

# PROTECTING PUBLIC HEALTH AND SAFETY



## NEW YORK STATE RADIOLOGICAL EMERGENCY PLANNING 2010

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## **RADIOLOGICAL EMERGENCY PREPAREDNESS PLAN**

### **PURPOSE**

The New York State Radiological Emergency Preparedness Plan (REPP) spells out New York's program for mitigating the possible consequences of a radiological emergency, especially an emergency that might occur at a nuclear power plant. The REPP is built on the premise that, as with any other emergency, all levels of government in concert with private sector organizations have the responsibility for safeguarding the health and safety of the people through carefully planned and coordinated actions.

The REPP has three major objectives:

1. To protect people living or working near nuclear power facilities, with special emphasis on the 10-mile radius surrounding each plant, called the Emergency Planning Zone (EPZ)
2. To organize and coordinate actions taken by the licensee, federal and state agencies, local governments, and support groups into a comprehensive, effective response
3. To effectively allocate and deploy resources and personnel in response to a radiological emergency

### **PLANNING AUTHORIZATION**

The REPP is an outgrowth of New York's initial emergency plan for radiation accidents (developed in 1971) and New York's Comprehensive Emergency Management Plan (CEMP), which provides a comprehensive emergency system to prevent or react to all types of emergencies (tornadoes, floods, blizzards, etc.) New York State's authority is contained in the following documents:

- New York State Executive Law, Article 2-B (1979 and Chapter 708, 1981)
- New York State Public Health Law, Section 201, 206
- New York State Sanitary Code, Part 16
- New York State Defense Emergency Act, Chapter 784, Laws of 1951

## REPP COMPONENTS

- Initial notification and warning
- Radiological accident assessment and evaluation
- Protective actions
  - Access control
  - Sheltering-in-place
  - Evacuation
  - Ingestion pathway precautions
- Parallel actions
  - Emergency medical services
  - Radiation exposure control
  - Law enforcement and crime prevention
  - Social service
  - Recovery
- Public information and education

## EMERGENCY RESPONSE

Under the REPP, the following organizations have pre-designated radiological emergency roles:

**County Government Chief Executive:** directs the implementation of their local county preparedness plan. Local governments have developed explicit procedures that parallel State procedures to inform and protect the public.

**Chairperson of the State Disaster Preparedness Commission (DPC):** directs State response activities to protect the public under the auspices of the Disaster Preparedness Commission; the State Department of Health is the lead response agency and spearheads radiological assessment and decision-making to protect public health.

**State Emergency Management Office (SEMO):** responsible for preparing and updating the plan, including site-specific sections that detail emergency response plans for potentially affected counties. SEMO acts as State/county/licensee liaison and, in the event of an emergency, deploys its staff to the licensee Emergency Operations Facility (EOF), the appropriate county Emergency Operations Center (EOC) and near-site Joint Information Center (JIC) to facilitate implementation of the plan. State agencies support local governments by providing personnel and resource assistance.

According to the plan, the chief executive officer of each county within the 10-mile radius of a nuclear power plant has the responsibility for the first line of protection and may proclaim a local state of emergency to aid response efforts. The chief executive may also ask the governor to declare a "State Disaster Emergency." With such action, the governor assumes the ultimate authority to command and coordinate State and local agency response activities.



## **INCIDENT CLASSIFICATION / NOTIFICATION**

In the event of a radiological incident, the nuclear power plant emergency director will immediately notify the State Emergency Management Office (SEMO) and the affected counties via a direct communication line called the Radiological Emergency Communications System (RECS).

The response taken by SEMO will depend on the severity of the incident described by pre-established classifications. Because these four classifications are based on specific plant conditions and measurements, they provide a clear indication of the seriousness of the event:

### **UNUSUAL EVENT**

#### **Definition**

This classification provides a means of early notification by the licensee of local, State, and federal agencies of minor events that could lead to consequences that are more serious. These events would result in no release of radioactivity beyond the plant boundaries requiring offsite response or monitoring unless further problems occur.

#### **State Response**

SEMO, the Department of Health, and the involved counties are notified via the RECS line; staff members are put on standby and SEMO monitors the situation.

### **ALERT**

#### **Definition**

Events that are in progress or have occurred involving an actual or potential decrease in the level of safety of the plant would be classified as an Alert. This event will not necessarily result in any release of radioactivity beyond plant boundaries. Any radiation releases to the environment are expected to be limited to small fractions of the Environmental Protection Agency (EPA) Protective Action Guideline (PAG) exposure level.

#### **State Response**

SEMO, the Department of Health, and the affected counties are notified; SEMO notifies appropriate State agency staff to report to the Emergency Operations Center (EOC). Public notification may be initiated by the local chief executive. The situation is closely monitored by SEMO.

## **SITE AREA EMERGENCY**

### **Definition**

Events are in progress or have occurred where significant radiation releases are possible, but are not expected to exceed EPA PAG exposure levels, except near the site boundary; and severe damage to the plant's nuclear fuel has not occurred; or which involve actual or major failures of plant functions needed for the protection of the public, are classified as a Site Area Emergency. In this situation, full mobilization of emergency response beyond the plant boundaries would take place, as well as dispatch of radiation monitoring teams if needed.

### **State Response**

Same as Alert, with additional notification to all ingestion EPZ counties (counties within a 50-mile radius of the affected reactor), activation of the public notification systems, and full activation of the State EOC.

## **GENERAL EMERGENCY**

### **Definition**

Substantial core degradation or melting with the potential for loss of systems or structures to contain the radioactivity is in progress or has occurred, would result in the classification of a General Emergency. Radiation releases can reasonably be expected to exceed EPA PAG exposure levels offsite for more than the immediate site area.

### **State Response**

All agencies and organizations involved in radiological emergency preparedness are notified, all EOCs are activated, and all pre-designated agency personnel and resources are deployed. If recommended by the Commissioner of Health, protective actions may be advised, such as evacuation or shelter-in-place.



## **PUBLIC NOTIFICATION OF A RADIOLOGICAL EMERGENCY**

Prompt notification systems have been installed surrounding all nuclear power plants in New York State to alert residents within 10 miles of a plant to any emergency requiring them to take action. These systems are made up of a combination of sirens, tone alert radios and the Emergency Alert System (EAS).

The emergency sirens are loud, high-pitched signals. In the event of an emergency related to a nuclear power plant, the sirens would be blown continuously for at least three minutes, differentiating them from fire or other emergency sirens that sound only briefly.

A long, uninterrupted siren indicates a hazard that may require action by the public. These sirens do not mean people should leave the area or take any immediate protective actions. A siren tone indicates only that the public should turn on their radios to an Emergency Alert System station in their area. If the sirens are blown, the Emergency Alert System will be the primary source for instructions about any actions that should be taken by the public to ensure their health and safety.

Emergency Alert System messages will be updated to provide the most current and accurate recommendations from county and State health and public safety officials.

If, for any reason, one or more of the special alert sirens fail to operate in any emergency, backup provisions have been made for prompt route alerting. In those areas affected by siren failure, public notification will be carried out by pre-designated emergency personnel in slow moving vehicles (i.e. automobiles and helicopters) equipped with public address systems.



## PROTECTIVE ACTION GUIDELINES

Protection Action Guidelines (PAGs) are used for planning purposes in New York State and are based on the U.S. Environmental Protection Agency's (EPA) guidelines. The recommendations below are based on the dose projections provided by experts during a radiological emergency. Actual decisions and recommendations for protective actions take into consideration a variety of factors, such as wind direction and velocity, time required for public notification and implementation, road conditions, time of day, expected duration of release and impact of decision on public exposure.

Protective Action	PAG (Projected Dose)	Comments
Evacuation (or shelter-in-place <sup>A</sup> )	1-5 rem <sup>B</sup>	Evacuations (or, for some situations, sheltering in place <sup>A</sup> ) should be initiated at 1 rem.
Administration of stable iodine	25 rem <sup>C</sup>	Requires approval of State medical officials

<sup>A</sup> Shelter-in-place may be the preferred protective action when it will provide protection greater than evacuation, based on the consideration of factors such as source term characteristics, and temporal or other site-specific conditions.

<sup>B</sup> The sum of the effective dose equivalent resulting from exposure to external sources and the committed effective dose equivalent incurred from all significant inhalation pathways during the early phase. Committed dose equivalents to the thyroid and to the skin may be 5 to 50 times larger, respectively.

<sup>C</sup> Committed dose equivalent to the thyroid from radioiodine.





## NEW YORK STATE KI (POTASSIUM IODIDE) POLICY

When people within the ten-mile emergency planning zone are instructed to evacuate or shelter-in-place, they will also be instructed to take KI – Potassium Iodide. This recommendation will be issued by the New York State Commissioner of Health or his/her designee. The instruction to take KI will be made over the Emergency Alert System and apply to members of the general public, emergency response personnel and special institutions within the area to be evacuated or sheltered in place.

The State has provided the counties surrounding the nuclear power plants with a sufficient quantity of KI for distribution to the people in the 10-mile Emergency Planning Zone. Each county is responsible for developing and implementing its own distribution plan. The KI is provided by the Nuclear Regulatory Commission (rev. 2- January 2007).

### SIX FACTS ABOUT KI

**What is KI?** KI (Potassium Iodide) is an over-the-counter drug that can protect one part of the body – your thyroid – if you are exposed to one form of radiation – radioactive iodine.

**How does it work?** KI fills your thyroid so that it cannot absorb any radioactive iodine. Each dose lasts for approximately 24 hours.

**What are the possible side effects to KI?** According to the FDA, the benefits of taking KI far exceed the risks. The possible side effects may include gastrointestinal disturbance and minor rash.

**How do I know when to I take KI?** If there is a radiological emergency at a nuclear power plant, an Emergency Alert System message will instruct you either to evacuate; shelter-in-place; and to take KI.

**How much KI should I take?** See the “Recommended Doses of KI” chart on the next page.

**Remember ...KI is NOT an alternative to evacuation.** KI only protects your thyroid from one form of radiation. Your best protection against the release of radiation is to leave the area if you are instructed to do so.

## RECOMMENDED DOSES OF KI FOR DIFFERENT RISK GROUPS

	<b>KI dose (mg)</b>	<b># ml liquid (65 mg/ml)</b>	<b># of 65 mg tablets</b>	<b># of 130 mg tablets</b>
Adults over 40 yrs	<b>130</b>	<b>2</b>	<b>2</b>	<b>1</b>
Adults over 18 through 40 yrs				
Pregnant or lactating women				
Adolescents over 12 through 18 yrs who weigh at least 150 pounds	<b>130</b>	<b>2</b>	<b>2</b>	<b>1</b>
Adolescents over 12 through 18 yrs who weigh less than 150 pounds	<b>65</b>	<b>1</b>	<b>1</b>	<b>1/2</b>
Children over 3 through 12 yrs	<b>65</b>	<b>1</b>	<b>1</b>	<b>1/2</b>
Over 1 month through 3 years	<b>32</b>	<b>1/2</b>	<b>1/2</b>	<b>1/4</b>
Birth through 1 month	<b>16</b>	<b>1/4</b>	<b>1/4</b>	<b>1/8</b>



## WHEN EVACUATION IS ADVISED

Certain conditions at a nuclear power plant could indicate the need for residents in the surrounding areas to leave their homes or places of business temporarily. The decision to recommend evacuation of specific areas would be made cooperatively by local and State health and public safety officials, based on present and potential plant and meteorological conditions. Individuals in the affected areas would be notified over the Emergency Alert System (EAS) following the sounding of special radiological emergency sirens.

Anyone in an Emergency Response Planning Area (ERPA) or Protective Action Area advised to evacuate should:

- Remain calm. In most cases, advice to leave the area will come well before a significant release of radiation, providing adequate time to prepare and leave your home.
- Take one dose of KI:
  - 130 mg for adults over 18 and children weighing over 150 pounds
  - 65 mg for children from 3 to 18 years
  - 32 mg for children three months to 3 years
  - 16 mg for newborn to 3 months
- Ignore all rumors. Stay tuned to the Emergency Alert System for official instructions.
- Avoid using the telephone to prevent line overloads and interference with emergency use.
- Gather items needed for a three-day visit, including:
  - Blankets or sleeping bags for each family member
  - Prescription medicines, if needed
  - Clothing
  - Personal items; soap, cosmetic items
  - Formula and other needs for infants and children
  - First aid kit
  - Checkbook, credit cards and important papers
  - Food for any pet you take with you
  - Portable radio with batteries
  - Flashlight with batteries
  - Emergency planning booklet and/or calendar mailed to your home describing evacuation routes and location of reception centers and congregate care centers

- Proceed to the home of a friend or relative outside the 10-mile Emergency Planning Zone (EPZ) or to your designated reception center. If there has been a release of radiation, you will be directed to the reception center for precautionary radiological monitoring.
- Offer a ride to a neighbor who may not have a car.
- Close car windows and vents and do not use the air conditioner or heater until beyond the emergency area.
- Leave only by the route designated as your location's evacuation route.
- If you do not have a ride, walk to the nearest emergency bus pick-up point listed in the emergency planning booklet.



## **RECEPTION CENTERS**

Reception centers are established for use during an emergency. The centers will be operated by county and State health, social services, and emergency preparedness officials. The location of the centers can be found in the emergency planning booklet/calendar appropriate to that area.

In the event of an evacuation during an emergency, a reception center can be used as a meeting point for family members with plans to stay at the home of a friend or relative outside the 10-mile Emergency Planning Zone (EPZ), or as a message center.

Anyone without arrangements for temporary lodging outside the EPZ should, if advised to evacuate, proceed via the appropriate evacuation route to the reception center. At the center, these individuals will be assigned to a nearby congregate care center operated by the Red Cross.

The center will offer food, medical care, and communications facilities.



## **WHEN STAYING INDOORS IS ADVISED**

During most types of nuclear power plant emergencies, there would be no need for evacuation of surrounding residents, even when the situation indicates that precautionary public protective measures are advisable. In most instances, individuals living in the plant vicinity would be best protected from exposure to a short-term release of radiation by following special instructions for staying indoors.

The decision to recommend temporary sheltering-in-place of people in some geographic areas would be made cooperatively by State and local health and public safety officials, based on present and potential plant and meteorological conditions. Individuals in the affected areas would be notified over the Emergency Alert System (EAS) following the sounding of special radiological emergency sirens.

Anyone in an area advised to shelter-in-place should:

- Stay inside.
- Close all windows and doors.
- Turn off air conditioners and other ventilation systems.
- Extinguish fires in fireplaces and close dampers.
- Stay tuned to the Emergency Alert System stations.
- Avoid using telephones to prevent overloading lines and interfering with emergency use.
- Keep family and pets inside the house.



## **PROTECTIVE ACTIONS FOR FARMERS**

If an accident at a nuclear power plant has the potential to affect livestock or the quality or marketability of farm products, the agricultural community in the affected areas will receive specific instructions through the media. These instructions will be based on recommendations by local and State officials from the departments of Health and Agriculture and Markets.

The protective actions that farmers may be asked to take result from the concern that livestock could eat contaminated feed and water, absorbing radioactive isotopes into their bodies, and ultimately passing this contamination into the food chain. This process eventually could contribute to exposure in humans from the ingestion of contaminated products.

As precautionary measures, farmers may be asked to:

- Provide dairy animals with shelter, stored feed and protected water supplies.
- Place other livestock on stored feed and protected water and shelter, if possible, after provisions have been made for dairy animals.
- Cover feed if outdoors, or bring feed inside a building.
- Store as much water as possible for livestock and cover wells, rain barrels, and tanks.
- Thoroughly wash crops brought in from a contaminated area; green vegetables exposed to contamination should have outer layers removed.
- Temporarily wear protective clothing (like that worn for pesticide applications) when working outdoors.

In the event of an accidental release of radiation from a nuclear power facility, milk, soil and crops from farms in the affected area will be monitored and sampled for possible contamination and farmers will be notified of any special precautions necessary.



## **PUBLIC INFORMATION**

In the event of a radiological emergency, the Public Information Officer for the New York State Disaster Preparedness Commission or his/her designee is the New York State spokesperson.

All information concerning the State's response to a nuclear power plant emergency will be released by the State spokesperson from the Joint Information Center (JIC).

News media will receive information about State activities only from the Joint Information Center.

The State Public Information Officer will receive information directly from the State Emergency Communications Center (SECC), which will have up-to-the-minute information on State, federal and local response activities as well as information concerning accident assessment, changing environmental conditions, and post-emergency recovery activities.

Each nuclear power plant site has a designated Joint Information Center from which the State, affected county (ies), and the licensee will issue information on all emergency response activities.

The State Public Information Officer or a designated deputy will be at the Joint Information Center at all times to keep the public updated on State response activities through the media.





## **GETTING THE NEWS DURING A RADIOLOGICAL EMERGENCY**

When events that may pose an emergency are occurring or expected to occur at a nuclear power plant, the press will be notified by news releases provided to the major wire services by the licensee, county, and/or State public information officers.

### **What information will the initial wire service releases provide?**

- Nature and extent of the event in progress at the nuclear power plant.
- Notification of activation of Joint Information Center (JIC).
- Telephone numbers to call for verified information concerning actions being taken in response to the emergency.

### **What is a Joint Information Center (JIC)?**

Joint Information Centers have been set up near each operating nuclear power site in the State. In the event of an emergency, the center established for the affected plant site would be the source of all information concerning the licensee, State, and county response activities. The Joint Information Center locations are:

- 200 Bradhurst Avenue, Hawthorne, New York 10532 (Indian Point Units 2 and 3)
- 10 Airport Road, Fulton, NY (Nine Mile Point Units 1 and 2, and James A. FitzPatrick)
- 1255 Research Forest, Macedon, NY 14502 (R. E. Ginna)

### **Under what conditions are Joint Information Centers opened?**

The JIC established near the affected site will be opened upon the declaration of an Alert. Once open, the JIC will function around the clock during the emergency.

### **What types of information or briefings will be available?**

The JIC will have the official spokespersons for the licensee, State, and county (ies). The licensee will provide information on plant conditions and licensee emergency response actions. The State and county will provide information on public protection actions and governmental emergency response actions.

### **Can anyone come to the Joint Information Centers?**

These facilities are for the news media, licensee, State, and local governmental officials only. Reporters with credentials will be issued an identification badge for access to the JIC.

### **Will there be workspace for reporters to use?**

Yes. While a workspace has been provided, reporters must bring their own broadcast equipment, computers, and other supplies.



## GLOSSARY OF TERMS

### RADIOLOGICAL PLANNING

**Congregate Care Center:** Facility where shelter and food is provided to evacuees.

**Comprehensive Emergency Management Plan (CEMP):** A plan that details comprehensive procedures for all types of emergencies in the state, i.e., floods, hurricanes, etc. A portion of the CEMP is the Radiological Emergency Preparedness Plan.

**Emergency Classifications:** The Nuclear Regulatory Commission's classifications of the four levels of radiological emergencies are Notification of Unusual Event; Alert; Site Area Emergency; and General Emergency.

**Emergency Operations Center (EOC):** A designated location at county and/or State headquarters from which the chief executive and staff can direct the action of the State and local agencies and emergency services.

**Emergency Operations Facility (EOF):** A facility operated by the power plant licensee for evaluating and controlling emergencies and coordinating responses with local and state representatives; its location is normally outside the plant exclusion area.

**Emergency Planning Zone (EPZ):** The area surrounding a nuclear power plant site designated for emergency planning purposes. The EPZ encompasses a radius of about 10 miles for the plume exposure pathway and about 50 miles for the ingestion exposure pathway.

**Emergency Response Planning Area (ERPA):** A subdivision of the plume exposure emergency planning zone; an EPZ is made up of several ERPAs – also known as *Protective Action Areas*.

**Exclusion Area:** The area surrounding a nuclear power plant facility in which the facility operator has the authority to determine and control all activities. No residences exist within a nuclear power plant exclusion zone.

**Ingestion EPZ:** The area surrounding the site, approximately a 50-mile radius where the principal exposure would be by ingesting contaminated water or food.

**Nuclear Facility Operator (NFO):** The organization licensed by the Nuclear Regulatory Commission to operate a nuclear facility.

**Plume Exposure Pathway:** The area surrounding a nuclear facility site (usually a radius of approximately 10 miles) where the principal exposure would be from: (a) whole body exposure to gamma radiation from the plume and from deposited material, and (b) inhalation exposure from the passing plume.

**Prevention/Mitigation:** The first of three designated phases of activity in the State plan for radiological emergencies – response and recovery phases follow. Actions during this phase aim to eliminate or reduce the probability of an emergency occurring, and minimize the impact of an emergency on public health and property.

**Protective Action:** Any action taken to protect the public's health in response to a radiological emergency, i.e., recommending sheltering-in-place, or evacuation and taking KI – potassium iodide.

**Protective Action Areas:** A subdivision of the plume exposure emergency planning zone; an EPZ is made up of several Protective Action Areas – also known as Emergency Response Planning Areas (ERPAs).

**Potassium Iodide (KI):** A thyroid-blocking agent that protects one organ - the thyroid - against one form of radiation - radioactive iodine. KI is available to all residents within the 10-mile emergency planning zone from their county emergency management office. The recommended dosage is:

130 mg for adults over 18 and children weighing over 150 pounds

65 mg for children from 3 to 18 years

32 mg for children three months to 3 years

16 mg for newborn to 3 months

**Reception Center:** A pre-designated location outside the plume exposure pathway through which evacuees will pass to receive initial assistance, radiological monitoring (if required), first aid, or direction to a congregate care center or medical facility.

**Recovery:** The last phase of activity in the State plan for radiological emergencies; efforts during this stage are to return to pre-emergency conditions.

**Response:** The phase of activity in a radiological emergency when protective actions are taken to protect public health and alleviate effects of a radioactive release.

## **RADIOLOGICAL MEASUREMENTS**

**Dose:** The amount of energy absorbed by matter received from ionizing radiation per unit mass of matter; expressed in rads.

**Exposure:** A measure of the ionization produced in air by X- or gamma radiation; expressed in Roentgens (R).

Although "dose" and "exposure" often are used interchangeably, the former (dose) is a measurement of energy absorbed in body tissue; the latter (exposure) is a measurement of ionizations in the air due to the presence of radiation.

**Rad:** Unit of radiation dose.

**Roentgen (R):** Unit of exposure, applicable only to X- and gamma radiation.

**Rem (Roentgen Equivalent Man):** A unit used to express all types of ionizing radiation on a common scale to indicate relative biological effects. For beta and gamma radiation, exposure to one (1) Roentgen delivers a dose of one (1) Rad, which is equivalent to one (1) Rem.

**Curie (Ci):** Amount of radioactive material in which  $3.7 \times 10^{10}$  atoms decay per second. The rate at which radioactive material is released to the environment may be expressed in units of curies per second (Ci/sec.).

**Milli (m):** One-thousandth of a unit (10), i.e., millirem (mRem)

**Micro (u):** One-millionth of a unit (10).

**Pico (p):** One-trillionth of a unit (10).

## DEFINITIONS OF RADIOLOGICAL TERMS

**Airborne Radioactive Material:** Any radioactive material dispersed in the air in the form of dust, fumes, mist, vapor, or gas.

**Background Radiation:** Cosmic rays and natural radioactivity are always present in the environment. In addition, man-made sources also may contribute to the background radiation level. The average New Yorker receives approximately 360 millirem per year from radon and background radiation.

**Decontamination:** The reduction or removal of contaminating radioactive material from a structure, area, object, or person.

**Dosimeter:** A personnel-monitoring instrument that measures the radiation dose received by an individual using the device.

**Exposure Pathways:** The ways in which the presence of radioactive materials in the environment lead to potential exposure to humans, i.e., inhalation of airborne radioactive material; ingestion of contaminated food or drink; and whole body exposure to a passing plume or ground contamination.

**Exposure Rate:** Amount of exposure received per unit of time, i.e., roentgens per second or roentgens per hour. The exposure rate is measured by a radiation detection instrument such as a Geiger counter or an ionization chamber.

**Film Badge:** Film encased in a badge-like holder that records radiation exposure for personnel monitoring purposes. The film usually is processed monthly for calculation of the absorbed dose. Results are reported in millirems (mRems).

**Half-life:** The time required for radioactive material to lose 50% of its activity by radioactive decay.

**Monitoring:** Periodic or continuous measuring of radiation by means of survey instruments that can detect and measure ionizing radiation.

**Area Monitoring:** Measurement of radiation level or contamination present in a specific area, building, room, etc.

**Personnel Monitoring:** Measurement of radiation levels that may have been received by an individual to the whole body or specific organs or body parts. The most common devices used for measuring exposure from external sources are film badges, thermoluminescent dosimeters (TLDs) and pocket dosimeters. Whole body counting or bioassay measurements of breath or excretions may be taken to determine internal intake of radioactive materials.

**Nuclear Reactor:** A device in which a fission chain reaction can be initiated, maintained and controlled. Its essential component is a core with fissionable fuel.

**Radiation:** The emission of energy through a material medium in the form of electromagnetic waves or particles that may impart their energy to the medium through the creation of electrically charged ion pairs. X- and gamma rays and alpha and beta particles are examples of ionizing radiation.

**Radioactive Decay:** The process by which an unstable nucleus of an atom spontaneously releases energy through the emission of radiation.

**Radioactive Release:** Introduction of radioactive materials into an uncontrolled environment.

**Thyroid Exposure:** Exposure of the thyroid gland to radiation from radioactive isotopes of iodine, which have been inhaled, absorbed or ingested.

**Thermoluminescent Dosimeter (TLD):** A dosimeter made of material that when heated emits light in amounts proportional to the amount of the radiation dose it received. Placed in a badge-type holder, it can be worn by an individual to measure his/her possible exposure to ionizing radiation.

**Transportation Emergency:** A radiological emergency that occurs during the transportation of radioactive materials.

**Whole Body Exposure:** Exposure of a major portion of the body to an external radiation field or resulting from the presence of radioactive material distributed throughout the body. Exposure of blood forming organs, gonads, head, trunk, and lenses of the eyes is also considered exposure to the whole body.