



Entergy Nuclear Issue Brief

March 25, 2011

Impact on U.S. Operations

What lessons have been learned and what impacts are expected?

- Although much is still unknown about the causes of the emergency, there will be lessons learned from this tragic event. Applying those lessons is a hallmark of the nuclear industry. Obviously, the natural environment at the damaged nuclear site in Japan is very different from the environment at Entergy's nuclear plants. For one thing, Japan is more susceptible to frequent and intense earthquakes than other developed countries. While it is still early, it appears that the nuclear units' safety systems functioned properly after the initial effects of the earthquake in Japan. Reports suggest it was the overwhelming tsunami that severely damaged the plant's cooling capabilities and recovery efforts.
- All U.S. nuclear power plants are taking actions *now* at each of their sites to verify each company's capability to maintain safety even in the face of severe adverse events, including the loss of significant operational and safety systems due to natural events, fires, aircraft impact and explosions. The industry is verifying that the capability to withstand a total loss of electric power to a nuclear power plant will function even after extreme events. We also will verify our capability to withstand flooding and the impact of floods on systems inside and outside the plant.
- There have been no indications of any impact on the license renewal process for Pilgrim and Indian Point. The NRC issued the extension of the operating license for Vermont Yankee through March 21, 2032, as they announced on March 10. This license extension comes after five years of careful and extensive review and confirms Vermont Yankee is a safe, reliable source of electricity and capable of operating for another 20 years.
- When the immediacy of the situation in Japan has passed, Americans will still find that a diverse mix of energy including nuclear, which provides one fifth of our nation's electricity, will be needed in order to meet the energy needs of this country.
- Entergy understands and appreciates that these forces, natural and man-made, require constant vigilance and preparation for the unexpected by working to mitigate environmental, security, safety and mechanical risks, to name a few. Accordingly, the company will continue to monitor closely the situation in Japan, and lessons will be learned and translated to even greater safety and effectiveness to meet the challenges of the most adverse and unexpected events, creating stronger public confidence in U.S. nuclear programs.

Even while other countries have ordered their nuclear power plants to shut down in the wake of the Japan crisis until they can be determined to be safe, the U.S. NRC has said that it is confident that U.S. nuclear plants are safe and that there is no need to shut them down. However, events such as the Japan crisis often have lessons to offer that can help us improve our oversight and regulation of the country's nuclear power plants.

As President Obama said on March 17: *“Our nuclear power plants have undergone exhaustive study, and have been declared safe for any number of extreme contingencies. But when we see a crisis like the one in Japan, we have a responsibility to learn from this event, and to draw from those lessons to ensure the safety and security of our people. That’s why I’ve asked the Nuclear Regulatory Commission to do a comprehensive review of the safety of our domestic nuclear plants in light of the natural disaster that unfolded in Japan.”*

The U.S. nuclear industry, the U.S. Nuclear Regulatory Commission, the Institute of Nuclear Power Operations, the World Association of Nuclear Operators and other expert organizations in the United States and around the world will conduct detailed reviews of the accident and identify lessons learned (both in terms of plant operation and design). Those lessons learned will be incorporated into the design and operation of U.S. nuclear power plants. Risk management is an ongoing practice at Entergy, including mitigating environmental, security, safety and mechanical risks, to name a few. The company understands and appreciates that these forces, natural and man-made, require constant vigilance and preparation for the unexpected.

Accordingly, Entergy will continue to monitor closely the situation in Japan, and lessons will be translated to greater safety and effectiveness even in the most adverse and unexpected events. When we fully understand the facts surrounding the event in Japan, we will use those insights to make nuclear energy even safer. The result will be stronger public confidence in U.S. nuclear programs.

Industry Actions Already Underway

By mid-April, Entergy along with all other U.S. nuclear operators will perform several actions to review current safety conditions at all 104 nuclear reactors:

- Verify each plant's capability to manage major challenges, such as aircraft impacts and loss of large areas of the plant due to natural events, fires or explosions. Specific actions include testing and inspecting equipment required to mitigate events and verifying qualifications of operators and support staff who implement them are current.
- Verify each plant's capability to manage a total loss of off-site power. This will require verification that all required materials are adequate and properly staged, that procedures are in place, and operator training includes a focus on these extreme events.
- Verify capability to mitigate flooding and the impact of floods on systems inside and outside the plant. Specific actions include verifying required materials & equipment are properly located to protect them from flood.
- Perform walk-downs and inspection of important equipment needed to respond successfully to extreme events like fires and floods. This work will include analysis to identify any potential that equipment functions could be lost during seismic events appropriate for the site, and development of strategies to mitigate any potential vulnerabilities.

The NRC voted on March 23 to establish an agency task force of current senior managers and former NRC experts with relevant experience. In addition to a short-term review already underway and with public status meetings through the summer, a longer-term review should begin within 90 days and will inform any permanent NRC regulation changes determined as necessary. The NRC also will conduct seismic review in 2012 on 27 plants, including IPEC and River Bend, selected because they showed the largest increase in seismic risk from a 1980s-era U.S. Geological Survey study. The earthquake risk review is part of an assessment the NRC conducted and released last year using revised USGS data of seismic activity in the eastern and central U.S. The NRC is planning to send letters to plant operators late this year. The

expectation is this analysis would show where plants could improve what already is an acceptable response to seismic events, NRC officials explained.

What Lessons were Learned from Three Mile Island?

On March 28, 1979, a combination of equipment failure, inadequately designed instrumentation and the inability of plant operators to understand the reactor's condition culminated in an accident at Three Mile Island Unit 2 in Pennsylvania. The fuel was heavily damaged, but the plant's design features worked, and there were no adverse impacts on public health and safety. Although a small amount of radiation was released, no deaths, injuries or direct health effects were caused, according to over a dozen independent studies. However, Unit 2 of the plant was shut down permanently.

Lessons from TMI-2 transformed the nuclear industry into one of the safest in the nation.

- Improved equipment provides operators better tools to identify and correct equipment and operational problems.
- Improved training enables operators and engineers to prevent and address equipment issues before they become a potential safety concern.
- Simulator training enables the industry to train and test operators in emergency situations using real-life examples such as TMI-2.
- The industry formed emergency plans at nuclear power plants and improved communications with off-site local, state and federal responders.

TMI-1, which remained in operation, is now one of the best-performing plants in the country – recently completing a world-record-breaking 688 days of continuous operation for a pressurized water reactor.

What Lessons were Learned from Chernobyl?

On April 26, 1986, an accident occurred at Unit 4 of the nuclear power station at Chernobyl, Ukraine, in the former Soviet Union. The accident, caused by a sudden surge of power, destroyed the reactor and released massive amounts of radioactive material into the environment. The Chernobyl reactors are of the RBMK type: high-power, pressure-tube reactors, moderated with graphite and cooled with water. At the time of the Chernobyl accident there were 17 RBMKs in operation in the Soviet Union and two in Lithuania.

Pripyat, the town near Chernobyl where most of the workers at the plant lived before the 1986 accident, was evacuated several days after the accident, because of radiological contamination. It was included in the 30-km Exclusion Zone around the plant and remains closed to all but those with authorized access.

U.S. reactors have different designs and controls to protect them against the combination of lapses that led to the accident at Chernobyl. Although the NRC has always acknowledged the possibility of major accidents, its regulatory requirements provide adequate protection, subject to continuing vigilance, including review of new information that may suggest weaknesses.

An April 1989 report and other NRC analyses since then concluded that no changes were needed in the NRC's regulations regarding the design or operation of U.S. commercial nuclear reactors directly as a result of Chernobyl. The NRC recognizes that the Chernobyl experience should remain a valuable part of the information to be taken into account when dealing with reactor safety issues in the future.

Impacts Expected

Until we understand clearly what has occurred at the Fukushima Daiichi nuclear power plants, and any consequences, it is difficult to speculate about the long-term changes to the U.S. nuclear energy program.

Nuclear energy has been and will continue to be a key element in meeting America's energy needs. The nuclear industry sets the highest standards for safety. Through our focus on continuous learning, we will incorporate lessons learned from the events in Japan into existing operations and the ongoing process of designing, licensing and building new nuclear power plants.

Opinion surveys show that public confidence in nuclear energy in the United States is strong. It's too early to say whether or not the public's opinion will change. However, the nuclear industry has a solid safety record in this country, a robust regulatory infrastructure and a defense in depth that governs operations and designs.

New Nuclear Impact

New plants in the U.S. have not yet started safety-related construction. There is ample time to incorporate lessons learned from these events during the construction period.

Two companies have started site preparation and other construction activities for new nuclear power plants in Georgia and South Carolina, with the expectation that they will receive their combined construction-operating licenses from the Nuclear Regulatory Commission in late 2011 or early 2012. The industry expects those new reactor projects will proceed. Both projects use a light water reactor design with advanced safety features. For example, these reactors rely on natural forces like gravity (rather than engineered safety features like pumps) to deliver cooling water to the reactor core.

In addition, a number of companies are moving forward with design, licensing and eventual construction of small modular reactors, which also incorporate design features that provide additional safety margins. Although America's 104 nuclear power plants are safe and meet all requirements necessary to protect public health and safety, these new designs are even safer.

License Renewal Process

The NRC and the U.S. nuclear industry will thoroughly evaluate the Japanese experience and will apply the relevant lessons learned to all operating U.S. nuclear plants in a timely manner, including nuclear plants that have applied for or have renewed licenses. It is too early to speculate on how these events might affect any license renewal processes.