APPENDIX A
Commercial Nuclear Power Reactors
Operating Reactors (continued)

Plant Name, Unit Number Licensee Location Docket Number NRC Web page Address	NRC Region	Con Type NSSS Architect Engineer Constructor	Licensed MWt MWe License Number	CP Issued OL Issued Comm. Op LR Issued SR Issued Exp. Date
Nine Mile Point Nuclear Station, Unit 2 Nine Mile Point Nuclear Station, LLC Scriba, NY (6 miles NE of Oswego, NY) 05000410 https://www.nrc.gov/info-finder/reactors/nmp2.html	I	BWR-MARK 2 GE 5 S&W S&W	3,988 1,292 NPF-69	06/24/1974 07/02/1987 03/11/1988 10/31/2006 N/A 10/31/2046
North Anna Power Station, Unit 1 Virginia Electric & Power Co. Mineral (Louisa County), VA (40 miles NW of Richmond, VA) 05000338 https://www.nrc.gov/info-finder/reactors/na1.html	II	PWR-DRYSUB WEST 3LP S&W S&W	2,940 948 NPF-4	02/19/1971 04/01/1978 06/06/1978 03/20/2003 N/A 04/01/2038
North Anna Power Station, Unit 2 Virginia Electric & Power Co. Mineral (Louisa County), VA (40 miles NW of Richmond, VA) 05000339 https://www.nrc.gov/info-finder/reactors/na2.html	II	PWR-DRYSUB WEST 3LP S&W S&W	2,940 944 NPF-7	02/19/1971 08/21/1980 12/14/1980 03/20/2003 N/A 08/21/2040
Oconee Nuclear Station, Unit 1 Duke Energy Carolinas, LLC Seneca, SC (30 miles W of Greenville, SC) 05000269 https://www.nrc.gov/info-finder/reactors/oco1.html	II	PWR-DRYAMB B&W LLP DBDB DUKE	2,610 847 DPR-38	11/06/1967 02/06/1973 07/15/1973 05/23/2000 N/A 02/06/2033
Oconee Nuclear Station, Unit 2 Duke Energy Carolinas, LLC Seneca, SC (30 miles W of Greenville, SC) 05000270 https://www.nrc.gov/info-finder/reactors/oco2.html	II	PWR-DRYAMB B&W LLP DBDB DUKE	2,610 848 DPR-47	11/06/1967 10/06/1973 09/09/1974 05/23/2000 N/A 10/06/2033
Oconee Nuclear Station, Unit 3 Duke Energy Carolinas, LLC Seneca, SC (30 miles W of Greenville, SC) 05000287 https://www.nrc.gov/info-finder/reactors/oco3.html	II	PWR-DRYAMB B&W LLP DBDB DUKE	2,610 859 DPR-55	11/06/1967 07/19/1974 12/16/1974 05/23/2000 N/A 07/19/2034
Palo Verde Nuclear Generating Station, Unit 1 Arizona Public Service Company Wintersburg, AZ (50 miles W of Phoenix, AZ) 05000528 https://www.nrc.gov/info-finder/reactors/palo1.html	IV	PWR-DRYAMB CE 80-2L BECH BECH	3,990 1,311 NPF-41	05/25/1976 06/01/1985 01/28/1986 04/21/2011 N/A 06/01/2045

APPENDIX A
Commercial Nuclear Power Reactors
Operating Reactors (continued)

Plant Name, Unit Number Licensee Location Docket Number NRC Web page Address	NRC Region	Con Type NSSS Architect Engineer Constructor	Licensed MWt MWe License Number	CP Issued OL Issued Comm. Op LR Issued SR Issued Exp. Date
Palo Verde Nuclear Generating Station, Unit 2 Arizona Public Service Company Wintersburg, AZ (50 miles W of Phoenix, AZ) 05000529 https://www.nrc.gov/info-finder/reactors/palo2.html	IV	PWR-DRYAMB CE 80-2L BECH BECH	3,990 1,314 NPF-51	05/25/1976 04/24/1986 09/19/1986 04/21/2011 N/A 04/24/2046
Palo Verde Nuclear Generating Station, Unit 3 Arizona Public Service Company Wintersburg, AZ (50 miles W of Phoenix, AZ) 05000530 https://www.nrc.gov/info-finder/reactors/palo3.html	IV	PWR-DRYAMB CE 80-2L BECH BECH	3,990 1,312 NPF-74	05/25/1976 11/25/1987 01/08/1988 04/21/2011 N/A 11/25/2047
Peach Bottom Atomic Power Station, Unit 2 Constellation Energy Generation Co., LLC Delta, PA (17.9 miles S of Lancaster, PA) 05000277 https://www.nrc.gov/info-finder/reactors/pb2.html	I	BWR-MARK 1 GE 4 BECH BECH	4,016 1,265 DPR-44	01/31/1968 10/25/1973 07/05/1974 05/07/2003 03/05/2020 08/08/2053
Peach Bottom Atomic Power Station, Unit 3 Constellation Energy Generation Co., LLC Delta, PA (17.9 miles S of Lancaster, PA) 05000278 https://www.nrc.gov/info-finder/reactors/pb3.html	I	BWR-MARK 1 GE 4 BECH BECH	4,016 1,285 DPR-56	01/31/1968 07/02/1974 12/23/1974 05/07/2003 03/05/2020 07/02/2054
Perry Nuclear Power Plant, Unit 1 Energy Harbor Nuclear Generation LLC/ Energy Harbor Nuclear Corp. Perry, OH (35 miles NE of Cleveland, OH) 05000440 https://www.nrc.gov/info-finder/reactors/perr1.html	III	BWR-MARK 3 GE 6 GIL KAIS	3,758 1,240 NPF-58	05/03/1977 11/13/1986 11/18/1987 N/A N/A 03/18/2026
Point Beach Nuclear Plant, Unit 1 NextEra Energy Point Beach, LLC Two Rivers, WI (13 miles NNW of Manitowoc, WI) 05000266 https://www.nrc.gov/info-finder/reactors/poin1.html	III	PWR-DRYAMB WEST 2LP BECH BECH	1,800 598 DPR-24	07/19/1967 10/05/1970 12/21/1970 12/22/2005 N/A 10/05/2030

APPENDIX A
Commercial Nuclear Power Reactors
Operating Reactors (continued)

Plant Name, Unit Number Licensee Location Docket Number NRC Web page Address	NRC Region	Con Type NSSS Architect Engineer Constructor	Licensed MWt MWe License Number	CP Issued OL Issued Comm. Op LR Issued SR Issued Exp. Date
Point Beach Nuclear Plant, Unit 2 NextEra Energy Point Beach, LLC Two Rivers, WI (13 miles NNW of Manitowoc, WI) 05000301 https://www.nrc.gov/info-finder/reactors/poin2.html	III	PWR-DRYAMB WEST 2LP BECH BECH	1,800 603 DPR-27	07/25/1968 03/08/1973[D] 10/01/1972 12/22/2005 N/A 03/08/2033
Prairie Island Nuclear Generating Plant, Unit 1 Northern States Power Co.—Minnesota Welch, MN (28 miles SE of Minneapolis, MN) 05000282 https://www.nrc.gov/info-finder/reactors/prai1.html	III	PWR-DRYAMB WEST 2LP FLUR NSP	1,677 521 DPR-42	06/25/1968 04/05/1974[E] 12/16/1973 06/27/2011 N/A 08/09/2033
Prairie Island Nuclear Generating Plant, Unit 2 Northern States Power Co.—Minnesota Welch, MN (28 miles SE of Minneapolis, MN) 05000306 https://www.nrc.gov/info-finder/reactors/prai2.html	III	PWR-DRYAMB WEST 2LP FLUR NSP	1,677 519 DPR-60	06/25/1968 10/29/1974 12/21/1974 06/27/2011 N/A 10/29/2034
Quad Cities Nuclear Power Station, Unit 1 Constellation Energy Generation Co., LLC Cordova, IL (20 miles NE of Moline, IL) 05000254 https://www.nrc.gov/info-finder/reactors/quad1.html	III	BWR-MARK 1 GE 3 S&L UE&C	2,957 908 DPR-29	02/15/1967 12/14/1972 02/18/1973 10/28/2004 N/A 12/14/2032
Quad Cities Nuclear Power Station, Unit 2 Constellation Energy Generation Co., LLC Cordova, IL (20 miles NE of Moline, IL) 05000265 https://www.nrc.gov/info-finder/reactors/quad2.html	III	BWR-MARK 1 GE 3 S&L UE&C	2,957 911 DPR-30	02/15/1967 12/14/1972 03/10/1973 10/28/2004 N/A 12/14/2032
R.E. Ginna Nuclear Power Plant R.E. Ginna Nuclear Power Plant, LLC Ontario, NY (20 miles NE of Rochester, NY) 05000244 https://www.nrc.gov/info-finder/reactors/ginn.html	I	PWR-DRYAMB WEST 2LP GIL BECH	1,775 581 DPR-18	04/25/1966 09/19/1969 07/01/1970 05/19/2004 N/A 09/18/2029

D: The AEC issued a provisional OL on 11/18/1971. The NRC issued a full-term OL on 03/08/1973.
E: The AEC issued a provisional OL on 08/09/1973. The NRC issued a full-term OL on 04/05/1974.

APPENDIX A
Commercial Nuclear Power Reactors
Operating Reactors (continued)

Plant Name, Unit Number Licensee Location Docket Number NRC Web page Address	NRC Region	Con Type NSSS Architect Engineer Constructor	Licensed MWt MWe License Number	CP Issued OL Issued Comm. Op LR Issued SR Issued Exp. Date
River Bend Station, Unit 1 Entergy Operations, Inc. St. Francisville, LA (24 miles NNW of Baton Rouge, LA) 05000458 https://www.nrc.gov/info-finder/reactors/rbs1.html	IV	BWR-MARK 3 GE 6 S&W S&W	3,091 968 NPF-47	03/25/1977 11/20/1985 06/16/1986 12/20/2018 N/A 08/29/2045
St. Lucie Plant, Unit 1 Florida Power & Light Co. Jensen Beach, FL (10 miles SE of Ft. Pierce, FL) 05000335 https://www.nrc.gov/info-finder/reactors/stl1.html	II	PWR-DRYAMB CE EBSO EBSO	3,020 981 DPR-67	07/01/1970 03/01/1976 12/21/1976 10/02/2003 N/A 03/01/2036
St. Lucie Plant, Unit 2 Florida Power & Light Co. Jensen Beach, FL (10 miles SE of Ft. Pierce, FL) 05000389 https://www.nrc.gov/info-finder/reactors/stl2.html	II	PWR-DRYAMB CE EBSO EBSO	3,020 987 NPF-16	05/02/1977 04/06/1983 08/08/1983 10/02/2003 N/A 04/06/2043
Salem Nuclear Generating Station, Unit 1 PSEG Nuclear, LLC Hancocks Bridge, NJ (18 miles SE of Wilmington, DE) 05000272 https://www.nrc.gov/info-finder/reactors/salm1.html	I	PWR-DRYAMB WEST 4LP PSEG UE&C	3,459 1,153 DPR-70	09/25/1968 12/01/1976 06/30/1977 06/30/2011 N/A 08/13/2036
Salem Nuclear Generating Station, Unit 2 PSEG Nuclear, LLC Hancocks Bridge, NJ (18 miles SE of Wilmington, DE) 05000311 https://www.nrc.gov/info-finder/reactors/salm2.html	I	PWR-DRYAMB WEST 4LP PSEG UE&C	3,459 1,142 DPR-75	09/25/1968 05/20/1981 10/13/1981 06/30/2011 N/A 04/18/2040
Seabrook Station, Unit 1 NextEra Energy Seabrook, LLC Seabrook, NH (13 miles S of Portsmouth, NH) 05000443 https://www.nrc.gov/info-finder/reactors/seab1.html	I	PWR-DRYAMB WEST 4LP UE&C UE&C	3,648 1,250 NPF-86	07/07/1976 03/15/1990 08/19/1990 03/12/2019 N/A 03/15/2050

APPENDIX A
Commercial Nuclear Power Reactors
Operating Reactors (continued)

Plant Name, Unit Number Licensee Location Docket Number NRC Web page Address	NRC Region	Con Type NSSS Architect Engineer Constructor	Licensed MWt MWe License Number	CP Issued OL Issued Comm. Op LR Issued SR Issued Exp. Date
Sequoyah Nuclear Plant, Unit 1 Tennessee Valley Authority Soddy-Daisy, TN (16 miles NE of Chattanooga, TN) 05000327 https://www.nrc.gov/info-finder/reactors/seq1.html	II	PWR-ICECND WEST 4LP TVA TVA	3,455 1,152 DPR-77	05/27/1970 09/17/1980 07/01/1981 09/24/2015 N/A 09/17/2040
Sequoyah Nuclear Plant, Unit 2 Tennessee Valley Authority Soddy-Daisy, TN (16 miles NE of Chattanooga, TN) 05000328 https://www.nrc.gov/info-finder/reactors/seq2.html	II	PWR-ICECND WEST 4LP TVA TVA	3,455 1,126 DPR-79	05/27/1970 09/15/1981 06/01/1982 09/28/2015 N/A 09/15/2041
Shearon Harris Nuclear Power Plant, Unit 1 Duke Energy Progress, Inc. New Hill, NC (20 miles SW of Raleigh, NC) 05000400 https://www.nrc.gov/info-finder/reactors/har1.html	II	PWR-DRYAMB WEST 3LP EBSO DANI	2,948 964 NPF-63	01/27/1978 10/24/1986 05/02/1987 12/17/2008 N/A 10/24/2046
South Texas Project, Unit 1 STP Nuclear Operating Co. Bay City, TX (90 miles SW of Houston, TX) 05000498 https://www.nrc.gov/info-finder/reactors/stp1.html	IV	PWR-DRYAMB WEST 4LP BECH EBSO	3,853 1,280 NPF-76	12/22/1975 03/22/1988 08/25/1988 09/28/2017 N/A 08/20/2047
South Texas Project, Unit 2 STP Nuclear Operating Co. Bay City, TX (90 miles SW of Houston, TX) 05000499 https://www.nrc.gov/info-finder/reactors/stp2.html	IV	PWR-DRYAMB WEST 4LP BECH EBSO	3,853 1,280 NPF-80	12/22/1975 03/28/1989 06/19/1989 09/28/2017 N/A 12/15/2048
Surry Power Station, Unit 1 Virginia Electric and Power Co. Surry, VA (17 miles NW of Newport News, VA) 05000280 https://www.nrc.gov/info-finder/reactors/sur1.html	II	PWR-DRYSUB WEST 3LP S&W S&W	2,587 838 DPR-32	06/25/1968 05/25/1972 12/22/1972 03/20/2003 05/04/2021 05/25/2052

APPENDIX A
Commercial Nuclear Power Reactors
Operating Reactors (continued)

Plant Name, Unit Number Licensee Location Docket Number NRC Web page Address	NRC Region	Con Type NSSS Architect Engineer Constructor	Licensed MWt MWe License Number	CP Issued OL Issued Comm. Op LR Issued SR Issued Exp. Date
Surry Power Station, Unit 2 Virginia Electric and Power Co. Surry, VA (17 miles NW of Newport News, VA) 05000281 https://www.nrc.gov/info-finder/reactors/sur2.html	II	PWR-DRYSUB WEST 3LP S&W S&W	2,587 838 DPR-37	06/25/1968 01/29/1973 05/01/1973 03/20/2003 05/04/2021 01/29/2053
Susquehanna Steam Electric Station, Unit 1 Susquehanna Nuclear, LLC Salem Township (Luzerne County), PA (70 miles NE of Harrisburg, PA) 05000387 https://www.nrc.gov/info-finder/reactors/susq1.html	I	BWR-MARK 2 GE 4 BECH BECH	3,952 1,247 NPF-14	11/03/1973 07/17/1982 06/08/1983 11/24/2009 N/A 07/17/2042
Susquehanna Steam Electric Station, Unit 2 Susquehanna Nuclear, LLC Salem Township (Luzerne County), PA (70 miles NE of Harrisburg, PA) 05000388 https://www.nrc.gov/info-finder/reactors/susq2.html	I	BWR-MARK 2 GE 4 BECH BECH	3,952 1,247 NPF-22	11/03/1973 03/23/1984 02/12/1985 11/24/2009 N/A 03/23/2044
Turkey Point Nuclear Generating, Unit 3 Florida Power & Light Co. Homestead, FL (20 miles S of Miami, FL) 05000250 https://www.nrc.gov/info-finder/reactors/tp3.html	II	PWR-DRYAMB WEST 3LP BECH BECH	2,644 837 DPR-31	04/27/1967 07/19/1972 12/14/1972 06/06/2002 12/04/2019 07/19/2052
Turkey Point Nuclear Generating, Unit 4 Florida Power & Light Co. Homestead, FL (20 miles S of Miami, FL) 05000251 https://www.nrc.gov/info-finder/reactors/tp4.html	II	PWR-DRYAMB WEST 3LP BECH BECH	2,644 861 DPR-41	04/27/1967 04/10/1973 09/07/1973 06/06/2002 12/04/2019 04/10/2053
Virgil C. Summer Nuclear Station, Unit 1 Dominion Energy South Carolina, Inc. Jenkinsville, SC (26 miles NW of Columbia, SC) 05000395 https://www.nrc.gov/info-finder/reactors/sum.html	II	PWR-DRYAMB WEST 3LP GIL DANI	2,900 971 NPF-12	03/21/1973 11/12/1982 01/01/1984 04/23/2004 N/A 08/06/2042

APPENDIX A
Commercial Nuclear Power Reactors
Operating Reactors (continued)

Plant Name, Unit Number Licensee Location Docket Number NRC Web page Address	NRC Region	Con Type NSSS Architect Engineer Constructor	Licensed MWt MWe License Number	CP Issued OL Issued Comm. Op LR Issued SR Issued Exp. Date
Vogtle Electric Generating Plant, Unit 1 Southern Nuclear Operating Co., Inc. Waynesboro, GA (26 miles SE of Augusta, GA) 05000424 https://www.nrc.gov/info-finder/reactors/vog1.html	II	PWR-DRYAMB WEST 4LP SBEC GPC	3,625.6 1,150 NPF-68	06/28/1974 03/16/1987 06/01/1987 06/03/2009 N/A 01/16/2047
Vogtle Electric Generating Plant, Unit 2 Southern Nuclear Operating Co., Inc. Waynesboro, GA (26 miles SE of Augusta, GA) 05000425 https://www.nrc.gov/info-finder/reactors/vog2.html	II	PWR-DRYAMB WEST 4LP SBEC GPC	3,625.6 1,152 NPF-81	06/28/1974 03/31/1989 05/20/1989 06/03/2009 N/A 02/09/2049
Waterford Steam Electric Station, Unit 3 Entergy Operations, Inc. Killona, LA (25 miles W of New Orleans, LA) 05000382 https://www.nrc.gov/info-finder/reactors/wat3.html	IV	PWR-DRYAMB COMB CE EBSO EBSO	3,716 1,165 NPF-38	11/14/1974 03/16/1985 09/24/1985 12/27/2018 N/A 12/18/2044
Watts Bar Nuclear Plant, Unit 1 Tennessee Valley Authority Spring City, TN (60 miles SW of Knoxville, TN) 05000390 https://www.nrc.gov/info-finder/reactors/wb1.html	II	PWR-ICECND WEST 4LP TVA TVA	3,459 1,123 NPF-90	01/23/1973 02/07/1996 05/27/1996 N/A N/A 11/09/2035
Watts Bar Nuclear Plant, Unit 2 Tennessee Valley Authority Spring City, TN (60 miles SW of Knoxville, TN) 05000391 https://www.nrc.gov/info-finder/reactors/wb2.html	II	PWR-ICECND WEST 4LP TVA TVA	3,411 1,122 NPF-96	01/24/1973 10/22/2015 10/19/2016 N/A N/A 10/22/2055
Wolf Creek Generating Station, Unit 1 Wolf Creek Nuclear Operating Corp. Burlington (Coffey County), KS (28 miles SE of Emporia, KS) 05000482 https://www.nrc.gov/info-finder/reactors/wc.html	IV	PWR-DRYAMB WEST 4LP BECH DANI	3,565 NPF-42	05/17/1977 06/04/1985[F] 09/03/1985 11/20/2008 N/A 03/11/2045

F: The original OL (NPF-32) was issued on 03/11/1985. The license was superseded by OL NPF-42, issued on 06/04/1985.

APPENDIX A
Commercial Nuclear Power Reactors
Operating Reactors Under Active Construction or Deferred Policy

Plant Name, Unit Number Licensee Location Docket Number NRC Web page Address	NRC Region	Con Type NSSS Architect Engineer Constructor	Licensed MWt MWe License Number	10 CFR 52.103(g) Finding COL Issued Comm. Op LR Issued Exp. Date
Bellefonte Nuclear Plant, Unit 1** Tennessee Valley Authority (6 miles NE of Scottsboro, AL) 05000438 https://www.nrc.gov/reactors/new-reactors/bellefonte-constr-permits.html	II	PWR-DRYAMB B&W 205 TVA TVA	3,763	12/24/1974
Bellefonte Nuclear Plant, Unit 2** Tennessee Valley Authority (6 miles NE of Scottsboro, AL) 05000439 https://www.nrc.gov/reactors/new-reactors/bellefonte-constr-permits.html	II	PWR-DRYAMB B&W 205 TVA TVA	3,763	12/24/1974
Enrico Fermi Nuclear Plant, Unit 3 DTE Electric Company Newport, MI (25 miles NE of Toledo, OH) 05200033 https://www.nrc.gov/reactors/new-reactors/col-holder/ferm3.html	III	ESBWR GEH	4,500 NPF-95	05/01/2015
North Anna Power Station, Unit 3 Dominion Virginia Power Mineral (Louisa County), VA (40 miles NW of Richmond, VA) 05200017 https://www.nrc.gov/reactors/new-reactors/col-holder/na3.html	II	BWR ESBWR GEH	4,500 NPF-103	06/02/2017
Turkey Point Plant, Unit 6 Florida Power and Light Homestead, FL (20 miles S of Miami, FL) 05200040 https://www.nrc.gov/reactors/new-reactors/col-holder/tp6.html	II	PWR AP1000 WEST 2LP	3,400 NPF-104	04/12/2018
Turkey Point Plant Unit 7 Florida Power and Light Homestead, FL (20 miles S of Miami, FL) 05200041 https://www.nrc.gov/reactors/new-reactors/col-holder/tp7.html	II	PWR AP1000 WEST 2LP	3,400 NPF-105	04/12/2018
Vogtle Electric Generating Plant, Unit 3 Southern Nuclear Operating Co., Inc. Waynesboro (Burke County), GA (26 miles SE of Augusta, GA) 05200025 https://www.nrc.gov/reactors/new-reactors/col-holder/vog3.html	II	PWR AP1000 WEST 2LP	3,400 NPF-91	02/10/2012 08/03/2022 08/03/2062

APPENDIX A
Commercial Nuclear Power Reactors
Operating Reactors Under Active Construction or Deferred Policy
(continued)

Plant Name, Unit Number Licensee Location Docket Number NRC Web page Address	NRC Region	Con Type NSSS Architect Engineer Constructor	Licensed MWt MWe License Number	10 CFR 52.103(g) Finding COL Issued Comm. Op. LR Issued Exp. Date
Vogtle Electric Generating Plant, Unit 4 Southern Nuclear Operating Co., Inc. Waynesboro (Burke County), GA (26 miles SE of Augusta, GA) 05200026 https://www.nrc.gov/reactors/new-reactors/col-holder/vog4.html	II	PWR AP1000 WEST 2LP	3,400 NPF-92	02/10/2012
William States Lee III Nuclear Station, Unit 3[A] Duke Energy Carolinas Cherokee County, SC (2 miles SE of Gafney, SC) 05200018 https://www.nrc.gov/reactors/new-reactors/col-holder/lee1.html	II	PWR AP1000 WEST 2LP	3,400 NPF-101	12/19/2016
William States Lee III Nuclear Station, Unit 4[A] Duke Energy Carolinas Cherokee County, SC (2 miles SE of Gafney, SC) 05200019 https://www.nrc.gov/reactors/new-reactors/col-holder/lee2.html	II	PWR AP1000 WEST 2LP	3,400 NPF-102	12/19/2016

A: In September 2017, Duke Energy announced cancellation of William States Lee III Nuclear Station, Units 3 and 4.

* Average capacity factor is listed in year order starting with 2014.
** Bellefonte Units 1 and 2 are under the Commission Policy Statement on Deferred Plants (52 FR 38077; October 14, 1987).
*** In June 2018, Nuclear Innovation North America submitted a letter requesting that South Texas Project, Units 3 and 4, combined licenses (COLs) be withdrawn.
Note: Plant names and data are as identified on the license as of September 2022.
Source: NRC, with some data compiled from the U.S. Department of Energy's (DOE's) Energy Information Administration (EIA).

APPENDIX B
New Nuclear Power Plant Licensing Applications

Applicant	Docket Number	Type	Submittal Date	Design	Site	State	Existing Plant?	Date Accepted	Status
Combined License (Construction and Operating)									
Nuclear Innovation North America, LLC (NINA)	05200012 & 05200013	COL	09/20/07 09/20//07	ABWR	South Texas Project, Units 3 and 4	TX	Yes	11/29/07	COL terminated 07/12/2018
Tennessee Valley Authority (TVA)	05200014 & 05200015	COL	10/30/07	AP1000	Bellefonte, Units 3 and 4	AL	No	01/18/08	Withdrawn–12/02/2016
Dominion Virginia Power	05200017	COL	11/27/07	ESBWR	North Anna, Unit 3	VA	Yes	01/28/08	COL Issued 06/02/2017
Duke Energy Carolinas	05200018 & 05200019	COL	12/13/07	AP1000	Lee Nuclear Station, Units 3 and 4	SC	No	02/25/08	COL Issued 12/19/2016
Progress Energy	05200022 & 05200023	COL	02/19/08	AP1000	Shearon Harris, Units 2 and 3	NC	Yes	04/17/08	Suspended–05/02/2013
Southern Nuclear Operating Co., Inc.	05200025 & 05200026	COL	03/28/08	AP1000	Vogtle, Units 3 and 4	GA	Yes	05/30/08	COL Issued 02/10/2012
AmerenUE	05200037	COL	07/24/08	U.S. EPR	Callaway, Unit 2	MO	Yes	12/12/08	Withdrawn–10/29/2015
DTE Electric Company	05200033	COL	09/18/08	ESBWR	Fermi, Unit 3	MI	Yes	11/25/08	COL Issued 05/01/2015
Luminant Generation Co.	05200034 & 05200035	COL	09/19/08	US-APWR	Comanche Peak, Units 3 and 4	TX	Yes	12/02/08	Suspended–03/31/2014
Entergy	05200036	COL	09/25/08	ESBWR	River Bend, Unit 3	LA	Yes	12/04/08	Withdrawn–06/14/2016
PPL Bell Bend	05200039	COL	10/10/08	U.S. EPR	Bell Bend (1 Unit)	PA	Yes	12/19/08	Withdrawn–09/22/2016
Florida Power and Light	05200040 & 05200041	COL	06/30/09	AP1000	Turkey Point, Units 6 and 7	FL	Yes	09/04/09	COL Issued 04/12/2018
Duke Energy Florida	05200029 & 05200030	COL	07/30/08	AP1000	Levy County, Units 1 and 2	FL	No	10/06/08	COL Terminated 04/26/2018
Oklo Power LLC	05200049	COL	03/11/20	Aurora	Idaho National Laboratory	ID	No	06/05/20	Denied–06/06/2022

APPENDIX B
New Nuclear Power Plant Licensing Applications (continued)

Applicant	Docket Number	Type	Submittal Date	Design	Site	State	Existing Plant?	Date Accepted	Status
Design Certification									
AREVA NP	05200020	DC	12/11/07	U.S. EPR	N/A	N/A	N/A	02/25/08	Suspended–03/27/2015
Mitsubishi Heavy Industries	05200021	DC	12/31/07	US-APWR	N/A	N/A	N/A	02/29/08	Suspended–03/03/2020
Korea Electric Power Company and Korea Hydro and Nuclear Power	05200046	DC	12/23/14	APR1400	N/A	N/A	N/A	03/04/15	Certified Issued 09/19/2019
Toshiba Corporation	05200044	DC	10/27/10	ABWR	N/A	N/A	N/A	12/14/10	Withdrawn–12/30/2016
GE-Hitachi Nuclear Energy	05200045	DC	12/7/10	ABWR	N/A	N/A	N/A	02/14/11	Certified Issued 09/29/2021
NuScale Power LLC	05200048	DC	01/6/17	NuScale	N/A	N/A	N/A	03/23/17	Scheduled
Early Site Permit									
PSEG Power, LLC, and PSEG Nuclear, LLC (PSEG)	05200043	ESP	05/25/10	Not yet announced	PSEG Site	NJ	Yes	08/04/10	Issued 05/06/2016
Tennessee Valley Authority	05200047	ESP	05/12/16	Not yet announced	Clinch River Site	TN	No	12/30/16	Issued 12/19/2019

Notes: Withdrawal was requested for Calvert Cliffs, Grand Gulf, Nine Mile Point, Victoria County, Bellefonte, and Callaway combined license and early site permit (ESP). In September 2017, Duke Energy announced cancellation of William States Lee III nuclear station Units 3 and 4.
Data are current as of September 30, 2022.. NRC-abbreviated reactor names listed.

APPENDIX C

Commercial Nuclear Power Reactors Undergoing Decommissioning and Permanently Shut Down Formerly Licensed to Operate

Unit Location Docket Number	Reactor Type MWt MWe	NSSS Vendor	OL Issued Shut Down OL Terminated Closure Date Est.	Decommissioning Alternative Selected Current License Status
Big Rock Point Charlevoix, MI 05000155	BWR 240	GE	05/01/1964 08/29/1997 01/08/2007	DECON DECON Completed
Crystal River 3 Crystal River, FL 05000302	PWR 2,609	B&W LLP	12/03/1976 02/20/2013 2074	SAFSTOR SAFSTOR in Progress
Dresden 1 Morris, IL 05000010	BWR 700	GE	09/28/1959 10/31/1978 2036	SAFSTOR SAFSTOR
Duane Arnold Palo, IA 05000331	BWR-MARK 1 1,912	GE 4	06/22/1970 08/10/2020 2040	SAFSTOR SAFSTOR in Progress
Fermi 1 Newport, MI 05000016	SCF 200	CE	05/10/1963 09/22/1972 2032	SAFSTOR SAFSTOR
Fort Calhoun 1 Ft. Calhoun, NE 05000285	PWR–DRYAMB 1,500	CE	08/09/1973 10/24/2016 2076	SAFSTOR SAFSTOR in Progress
Fort St. Vrain Platteville, CO 05000267	HTG 842	GA	12/21/1973 08/18/1989 08/08/1997	DECON DECON Completed
GE EVESR Sunol, CA 05000183	Experimental Superheat Reactor 12.5	GE	11/12/1963 02/01/1967 04/15/1970 2025	SAFSTOR SAFSTOR
GE VBWR (Vallecitos) Sunol, CA 05000018	BWR 50	GE	08/31/1957 12/09/1963 2025	SAFSTOR SAFSTOR
Haddam Neck Meriden, CT 05000213	PWR 1,825	WEST	12/27/1974 12/05/1996 11/26/2007	DECON DECON Completed

APPENDIX C

Commercial Nuclear Power Reactors Undergoing Decommissioning and Permanently Shut Down Formerly Licensed to Operate (continued)

Unit Location Docket Number	Reactor Type MWt MWe	NSSS Vendor	OL Issued Shut Down OL Terminated Closure Date Est.	Decommissioning Alternative Selected Current License Status
Humboldt Bay 3 Eureka, CA 05000133	BWR 200	GE	08/28/1962 07/02/1976 2019	DECON DECON in Progress
Indian Point 1 Buchanan, NY 05000003	PWR 615	B&W	03/26/1962 10/31/1974 2036	DECON DECON in Progress
Indian Point 2 Buchanan, NY 05000247	PWR 3,216	WEST	09/28/1973 04/30/2020	DECON DECON in Progress
Indian Point 3 Buchanan, NY 05000286	PWR 3,216	WEST	12/12/1975 04/30/2021	DECON DECON in Progress
Kewaunee Carlton, WI 05000305	PWR 1,772	WEST 2LP	12/21/1973 05/07/2013 2073	SAFSTOR SAFSTOR
LaCrosse Genoa, WI 05000409	BWR 165	AC	07/03/1967 04/30/1987 2020	DECON DECON in Progress
Maine Yankee Wiscasset, ME 05000309	PWR 2,700	CE	06/29/1973 12/06/1996 09/30/2005	DECON DECON Completed
Millstone 1 Waterford, CT 05000245	BWR 2,011	GE	10/31/1970 07/21/1998 12/31/2056	SAFSTOR SAFSTOR
Oyster Creek Forked River, NJ 05000219	BWR 1,930	GE	04/09/1969 09/17/2018 2078	SAFSTOR SAFSTOR
Palisades Covert, MI 05000255	PWR-DRYAMB 2,565.4	CE	02/21/1991[A] 05/31/2022	SAFSTOR SAFSTOR

A: The AEC issued a provisional operating license on 03/24/1971, allowing commercial operation. The NRC issued a full-term operating license on 02/21/1991.

APPENDIX C

Commercial Nuclear Power Reactors Undergoing Decommissioning and Permanently Shut Down Formerly Licensed to Operate (continued)

Unit Location Docket Number	Reactor Type MWt MWe	NSSS Vendor	OL Issued Shut Down OL Terminated Closure Date Est.	Decommissioning Alternative Selected Current License Status
Pathfinder Sioux Falls, SD 05000130	BWR 190	AC	03/12/1964 09/16/1967 07/27/2007	DECON DECON Completed
Peach Bottom 1 Delta, PA 05000171	HTG 115	GA	01/24/1966 10/31/1974 12/31/2034	SAFSTOR SAFSTOR
Pilgrim Plymouth, MA 05000293	BWR-MARK 1 2,028	GE 3	06/08/1972 05/31/2019 2064	SAFSTOR SAFSTOR
Rancho Seco Herald, CA 05000312	PWR 2,772	B&W	08/16/1974 06/07/1989 09/25/2009	DECON DECON Completed
San Onofre 1* San Clemente, CA 05000206	PWR 1,347	WEST	03/27/1967 11/30/1992 2030	DECON SAFSTOR
San Onofre 2 San Clemente, CA 05000361	PWR CE 3,438	CE	02/16/1982 06/12/2013 2030	DECON DECON in Progress
San Onofre 3 San Clemente, CA 05000362	PWR CE 3,438	CE	11/15/1982 06/12/2013 2030	DECON DECON in Progress
Savannah, N.S. Baltimore, MD 05000238	PWR 74	B&W	08/1965 11/1970 2031	DECON DECON in Progress
Saxton Saxton, PA 05000146	PWR 23.5	WEST	11/15/1961 05/01/1972 11/07/2005	DECON DECON Completed
Shoreham Wading River, NY 05000322	BWR 2,436	GE	04/21/1989 06/28/1989 04/11/1995	DECON DECON Completed

APPENDIX C

Commercial Nuclear Power Reactors Undergoing Decommissioning and Permanently Shut Down Formerly Licensed to Operate (continued)

Unit Location Docket Number	Reactor Type MWt MWe	NSSS Vendor	OL Issued Shut Down OL Terminated Closure Date Est.	Decommissioning Alternative Selected Current License Status
Three Mile Island 1 Middletown, PA 05000289	PWR 2,568	WEST	04/19/1974 09/20/2019 2079	SAFSTOR
Three Mile Island 2** Middletown, PA 05000320	PWR 2,770	B&W	02/08/1978 03/28/1979 12/31/2036	DECON DECON in Progress
Trojan Rainier, OR 05000344	PWR 3,411	WEST	11/21/1975 11/09/1992 05/23/2005	DECON DECON Completed
Yankee Rowe Rowe, MA 05000029	PWR 600	WEST	12/24/1963 10/01/1991 08/10/2007	DECON DECON Completed
Vermont Yankee Vernon, VT 05000271	BWR-Mark 1 1,912	GE 4	03/21/1972 12/29/2014 2030	DECON DECON in Progress
Zion 1 Zion, IL 05000295	PWR 3,250	WEST	10/19/1973 02/21/1997 2021	DECON DECON in Progress
Zion 2 Zion, IL 05000304	PWR 3,250	WEST	11/14/1973 09/19/1996 2021	DECON DECON in Progress

* Site has been dismantled and decontaminated with the exception of the reactor vessel, which is in long-term storage.

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

Notes: GE Bonus, Hallam, and Piqua decommissioned reactor sites are part of the Department of Energy's nuclear legacy. For more information, visit DOE's Legacy Management website at https://energy.gov/lm/sites/lm-sites. CVTR, Elk River, and Shippingport decommissioned reactor sites were either decommissioned before the formation of the NRC or were not licensed by the NRC. N.S. = Nuclear Ship
See the NRC Online Glossary for definitions of decommissioning alternatives (DECON, SAFSTOR).

Source: DOE, "Integrated Database for 1990, U.S. Spent Fuel and Radioactive Waste, Inventories, Projections, and Characteristics" (DOE/RW-0006, Revision 6), and NRC, "Nuclear Power Plants in the World," Edition 6.

Data are current as of August 2021.

APPENDIX D

Canceled Commercial Nuclear Power Reactors
10 CFR Part 50—Domestic Licensing of Production and Utilization Facilities

Unit Utility Location	Con Type MWe per Unit	Canceled Date Status Docket Number
Allens Creek 1 Houston Lighting & Power Company 4 miles NW of Wallis, TX	BWR 1,150	1982 Under CP Review 05000466
Allens Creek 2 Houston Lighting & Power Company 4 miles NW of Wallis, TX	BWR 1,150	1976 Under CP Review 05000467
Atlantic 1 & 2 Public Service Electric & Gas Company Floating plants off the coast of NJ	PWR 1,150	1978 Under CP Review 05000477 & 478
Bailly 1 Northern Indiana Public Service Company 12 miles NNE of Gary, IN	BWR 645	1981 With CP 05000367
Barton 1 & 2 Alabama Power & Light 15 miles SE of Clanton, AL	BWR 1,159	1977 Under CP Review 05000524 & 525
Barton 3 & 4 Alabama Power & Light 15 miles SE of Clanton, AL	BWR 1,159	1975 Under CP Review 05000526 & 527
Black Fox 1 & 2 Public Service Company of Oklahoma 3.5 miles S of Inola, OK	BWR 1,150	1982 Under CP Review 05000556 & 557
Blue Hills 1 & 2 Gulf States Utilities Company SW tip of Toledo Bend Reservoir, TX	PWR 918	1978 Under CP Review 05000510 & 511
Cherokee 1 Duke Power Company 6 miles SSW of Blacksburg, SC	PWR 1,280	1983 With CP 05000491
Cherokee 2 & 3 Duke Power Company 6 miles SSW of Blacksburg, SC	PWR 1,280	1982 With CP 05000492 & 493
Clinch River Project Management Corp., DOE, TVA 23 miles W of Knoxville, in Oak Ridge, TN	LMFB 350	1983 Under CP Review 05000537
Clinton 2 Illinois Power Company 6 miles E of Clinton, IL	BWR 933	1983 With CP 05000462
Davis-Besse 2 & 3 Toledo Edison Company 21 miles ESE of Toledo, OH	PWR 906	1981 Under CP Review 05000500 & 501

APPENDIX D

Canceled Commercial Nuclear Power Reactors

10 CFR Part 50—Domestic Licensing of Production and Utilization Facilities (continued)

Unit Utility Location	Con Type MWe per Unit	Canceled Date Status Docket Number
Douglas Point 1 & 2 Potomac Electric Power Company Charles County, MD	BWR 1,146	1977 Under CP Review 05000448 & 449
Erie 1 & 2 Ohio Edison Company Berlin, OH	PWR 1,260	1980 Under CP Review 05000580 & 581
Forked River 1 Jersey Central Power & Light Company 2 miles S of Forked River, NJ	PWR 1,070	1980 With CP 05000363
Fort Calhoun 2 Omaha Public Power District 19 miles N of Omaha, NE	PWR 1,136	1977 Under CP Review 05000548
Fulton 1 & 2 Philadelphia Electric Company 17 miles S of Lancaster, PA	HTG 1,160	1975 Under CP Review 05000463 & 464
Grand Gulf 2 Entergy Nuclear Operations, Inc. 20 miles SW of Vicksburg, MS	BWR 1,250	1990 With CP 05000417
Greene County Power Authority of the State of NY 20 miles N of Kingston, NY	PWR 1,191	1980 Under CP Review 05000549
Greenwood 2 & 3 Detroit Edison Company Greenwood Township, MI	PWR 1,200	1980 Under CP Review 05000452 & 453
Hartsville A1 & A2 Tennessee Valley Authority 5 miles SE of Hartsville, TN	BWR 1,233	1984 With CP 05000518 & 519
Hartsville B1 & B2 Tennessee Valley Authority 5 miles SE of Hartsville, TN	BWR 1,233	1982 With CP 05000520 & 521
Haven 1 (formerly Koshkonong) Wisconsin Electric Power Company 4.2 miles SSW of Fort Atkinson, WI	PWR 900	1980 Under CP Review 05000502
Haven 2 (formerly Koshkonong) Wisconsin Electric Power Company 4.2 miles SSW of Fort Atkinson, WI	PWR 900	1978 Under CP Review 05000503
Hope Creek 2 Public Service Electric & Gas Company 18 miles SE of Wilmington, DE	BWR 1,067	1981 With CP 05000355

APPENDIX D

Canceled Commercial Nuclear Power Reactors

10 CFR Part 50—Domestic Licensing of Production and Utilization Facilities (continued)

Unit Utility Location	Con Type MWe per Unit	Canceled Date Status Docket Number
Jamesport 1 & 2 Long Island Lighting Company 65 miles E of New York City, NY	PWR 1,150	1980 With CP 05000516 & 517
Marble Hill 1 & 2 Public Service of Indiana 6 miles NE of New Washington, IN	PWR 1,130	1985 With CP 05000546 & 547
Midland 1 Consumers Power Company S of City of Midland, MI	PWR 492	1986 With CP 05000329
Midland 2 Consumers Power Company S of City of Midland, MI	PWR 818	1986 With CP 05000330
Montague 1 & 2 Northeast Nuclear Energy Company 1.2 miles SSE of Turners Falls, MA	BWR 1,150	1980 Under CP Review 05000496 & 497
New England 1 & 2 New England Power Company 8.5 miles E of Westerly, RI	PWR 1,194	1979 Under CP Review 05000568 & 569
New Haven 1 & 2 New York State Electric & Gas Corporation 3 miles NW of New Haven, NY	PWR 1,250	1980 Under CP Review 05000596 & 597
North Anna 3 Virginia Electric & Power Company 40 miles NW of Richmond, VA	PWR 907	1982 With CP 05000404
North Anna 4 Virginia Electric & Power Company 40 miles NW of Richmond, VA	PWR 907	1980 With CP 05000405
North Coast 1 Puerto Rico Water Resources Authority 4.7 miles ESE of Salinas, PR	PWR 583	1978 Under CP Review 05000376
Palo Verde 4 & 5 Arizona Public Service Company 36 miles W of Phoenix, AZ	PWR 1,270	1979 Under CP Review 05000592 & 593
Pebble Springs 1 & 2 Portland General Electric Company 55 miles WSW of Richland, WA, near Arlington, OR	PWR 1,260	1982 Under CP Review 05000514 & 515
Perkins 1, 2, & 3 Duke Power Company 10 miles N of Salisbury, NC	PWR 1,280	1982 Under CP Review 05000488, 489 & 490
Perry 2 Cleveland Electric Illuminating Co. 35 miles NE of Cleveland, OH	BWR 1,205	1994 Under CP Review 05000441

APPENDIX D

Canceled Commercial Nuclear Power Reactors

10 CFR Part 50—Domestic Licensing of Production and Utilization Facilities (continued)

Unit Utility Location	Con Type MWe per Unit	Canceled Date Status Docket Number
Phipps Bend 1 & 2 Tennessee Valley Authority 15 miles SW of Kingsport, TN	BWR 1,220	1982 With CP 05000553 & 554
Pilgrim 2 Boston Edison Company 4 miles SE of Plymouth, MA	PWR 1,180	1981 Under CP Review 05000471
Pilgrim 3 Boston Edison Company 4 miles SE of Plymouth, MA	PWR 1,180	1974 Under CP Review 05000472
Quanicassee 1 & 2 Consumers Power Company 6 miles E of Essexville, MI	PWR 1,150	1974 Under CP Review 05000475 & 476
River Bend 2 Gulf States Utilities Company 24 miles NNW of Baton Rouge, LA	BWR 934	1984 With CP 05000459
Seabrook 2 Public Service Co. of New Hampshire 13 miles S of Portsmouth, NH	PWR 1,198	1988 With CP 05000444
Shearon Harris 2 Carolina Power & Light Company 20 miles SW of Raleigh, NC	PWR 900	1983 With CP 05000401
Shearon Harris 3 & 4 Carolina Power & Light Company 20 miles SW of Raleigh, NC	PWR 900	1981 With CP 05000402 & 403
Skagit/Hanford 1 & 2 Puget Sound Power & Light Company 23 miles SE of Bellingham, WA	PWR 1,277	1983 Under CP Review 05000522 & 523
Sterling Rochester Gas & Electric Corporation 50 miles E of Rochester, NY	PWR 1,150	1980 With CP 05000485
Summit 1 & 2 Delmarva Power & Light Company 15 miles SSW of Wilmington, DE	HTG 1,200	1975 Under CP Review 05000450 & 451
Sundesert 1 & 2 San Diego Gas & Electric Company 16 miles SW of Blythe, CA	PWR 974	1978 Under CP Review 05000582 & 583
Surry 3 & 4 Virginia Electric & Power Company 17 miles NW of Newport News, VA	PWR 882	1977 With CP 05000434 & 435
Tyrone 1 Northern States Power Company 8 miles NE of Durond, WI	PWR 1,150	1981 Under CP Review 05000484

APPENDIX D

Canceled Commercial Nuclear Power Reactors

10 CFR Part 50—Domestic Licensing of Production and Utilization Facilities (continued)

Unit Utility Location	Con Type MWe per Unit	Canceled Date Status Docket Number
Tyrone 2 Northern States Power Company 8 miles NE of Durond, WI	PWR 1,150	1974 With CP 05000487
Vogtle 3 & 4 Georgia Power Company 26 miles SE of Augusta, GA	PWR 1,113	1974 With CP 050000426 & 427
Washington Nuclear 1 (WPPSS) Energy Northwest 12 miles NE of Richland, WA	PWR 1,266	1995 With CP 05000460
Washington Nuclear 3 (WPPSS) Energy Northwest 12 miles NE of Richland, WA	PWR 1,242	1995 With CP 05000508
Washington Nuclear 4 (WPPSS) Energy Northwest 12 miles NE of Richland, WA	PWR 1,218	1982 With CP 05000513
Washington Nuclear 5 (WPPSS) Energy Northwest 12 miles NE of Richland, WA	PWR 1,242	1982 With CP 05000509
Yellow Creek 1 & 2 Tennessee Valley Authority 15 miles E of Corinth, MS	BWR 1,285	1984 With CP 05000566 & 567
Zimmer 1 Cincinnati Gas & Electric Company 25 miles SE of Cincinnati, OH	BWR 810	1984 With CP 05000358

APPENDIX D

Canceled Commercial Nuclear Power Reactors

10 CFR Part 52—Licensing, Certification, and Approvals for Nuclear Power Plants

Unit Utility Location	Con Type MWe per Unit	Canceled Date Status Docket Number
Bellefonte 3 & 4 Tennessee Valley Authority Scottsboro, Jackson County, AL	AP1000 3,763	December 2, 2016 With COL Review 05200014 & 05200015
Bell Bend Bell Bend, LLC Luzerne County, PA	U.S. EPR 1,600	September 22, 2016 With COL Review 5200039
Callaway 2 Union Electric Company (Ameren UE) Fulton, Callaway County, MO	U.S. EPR 1,600	October 29, 2015 With COL Review 05200037
Calvert Cliffs 3 UniStar Nuclear Operating Services, LLC Near Lusby in Calvert County, MD	U.S. EPR 1,594	July 17, 2015 With COL Review 05200016
Grand Gulf 3 Entergy Operations, Inc. Near Port Gibson in Claiborne County, MS	ESBWR 1,594	September 15, 2015 With COL Review 05200024
Levy 1 and 2 Duke Energy Florida 2 miles NE of Inglis, FL	AP1000 1,100	April 26, 2018 With COL 05200029 & 05200030
Nine Mile Point 3 UniStar Nuclear Operating Services, LLC 25 miles SE of Cincinnati, OH	ESBWR 1,594	March 31, 2014 With COL Review 05000038
River Bend 3 Entergy Operations, Inc. St. Francisville, LA	ESBWR 1,594	June 14, 2016 With COL Review 05200036
South Texas Project 3 and 4 Nuclear Innovation North America, LLC Bay City, TX	ABWR 3,926	July 12, 2018 With COL 05200012 & 05200013
V.C. Summer, Units 2 and 3 South Carolina Electric & Gas Co. Jenkinsville, SC	AP100 1,100	March 6, 2019 With COL 05200027 & 05200028
Victoria County Station 1 and 2 Exelon Nuclear Texas Holdings, LLC Near Victoria City in Victoria County, TX	ESBWR 4,500	July 20, 2010 With COL Review 05200031 & 05200032

Notes: Cancellation is defined as public announcement of cancellation or written notification to the NRC. Only NRC-docketed applications are included. "Status" is the status of the application at the time of cancellation. NRC actions are still pending. In September 2017, Duke Energy announced plans to cancel William States Lee III Nuclear Station, Units 3 and 4. Data are current as of September 30,2022. NRC-abbreviated reactor names are listed.

Source: DOE/EIA, "Commercial Nuclear Power 1991," DOE/EIA-0438, Appendix E, and the NRC data.

APPENDIX E
Commercial Nuclear Power Reactor Operating Licenses—Issued by Year

1969	Dresden 2*
	Ginna*
	Nine Mile Point 1*
	(1974)
1970	Point Beach 1*
	Robinson 2
1971	Dresden 3
	Monticello 1* (1970)
1972	Quad Cities 1
	Quad Cities 2
	Surry 1
	Turkey Point 3
1973	Browns Ferry 1
	Oconee 1
	Oconee 2
	Peach Bottom 2
	Point Beach 2*
	Surry 2
	Turkey Point 4
1974	Arkansas Nuclear 1
	Browns Ferry 2
	Brunswick 2
	Calvert Cliffs 1
	Cooper
	D.C. Cook 1
	FitzPatrick
	Hatch 1
	Oconee 3
	Peach Bottom 3
	Prairie Island 1
	Prairie Island 2
1975	Millstone 2
1976	Beaver Valley 1
	Browns Ferry 3
	Brunswick 1
	Calvert Cliffs 2
	Salem 1
	St. Lucie 1
1977	Davis-Besse 1
	D.C. Cook 2
	Farley 1
1978	Arkansas Nuclear 2
	Hatch 2
	North Anna 1
1980	North Anna 2
	Sequoyah 1
1981	Farley 2
	McGuire 1
	Salem 2
	Sequoyah 2
1982	LaSalle 1
	Summer 1
	Susquehanna 1
1983	McGuire 2
	St. Lucie 2
1984	Callaway
	Columbia
	Diablo Canyon 1
	Grand Gulf 1
	LaSalle 2 (1983)
	Susquehanna 2
1985	Byron 1
	Catawba 1
	Diablo Canyon 2
	Fermi 2
	Limerick 1
	Palo Verde 1
	River Bend 1
	Waterford 3
	Wolf Creek 1
1986	Catawba 2
	Hope Creek 1
	Millstone 3
	Palo Verde 2
	Perry 1
1987	Beaver Valley 2
	Braidwood 1
	Byron 2
	Clinton 1
	Harris 1(1986)
	Nine Mile Point 2
	Palo Verde 3
	Vogtle 1
1988	Braidwood 2
	South Texas Project 1
1989	Limerick 2
	South Texas Project 2
	Vogtle 2
1990	Comanche Peak 1
	Seabrook 1
1993	Comanche Peak 2
1996	Watts Bar 1
2015	Watts Bar 2

* The Atomic Energy Commission issued a provisional operating license allowing commercial operations.
Notes: This list is limited to reactors licensed to operate. Year is based on the date the initial full-power operating license was issued. NRC-abbreviated reactor names are listed. Data are current as of September 2022.

APPENDIX F
Commercial Nuclear Power Reactor Operating Licenses—Expiration by Year, 2024–2055

2024	Diablo Canyon 1
2025	Diablo Canyon 2
2026	Clinton 1
	Perry 1
2029	Dresden 2
	Ginna
	Nine Mile Point 1
2030	Comanche Peak 1
	Monticello 1
	Point Beach 1
	Robinson 2
2031	Dresden 3
2032	Quad Cities 1
	Quad Cities 2
2033	Browns Ferry 1
	Comanche Peak 2
	Oconee 1
	Oconee 2
	Point Beach 2
	Prairie Island 1
2034	Arkansas Nuclear 1
	Browns Ferry 2
	Brunswick 2
	Calvert Cliffs 1
	D.C. Cook 1
	Cooper
	FitzPatrick
	Hatch 1
	Oconee 3
	Prairie Island 2
2035	Millstone 2
	Watts Bar 1
2036	Beaver Valley 1
	Browns Ferry 3
	Brunswick 1
	Calvert Cliffs 2
	St. Lucie 1
	Salem 1
2037	D.C. Cook 2
	Davis-Besse 1
	Farley 1
2038	Arkansas Nuclear 2
	Hatch 2
	North Anna 1
2040	North Anna 2
	Salem 2
	Sequoyah 1
2041	Farley 2
	McGuire 1
	Sequoyah 2
2042	LaSalle 1
	Summer 1
	Susquehanna 1
2043	Catawba 1
	Catawba 2
	Columbia
	LaSalle 2
	McGuire 2
	St. Lucie 2
2044	Byron 1
	Callaway
	Grand Gulf 1
	Limerick 1
	Susquehanna 2
	Waterford 3
2045	Fermi 2
	Millstone 3
	Palo Verde 1
	River Bend 1
	Wolf Creek 1
2046	Braidwood 1
	Byron 2
	Harris 1
	Hope Creek 1
	Nine Mile Point 2
	Palo Verde 2
2047	Beaver Valley 2
	Braidwood 2
	Palo Verde 3
	South Texas Project 1
	Vogtle 1
2048	South Texas Project 2
2049	Limerick 2
	Vogtle 2
2050	Seabrook
	Surry 1
	Turkey Point 3
2052	Peach Bottom 2
2053	Surry 2
	Turkey Point 4
2054	Peach Bottom 3
2055	Watts Bar 2

Notes: NRC-abbreviated reactor names are listed. Data are current as of September 2022.

APPENDIX G
Operating Nuclear Research and Test Reactors Regulated by the NRC

Licensee Location	Reactor Type OL Issued	Power Level (kW)	Licensee Number Docket Number
Aerotest San Ramon, CA	TRIGA (Indus) 07/02/1965	250	R-98 05000228
Armed Forces Radiobiology Research Institute Bethesda, MD	TRIGA 06/26/1962	1,100	R-84 05000170
Dow Chemical Company Midland, MI	TRIGA MARK I 07/03/1967	300	R-108 05000264
GE-Hitachi Sunol, CA	Tank 10/31/1957	100	R-33 05000073
Idaho State University Pocatello, ID	AGN-201 #103 10/11/1967	0.005	R-110 05000284
Kansas State University Manhattan, KS	TRIGA MARK II 10/16/1962	1,250	R-88 05000188
Massachusetts Institute of Technology Cambridge, MA	HWR Reflected 06/09/1958	6,000	R-37 05000020
Missouri University of Science and Technology Rolla, MO	Pool, MTR type fuel 11/21/1961	200	R-79 05000123
National Institute of Standards and Technology Gaithersburg, MD	Nuclear Test 05/21/1970	20,000	TR-5 05000184
North Carolina State University Raleigh, NC	Pulstar 08/25/1972	1,000	R-120 05000297
Ohio State University Columbus, OH	Pool 02/24/1961	500	R-75 05000150
Oregon State University Corvallis, OR	TRIGA MARK II 03/07/1967	1,100	R-106 05000243
Pennsylvania State University State College, PA	TRIGA 07/08/1955	1,100	R-2 05000005
Purdue University West Lafayette, IN	Lockheed 08/16/1962	12	R-87 05000182
Reed College Portland, OR	TRIGA MARK I 07/02/1968	250	R-112 05000288
Rensselaer Polytechnic Institute Troy, NY	Critical Assembly 07/03/1964	0.1	CX-22 05000225
Rhode Island Atomic Energy Commission Narragansett, RI	GE Pool 07/23/1964	2,000	R-95 05000193
Texas A&M University College Station, TX	AGN-201M #106 08/26/1957	0.005	R-23 05000059

APPENDIX G
Operating Nuclear Research and Test Reactors Regulated by the NRC (continued)

Licensee Location	Reactor Type OL Issued	Power Level (kW)	Licensee Number Docket Number
Texas A&M University College Station, TX	TRIGA 12/07/1961	1,000	R-83 05000128
U.S. Geological Survey Denver, CO	TRIGA MARK I 02/24/1969	1,000	R-113 05000274
University of California/Davis Sacramento, CA	TRIGA MARK II 08/13/1998	2,300	R-130 05000607
University of California/Irvine Irvine, CA	TRIGA MARK I 11/24/1969	250	R-116 05000326
University of Florida Gainesville, FL	Argonaut 05/21/1959	100	R-56 05000083
University of Maryland College Park, MD	TRIGA 10/14/1960	250	R-70 05000166
University of Massachusetts/Lowell Lowell, MA	GE Pool 12/24/1974	1,000	R-125 05000223
University of Missouri/Columbia Columbia, MO	Tank 10/11/1966	10,000	R-103 05000186
University of New Mexico Albuquerque, NM	AGN-201M #112 09/17/1966	0.005	R-102 05000252
University of Texas Austin, TX	TRIGA MARK II 01/17/1992	1,100	R-129 05000602
University of Utah Salt Lake City, UT	TRIGA MARK I 09/30/1975	100	R-126 05000407
University of Wisconsin Madison, WI	TRIGA 11/23/1960	1,000	R-74 05000156
Washington State University Pullman, WA	TRIGA 03/06/1961	1,000	R-76 05000027

Note: Data are current as of September 2022.

APPENDIX H
Nuclear Research and Test Reactors under Decommissioning Regulated by the NRC

Licensee Location	Reactor Type Power Level (kW)	OL Issued Shutdown
General Atomics	TRIGA MARK F	07/01/60
San Diego, CA	1,500	09/07/94
General Atomics	TRIGA MARK I	05/03/58
San Diego, CA	250	12/17/96
General Electric Company	GETR (Tank)	01/07/59
Sunol, CA	50,000	06/26/85

Note: Data are current as of September 2022.

APPENDIX I
Commercial Nuclear Power Plant Licensing History 1955–2022

	Original Licensing Regulations (10 CFR Part 50)[1]		Alternative Licensing Regulations (10 CFR Part 52)[3]			
Year	CP Issued[2]	Full-Power OL Issued	COL Issued[4]	Operating COLs[5]	Permanent Shutdowns[6]	Operable Units
1955	1	0	--	--	0	0
1956	3	0	--	--	0	0
1957	1	1	--	--	0	1
1958	0	0	--	--	0	1
1959	3	1	--	--	0	2
1960	7	1	--	--	0	3
1961	0	0	--	--	0	3
1962	1	6	--	--	0	9
1963	1	2	--	--	1	11
1964	3	3	--	--	1	13
1965	1	0	--	--	0	13
1966	5	2	--	--	17	14
1967	14	3	--	--	2	15
1968	23	0	--	--	1	13
1969	7	4	--	--	0	17
1970	10	3	--	--	1	20
1971	4	2	--	--	0	22
1972	8	6	--	--	2	27
1973	14	15	--	--	0	42
1974	23	15	--	--	2	55
1975	9	2	--	--	0	57
1976	9	7	--	--	1	63
1977	15	4	--	--	0	67
1978	13	4	--	--	1	70
1979	2	0	--	--	1	69
1980	0	2	--	--	0	71
1981	0	4	--	--	0	75
1982	0	4	--	--	1	78
1983	0	3	--	--	0	81
1984	0	6	--	--	0	87
1985	0	9	--	--	0	96
1986	0	5	--	--	0	101
1987	0	8	--	--	1	107
1988	0	2	--	--	0	109
1989	0	4	--	--	3	111
1990	0	2	--	--	0	112
1991	0	0	--	--	1	111
1992	0	0	--	--	2	109
1993	0	1	--	--	0	110
1994	0	0	--	--	0	109
1995	0	0	--	--	0	109
1996	0	1	--	--	3	109

APPENDIX I
Commercial Nuclear Power Plant Licensing History 1955–2022 (continued)

	Original Licensing Regulations (10 CFR Part 50)[1]		Alternative Licensing Regulations (10 CFR Part 52)[3]			
Year	CP Issued[2]	Full-Power OL Issued	COL Issued[4]	Operating COLs[5]	Permanent Shutdowns[6]	Operable Units
1997	0	0	0	0	2	107
1998	0	0	0	0	1	104
1999–2011	0	0	0	0	0	104
2012	0	0	4 units	0	0	104
2013	0	0	0	0	4	100
2014	0	0	0	0	1	99
2015	0	1	1 unit	0	0	100
2016	0	0	6 units	0	1	99
2017	0	0	1 unit	0	0	99
2018	0	0	2 units	0	1	98
2019	0	0	0	0	2	96
2020	0	0	0	0	2	94
2021	0	0	0	0	1	93
2022	0	0	0	1	1	93*
Total	177	133	14 units	1	40	– –

U.S. Atomic Energy Commission was the regulatory authority.

– – Not applicable

* Includes Vogtle Electric Generating Plant, Unit 3 (Southern Nuclear), which plans to enter service in the first quarter of 2023.

[1] Data in columns 1–3 are based on 10 CFR Part 50, "Domestic Licensing of Production and Utilization Facilities." Numbers reflect permits or licenses issued in a given year, not extant permits or licenses.

[2] Issuance by regulatory authority of a permit, or equivalent permission, to begin construction. Under alternative licensing regulations in 10 CFR Part 52, "Licenses, Certifications, and Approvals for Nuclear Power Plants," a construction permit (CP) is not issued separately from the operating license.

[3] Data in columns 4–6 are based on 10 CFR Part 52. Numbers reflect permits or licenses issued in a given year, not extant permits or licenses.

[4.] Number of combined licenses (COLs) issued in a given year, including six that were subsequently terminated. See appendix A on status of plant construction and appendix B for more information on withdrawn and suspended applications.

[5] Issuance by the NRC of a finding under 10 CFR 52.103(g), in a given year.

[6] Number of operating plants transitioned to shutdown in a given year. Does not represent the total number of reactor units included.

[7] These are U.S. Department of Energy (DOE) nuclear legacy sites: Hallam (1964), Piqua (1966), Elk River (1968), and Shippingport (1982). For more information, visit the DOE's Legacy Management website at https://energy.gov/lm/sites/lm-sites and see the NRC Online Glossary for definitions of
decommissioning alternatives (DECON, SAFSTOR).

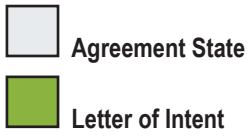
Source: U.S. Energy Information Administration/Annual Energy Review 2011 located at https://www.eia.gov/aer and compilation of NRC information following 2011.

Data are current as of September 2022.

APPENDIX J
Materials Licenses by State

Number of Licenses

State	NRC	Agreement States
Alabama	9	329
Alaska	56	0
Arizona	5	352
Arkansas	4	176
California	46	1,634
Colorado	17	311
Connecticut	111	0
Delaware	37	0
District of Columbia	33	0
Florida	21	1,533
Georgia	15	385
Hawaii	49	0
Idaho	63	0
Illinois	18	544
Indiana	194	0
Iowa	1	131
Kansas	13	248
Kentucky	6	339
Louisiana	11	436
Maine	2	89
Maryland	64	508
Massachusetts	16	396
Michigan	380	0
Minnesota	12	147
Mississippi	6	244
Missouri	214	0
Montana	74	0
Nebraska	3	203
Nevada	1	223



Number of Licenses

State	NRC	Agreement States
New Hampshire	2	70
New Jersey	21	523
New Mexico	6	203
New York	14	1,270
North Carolina	18	526
North Dakota	3	73
Ohio	42	522
Oklahoma	13	251
Oregon	3	254
Pennsylvania	40	494
Rhode Island	1	42
South Carolina	4	320
South Dakota	33	0
Tennessee	22	493
Texas	41	1,385
Utah	6	190
Vermont	1	32
Virginia	43	374
Washington	11	320
West Virginia	131	0
Wisconsin	6	286
Wyoming	69	15
Puerto Rico	92	0
Virgin Islands	10	0
Guam	5	0
American Samoa	2	0
Northern Marianas	1	0
Total number of materials licenses in Agreement State jurisdiction		15,871
Total number of materials licenses in NRC jurisdiction		2,120
Total number of materials licenses in the United States		17,991

Notes: The NRC and Agreement State data are current as of September 2022. These totals represent an estimate because the number of specific radioactive materials licenses per State may change daily. The NRC licenses Federal agencies in Agreement States.

APPENDIX K
Major U.S. Fuel Cycle Facility Sites

Licensee	Location	Status	Docket #
Uranium Hexafluoride Conversion Facility			
Honeywell International, Inc.	Metropolis, IL	ready-idle*	04003392
Uranium Fuel Fabrication Facilities			
Global Nuclear Fuel-Americas, LLC	Wilmington, NC	active	07001113
Westinghouse Electric Company, LLC Columbia Fuel Fabrication Facility	Columbia, SC	active	07001151
Nuclear Fuel Services, Inc.	Erwin, TN	active	07000143
BWXT Nuclear Operations Group, Inc.	Lynchburg, VA	active	07000027
Framatome, Inc.	Richland, WA	active	07001257
TRISO-X, LLC	Oak Ridge, TN	license application under review	07007027
Gas Centrifuge Uranium Enrichment Facilities			
Centrus Energy Corp American Centrifuge Plant	Piketon, OH	license issued, under construction	07007004
Centrus Energy Corp Lead Cascade	Piketon, OH	license active (facility decommissioned)	07007003
URENCO-USA (Louisiana Energy Services)	Eunice, NM	active	07003103
Uranium Enrichment Laser Separation Facility			
GE-Hitachi Global Laser Enrichment, LLC	Wilmington, NC	license terminated	07007016
Depleted Uranium Deconversion Facility			
International Isotopes, Inc.	Hobbs, NM (Lea County)	license issued, construction not started	04009086

* The facility is being maintained with minimal operations to support a future return to production.
Notes: On February 8, 2019, the NRC issued a termination of the construction authorization (CAMOX-001) for the Mixed-Oxide Fuel Fabrication Facility (see Agencywide Documents Access and Management System (ADAMS) Accession No. ML18318A135). Centrus Energy Corp–American Centrifuge Plant is under construction for High Assay Low Enriched Uranium Demonstration Program. On January 5, 2021, the NRC issued a letter terminating the license for the Global Laser Enrichment Facility (see ADAMS Accession No. ML20293A175. On April 6, 2022, the NRC received a special nuclear material license application under Title 10 of the *Code of Federal Regulations* Part 70, "Domestic Licensing of Special Nuclear Material, from TRISO-X, LLC for the nation's first high-assay low-enrichment uranium fuel fabrication facility (ML22101A200).

Note: Data are current as of September 30, 2022.

APPENDIX L
Dry Spent Fuel Storage Designs: NRC-Approved for Use by General Licensees

Vendor	Docket #	Storage Design Model
General Nuclear Systems, Inc.	07201000	CASTOR V/21 (expired)
NAC International, Inc.	07201002	NAC S/T (expired)
	07201003	NAC-C28 S/T (expired)
	07201015	NAC-UMS
	07201025	NAC-MPC
	07201031	MAGNASTOR
	07201013	NAC-STC
Holtec International	07201008	HI-STAR 100
	07201014	HI-STORM 100
	07201032	HI-STORM FW
	07201040	HI-STORM UMAX
Westinghouse Electric Co.	07201007	VSC-24
	07201026	Fuel Solutions™ (WSNF-220, -221, -223) W-150 Storage Cask W-100 Transfer Cask W-21, W-74 Canisters
TN Americas, LLC (formerly Transnuclear, Inc.)	07201005	TN-24 (expired)
	07201027	TN-68
	07201021	TN-32
	07201004	Standardized NUHOMS®-24P, -24PHB, 24PTH, -32PT, -32PTH1, -37PTH, -52B, -61BT DSC,-61BTH, -69BTH
	07201029	Standardized Advanced NUHOMS®-24PT1, -24PT4
	07201030	NUHOMS® HD-32PTH
	07201042	NUHOMS® EOS

Notes: Data are current as of September 2022.

Scan QR Code for the latest list for the Dry Spent Fuel Storage Designs: NRC Approved for General Use on website

APPENDIX M

Dry Cask Spent Fuel Storage Licensees

Name Licensee	License Type	Vendor	Storage Model	Docket Number
Arkansas Nuclear Entergy Nuclear Operations, Inc.	GL	Westinghouse Electric Co. Holtec International	VSC-24 HI-STORM 100	07200013
Beaver Valley FirstEnergy Nuclear Operating Company	GL	TN Americas, LLC	NUHOMS®-37PTH	07201043
Big Rock Point Entergy Nuclear Operations, Inc.	GL	Westinghouse Electric Co.	Fuel SolutionsTM W74	07200043
Braidwood Exelon Generation Co., LLC	GL	Holtec International	HI-STORM 100	07200073
Browns Ferry Tennessee Valley Authority	GL	Holtec International	HI-STORM 100S HI-STORM FW	07200052
Brunswick Carolina Power Co.	GL	TN Americas, LLC	NUHOMS®-HD-61BTH	07200006
Byron Exelon Generation Co., LLC	GL	Holtec International	HI-STORM 100	07200068
Callaway Union Electric Co. Ameren Missouri	GL	Holtec International	HI-STORM UMAX	07201045
Calvert Cliffs Calvert Cliffs Nuclear Power Plant, Inc.	SL	TN Americas, LLC	NUHOMS®-24P NUHOMS®-32P	07200008
Catawba Duke Energy Carolinas, LLC	GL	NAC International, Inc.	NAC-UMS® MAGNASTOR®	07200045
Clinton Exelon Generation Co., LLC	GL	Holtec International	HI-STORM FW	07201046
Columbia Generating Station Energy Northwest	GL	Holtec International	HI-STORM 100S	07200035
Comanche Peak Luminant Generation Company, LLC	GL	Holtec International	HI-STORM 100	07200074
Cooper Nuclear Station Nebraska Public Power District	GL	TN Americas, LLC	NUHOMS®-61BT	07200066
Crystal River Duke Energy Company	GL	TN Americas, LLC	NUHOMS®--32PT	07201035
Davis-Besse FirstEnergy Nuclear Operating Company	GL	TN Americas, LLC	NUHOMS®-24P NUHOMS®--32PTH	07200014
D.C. Cook Indiana/Michigan Power	GL	Holtec International	HI-STORM 100	07200072
Diablo Canyon Pacific Gas & Electric Co.	SL	Holtec International	HI-STORM 100	07200026
Dresden Exelon Generation Company, LLC	GL	Holtec International	HI-STAR 100 HI-STORM 100	07200037

APPENDIX M

Dry Cask Spent Fuel Storage Licensees (continued)

Name Licensee	License Type	Vendor	Storage Model	Docket Number
Duane Arnold NextEra Energy Inc. Duane Arnold, LLC	GL	TN Americas, LLC	NUHOMS®-61BT	07200032
Fermi DTE Electric Company	GL	Holtec International	HI-STORM 100	07200071
Fort Calhoun Omaha Public Power District	GL	TN Americas, LLC	NUHOMS®-32PT	07200054
Fort St. Vrain* U.S. Department of Energy	SL	FW Energy Applications, Inc.	Modular Vault Dry Store	07200009
Grand Gulf Entergy Nuclear Operations, Inc.	GL	Holtec International	HI-STORM 100S	07200050
H.B. Robinson Carolina Power & Light Company	SL GL	TN Americas, LLC TN Americas, LLC	NUHOMS®-7P NUHOMS®-24P NUHOMS®-24PTH	07200003 07200060
Haddam Neck CT Yankee Atomic Power	GL	NAC International, Inc.	NAC-MPC	07200039
Hatch Southern Nuclear Operating Co. Inc.	GL	Holtec International	HI-STORM100 HI-STAR100	07200036
Hope Creek PSEG Nuclear, LLC	GL	Holtec International	HI-STORM 100	07200048
Humboldt Bay Pacific Gas & Electric Co.	SL	Holtec International	HI-STAR 100HB	07200027
Idaho National Laboratory TMI-2 U.S. Department of Energy	SL	TN Americas, LLC	NUHOMS®-12T	07200020
Idaho Spent Fuel Facility U.S. Department of Energy	SL	Foster Wheeler	Concrete Vault	07200025
Indian Point Entergy Nuclear Operations, Inc.	GL	Holtec International	HI-STORM 100	07200051
James A. FitzPatrick Entergy Nuclear	GL	Holtec International Operations, Inc.	HI-STORM 100 HI-STORM 100S	07200012 07200013
Joseph M. Farley Southern Nuclear Operating Co.	GL	Holtec International	HI-STORM 100S	07200042
Kewaunee Dominion Energy	GL	TN Americas, LLC NAC International, Inc.	NUHOMS®-32PT MAGNASTOR®	07200064
Kewaunee, Inc. La Salle Exelon Generation Co., LLC	GL	Holtec International	HI-STORM 100S	07200070
LaCrosse Dairyland Power	GL	NAC International, Inc.	NAC-MPC	07200046
Limerick Exelon Generation Co., LLC	GL	TN Americas, LLC	NUHOMS®-61BT NUHOMS®-61BTH	07200065
Maine Yankee Maine Yankee Atomic Power Company	GL	NAC International, Inc.	NAC-UMS®	07200030
McGuire Duke Energy, LLC	GL	TN Americas, LLC NAC International, Inc.	TN-32 NAC-UMS® MAGNASTOR®	07200038

APPENDIX M

Dry Cask Spent Fuel Storage Licensees (continued)

Name Licensee	License Type	Vendor	Storage Model	Docket Number
Millstone Dominion Generation	GL	TN Americas, LLC	NUHOMS®-32PT	07200047
Monticello Northern States Power Co., Minnesota	GL	TN Americas, LLC	NUHOMS®-61BT NUHOMS®-61BTH	07200058
Nine Mile Point Constellation Energy	GL	TN Americas, LLC	NUHOMS®-61BT	07201036
North Anna Virginia Electric & Power Co. (Dominion Energy Virginia)	GL SL	TN Americas, LLC TN Americas, LLC	NUHOMS®32PTH1 TN-32 07200016	07200056
Oconee Duke Energy Company	SL GL	TN Americas, LLC TN Americas, LLC	NUHOMS®-24P NUHOMS®-24P	07200004 07200040
Oyster Creek Oyster Creek Environmental Protection, LLC	GL	TN Americas, LLC	NUHOMS®-61BT NUHOMS®-61BTH	07200015
Palisades Entergy Nuclear Operations, Inc.	GL	Westinghouse Electric Co TN Americas, LLC Holtec International	VSC-24 NUHOMS®-32PT NUHOMS®-24PT HI-STORM FW	07200007
Palo Verde Arizona Public Service Co.	GL	NAC International, Inc.	NAC-UMS®	07200044
Peach Bottom Exelon Generation Co., LLC	GL	TN Americas, LLC	TN-68 07200029	
Perry FirstEnergy	GL	Holtec International	HI-STORM 100	07200069
Pilgrim Holtec Pilgrim, LLC	GL	Holtec International	HI-STORM 100	07201044
Point Beach NextEra Energy	GL	Westinghouse Electric Co. TN Americas, LLC	VSC-24 07200005 NUHOMS®-32PT	
Prairie Island Northern States Power Co., Minnesota	SL	TN Americas, LLC	TN-40 HT TN-40	07200010
Private Fuel Storage Facility	SL	Holtec International	HI-STORM 100	07200022
Quad Cities Exelon Generation Co., LLC	GL	Holtec International	HI-STORM 100S	07200053
Rancho Seco Sacramento Municipal Utility District	SL	TN Americas, LLC	NUHOMS®-24PT	07200011
R.E. Ginna Constellation Energy	GL	TN Americas, LLC	NUHOMS®-32PT	07200067
River Bend Entergy Nuclear Operations, Inc.	GL	Holtec International	HI-STORM 100S	07200049
Salem PSEG Nuclear (Duplicate, see Hope Creek)	GL	Holtec International	HI-STORM 100	07200048
San Onofre Southern California Edison Co.	GL	TN Americas, LLC Holtec International	NUHOMS®-24PT4 NUHOMS®-24PT1 HI-STORM UMAX	07200041

APPENDIX M

Dry Cask Spent Fuel Storage Licensees (continued)

Name Licensee	License Type	Vendor	Storage Model	Docket Number
Seabrook FPL Energy	GL	TN Americas, LLC	NUHOMS®-HD-32PTH	07200063
Sequoyah Tennessee Valley Authority	GL	Holtec International	HI-STORM 100 HI-STORM FW HI-STORM 100S	07200034
South Texas Project STP Nuclear Operating Co.	GL	Holtec International	HI-STORM FW	07201041
St. Lucie Florida Power & Light Co.	GL	TN Americas, LLC	NUHOMS®-HD-32PTH	07200061
Surry Virginia Electric & Power Co. (Dominion Energy Virginia)	SL GL	TN Americas, LLC TN Americas, LLC Gesellschaft für Nuklear-Service NAC International, Inc. Westinghouse Electric Co	NUHOMS®HD NUHOMS®HD-32PTH Castor NAC-128 MC-10	07200002 07200055
Susquehanna Pennsylvania Power & Light Co.	GL	TN Americas, LLC	NUHOMS®-52B NUHOMS®-61BT NUHOMS®-61BTH	07200028
Three Mile Island, Unit 1 Exelon Generation Co. LLC	GL	NAC International, Inc.	NAC MAGNASTOR	07200077
Trojan Portland General Electric Corp.	SL	Holtec International	HI-STORM 100	07200017
Turkey Point ISFSI Florida Power & Light Co.	GL	TN Americas, LLC	NUHOMS®-HD-32PTH	07200062
Vermont Yankee NorthStar Vermont Yankee, LLC	GL	Holtec International	HI-STORM 100	07200059
Virgil C. Summer South Carolina Electric & Gas	GL	Holtec International	HI-STORM FW	07201038
Vogtle Southern Nuclear Operating Co. Inc.	GL	Holtec International	HI-STORM 100S	07201039
Waterford Steam Electric Station Entergy Nuclear Operations, Inc.	GL	Holtec International	HI-STORM 100	07200075
Watts Bar Tennessee Valley Authority	GL	Holtec International	HI-STORM FW	07201048
WCS Consolidated Interim Storage Facility, CISF Interim Storage Partners, LLC	SL	TN Americas, LLC NAC International, Inc.	NUHOMS®-MP187 NUHOMS 24PT1 NUHOMS 61BT NUHOMS 61BTH NAC-MPC NAC-UMS® MAGNASTOR®	07201050

APPENDIX M
Dry Cask Spent Fuel Storage Licensees (continued)

Name Licensee	License Type	Vendor	Storage Model	Docket Number
Wolf Creek Wolf Creek Nuclear Operating Corp.	GL	TN Americas LLC	NUHOMS EOS	07200079
Yankee Rowe Yankee Atomic Electric	GL	NAC International, Inc.	NAC-MPC	07200031
Zion Zion Solutions, LLC	GL	NAC International, Inc.	MAGNASTOR®	07201037

* Fort St. Vrain independent spent fuel storage installation (ISFSI) NRC SNM-2504 license was transferred to U.S. Department of Energy on June 4, 1999. License Types: SL = site-specific license, GL = general license
Notes: NRC-abbreviated unit names. Data are current as of September 2022.

APPENDIX N
U.S. Low-Level Radioactive Waste Disposal Compact Membership

Appalachian Compact
Delaware
Maryland
Pennsylvania
West Virginia

Atlantic Compact
Connecticut
New Jersey
South Carolina*

Central Compact
Arkansas
Kansas
Louisiana
Oklahoma

Central Midwest Compact
Illinois
Kentucky

Midwest Compact
Indiana
Iowa
Minnesota
Missouri
Ohio
Wisconsin

Northwest Compact
Alaska
Hawaii
Idaho
Montana
Oregon
Utah*
Washington*
Wyoming

Rocky Mountain Compact
Colorado
Nevada
New Mexico
(Northwest accepts Rocky Mountain waste as agreed between compacts.)

Southeast Compact
Alabama
Florida
Georgia
Mississippi
Tennessee
Virginia

Southwestern Compact
Arizona
California
North Dakota
South Dakota

Texas Compact
Texas*
Vermont

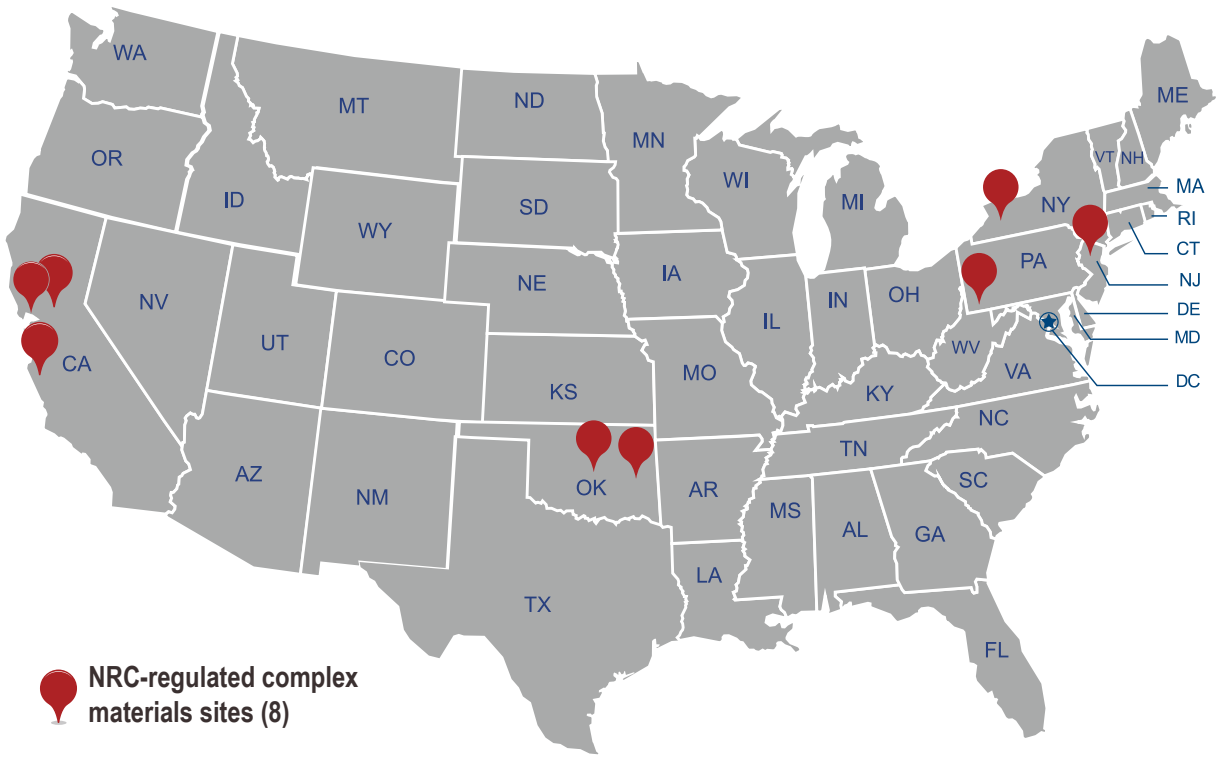
Unaffiliated
District of Columbia
Maine
Massachusetts
Michigan
Nebraska
New Hampshire
New York
North Carolina
Puerto Rico
Rhode Island

Closed Low-Level Radioactive Waste Disposal Facility Sites Licensed by the NRC or Agreement States

Beatty, NV, closed 1993
Sheffield, IL, closed 1978
Maxey Flats, KY, closed 1977
West Valley, NY, closed 1975

* Site of an active low-level waste disposal facility.
Note: Data are current as of September 2022.

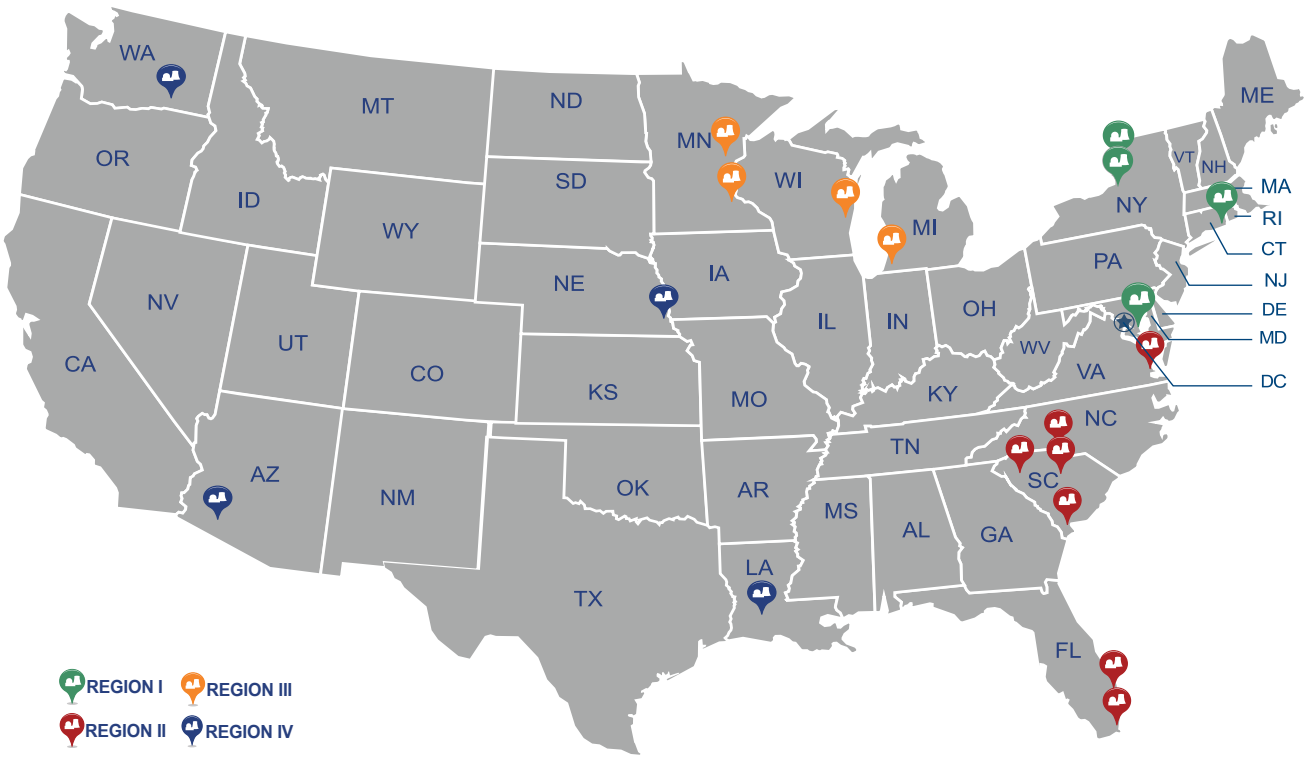
APPENDIX O
NRC-Regulated Complex Materials Sites Undergoing Decommissioning



Company	Location
Alameda Naval Air Station	Alameda, CA
BWX Technology, Inc., Shallow Land Disposal Area	Vandergrift, PA
Cimarron Environmental Response Trust	Cimarron City, OK
Department of the Army, Picatinny Arsenal (ARDEC)	Picatinny, NJ
Fansteel Metals (Formerly FMRI)	Muskogee, OK
Hunter's Point Naval Shipyard	San Francisco, CA
McClellan Air Force Base	Sacramento, CA
West Valley Demonstration Project	West Valley, NY

Note: Data are current as of September 2022.

APPENDIX P
Native American Reservations and Trust Lands within a 50-Mile Radius of an Operating Nuclear Power Plant



ARIZONA
Palo Verde
Ak-Chin Indian Community
Gila River Reservation
Tohono O'odham Trust Land

CONNECTICUT
Millstone
Mohegan Reservation
Mashantucket Pequot Reservation
Narragansett Reservation
Shinnecock Indian Nation

FLORIDA
St. Lucie
Brighton Reservation
(Seminole Tribes of Florida)
Fort Pierce Reservation

Turkey Point
Hollywood Reservation
(Seminole Tribes of Florida)
Miccosukee Reservation
Miccosukee Trust Land

LOUISIANA
River Bend
Tunica-Biloxi Reservation

MARYLAND
Calvert Cliffs
Rappahannock Tribe
Upper Mattaponi Tribe

MICHIGAN
DC Cook
Pokagon Reservation
Pokagon Trust Land

MINNESOTA
Monticello
Shakopee Community
Shakopee Trust Land
Mille Lacs Reservation

Prairie Island
Prairie Island Community*
Prairie Island Trust Land*
Shakopee Community
Shakopee Trust Land

NEBRASKA
Cooper
Sac & Fox Trust Land
Sac & Fox Reservation
Iowa Reservation
Iowa Trust Land
Kickapoo

NEW YORK
FitzPatrick
Onondaga Reservation
Oneida Reservation

Nine Mile Point
Onondaga Reservation
Oneida Reservation

NORTH CAROLINA
McGuire
Catawba Reservation

SOUTH CAROLINA
Catawba
Catawba Reservation

Oconee
Eastern Cherokee Reservation

Summer
Catawba Reservation

VIRGINIA
Surry
Pamunkey Reservation
Chickahominy Indian Tribe
Chickahominy Indian Tribe
—Eastern Division
Nansemond Indian Tribe
Upper Mattaponi Tribe

WASHINGTON
Columbia
Yakama Reservation
Yakama Trust Land

WISCONSIN
Point Beach
Oneida Trust Land
Oneida Reservation

*** Tribe is located within the 10-mile emergency preparedness zone of operating reactors.**

Note: This table uses NRC-abbreviated reactor names and Native American Reservation and Trust land names. There are no reservations or Trust lands within 50 miles of a reactor in Alaska, Hawaii, or U.S. Territories. For more information on other Tribal concerns, go to the NRC website at https://www.nrc.gov. NRC-abbreviated reactor names listed. Data as of September 30, 2022.

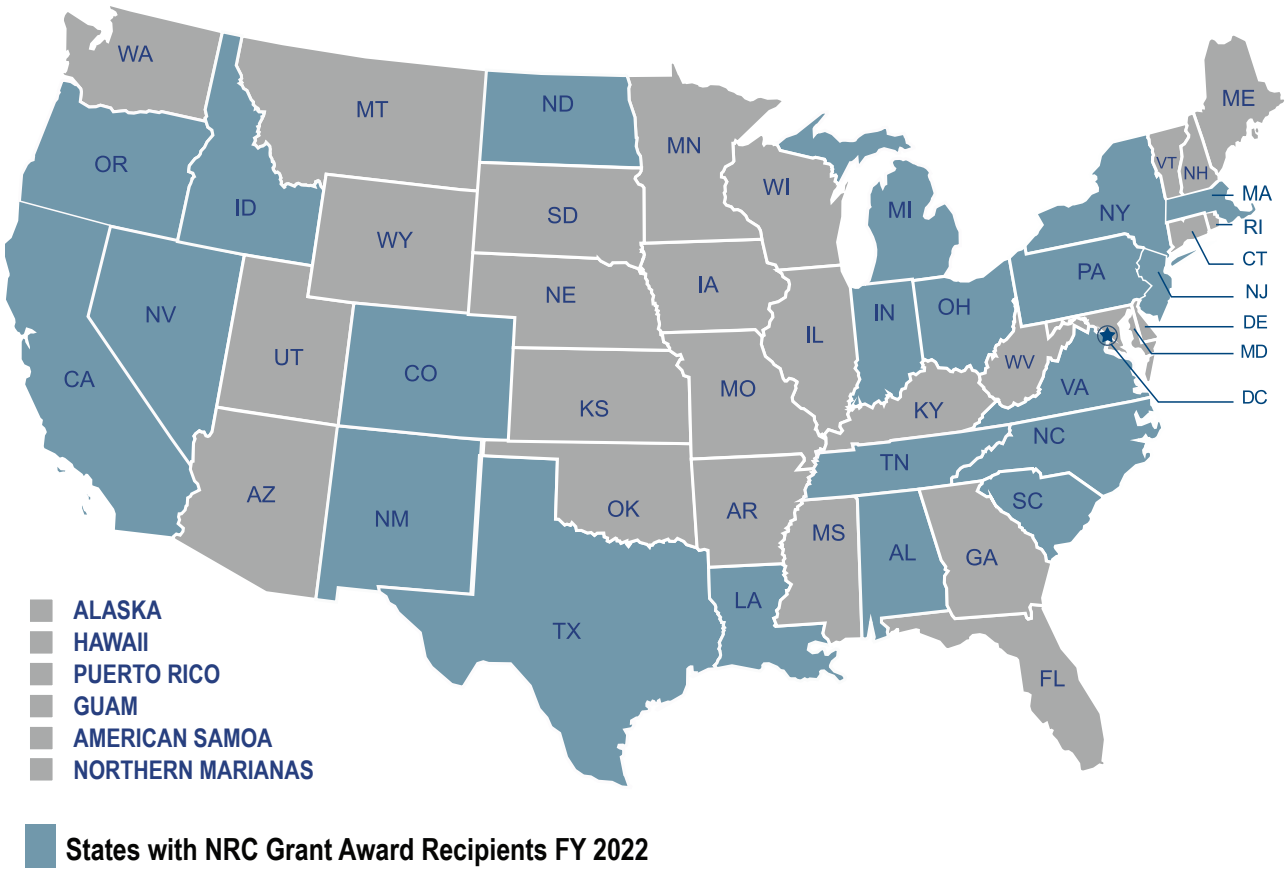
APPENDIX Q
States with NRC Grant Award Recipients, Fiscal Year 2022

State	Amount Awarded	Type of Grant	Academic Institution	Title of Proposal
AL	$375,735	Fellowship	University of Alabama at Birmingham	UAB Fellowship Program for Master's in Health Physics Students
CA	$500,000	Research and Development Grant	University of California - Los Angeles	Extending Human Reliability Analysis Methods for Explicit Inclusion of Organizational Factors: Methodology and PRA Implications
CA	$450,000	Faculty Development	San Jose State University Research	Re-establishing Nuclear Science Research at SJSU
CO	$400,000	Fellowship	Colorado School of Mines	Colorado School of Mines Nuclear Science and Engineering Fellowship Program
ID	$450,000	Faculty Development	Idaho State University	Faculty Development Program in Nuclear Engineering at Idaho State University
ID	$394,695	Fellowship	Idaho State University	Idaho State University and NRC Nuclear Science Fellowship Program
ID	$192,390	Scholarship	Idaho State University	Idaho State University and NRC Nuclear Science Scholarship Program
IN	$450,000	Faculty Development	Purdue University	Purdue Nuclear Engineering Junior Faculty Development Program
LA	$199,998	Scholarship	Louisiana State University	LSU Nuclear Multidisciplinary Scholarship Program
MA	$399,942	Fellowship	Worcester Polytechnic Institute	WPI Nuclear Science and Engineering Graduate Fellowship Program
MI	$400,000	Fellowship	University of Michigan	Nuclear Engineering Fellowship Program at the University of Michigan
NC	$500,000	Research and Development Grant	North Carolina State University	Trustworthiness of Digital-Twin-Based Automation Technology in Nuclear Power Plant Operation
NC	$200,000	Scholarship	Western Carolina University	Undergraduate Research Learning Community Fostering Nuclear Workforce Development
ND	$131,163	Trade & Community College	Bismarck State College	Trade Schools and Community College Scholarship Program
NJ	$199,523	Scholarship	Thomas Edison State University	Thomas Edison State University Scholarship Program for Qualified Students Matriculated in Nuclear Energy Engineering, Electronics Systems Engineering Technology, Radiation Protection, Cyber Security, Technical and Information Technology Degree Programs
NM	$500,000	Research and Development Grant	University of New Mexico	Molten Salt Spill Experiments for Validating NRC Tools in Support of Molten Salt Reactor Source Term and Accident Analyses
NV	$450,000	Faculty Development	University of Nevada - Reno	University of Nevada, Reno Faculty Development Program in Nuclear Waste Forms
NY	$498,770	Research and Development Grant	Rochester Institute of Technology	High-Temperature and Seismic Response of Concrete Lining Structures and Clay in Nuclear Waste Disposal
NY	$399,168	Fellowship	City University of New York	Nuclear Energy Fellowship Program at City College of New York and Hunter College
OH	$455,991	Research and Development Grant	University of Cincinnati	In Vivo Measurement of Low Energy Photon Associated with an Internal Deposition of Mixed Oxide Nuclear Fuel

APPENDIX Q
States with NRC Grant Award Recipients, Fiscal Year 2022 (continued)

State	Amount Awarded	Type of Grant	Academic Institution	Title of Proposal
OH	$450,000	Faculty Development	Ohio State University	The Ohio State University Nuclear Engineering Faculty Development Program
OR	$450,000	Faculty Development	Oregon State University	Faculty Development Program in Radioactive Materials Characterization at Oregon State
OR	$400,000	Fellowship	Oregon State University	Oregon State University Nuclear Science Fellowship Program
PA	$500,000	Research and Development Grant	University of Pittsburgh	Nuclear-Specific Experimental and Computational Benchmark Problems for Laser Powder Bed Fusion Additive Manufacturing
PA	$500,000	Research and Development Grant	Pennsylvania State University	Reduced Order Modeling for Coupled Neutronics/Thermal Fluids Analysis of Molten Salt Reactors in CRAB to Enable Uncertainty Analysis
PA	$450,000	Faculty Development	Pennsylvania State University	Faculty Development Grant for Radiochemistry and Applications of Neutron Irradiation
PA	$400,000	Fellowship	Pennsylvania State University	Fellowship Grant for Nuclear Engineering Graduate Students at Pennsylvania State University
SC	$499,859	Research and Development Grant	Clemson University	Coupling Life-Cycle Impact Assessment and Risk Assessment for Sustainability-Informed Decision Making
SC	$450,000	Faculty Development	Clemson University	Junior Faculty Position in Actinide Chemistry at Clemson University
SC	$400,000	Fellowship	Clemson University	U.S. NRC Fellowship Education Grant at Clemson University
TN	$500,000	Research and Development Grant	University of Tennessee	Validation and Testing of NRC Tools for Accident Tolerant Fuel Behavior in Reactivity-Initiated Accidents Using Separate Effects Test Data
TN	$450,000	Faculty Development	University of Tennessee	Faculty Development Program in Nuclear Fusion Safety at the University of Tennessee
TX	$500,000	Research and Development Grant	University of Texas at Austin	Advanced Condition Monitoring of Dry Storage Canisters by Helical Guided Ultrasonic Waves
TX	$450,000	Faculty Development	Texas A&M University	Faculty Development Program in Nuclear Engineering at Texas A&M University
VA	$499,996	Research and Development Grant	Virginia Polytechnic Institute	A Comprehensive Experimental and Modeling Study of Annular Two-Phase Flow
VA	$450,000	Faculty Development	Virginia Polytechnic Institute	Virginia Tech Multi-campus Nuclear Engineering Faculty Development Program

APPENDIX Q
States with NRC Grant Award Recipients, Fiscal Year 2022 (continued)



APPENDIX R
Significant Enforcement Actions Issued, Fiscal Year 2022

Significant (escalated) enforcement actions include notices of violation (NOVs) for severity level (SL) I, II, or III violations; NOVs associated with inspection findings that the significance determination process (SDP) categorizes as White, Yellow, or Red; civil penalties (CPs); and enforcement-related orders. The NRC Enforcement Policy also allows related violations to be categorized collectively as a single problem. Escalated enforcement actions are issued to reactor, materials, and individual licensees; nonlicensees; and fuel cycle facility licensees.

Action #	Name	Type	Issue Date	Enforcement Action
IA-21-043	Ms. Lilly Porter	Individual	10/7/2021	SLIII/NOV
EA-21-058	Empire Paving Inc.	Materials	11/8/2021	SLIII Problem/NOV; SLIII/NOV
EA-21-109	Southern Nuclear Operating Co. (Vogtle Electric Generating Plant)	Reactor	11/17/2021	(2) White/NOV
EA-21-102	BRL-NDT Services	Materials	11/26/2021	SLIII Problem/NOV/SLIV
IA-21-049	Ms. Peggy Lucky	Individual	11/26/2021	SLIII/NOV
EA-21-034	Mountain View Hospital	Materials	12/15/2021	SLIII Problem/NOV; (4) SLIV
EA-20-125	Entergy Operations, Inc. (Grand Gulf Nuclear Station)	Reactor	12/15/2021	SLIII/NOV
IA-20-054	Mr. Maurice Omaits	Individual	12/15/2021	SLIII/NOV
EA-21-115	Department of Army	Materials	1/3/2022	SLIII/NOV
EA-21-026	Southern Nuclear Operating Co. (Vogtle Electric Generating Plant)	Reactor	1/4/2022	SLIII/NOV
IA-21-050	Mr. Michael Giles	Individual	1/4/2022	SLIII/NOV
EA-21-119	KRONUS, Inc.	Materials	1/25/2022	SLIII/NOV
EA-21-041	Holtec Decommissioning International LLC (Oyster Creek Nuclear Generating Station)	Reactor	1/26/2022	Confirmatory Order result of an ADR mediation/CP $50,000
IA-21-040	Mr. Kevin Wright	Individual	1/26/2022	SLIII/NOV
IA-21-051	Mr. Magnus Quitmeyer	Individual	1/27/2022	SLIII/NOV
EA-21-114	Union Carbide Corporation	Materials	2/14/2022	SLIII/NOV; (3) SLIV
EA-21-134	Geotechnical and Materials Engineers, Inc.	Materials	2/14/2022	SLIII Problem/NOV/SLIV
EA-21-120	Marian Medical LLC	Materials	2/16/2022	SLIII Problem/NOV/CP $7,000
EA-21-133	Acuren Inspection, Inc.	Materials	2/28/2022	SLIII Problem/NOV/CP $16,000
EA-21-155	Energy Harbor Nuclear Corp. (Davis-Besse Nuclear Power Station)	Reactor	3/1/2022	White/NOV
EA-21-045	Steel City Gamma, LLC	Materials	3/2/2022	SLII Problem/NOV/CP $25,600
IA-21-062	Mr.Joseph Berkich	Individual	3/2/2022	Order banning for 5 years
EA-21-146	Somat Engineering Inc.	Materials	3/3/2022	Confirmatory Order result of an ADR mediation
EA-21-103	Cultilux	Materials	3/14/2022	SLIII Problem/NOV
EA-21-145	Northwest Inspection, Inc.	Materials	3/14/2022	SLIII/NOV

APPENDIX R
Significant Enforcement Actions Issued, Fiscal Year 2022 (continued)

Action #	Name	Type	Issue Date	Enforcement Action
EA-21-100	Kakivik Asset Management, LLC	Materials	4/5/2022	SLIII Problem/NOV
EA-21-059	U.S. Department of Veterans Affairs	Materials	4/21/2022	Confirmatory Order result of an ADR mediation
EA-21-132	Defense Health Agency	Materials	4/27/2022	SLIII/NOV/CP $3,500
EA-22-001	University of Wyoming	Materials	5/17/2022	SLIII Problem/NOV
EA-21-027	Avera McKennan	Materials	5/19/2022	Confirmatory Order result of an ADR mediation
IA-21-060	Ms. Shannon Gray	Individual	5/19/2022	Confirmatory Order result of an ADR mediation
IA-21-061	Ms. Traci Hollingshead	Individual	5/19/2022	Confirmatory Order result of an ADR mediation
EA-21-125	Industrial Nuclear Company, Inc.	Materials	5/27/2022	SLIII/NOV/SLIV
EA-22-022	Core Engineering & Consulting, Inc.	Materials	6/2/2022	(2) SLIII/NOV
IA-22-025	Mr. Matthew Carberry	Individual	6/7/2022	SLIII/NOV
EA-21-129	Advanced Inspection Technologies	Materials	6/14/2022	SLIII/NOV/CP $8,000
IA-21-069	Ms. Sharon Busby	Individual	6/14/2022	SLIII/NOV
EA-22-021	Niowave, Inc.	Materials	6/30/2022	SLIII Problem/NOV
EA-22-020	Alt and Witzig Engineering, Inc.	Materials	7/11/2022	SLIII Problem/NOV/CP $8,000
EA-21-148	U.S. Department of Commerce (National Institute of Standards and Technology)	Reactor	8/1/2022	Confirmatory Order result of an ADR mediation
EA-22-018	Testing Engineers & Consultants, Inc.	Materials	8/11/2022	(3) SLIII/NOV/CP $24,000
IA-22-027	Mr. Ronald Salgado	Individual	8/12/2022	SLIII/NOV
EA-21-167	Indiana University	Materials	9/1/2022	SLIII Problem/NOV/CP $8,000
IA-22-005	Dr. Sabah Butty	Individual	9/1/2022	SLIII/NOV
IA-22-006	Dr. Maximilian Pyko	Individual	9/1/2022	SLIII/NOV
EA-22-033	Waterford Steam Electric Station, Unit 3	Reactor	9/12/2022	White/NOV
EA-22-007	Air Force Medical Readiness Agency	Materials	9/22/2022	SLIII/NOV; (3) SLIII Problem/NOV/CP $96,000

APPENDIX S
International Activities:
LIST OF IMPORT AND EXPORT LICENSES ISSUED, FISCAL YEAR 2022: APPENDIX P

License Number	Applicant	Docket Number
PXB14b.09	Source Production & Equipment Co., Inc.	11006034
PXB169.04	Baker Hughes Oilfield Operations, LLC	11006064
PXB178.03	JL Shepherd & Associates	11006117
PXB215b.02	ISOFLEX Radioactive, LLC	11006262
PXB220.02	Baker Hughes Oilfield Operations, Inc.	11006304
PXB221.02	NSSI/Sources & Services, Inc.	11006308
PXB221.03	NSSI/Sources & Services, Inc.	11006308
PXB224.02	ISOFLEX Radioactive, LLC	11006318
PXB230.00	Halliburton Energy Services, Inc.	11006359
PXB234.00	Weatherford International Inc. & Subsidiaries & Affiliate Companies	11006390
PXB235.01	QSA Global, Inc.	11006391
PXB237.01	Baker Hughes Oilfield Operations, Inc.	11006412
PXB241.00	Brigham and Women's Hospital	11006449
PXB242.00	Halliburton Energy Services, Inc.	11006450
PXB3.13	Nordion (Canada) Inc.	11006070
PXB6.37	Alpha-Omega Services, Inc.	11006027
PXB6.38	Alpha-Omega Services, Inc.	11006027
PXB6.39	Alpha-Omega Services, Inc.	11006027
PXB6.40	Alpha-Omega Services, Inc.	11006027

Licenses under Appendix P to 10 CFR Part 110, "Export and Import of Nuclear Equipment and Material," support the use of radioactive sealed sources for a variety of medical, industrial, research, and educational activities. Some applicants have previously obtained a combined export/import license to allow export and import of U.S.-origin sources for return back to the U.S. supplier after the source has been used. These combined licenses are no longer being issued and can no longer be amended going forward, because such imports are authorized under a general license (see 10 CFR 110.27, "General license for imports," and paragraph (1) under the definition of "Radioactive Waste" in 10 CFR 110.2). These combined import/export licenses needing amendment are converted to export-only licenses. The 2010 changes to 10 CFR Part 110 generally necessitate specific licenses for only Appendix P Category 1 and 2 exports.

Note: Data are current as of September 2022.

APPENDIX S
International Activities: (continued)
LIST OF IMPORT AND EXPORT LICENSES, FISCAL YEAR 2022: NON-APPENDIX P

License Number	Applicant	Docket Number
XB1344/01	Humboldt Scientific, Inc.	11006375
XB1356	Eckert & Ziegler Isotope Products	11006415
XCOM1047/04	Westinghouse Electric Company	11004358
XCOM1276/02	Curtiss-Wright Flow Control Service, LLC	11006135
XCOM1286/02	Curtiss-Wright Flow Control Service, LLC	11006171
XCOM1294/01	Curtiss-Wright Flow Control Corporation	11006207
XCOM1329/01	Curtiss-Wright Flow Control Service, LLC	11006355
XCOM1331	Starwin Industries	11006369
XCOM1333/01	Curtiss-Wright Flow Control Corporation	11006374
XCOM1334	General Atomics	11006381
XCOM1338	Marotta Controls, Inc.	11006408
XCOM1339	Materion Brush, Inc.	11006419
XCOM1340	Technetics Group, LLC	11006425
XCOM1345	Curtiss-Wright Flow Control Service, LLC	11006438
XCOM1350	Eaton Corporation	11006445
XCOM1352	Materion Brush, Inc.	11006452
XMAT412/04	Linde Gas & Equipment Inc.	11005876
XMAT413/04	Linde Gas & Equipment Inc.	11005877
XMAT415/05	Linde Electronics and Specialty Gases	11005907
XMAT423/04	Linde Gas & Equipment Inc.	11006029
XMAT437/02	Linde Gas & Equipment Inc.	11006238
XMAT448/03	Cambridge Isotope Laboratories Inc.	11006349
XMAT449/01	Cambridge Isotope Laboratories Inc.	11006350
XMAT451/01	Cambridge Isotope Laboratories, Inc.	11006352
XMAT456	Linde Gas North America, LLC	11006416
XR170/03	Curtiss-Wright Electro-Mechanical Corporation	11005552
XR172/05	Curtiss-Wright Electro-Mechanical Corporation	11006015
XSNM3135/06	Global Nuclear Fuel - Americas L.L.C.	11005186
XSNM3697/03	Framatome Inc.	11005959
XSNM3822	U.S. Department of Energy/NNSA	11006422
XSNM3824	Edlow Intenational Co. as Agent for X Energy, LLC	11006429

APPENDIX S
International Activities: (continued)
LIST OF IMPORT AND EXPORT LICENSES, FISCAL YEAR 2022: NON-APPENDIX P (continued)

XSNM3825	Westinghouse Electric Company LLC	11006430
XSNM3826	NBL Program Office NNSA	11006431
XSNM3827	NBL Program Office NNSA	11006433
XSNM3829	Westinghouse Electric Company LLC	11006446
XSOU8789/08	ConverDyn	11005360
XSOU8855	MP Mine Operations LLC	11006432
XW008/06	Diversified Scientific Services, Inc. (DSSI)	11005323
XW018/02	EnergySolutions Services, Inc.	11005897
XW027/01	Perma-Fix Northwest Richland, Inc.	11006380
XW028	Perma-Fix Northwest Richland, Inc.	11006420
XW029	Perma-Fix Northwest Richland, Inc.	11006421

Non-Appendix P Components Guide
(XSNM) denotes export of special nuclear material (plutonium, uranium-233, or uranium enriched above 0.711 percent, by weight, in the isotope uranium-235).
(XCOM) denotes export of minor reactor components or other nuclear facility (e.g., nuclear fabrication) components under NRC jurisdiction (refer to 10 CFR Part 110, Appendix A, Items (5)–(9), for minor reactor components and
Appendices B–K and N–O for other nuclear facility components).
(XSOU) denotes export of source material (natural or depleted uranium, thorium, a mixture of uranium and thorium other than special nuclear material, or certain ores [e.g., tantalum and niobium that contain, by weight, 0.05 percent or more of the aforementioned materials for non-nuclear end use]).
(XB) denotes export of byproduct material; refer to 10 CFR Part 110, Appendix L, for an illustrative list of byproduct materials under NRC jurisdiction.
(XR) denotes export of reactor equipment, refer to 10 CFR Part 110, Appendix A, Items (1)–(4).
(IW) denotes import of radioactive waste.
(XW) denotes export of radioactive waste.

Note: Data are current as of September 2022.

APPENDIX T

List of Some Major Uses of Radioisotopes in the United States

A radioisotope is an unstable isotope of an element that decays or disintegrates spontaneously, thereby emitting radiation. Approximately 5,000 natural and artificial radioisotopes have been identified. Radioisotopes come from three sources: from nature, such as radon in the air or radium in the soil; from machine-produced nuclear interactions in devices, such as linear accelerators and cyclotrons; or from nuclear reactors.

The licensing and regulation of radioisotopes in the United States are shared by the NRC, the U.S. Environmental Protection Agency (EPA), and many State governments. The EPA is also responsible for, among other things, setting air emission and drinking water standards for radionuclides. The States regulate radioactive substances that occur naturally or are produced by machines, such as linear accelerators or cyclotrons. The Food and Drug Administration (FDA) regulates the manufacture and use of linear accelerators; the States regulate their operation.

Americium-241
Used in many smoke detectors for homes and businesses; to measure levels of toxic lead in dried paint samples; to ensure uniform thickness in rolling processes like steel and paper production; and to help determine where oil wells should be drilled.

Cadmium-109
Used to analyze metal alloys for checking stock, scrap sorting.

Calcium-47
Important aid to biomedical researchers studying the cellular functions and bone formation in mammals.

Californium-252
Used to inspect airline luggage for hidden explosives, to gauge the moisture content of soil in the road construction and building industries, and to measure the moisture of materials stored in soils.

Carbon-14
Major research tool. Helps ensure potential new drugs are metabolized without forming harmful byproducts. Used in biological research, agriculture, pollution control, and archeology.

Cesium-137
Used to measure correct patient dosages of radioactive pharmaceuticals; to measure and control the liquid flow in oil pipelines; to tell researchers whether oil wells are plugged by sand; and to ensure the right fill level for packages of food, drugs, and other products. (The products in these packages do not become radioactive.)

Chromium-51
Used in research in red blood cell survival studies.

Cobalt-57
Used as a tracer to diagnose pernicious anemia.

Cobalt-60
Used to sterilize surgical instruments and to improve the safety and reliability of industrial fuel oil burners. Used in cancer treatment, food irradiation, gauges, and radiography.

Curium-244
Used in mining to analyze material excavated from pits and slurries from drilling operations.

Fluorine-18
Used for positron emission imaging in medical diagnosis.

Gallium-68
Used for positron emission imaging in medical diagnosis.

Iodine-123
Widely used to diagnose thyroid disorders and other metabolic disorders including brain function.

Iodine-125
Major diagnostic tool used in clinical tests and to diagnose thyroid disorders. Also used in biomedical research.

Iodine-129
Used to check some radioactivity counters at in vitro diagnostic testing laboratories.

Iodine-131
Used to treat thyroid disorders.

Iridium-192
Used to test the integrity of pipeline welds, boilers, and aircraft parts and in brachytherapy/tumor irradiation.

Iron-55
Used to analyze electroplating solutions and to detect the presence of sulphur in the air. Used in metabolism research.

Krypton-85
Used in indicator lights in appliances such as clothes washers and dryers, stereos, and coffee makers; to gauge the thickness of thin plastics and sheet metal, rubber, textiles, and paper; and to measure dust and pollutant levels.

Lutecium-177
Used as part of radiopharmaceuticals for treatment of cancer.

Nickel-63
Used to detect explosives, in voltage regulators and current surge protectors in electronic devices, and in electron capture detectors for gas chromatographs.

Phosphorus-32
Used in molecular biology and genetics research.

Phosphorus-33
Used in molecular biology and genetics research.

Plutonium-238
Has powered more than 20 NASA spacecraft since 1972. (The most common radioisotopes of plutonium are Pu-238, Pu-239, and Pu-240.)

Polonium-210
Reduces the static charge in production of photographic film and other materials.

Promethium-147
Used in electric blanket thermostats and to gauge the thickness of thin plastics, thin sheet metal, rubber, textiles, and paper.

Radium-226
Makes lighting rods more effective. (The most common isotopes of radium are Ra-226 and Ra-228. Radium-226 is part of the uranium decay series. Radium-228 and Ra-224 are part of the thorium decay series. All isotopes of radium are radioactive. Radium decays to produce radon gas.)

Selenium-75
Used in protein studies in life science research.

Sodium-24
Used to locate leaks in industrial pipe lines and in oil well studies.

Strontium-85
Used to study bone formation and metabolism.

Strontium-90
Used in survey meters by schools, the military, and emergency management authorities. Also used in cigarette manufacturing sensors and medical treatment.

Sulphur-35
Used in genetics and molecular biology research.

Technetium-99m
The most widely used radioactive pharmaceutical for diagnostic studies in nuclear medicine. Different chemical forms are used for brain, bone, liver, spleen, and kidney imaging and also for blood flow studies.

Thallium-201
Used in nuclear medicine for nuclear cardiology and tumor detection.

Thallium-204
Used to measure dust and pollutant levels on filter paper and to gauge the thickness of plastics, sheet metal, rubber, textiles, and paper.

Thorium-229
Helps fluorescent lights last longer.

Thorium-232
As thoriated tungsten, used in electric arc welding rods in construction, aircraft, petrochemical, and food processing equipment industries.

Thorium-230
Provides coloring and fluorescence in colored glazes and glassware.

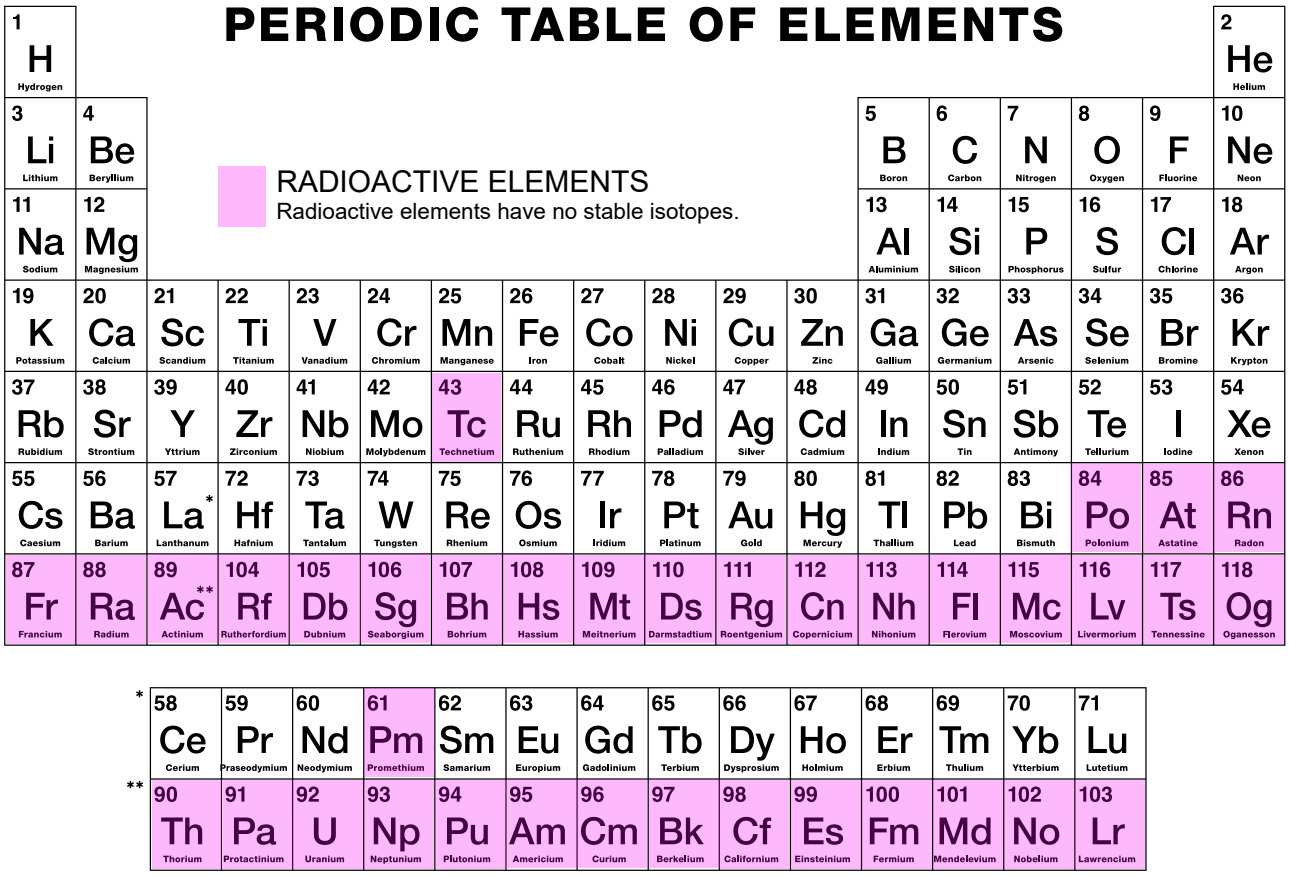
Tritium
Major tool for biomedical research. Used for life science and drug metabolism studies to ensure the safety of potential new drugs; for luminous exit signs; for luminous dials, gauges, and wrist watches; to produce luminous paint; and for geological prospecting and hydrology.

Uranium-235
Fuel for nuclear power plants and naval nuclear propulsion systems; previously used to produce fluorescent glassware, a variety of colored glazes, and wall tiles.

Xenon-133
Used in nuclear medicine for lung ventilation and blood flow studies.

Yttrium-90
Used as microsphere brachytherapy for treatment of liver cancers.

Source: NUREG/BR-0217, Revision 1, "The Regulation and Use of Radioisotopes in Today's World," April 2000.For more information visit the following web pages:
EPA at https://www.epa.gov/radiation/radionuclides
FDA at https://www.fda.gov radiation-emitting-products
National Nuclear Data Center at https://www.nndc.bnl.gov/



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There may be a supplementary document produced reflecting specific sections of the document.

11. ABSTRACT *(200 words or less)*

The U.S. Nuclear Regulatory Commission (NRC) has published the Information Digest annually since 1989. Beginning with this edition, the Digest will begin a 2-year publication cycle. The Digest provides information about agency activities and licensees from the various industries it regulates. It describes the agency's responsibilities and activities and provides general information on nuclear-related topics. The Information Digest includes NRC and industry data in an easy-to-read format. Infographics help explain the information with visual aids.

The 2022–2023 Information Digest includes NRC data and non-NRC data (e.g., International Atomic Energy Agency, Energy Information Administration, and U.S. Department of Energy), which were updated as of September 30, 2022, including data in maps and graphics. Beginning with this edition, the Digest provides QR codes to direct users to the most current information. The next Information Digest containing updated data will be published in February 2025.

The NRC reviews the information from industry and international sources but does not independently verify it. The NRC is the source of all photographs, graphics, and tables unless otherwise noted. All information is final unless otherwise noted. Any corrections and updates will appear in the digital version of the publication on the NRC Web site at https://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr1350/.

The NRC welcomes comments or suggestions on the Information Digest. To submit comments, write to the Office of Public Affairs at U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or at opa.resource@nrc.gov.

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