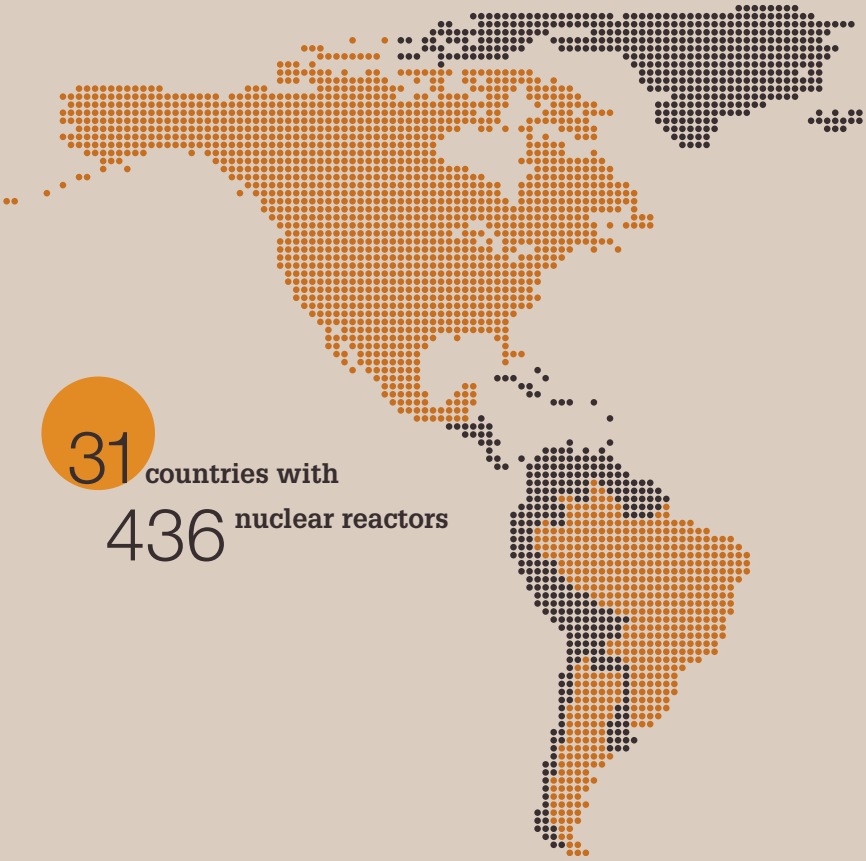
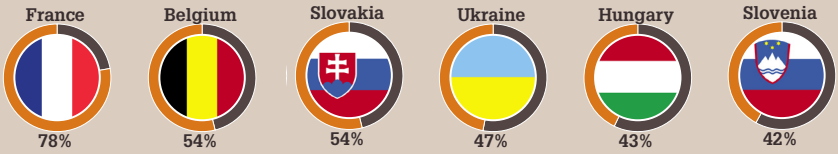
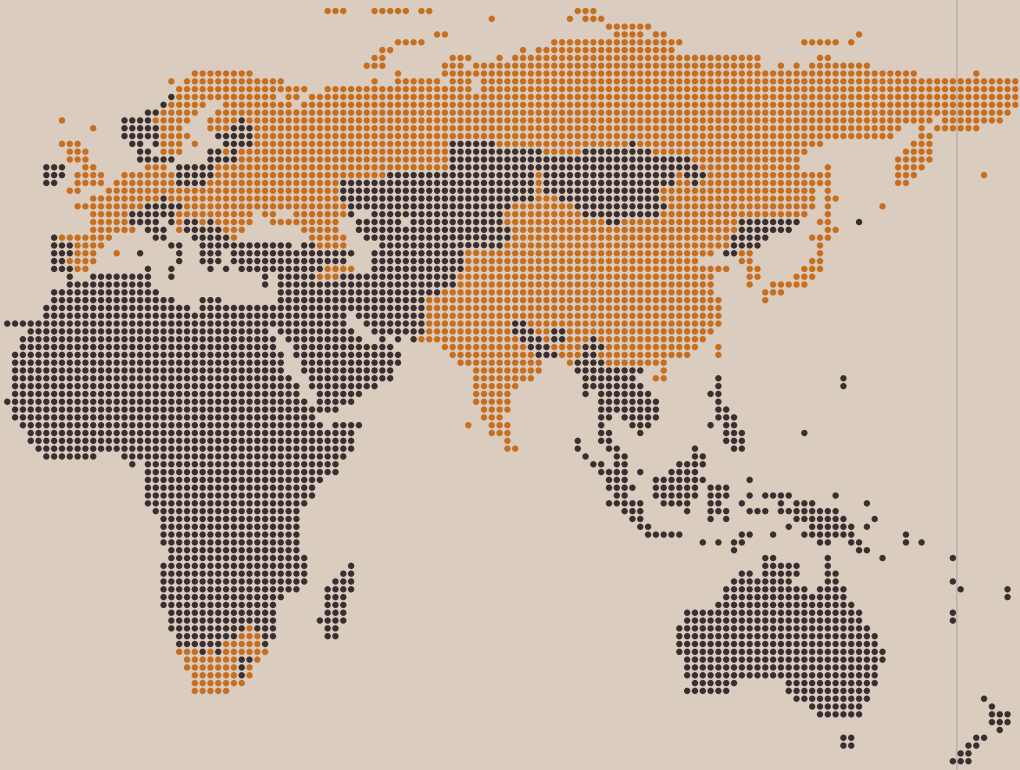
U.S. and Worldwide Nuclear Energy



31 countries with **436** nuclear reactors

Nuclear Share Generated





Switzerland

41%

Sweden

40%

Rep. Korea

35%

Bulgaria

33%

Spain

20%

U.S.A.

19%

U.S. Electricity Generated by Commercial Nuclear Power

As of May 2012, the 104 NRC-licensed nuclear reactors accounted for about 20 percent of U.S. net electric generation, providing 790 billion kilowatthours of electricity (see Figures 6 and 7).

Thirty-one of the 50 States generate electricity from nuclear power plants. Of these states, three (New Jersey, South Carolina, and Vermont) generated more than 50 percent of their electricity from nuclear power. In addition, 12 States generated 25 to 50 percent of their electricity from nuclear power. The data cited reflect the percentages of the total net generation in these States that were from nuclear sources (see Figure 8).

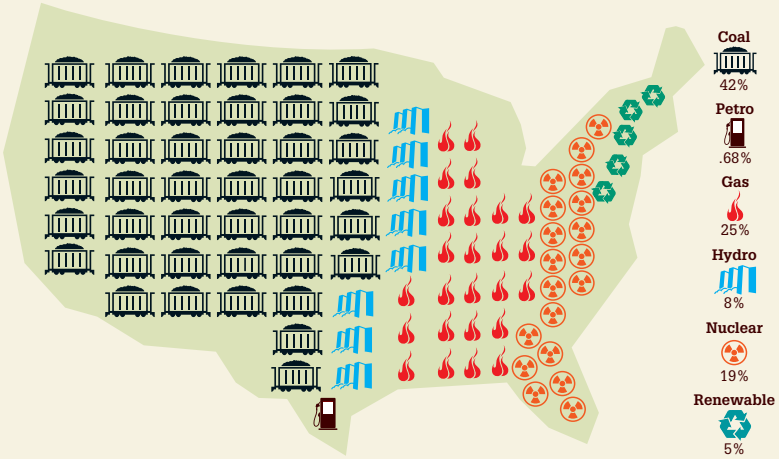
See Appendix L for the nuclear electricity generated by State.

Since the 1970s, the Nation's utilities have sought power uprates as a way to generate more electricity from existing nuclear plants. By January 2012, the NRC had approved 140 power uprates, resulting in a gain of approximately 6,194 megawatts electric (MWe) at existing plants. Collectively, these uprates have added the equivalent of six new reactors' worth of electrical generation at existing plants. Licensees responding to a December 2011 NRC survey indicated that they plan to submit 15 power uprate applications in the next 5 years. If these applications are approved, the resulting uprates would add another 1,160 MWe to the Nation's generating capacity (see Figure 9).

Worldwide Electricity Generated by Commercial Nuclear Power

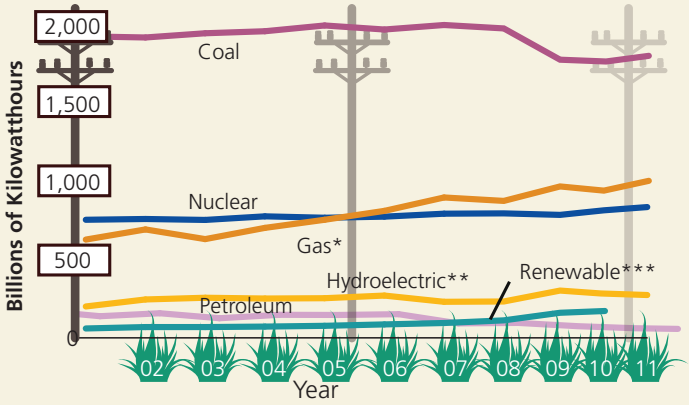
As of May 2012, there were 436 operating reactors (at least partially) in 31 countries with a total installed capacity of 370,499 megawatts electric (MWe) (see Figure 10). In addition, five nuclear power plants were in long-term shutdown, and 66 were under construction. Based on preliminary data in 2011, France had the highest nuclear portion (78 percent) of total domestic energy generated (see Figure 11).

Figure 6. U.S. Net Electric Generation by Energy Source, 2011



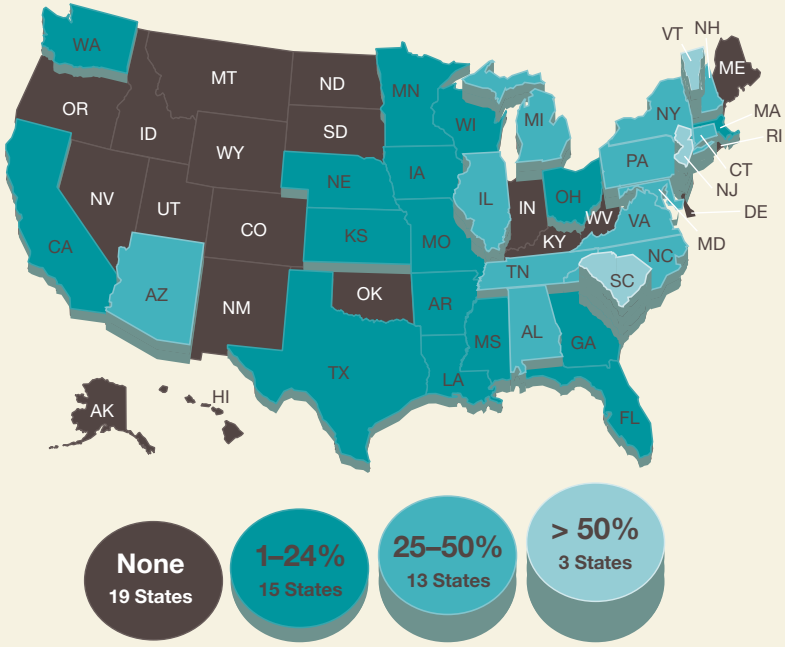
Source: DOE/EIA, May 2012, www.eia.doe.gov

Figure 7. U.S. Net Electric Generation by Energy Source, 2002–2011



* Gas includes natural gas, blast furnace gas, propane gas, and other manufactured and waste gases derived from fossil fuel.
** Hydroelectric includes conventional hydroelectric and hydroelectric pumped storage.
*** Renewable energy includes geothermal, wood and nonwood waste, wind, and solar energy.
Source: DOE/EIA, May 2012, www.eia.doe.gov

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



Source: DOE/EIA, "State Electricty Profiles," Data from May 2012, www.eia.doe.gov

Figure 9. Power Uprates: Past, Current, and Future

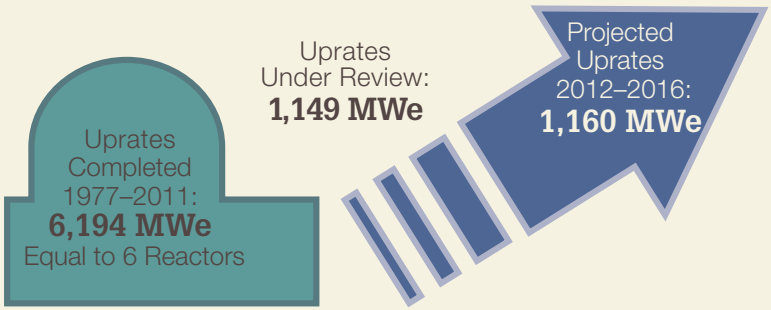
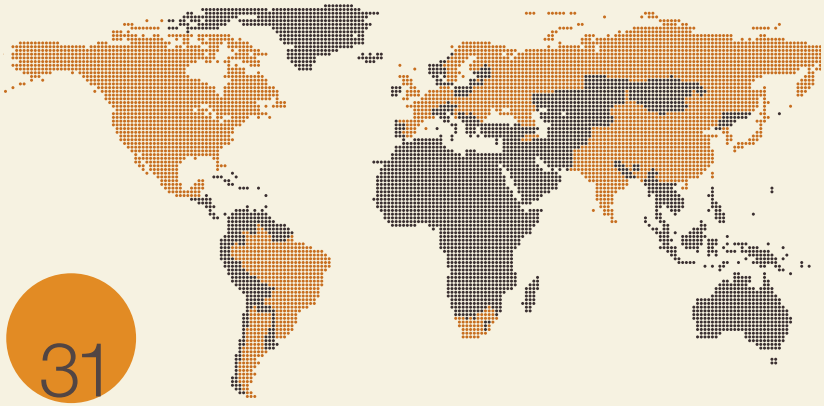
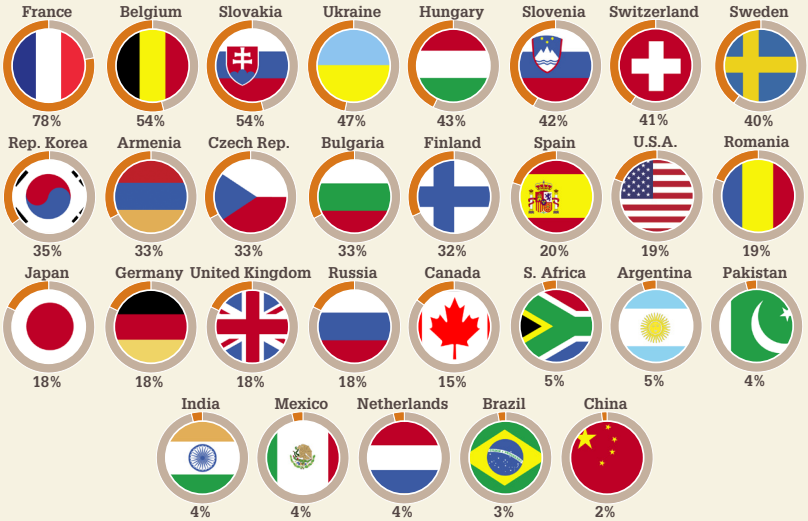


Figure 10. Operating Nuclear Power Plants Worldwide



Source: IAEA, Power Reactor Information System database, as of May 2012

Figure 11. Nuclear Share of Electricity Generated by Country, 2011



Note: The country's short-form name is used.
Source: IAEA, Power Reactor Information System database, as of May 2012

International Activities

The NRC performs certain legislatively mandated international duties. These include licensing the import and export of nuclear materials and equipment and participating in activities supporting U.S. Government compliance with international treaty and agreement obligations. The NRC has bilateral programs of assistance or cooperation with 42 countries, Taiwan, and the European Atomic Energy Community (see Figure 12).

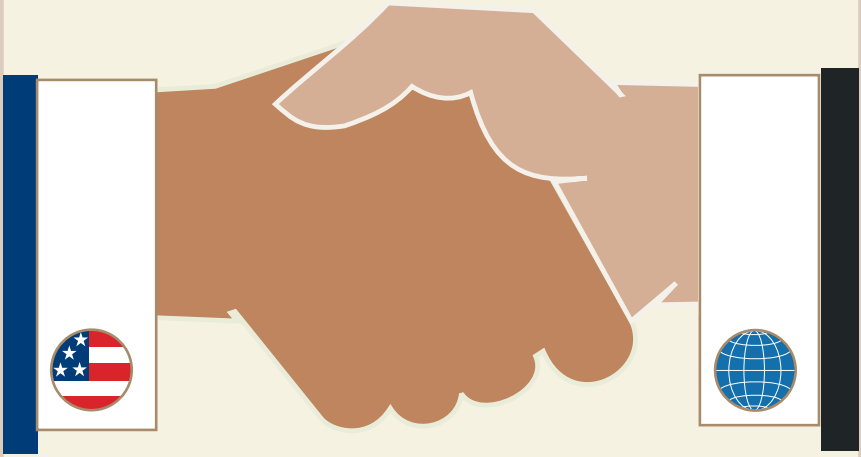
See Appendix S for the number of nuclear power reactors by nation and Appendix T for nuclear power units by reactor type, worldwide.

The NRC has supported U.S. Government nuclear safety initiatives with countries in Europe, Africa, Asia, and Latin America. In addition, the NRC actively cooperates with multinational organizations, such as the International Atomic Energy Agency (IAEA) and the Nuclear Energy Agency (NEA), a part of the Organization for Economic Co-operation and Development. The NRC also has a robust international cooperative research program.

Since its inception, the agency has hosted over 350 foreign nationals in on-the-job training assignments at NRC Headquarters and the regional offices. The NRC's Foreign Assignee Program helps instill regulatory awareness, capabilities, and commitments in exchanges with assignees from other countries. It also helps to enhance the regulatory expertise of both foreign assignees and NRC staff. Additionally, the program improves channels of communication through interaction with the international nuclear community and development of relationships with key personnel in foreign regulatory agencies. Through its export and import authority, the NRC upholds the U.S. Government goals of limiting the proliferation of materials that could be used in weapons, and supports the safe and secure use of civilian nuclear and radioactive materials worldwide. The NRC continues to work to strengthen the export and import regulations of nuclear equipment and materials and to improve communication between domestic and international stakeholders.

The NRC assists in implementing the U.S. Government's international nuclear policies through developing and implementing legal instruments that address nuclear nonproliferation, safety, international safeguards, physical protection, emergency notification and assistance, spent fuel and waste management, and liability.

Figure 12. Bilateral Information Exchange and Cooperation Agreements with the NRC



Agreement Country, Renewal Date		
Argentina, 2012	Germany, 2012	Poland, 2015
Armenia, 2012	Greece, 2013	Romania, 2016
Australia, 2013	Hungary, 2012	Russia*, 2001
Belgium, 2014	Indonesia, 2013	Slovakia, 2015
Brazil, 2014	Israel, 2016	Slovenia, 2015
Bulgaria*, 2011	Italy, 2015	South Africa, 2014
Canada, 2012	Japan, 2015	Spain, 2015
China, 2013	Kazakhstan, 2014	Sweden*, 2011
Croatia, 2013	Korea, Rep. of, 2015	Switzerland, 2012
Czech Republic, 2014	Lithuania, 2015	Thailand, 2012
Egypt, 1991	Mexico, 2012	Ukraine, 2016
EURATOM, 2014	Netherlands, 2013	United Arab Emirates, 2015
Finland*, 2011	Peru, Open-Ended	United Kingdom, 2013
France, 2013	Philippines, Open-Ended	Vietnam, 2013

Note: The country's short-form name is used. The NRC also provides support to the American Institute in Taiwan. Egypt's agreement has been deferred until its regulatory body requests reinstatement.

EURATOM—The European Atomic Energy Community

* In negotiation

The NRC participates in the negotiation and implementation of U.S. bilateral agreements for peaceful nuclear cooperation under Section 123 of the U.S. Atomic Energy Act of 1954, as amended. The NRC ensures licensee compliance with the U.S. Voluntary Safeguards Offer agreement and its additional protocol to the U.S.-IAEA Agreement for the Application of Safeguards in the United States.

The NRC also participates in a wide range of mutually beneficial international exchange programs that enhance the safety and security of peaceful nuclear activities worldwide. These low-cost, high-impact programs provide joint cooperative activities and assistance to other countries to develop and improve regulatory organizations. The NRC engages in the following activities:

- cooperates with countries with mature nuclear programs to ensure the timely exchange of applicable nuclear safety and security information relating to operating reactors and consults with these countries on new reactor-related activities;
- ensures prompt notification to foreign partners about U.S. safety issues, notifies NRC program offices about foreign safety issues, and shares security information with selected countries;
- initiates bilateral discussions in such regulatory areas as licensing, inspection, and enforcement with countries that have recently built facilities or have vendors of equipment that may be imported to the United States during the anticipated construction of new nuclear power plants;

Photo courtesy of IAEA

The NRC participates in the annual General International Conference for the IAEA in Vienna, Austria.

- participates in the Multinational Design Evaluation Program, which leverages the resources of interested regulatory authorities to review new designs of nuclear power reactors;
- participates in a variety of conventions, treaties, and other legal and political instruments that together make up the international nuclear regime. For example, the NRC participated in the Third Review Meeting of the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management in May 2012, and the Extraordinary Meeting of the Convention on Nuclear Safety, convened specifically to address followup to Fukushima-related issues, in August 2012. The NRC also provided technical and policy support to the U.S. delegation to the 2012 Preparatory Committee Meeting of the Nuclear Non-Proliferation Treaty;
- provides guidance about export and import licensing for nuclear materials and equipment published in 10 CFR Part 110, "Export and Import of Nuclear Equipment and Material"; the NRC continues its outreach to other countries on the Code of Conduct on the Safety and Security of Radioactive Sources and through bilateral meetings to ensure consistency in national regulatory approaches;
- assists other countries in developing and improving regulatory programs through training, workshops, peer review of regulatory documents, working group meetings, and exchanges of technical information and specialists;
- assists countries, through a pilot program begun in 2008, to ensure regulatory control over radioactive sources through development of standards and provision of training and workshops; in 2010, the program expanded to Latin America; and in 2011, outreach began to countries in Africa;
- participates in the programs of IAEA, NEA, and the European Union concerned with safety research and regulatory matters, radiation protection, risk assessment, emergency preparedness, waste management, transportation, safeguards, physical protection, security, standards development, training, technical assistance, and communications;
- participates in the International Nuclear Regulators Association meetings to influence and enhance nuclear safety. Association members are the most senior officials of well-established independent national nuclear regulatory organizations. Current members are Canada, France, Germany, Japan, Republic of Korea, Spain, Sweden, the United Kingdom, and the United States;

- meets, through the NRC's Advisory Committee on Reactor Safeguards (ACRS), with other international advisory committees through annual working group meetings and plenary meetings every 4 years to exchange information;
- participates in joint cooperative research programs through approximately 100 multilateral agreements with 30 countries and Taiwan to leverage access to foreign test facilities not otherwise available to the United States. Access to foreign test facilities expands the NRC's knowledge base and contributes to the efficient and effective use of the NRC's resources in conducting research on high-priority safety issues; and
- in October 2011, the NRC hosted an IAEA workshop on lessons learned from Integrated Regulatory Review Service (IRRS) missions, the purpose of which was for countries that have had IRRS missions to share experiences and insights to strengthen the IRRS process.

Immediately after the March 11, 2011, earthquake and tsunami in Japan, a team of subject matter experts on reactor safety, protective measures, and international relations from the NRC, the U.S. Department of Energy, and the U.S. Department of Health and Human Services traveled to Japan to help the Government of Japan assess and address the emergency at the Fukushima Dai-ichi nuclear power plant.

The NRC continues to maintain its longstanding relationship with its Japanese regulatory and other governmental and private sector counterparts. The agencies exchange technical information and lessons being learned as a result of the accident. Japanese counterparts include organizations such as the Nuclear and Industrial Safety Agency, the Japan Nuclear Energy Safety; Tokyo Electric Power Company; the Ministry of Economy, Trade and Industry; the Ministry of Education, Culture, Sports, Science and Technology; and the Ministry of Foreign Affairs.

In late 2011, the NRC ended its staff-level presence in Tokyo. The NRC Near-Term Task Force reviewed the events in Japan and has issued its findings and made recommendations for improvements to NRC requirements, programs, and processes. The Commission issued orders based on Task Force recommendations in March 2012. A steering committee will be established for the NRC and its Japanese regulatory counterpart to continue its information exchanges.

Figure 13. Actions in Response to the Japan Nuclear Accident: Timeline

March 11, 2011 (AM)

A magnitude 9.0 earthquake strikes near Honshu, Japan, generating an estimated 45-foot (14 meter) tsunami at the Fukushima Dai-ichi nuclear power plant.

Commission Public Meetings

The Commission briefs Congress and provides opportunities for citizens to be heard starting in March 2011.

April and May 2011

The NRC reports all U.S. nuclear power plants have appropriate post-9/11 emergency equipment and procedures in place.

September 2011

NRC resident inspectors begin examining U.S. nuclear fuel cycle facilities' plans and procedures for safely dealing with severe events.

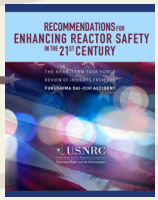
March 11, 2011 (PM)

The NRC staffs its Headquarters Operations Center on a 24/7 basis, first monitoring tsunami effects on the U.S. West Coast, and then supporting the U.S. response to the Japan nuclear accident until May 16th, 2011. The first of many reactor experts are sent to Japan as part of a USAID mission.

March 23, 2011

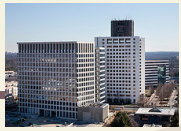
NRC resident inspectors begin reexamining post-9/11 emergency equipment and related items at U.S. nuclear power plants, in light of details from the Fukushima accident.

July 2011



The NRC's Near-Term Task Force issues its report on lessons learned from Fukushima.

Next Steps



Over the next months, the NRC takes numerous actions on the lessons learned to ensure appropriate enhancements are implemented.