

Nuclear Failure

General

Following the Three Mile Island accident in 1979, the Nuclear Regulatory Commission (NRC) reexamined the role of emergency planning for protection of the public in the vicinity of nuclear power plants. The NRC issued regulations requiring that before a plant could be licensed to operate, the NRC must have “reasonable assurance that adequate protective measures can and will be taken in the event of a radiological emergency.” The regulations set forth 16 emergency planning standards and define the responsibilities of licensee, and state and local organizations involved in emergency response. The added feature of emergency planning to the NRC’s “defense-in-depth” philosophy provides that, even in the unlikely event of a release of radioactive materials to the environment, there is reasonable assurance that actions can be taken to protect the population around nuclear power plants.

Through a Memorandum of Understanding (MOU), the Nuclear Regulatory Commission (NRC) and FEMA share federal oversight for radiological emergency response planning matters for licensed nuclear power plants. It is such that their mutual efforts will be directed toward more effective plans and related preparedness measures at and in the vicinity of nuclear reactors and fuel cycle facilities. The Memorandum of Understanding between the agencies was signed on January 14, 1980 in response to the president’s decision of December 7, 1979, stating that FEMA: coordinates all federal planning for the *off-site* impact of radiological emergencies; take the lead for assessing *off-site* radiological emergency response plans and preparedness; makes findings and determinations as to the adequacy and capability of implementing *off-site* plans; and communicates those findings and determinations to the NRC. The NRC reviews those FEMA findings and determinations in conjunction with the NRC *on-site* findings to determine the overall state of emergency preparedness.

A separate MOU, dated October 22, 1980, deals with NRC and FEMA cooperation and responsibilities in response to an actual or potential radiological emergency. Operations Response Procedures have been developed that implement the provisions of the Incident Response MOU. These documents are intended to be consistent with the Federal Radiological Emergency Response Plan, which describes the relationships, roles, and responsibilities of federal agencies for responding to accidents involving peacetime nuclear emergencies.¹

Regulations

For planning purposes, FEMA and the NRC have defined the plume exposure pathway emergency planning zone (EPZ) – also known as an “at risk area” – consisting of an area about 10 miles in radius, and an ingestion pathway EPZ about 50 miles in radius around each nuclear power plant. EPZ size and configuration may vary in relation to local emergency response needs and capabilities as affected by such conditions as demography, topography, land characteristics, access routes, evacuation routes, and jurisdictional boundaries.

¹ Nuclear Regulatory Commission; www.nrc.gov

Counties within the ingestion exposure pathway are considered “support counties.” FEMA and the NRC’s requirements for emergency planning are contained in Title 10 of the Code of Federal Regulations, Part 50.47 and cover the following topics:

- assignment of responsibility;
- emergency response support and resources;
- notification methods and procedures;
- public education and information;
- accident assessment;
- radiological exposure control;
- recovery and reentry planning and post-accident operations;
- responsibility for the planning effort;
- development, periodic review and distribution of emergency plans;
- on-site emergency organization;
- emergency classification system;
- emergency communications;
- emergency facility and equipment;
- protective response;
- medical and public health support;
- exercises and drills; and
- radiological emergency response training.

The Pennsylvania Emergency Management Agency (PEMA), in conjunction with the Commonwealth’s risk counties — which includes Perry — has identified the specific EPZ around each of the five nuclear power plants in Pennsylvania. As such, there are on-site and off-site Radiological Emergency Response Plans for each power plant. Each plant owner is required to exercise its emergency plan with off-site authorities at least once every two years to ensure state and local officials remain proficient in implementing the plan.

History

Pennsylvania is home to the worst nuclear facility accident in the history of the nation. Although it did not occur in Perry County, the effects of it were felt nationwide. After the accident at Three Mile Island, state, county, and municipal entities designed plans for handling future accidents so that safety could be assured for all residents. However, many “unusual events” and “alerts” occur every year at the nuclear facilities across the nation. These are events that require the notification of the local emergency managers.



**Table C.13
Emergency Classification Levels**

Notification of Unusual Event	This is the least serious of the four levels. The event poses no threat to you or plant employees, but emergency officials are notified. No action by the public is necessary.
Alert	An alert is declared when an event has occurred that could reduce the plant’s level of

	safety, but backup systems still work. Emergency agencies are notified and kept informed, but no action by the public is necessary.
Site Area Emergency	A Site Area Emergency is declared when an event involving major problems with the plant's safety systems has progressed to the point that a release of some radioactivity into the air or water is possible, but is not expected to exceed Environmental Protection Agency Protective Action Guidelines (PAGs) beyond the site boundary. Thus, no action by the public is necessary.
General Emergency	This is the most serious of the four classifications and is declared when an event at the plant has caused a loss of safety systems. If such an event occurs, radiation could be released that would travel beyond the site boundary. State and local authorities will take action to protect the residents living near the plant. The alert and notification system will be sounded.

Source: U.S. Nuclear Regulatory Commission (NRC)

Vulnerability

As seen below, there are three different types of nuclear accidents: criticality, loss of coolant, and loss of containment.

**Table C.14
Nuclear Accident Categories**

Criticality	Accidents that involve a loss of control of nuclear assemblies or power reactors
Loss-of-Coolant	Accidents that involve a reactor coolant system experiencing a break or opening large enough so that the coolant inventory in the system cannot be maintained by the normally operating makeup system
Loss-of-Containment	Accidents that involves the release of radioactivity and have involved materials such as tritium, fission products, plutonium, and natural, depleted, or enriched uranium

Source: U.S. Nuclear Regulatory Commission (NRC)

In the wake of an accident, the primary nuclear exposure for the immediate area around a nuclear power plant can last from hours to months. The health of the citizens in the surrounding area is the primary immediate concern; next, is the long-term impact on the environment. Livestock, livestock by-products, and crops can be contaminated for many years after a nuclear incident. The health effects reported from the psychological stress of individuals living in the immediate area will strain stress management and disaster psychology resources to the limit.

The closest nuclear facility to Perry County is Three Mile Island nuclear power plant, located approximately 42 miles southeast of New Bloomfield in Londonderry Township. Three Mile Island nuclear power plant is a 816-megawatt facility Exelon and operated by AmerGen Energy Company.² Perry County is located within the 50-mile ingestion zone radius for this facility.

If an accident should occur, state agencies would sample milk, livestock feed and forage, crops, and farm water supplies within the ingestion exposure pathway.

The possibility of a radiation release from a nuclear power plant of sufficient quantity to constitute a threat to the safety of the public is remote given all the safety precautions and regulations in effect. Regardless of how remote it may be, the probability of such an event must be considered in developing an overall hazard vulnerability analysis for Perry County.

² Energy Information Administration; www.eia.doc.gov

While Perry county is not considered a Host county for persons evacuated from the risk area around the Three Mile Island Facility, it is expected that a certain number of evacuees would come to Perry County to live with friends and relatives, or may own property in Perry County.

Probability

Pennsylvania is home to the only nuclear power plant in the United States to have reached the emergency classification level of “General Emergency.” Since the 1979 accident at the Three Mile Island nuclear power plant, nuclear power has become one of the safest and most heavily regulated industries in the nation. The frequency of nuclear accidents in the United States is extremely low, with a frequency of occurrence approximately once every 30 years or less. Likewise, the likelihood of another incident at Three Mile Island is low.

Maximum Threat

The effects and impacts of a nuclear threat depend on the type of radiation released, the duration of the release, the volume of the release, and the existing weather conditions, such as wind speed and direction. Since Perry County is located well outside the 10-mile “at-risk area” for the Three Mile Island facility, the risk associated with a Three Mile Island incident is dramatically lessened. Should a nuclear incident occur; the greatest threat and highest impact would be to the health and safety of the citizens. Additionally, the potential exists for catastrophic impacts on property, facilities, infrastructure, essential services, the environment, and the County’s economy. Dense population areas and outlying residential areas could experience the greatest impact as a result of radiation ingestion.

Secondary Effects

Power failure is the most common secondary effect of a nuclear incident. More serious secondary effects would include public health emergencies, resulting from widespread radionuclide ingestion and/or radiation fallout.

Radionuclide contamination could have lasting impacts on structures, facilities, and infrastructure in the affected areas, primarily in urban and residential areas. Radionuclide ingestion by domesticated farm animals could force agricultural product embargos, placing severe strain on the economy. Radiological particulate contamination of the environment could impact natural resources, disrupt service delivery, and cause work cessation and evacuations. Other response measures that result from the event could damage the local economy.