



# RADIOLOGICAL EMERGENCY

## CITIZEN AND MEDIA BOOKLET



# INTRODUCTION

The U.S. Department of Energy estimates 20 percent of the electricity produced in the U.S. comes from nuclear energy created at nuclear power plants. The Midwest is home to 26 different nuclear power plants, four of which are located in close proximity to northern Indiana. Although the likelihood of a radiological emergency situation from any of these four power plants is highly unlikely, it is still something for which the state of Indiana must actively prepare.

This booklet is intended to act as a resource to media and citizens who need to quickly understand common terms and what may happen in a radiological emergency.



# EMERGENCY CLASSIFICATION SYSTEM

The Emergency Classification System is a standard emergency alert system distributed by nuclear power plant operators to notify the public that something unusual is happening at the power plant. The system is designed for a rapid and coordinated local, state and federal response. The agency that responds to the emergency alert system will depend on the type of emergency situation that is occurring. There are four different emergency classification “levels.”

Notification of Unusual Event (Lowest Severity)

Alert

Site Area Emergency

General Emergency (Highest Severity)

## Notification of Unusual Event (Lowest Severity)

A Notification of Unusual Event (NOUE) can be triggered by any problem within the plant that potentially could lead to a decrease in safety. In this emergency level, no releases of radioactive material requiring offsite response or monitoring are expected, and the situation does not pose any threat to public safety.

### Alert

An Alert emergency level is triggered by any type of event that causes a reduction in plant safety. A radiation release from the power plant is possible, but only in small amounts that are within the U.S. Environmental Protection Agency (EPA) protection action guideline exposure levels. Alerts are not considered a threat to the public, although state agencies are able to choose what precautionary actions should be taken (i.e. activation of Emergency Operations Center).

#### Some examples of Unusual Events:

- Some leakage of reactor coolant water
- The loss of off-site power for more than 15 minutes
- On-site or off-site communications equipment becoming unavailable

#### Some examples of Alerts:

- An on-site fire that could potentially cause failure of plant safety systems
- Natural or man-made events that threaten the stability of vital plant equipment
- Radiation levels becoming high in certain areas of the plant, which causes an unsafe environment for plant operators



## Site Area Emergency

Site Area Emergencies (SAE) are triggered when events that cause a serious safety condition occur at the plant. In this emergency level, a radiation release is possible, but it is not expected to exceed the U.S. EPA protective action guideline exposure levels or leave the boundaries of the plant itself. The purpose of a Site Area Emergency is to adequately staff emergency response centers and to ensure the public is prepared if the situation worsens.

### Some examples of Site Area Emergencies:

- The reactor losing large amounts of cooling water
- The actual or potential loss of two of three power plant safety barriers
- Power plant security becomes compromised

## General Emergency (Highest Severity)

A General Emergency (GE) is the highest emergency level, and is triggered when the reactor core becomes or is expected to become damaged. During General Emergencies, radiation release is expected to be above the U.S. EPA protective guidelines, and exposure levels are expected to go beyond plant boundaries. Members of the public living within a 50 mile radius of the power plant will immediately be notified and provided with protective action information.

### Some examples of General Emergencies:

- Plant operators have lost control of the facility
- Two of three safety barriers have been lost, and the third barrier is expected to be lost
- The reactor core has experienced severe damage

# POWER PLANT CONTAINMENT BARRIERS

Nuclear power plants have three different containment barriers to keep the fuel and radiation from entering the environment and harming the public. Although there are only three major barriers, each is designed with a number of fail safes and redundancies that allow operators to address any small issues that might arise. The likelihood of one of these containment barriers failing is minimal, meaning the likelihood of all three containment barriers failing at the same time is highly unlikely to occur.

1st Barrier: Fuel Cladding

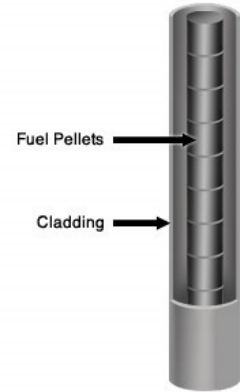
2nd Barrier: Reactor Coolant System and Pressure Vessel

3rd Barrier: Reactor Containment Building



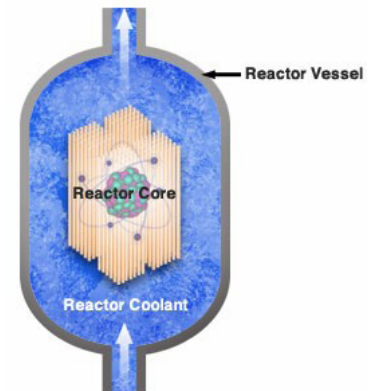
## 1st Barrier: Fuel Cladding

Reactors use “pellets” of nuclear fuel for power. These pellets are contained inside fuel rods. Each fuel rod is approximately 12 feet long and is encased inside a metal tube called a fuel cladding. The fuel cladding prevents the nuclear material from escaping into the reactor cooling water.



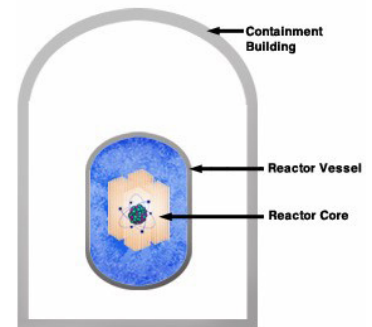
## 2nd Barrier: Reactor Coolant System and Pressure Vessel

The reactor coolant system uses pressurized water to cool the reactor core and keep the system from overheating. The reactor core and coolant water is stored inside a cylindrical steel casing called the reactor pressure vessel. The reactor pressure vessel's walls are thick enough to withstand the pressure from the reactor water. If one of the fuel claddings were to fail, the reactor pressure vessel will contain the nuclear materials that leak from the failed cladding.



## 3rd Barrier: Reactor Containment Building

The reactor containment building is a high-density, reinforced concrete dome that houses the reactor pressure vessel. These structures are designed to withstand severe accidents (e.g., vehicle collisions), natural disasters (e.g., tornados) and man-made disasters. If the fuel cladding and reactor pressure vessel containments were to both fail, the reactor containment building will prevent most of the radiation from escaping into the atmosphere.



# EVACUATION VS. RELOCATION

During a General Emergency, citizens living within a 50 mile radius of the affected power plant will be given specific instructions to evacuate or relocate to an area that will keep them safe from harmful radiation exposure. Local or state officials will make the decision to evacuate or relocate citizens.

## Evacuation

**Evacuation** is a protection strategy that moves citizens away from an actual or potential hazard, and involves a sense of urgency to protect the lives and health of those in the area. During times of evacuation, an Evacuation Time Estimate (ETE) is used to determine the time required for citizens to be safely evacuated from the area determined to be the evacuation zone.

## Relocation

**Relocation** is when citizens need to be moved out of an area for a length of time in order to avoid chronic radiation exposure. While this process allows for more packing and preparation time than evacuation, following the instructions of public safety officials is important.



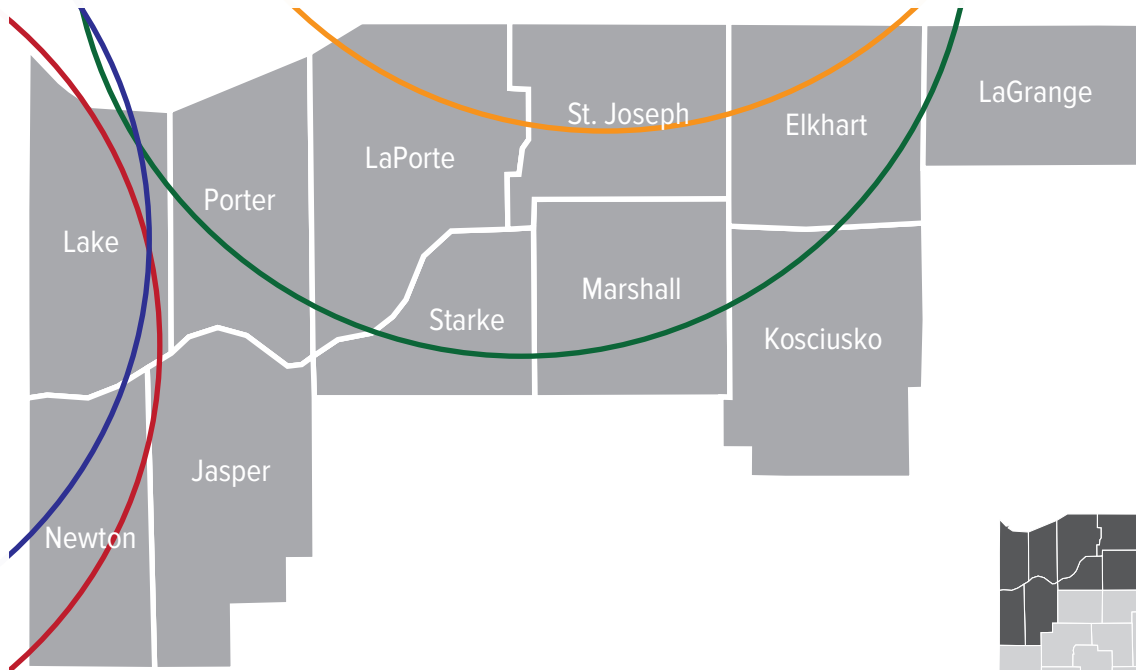
## INGESTION PATHWAY ZONE





During a General Emergency situation, land within a 50 mile circle of the plant is known as the Ingestion Pathway Zone. Following a large-scale incident, experts anticipate that food and water found outdoors within this area may become contaminated with radioactive material. Any food or water found outdoors within the Ingestion Pathway Zone should not be consumed, as it may be a threat to the health and safety of the general public. Wild game that is hunted in the Ingestion Pathway zone during the events of a General Emergency should not be consumed, as there is a possibility it could be contaminated with radiation.

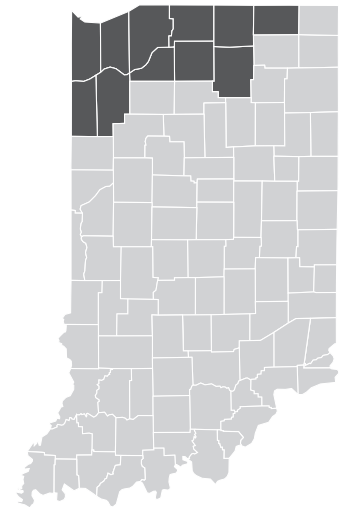
Following an incident, radiation and food specialists will work to test food, water and other items that may have been impacted. As these specialists learn more, they will work with local and state officials to provide additional safety instructions to citizens.

## There are **11** Indiana counties that are in an Ingestion Pathway Zone:

- Elkhart
- Jasper
- Kosciusko
- LaGrange
- Lake
- LaPorte
- Marshall
- Newton
- Porter
- St. Joseph
- Starke



-  Braidwood Nuclear Generating Station
-  Dresden Nuclear Generating Station
-  DC Cook Nuclear Plant
-  Palisades Nuclear Plant



## FREQUENTLY ASKED QUESTIONS

What is the difference between radiation contamination and radiation exposure?

**Radiation contamination** is when an object or person has radioactive particles on or inside their body. An object or person's body can be decontaminated by removing all clothing and washing with soap and water. **Radiation exposure** is when a person's body absorbs radiation. Exposure stops when a person leaves the area of the radiation source.

How can exposure to radiation be minimized?

An individual can reduce his/her exposure to radiation by spending less time around radiation sources, keeping a greater distance away from radiation sources and providing better shielding from a radiation source, such as a concrete structure.

Can a nuclear power plant explode like a nuclear weapon?

No, it cannot. A nuclear power plant's reactor is designed and configured differently from a nuclear weapon. Unlike a nuclear weapon, the amount of radiation energy created in a nuclear reactor is controlled and maintained through the use of reactor control rods.

## MORE FREQUENTLY ASKED QUESTIONS

### Is radiation exposure from a nuclear power plant always fatal?

No, it is not necessarily fatal. During normal power plant operations, the routine radiation emission amount is never enough to be lethal. If a General Emergency incident were to occur, it is highly unlikely that individuals living within the 50 mile Ingestion Pathway Zone will be within the area long enough for the exposure to be lethal.

### How can I learn more about nuclear power plants and radiation emergency preparedness?

To learn more about the Indiana Department of Homeland Security's Radiological Emergency Preparedness program, visit <https://www.in.gov/dhs/3523.htm>.

To learn more about nuclear power plants and their safety guidelines, visit the U.S. Nuclear Regulatory Commission's website at <https://www.nrc.gov>.

For more information on radiation emergency preparedness, visit the Center for Disease Control and Prevention's website at <https://emergency.cdc.gov/radiation/>.