

Emergency Preparedness Near Nuclear Power Plants

January 2009

Key Facts

■ Federal law requires that energy companies develop and exercise sophisticated emergency response plans to protect public health and safety in the event of an accident at a nuclear power plant. The U.S. Nuclear Regulatory Commission approves these plans. In addition, the NRC coordinates approval of these plans with the U.S. Department of Homeland Security/Federal Emergency Management Agency's Radiological Emergency Preparedness Program (REPP), which has the lead role in emergency planning beyond the nuclear plant site. An approved emergency plan is required for the plant to maintain its federal operating license.

■ Every nuclear power plant is designed, constructed and managed to prevent radioactive releases, even in the event of natural disasters, operational accidents or terrorist acts. A variety of measures work together to protect public safety: the design and safety features built into the plant; the multiple layers of physical barriers that protect the reactor; and highly trained, federally certified professionals who operate the plant safely and know how to respond in the event of emergencies.

■ The U.S. Environmental Protection Agency and the NRC, with input from several other federal agencies, determined that a 10-mile emergency planning zone (EPZ) is appropriate to protect public health and safety in the event of an accident at a nuclear power plant. The federal task force also established a 50-mile zone to protect the public from exposure to radioactive materials through consumption of food, milk and water should such an event occur.

■ A nuclear plant's emergency planning zone must provide protective measures, such as sheltering, evacuation and consideration of distributing potassium iodide to communities within the 10-mile EPZ.

■ Each nuclear plant site must test its emergency plan every two years in a coordinated exercise with local and state government agencies. The NRC evaluates the performance of the company's plan. REPP evaluates the emergency plans of towns and cities near nuclear power plants. If the NRC or REPP has concerns about the adequacy of emergency preparedness, the NRC could suspend plant operation until these concerns are resolved.

■ Following the events of Sept. 11, 2001, the NRC issued new requirements and

guidance that focus in part on emergency preparedness at plant sites in response to terrorist threats. The industry has implemented these measures, which address such issues as on-site evacuation, public health and safety, public communications and emergency staffing, as well as procedures and plans in the specific context of a terrorist attack.

■ The White House Office of Science and Technology Policy (OSTP) concluded in January 2008 that distribution of potassium iodide in the region 10 to 20 miles from a nuclear power plant is unnecessary. Interdiction of any contaminated food and evacuation are more effective measures for protecting the public, OSTP said.

■ Several communities have used off-site nuclear plant emergency plans in response to other types of emergencies. For example, during the October 2007 wildfires in California, county emergency officials drew on relationships and communications links they had established during their years of planning for nuclear-related events.

Emergency Planning: A Prerequisite to Licensing

In 1980, Congress mandated that energy companies develop, and periodically test, a comprehensive emergency response plan for each nuclear power



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plant. The 1980 NRC Authorization Act strengthened and expanded the emergency preparedness requirements already imposed on nuclear plants.

In 2001, the NRC revised its emergency planning regulations for nuclear power reactors to provide states the option to use potassium iodide (KI) tablets as a secondary protective measure for the public.¹ KI would supplement evacuation and sheltering in the unlikely event of a nuclear power reactor accident. If taken within several hours of exposure to radioactive iodine, KI can protect the thyroid gland. KI does not protect any other part of the body, nor does it protect against any other radioactive element.

Emergency response plans have a very broad reach, involving at least 200 people at each nuclear power plant. Local, state and NRC officials also are included in the company's plan and participate in periodic exercises to demonstrate the plan's viability.

No U.S. nuclear power plant can operate without an approved and tested emergency response plan. REPP must review and provide a recommendation to the NRC regarding the reasonable assurance that state and local emergency response plans can protect public health and safety.

Emergency Response Plans Put to the Test

All U.S. nuclear plants must participate in reviewed, full-scale emergency exercises every two years. For each exercise, the utility creates a confidential emergency scenario for use by plant staff and local emergency response organizations, including law enforcement, local hospitals, radiological monitoring teams and others. Post-exercise critiques by the federal agencies and exercise participants identify areas for correction in future exercises or any improvements needed in the plan itself.

The NRC also requires that plants conduct training drills in alternate years to test their emergency response capabilities for dealing with a range of events. State and local emergency management officials often participate in these drills. Since the drills are not graded, the NRC permits supervised instruction and resolution of the drill scenarios' problems. NRC inspectors at the plants often observe the drills. After the drills, plant officials incorporate lessons learned and corrective actions into the emergency response plan.

NRC headquarters and regional staff participate in at least one emergency exercise per year in each of the four regions. The agency's emergency response facility and teams are critiqued on their responses to the simulated emergency.

Companies frequently conduct unannounced drills of various aspects of their nuclear plants' response plans to develop and maintain key skills, including coordination, communications, assessment of emergency medical and fire brigade response, and radiation dose assessment. Each company also must provide initial training and annual retraining of everyone with emergency response duties.

The nuclear energy industry and the NRC have enhanced integration of a security-threat response into the emergency preparedness drills performed every other year at nuclear power plants.

Extensive testing of emergency plans maintains a continual state of readiness, upgrades emergency preparedness based on lessons learned from drills and exercises, and demonstrates coordination among all parties to ensure an integrated and effective response to any emergency.

Federal Agencies Set Emergency Plan Zones

EPA, the NRC and other federal agencies developed the planning basis for a radiological emergency preparedness program in 1978.

The Federal Radiological Preparedness Coordinating Committee—chaired by the director of the DHS sector-specific agency—uses these planning tools to coordinate all federal responsibilities for assisting state and local governments in radiological emergency planning and preparedness activities.

¹ U.S. Nuclear Regulatory Commission final rule, "Consideration of Potassium Iodide in Emergency Plans" (66 *Federal Register* 5427, Jan. 19, 2001).

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This multi-agency federal task force determined that a 10-mile radius encompassing a nuclear power facility is an appropriate EPZ in the event of a release of radioactive material from the reactor. The projected radiation doses that would result from most hypothetical reactor accidents would not be a threat to public health and safety beyond the 10-mile zone, the task force concluded.

The task force also established a 50-mile zone to limit public exposure to radioactive materials through consumption of contaminated water, milk or foods.

Evacuation and/or sheltering, and consideration of distributing KI, are required only for those residents within the 10-mile EPZ, according to federal protective action guidelines.

Although unlikely, a serious reactor accident likely would evolve over a period of several hours, thus providing time for orderly evacuation or sheltering, if necessary, in the 10-mile EPZ.

Each year, the companies that operate nuclear plants provide residents within the 10-mile EPZ with information explaining radiation and telling them measures to take in the event of an emergency.

KI Unnecessary Beyond 10 Miles of a Plant

In 2002, Congress passed a law to make available to state and local governments enough KI tablets for stockpiling and distribution to the population within 20 miles of a nuclear

power plant. However, the law permits the government to waive the KI program if it finds a more effective way to protect the public from potential exposure to radioactive iodine.

The National Academy of Sciences recognized that sound science and public policy did not support widespread distribution of KI.

In January 2008, OSTP issued a “decision memorandum” stating that distribution of KI in the region 10 to 20 miles from a nuclear power plant is unnecessary. “I have determined that a more effective preventive measure does exist for the extended zone covered by the Act, namely avoidance of exposure altogether through evacuation of the potentially affected population and interdiction of contaminated food,” wrote OSTP Director John Marburger.

OSTP’s decision is entirely independent of the likelihood of an accident that could produce radioactive iodine concentrations of concern beyond the 10-mile EPZ. However, Marburger noted that the likelihood of such a situation arising is on the order of one in a million to one in 10 million.

He also said the type of event that could release radioactive iodine would release other radioisotopes as well. “Evacuation and interdiction of contaminated food products are the preferred actions to prevent exposures to these other radionuclides, and will have to be

taken in response to such an event in any case.”

Emergency Response Highly Coordinated

In the event of an emergency, the company operating the nuclear facility classifies the event; notifies local, state and federal emergency response organizations; and provides protective-action recommendations. Nuclear power plants are enhancing their emergency plans to address situations that may arise in the context of a “hostile action,” as defined by the NRC.

Local and state emergency response organizations confirm the severity of the event and determine the protective action guides for residents within 10 miles. If necessary, protective actions can be provided beyond 10 miles. These protective actions could be a combination of evacuation, sheltering and, in some cases, the use of KI tablets.

Local and state authorities also have responsibility for providing information about protective measures to those in the EPZ. These authorities must be able to activate notification systems within 15 minutes of learning about a situation requiring action.

The NRC provides guidelines for classifying incidents at nuclear plants based on their potential severity, ranging from “notification of unusual event” (no emergency-plan activation needed) to “alert,” “site area emergency” and “general emergency.”

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- A notification of unusual event, the lowest classification, means that a minor plant event—either an operational event or security threat—has occurred, but no radiation release has occurred.
- An alert means that there is an actual or potential reduction in the plant's safety level or a security event that could threaten site personnel or damage plant equipment.²
- A site area emergency suggests a more serious event. Major safety equipment either has failed or is deemed likely to fail.
- A general emergency is the most serious event. In this instance, radiation may leak outside the plant and beyond the plant boundary.

Nuclear power plants have detailed guidelines for determining when to declare each of the event classifications. The nuclear industry is enhancing its guidelines and emergency preparedness programs to incorporate a broader range of potential activities involving hostile action. For such events, the criteria are stricter than for operational events—that is, the plant may declare an alert in the case of hostile action, even though all equipment and systems are operating normally.

² Under the U.S. Department of Homeland Security's National Response Plan, a nuclear plant security event classified at the alert level or higher is an incident of national significance. Federal resources may be made available to assist with emergency response if state and local resources are overwhelmed.

Any type of nuclear plant event is rare. In 2007, the industry recorded 13 notifications of unusual events and six alerts.

Experience With Emergency Plans

There has never been the need to activate a nuclear plant emergency preparedness plan to deal with a radiological event. However, local officials have successfully used emergency response plans developed by the nuclear industry in responding to non-nuclear emergencies. All the evacuations were carried out safely.

Three examples:

- In October 2007, wildfires ravaged 380,000 acres of California, causing more than \$1 billion in damage. Fire destroyed 1,300 homes and prompted the evacuation of 300,000 people in various parts of the state. Emergency responders in the communities around the San Onofre nuclear power plant drew on the relationships and communications links established through their experience in nuclear plant emergency preparedness.
- The evacuation of 10,000 people from Cedar Rapids, Iowa, in 1985, following a fire at a city-operated sewage treatment plant that dispersed a cloud of toxic fumes over the city. State and local officials used a draft plan developed for the Duane Arnold nuclear plant.
- The evacuation of 17,000 residents of St. Charles

Parish, La., following a leak from a nearby chemical plant in December 1982. State and local officials worked from a draft plan for Entergy's Waterford 3 nuclear plant, which was not yet operating.

Coordination, Practice Key to Effectiveness

A 2004 study of large-scale evacuations found that they are "very effective and successfully save lives and reduce the potential number of injuries associated with the hazard." The finding held true whether the evacuations were planned or ad hoc.³

The study found that close coordination among emergency response entities is an "overwhelming factor" contributing to the success of an evacuation.

Sandia National Laboratories conducted the study for the NRC. Starting with a sample of 230 large-scale evacuations between 1990 and 2003, Sandia selected 50 for detailed case studies. The resulting 50-case sample included five evacuations of more than 100,000 people, ranging from 270,000 to 666,000, both for hurricanes. One of the five was the Sept. 11, 2001, evacuation of lower Manhattan after the attack on the World Trade Center. The 50 detailed case studies also included 33 evacuations dealing with technologi-

³ "Identification and Analysis of Factors Affecting Emergency Evacuations," NUREG/CR-6864, Vol. 1; SAND2004-5901, U.S. Nuclear Regulatory Commission, January 2005.

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cal hazards. No radiological-related evacuations occurred during the time frame covered by the study.

The study found that close coordination among emergency responders, training and exercises contribute to the effectiveness of evacuations. All 50 communities provided training to their emergency response personnel; 40 percent conducted full-scale exercises.

Industry Commitment To Preparedness

Emergency preparedness at U.S. nuclear power plants is an integral part of daily operations. A commitment to excellence throughout the industry, coupled with continual training and testing, has produced a high level of preparedness.

For example:

- Emergency response plans are upgraded constantly through lessons learned from actual plan activations, as well as repeated drills, exercises and critiques.
- Following the events of Sept. 11, 2001, the industry has taken a wide range of steps to assess emergency preparedness programs. These include an industry-wide review of management oversight of plant programs and communications approaches. Emergency responders apply lessons learned to strengthen emergency preparedness.
- Training programs are conducted annually for all emergency response person-

nel. The National Nuclear Accrediting Board accredits training programs for operators and technical staff who use emergency operating procedures.

- Nuclear companies have built emergency response facilities and upgraded existing facilities to aid in effective handling of emergencies.

Advancements in communications technology have improved the ability to notify appropriate plant employees, emergency response personnel and the public if an event were to occur.

The nuclear industry supports state and local off-site emergency readiness by funding, in part, emergency response personnel, development of plans and procedures, facilities, equipment, training, and participation in drills and exercises.

In 2008, the industry paid \$30 million to the Department of Homeland Security for radiological emergency preparedness.

This fact sheet also is available at www.nei.org.