

**New York State Office of Emergency
Management**

**County Radiological
Ingestion Pathway
Information Guide**



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COUNTY RADIOLOGICAL INGESTION PATHWAY INFORMATION GUIDE

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COUNTY RADIOLOGICAL INGESTION PATHWAY INFORMATION GUIDE

A. INTRODUCTION:

Radiation occurs naturally and is a normal part of our environment. Although it is not possible to eliminate all human exposure to radiation, our goal is to limit exposure from accidental releases of radioactive materials. The purpose of this guide is to provide information in an attempt to prevent the ingestion of radioactive material following an accident at a nuclear power plant, other fixed facility, or a transportation incident involving radioactive material.

An Emergency Planning Zone (EPZ) is a pre-determined area surrounding an electricity generating commercial nuclear power plant where planning is undertaken to assure that prompt and effective actions can be taken to protect the public in the event of an accident. EPZs are already pre-established for the three nuclear power sites in New York State: Ginna Nuclear Station, the Nine Mile Point site and the Indian Point Energy Center. However, during an accident at a transportation incident or an accident occurring at a fixed facility, an Emergency Planning Zone may need to be established on an ad hoc basis.

The **Plume Exposure EPZ** is approximately a 10-mile radius around the nuclear plant. When radioactive material is released as a result of an accident or incident, it may move through the air as a **plume** (cloud) of gas or particles, or be **deposited** on the ground or other surfaces. People and animals may be exposed to radiation through inhalation or submersion in a radioactive **plume**, or by being near radioactive material **deposited** by the plume on the ground or other surfaces. These are examples of the plume exposure pathway.

The **Ingestion Pathway EPZ** is approximately a 50-mile radius around the nuclear plant and includes the Plume Exposure EPZ. When radioactive material from a plume, or a liquid or solid spill, falls on crops or produce, or on surface water supplies, the potential exists for this radiation to be taken into the body through **eating** or **drinking** these radiologically contaminated foodstuffs and drinking water. These are examples of the ingestion exposure pathway.

We can limit or prevent **plume exposure** by moving people away from or out of the plume through the process of evacuation. **Ingestion pathway exposure** is best avoided or limited by preventing the ingestion of radiologically contaminated material from occurring; and this is the primary idea behind this Information Guide, because once radioactive material is ingested it may be very difficult to expel from the body. The data collection, analysis and decision-making processes for avoiding or limiting radioactive exposure from the ingestion pathway should be understood at all levels of government to ensure a coordinated and effective response.

The immediate concern in a radiation accident is to prevent or limit people from direct

exposure to high levels of radiation in the plume. Ingestion exposure protection can wait until more hazardous emergency or radiation conditions are abated. Since response activities to limit or reduce plume or direct radiation exposure may involve complicated or multi-faceted response actions such as public evacuation, taking Potassium Iodide (KI), and /or instructing the public to shelter-in-place, most ingestion pathway response activities are usually not considered until after the release of radiation has been terminated. The only exception to this concept is the public instruction advising farmers to bring livestock in from pasture to a covered location and provide them with protected feed and water.

Some protective actions that are undertaken during the actual plume or release phase of the emergency are effective in dealing with both plume exposure issues and ingestion pathway issues. For example, the evacuation of people from an Emergency Planning Zone because of plume or deposition concerns will also obviously limit that population from drinking contaminated water or eating contaminated garden produce in those areas. Although this guide only addresses the ingestion pathway, decision makers must consider the overall response activities that are or have been undertaken when planning and implementing ingestion pathway protective actions.

Following the termination of a release of radioactive materials to the environment, the State initially will determine whether deposited materials are at levels which could necessitate the temporary relocation of the public in certain areas or the determination may be to allow evacuees from certain areas to return home and resume normal activities. Concurrently, the State will identify those geographic areas where protective actions for food and water would have to be implemented.

Many of the radiological determinations can be analyzed simultaneously through the use of sampling teams taking air and ground radiological surveys, but in a large-scale event, such as a release from a nuclear power plant, the resources of the federal government would be required to provide deposition mapping. The use of the Federal Aerial Measuring System (AMS) overflight capability utilizes fixed and rotary wing aircraft with sophisticated detection and mapping capabilities. These aircraft surveys would then be followed by ground surveys and sampling in very specific locations.

Some ingestion pathway protective actions can be taken before the analysis is performed, and perhaps even before a release occurs. An example is the previously cited action of placing milk animals and other livestock on stored feed, providing a protected water supply and shelter or putting restrictions on consumption of surface water supplies.

The steps to prevent ingestion of radioactive material are:

- Identify the land area possibly contaminated.
- Develop and implement a radiological monitoring and sampling plan. Perform laboratory analysis of the samples.
- Calculate exposures from the various pathways (milk, water, food).
- Compare exposures with Protective Action Guides (PAGs). Select and implement appropriate protective actions. Verify the effectiveness of the protective actions.

The State takes the lead role in planning and implementing the ingestion pathway program in order to maintain consistent sampling and laboratory standards.

B. RESPONSE:

1. Alert and Notification

When a radioactive incident occurs, local, county, and state officials will be alerted by the facility or emergency responders about the situation. Local officials who become aware of an incident will notify the State through the State Warning Point (518-292-2200). If the State becomes aware of an incident, it will ensure that the county(s) has been notified, as well as the federal government if appropriate. State Health Department radiological experts will be notified by the State Warning Point or other source and their assistance should be requested. The State Health Department will coordinate with the existing County Health Departments. The State will analyze the circumstances of the event and advise appropriate officials of needed protective actions. The State radiological experts will determine if an ingestion pathway hazard exists.

2. Command and Control

Section 201 of the Public Health Law designates the State Health Department as the agency responsible for protecting the public from radioactive materials. A few localities or counties may have health departments with radiological expertise. In most areas, only the State Health Department, Bureau of Environmental Radiation Protection, is qualified to deal with radiation accidents or ingestion exposure issues. Where local health departments are qualified, they may participate in the response with the State Health Department as appropriate.

All affected government jurisdictions in involved areas will be consulted regarding the situation and needed actions. When large areas are involved, it may be appropriate to activate local, county or state Emergency Operations Centers to enhance coordination of the operation. The Incident Command System (ICS) developed by the National Incident Management System (NIMS) will be used for the State command and control in accordance with the Governor's Executive Order No. 26 of 1996, *Establishing a Management System for Emergency Response*.

Under the Incident Command System, if the scene of an incident is localized and a local Incident Commander is present, state responders must coordinate all on-scene activities in advance with the Incident Commander. The local Incident Commander may choose to appoint a Liaison Officer to interface with state responders. For a large-scale event, the State will interface with local response efforts in accordance with the Incident Command System, and will provide a liaison to the affected jurisdiction(s). The State will also coordinate with the federal government for any federal assets deployed in the affected area.

3. Sampling and Analysis

The State will determine the need for radiological monitoring and ingestion pathway sampling and, if needed, will select, organize, and equip sampling teams. Sampling teams will include at least three people, a local representative, such as from the Cooperative Extension Office or Farm Services Agency and a radiological specialist from the Department of Health or the Department of Environmental Conservation. The third member of this team will be a trained individual on milk sampling techniques from the Department of Agriculture and Markets. Specific types of samples will be collected and documented in accordance with the sampling plan and standard procedures and methods. Samples will include: water, vegetation, crops, milk, soil etc.

The State will make arrangements for transportation of the samples to the State Department of Health Laboratories in Albany or other facilities identified by the State for radiological analysis. Samples will be analyzed by the designated laboratories and the results provided to the State Department of Health, Bureau of Environmental Radiation Protection for assessment and evaluation.

4. Assessment and Evaluation

Health Department radiological experts will calculate projected ingestion doses based on laboratory sample results. These results will be compared with the limits established by the Environmental Protection Agency and the Food & Drug Administration. These limits are called Protective Action Guides (PAGs).

PAGs are decision tools for public officials. They are projected radiation doses at which protective actions to reduce or avoid those doses are warranted. The projected radiation dose is the dose estimated to be received in a specified time in the absence of protective actions. PAG levels have been set to avoid acute effects on health and to limit the risk of delayed effects.

The risk to health from the protective actions themselves should not exceed the health risk from the dose that would be avoided. Professional judgment is required in implementing response plans as local conditions during the emergency cannot be anticipated.

5. Choosing and Implementing Protective Actions:

Once the ingestion pathways are identified, local, state and federal officials will consider various protective actions that may be taken to prevent or reduce ingestion. The ingestion pathway includes the milk pathway, water pathway, or other food pathways.

Factors considered prior to protective action decision making include:

- Protective actions that are feasible and their consequences
- Relative proportion and importance of any suspected contaminated food in the diet
- Availability of substitute foods or stored feed
- Relative contribution of other foods to the total dose
- Time and effort required to implement the protective action

Protective Actions that might be taken, depending on circumstances, include:

- Placing milk animals and other livestock on stored feed, protected water and placing them under shelter
- Quarantining or disposing of contaminated produce and food
- Restrict drinking contaminated water
- Prevent contaminated food from coming to market
- Prevent consumption of game food or fish

6. Public Information - Joint Information Center

A critical element for successful ingestion exposure operations is public information. For a nuclear power plant accident, a Joint Information Center will likely already have been established as described in the State Radiological Emergency Preparedness Plan. For other types of incidents, if the affected area is large enough, a Joint Information Center will be established by the State to coordinate release of information through local, State, industry and federal news releases and media briefings.

C. ORGANIZATIONAL RESPONSIBILITIES:

1. State Role

- Provide appropriate alert and notification to county/local, state and federal agencies.
- Maintain ongoing monitoring programs (i.e., public water supply).
- Determine the need for monitoring and ingestion pathway sampling.
- Provide sampling personnel from the Department of Health, Department of Environmental Conservation, Department of Labor, and the Department of Agriculture and Markets.
- State Assessment and Evaluation (A&E) personnel develop a monitoring and sampling plan in coordination with local and federal counterparts.
- Develop appropriate Protective Actions.
- State A&E personnel estimate the plume footprint and develop a sampling plan. Provide advance training for radiological monitors to serve on sampling teams. Assemble, organize, and provide procedures for sampling teams.
- Collect and transport samples to the DOH Laboratory in Albany or other suitable facilities. Arrange for analysis of samples by DOH Laboratory or other laboratories.
- Analyze laboratory data to refine plume deposition area, and projected doses.
- Implement protective actions in coordination with local and federal government.
- Develop public advisories in coordination with local and federal government.
- Participate in Joint Information Center operations.
- Implement market level monitoring to ensure effectiveness of protective actions.
- Provide guidance on remedies for those who have suffered economic losses.

2. County Role

- Provide appropriate alert and notification to county agencies.
- Contact appropriate local organizations, i.e.: County Cooperative Extension, etc.
- Provide information to State A&E needed for the sampling plan.
 - Types of crops in the potentially affected area.
 - Farms, processors, water supplies in the potentially impacted area.
 - Other agricultural activities.
 - Personnel for sampling teams, if available.
 - Assist in gathering and transporting samples, if requested.
 - Assist the state in selecting and implementing appropriate protective actions.
 - Participate in Joint Information Center operations.

3. Federal Role

- Provide appropriate alert and notification to federal agencies.
- Activate U.S. Department of Energy's Radiological Assistance Plan (RAP).
- Assist in developing a monitoring and sampling plan in coordination with state and local counterparts.
- Assist in radiation monitoring and assessment.
- Develop public advisories in coordination with local and State government.
- Provide other technical or laboratory assistance and personnel.
- Participate in Joint Information Center operations.
- Provide assistance on reentry, recovery and relocation activities.

4. Facility/Transporter Role

- Notify local and State government of any radioactive incident and/or release.
- Provide other appropriate alert and notification.
- Stop or limit the release as soon as possible.
- Provide information on type and duration of release.
- Perform radiological monitoring, if possible.
- Participate in Joint Information Center operations.

D. GLOSSARY

NOTE: Although some of these terms do not appear in this information guide, many may be referred to during the conference calls conducted during the drills/exercises or events.

Access Control: All activities accomplished for the purpose of controlling entry or re-entry into a restricted zone to minimize the radiation exposure of individuals. This function is needed to prevent the general public from entering the restricted zone and permitting only emergency workers with essential missions and limited members of the general public to enter a restricted zone.

Aerial Measuring System (AMS): Department of Energy (DOE) operated aerial radiation surveillance program which may be used for plume verification and ground deposition monitoring.

Airborne Radioactive Material: Any radioactive material dispersed in the air in the form of dusts, fumes, mists, vapors or gases.

Assessment: The compilation and analysis of all available accident data and information in order to determine actual and projected radiation doses to the affected population that may result from the accident.

Background Radiation: Radiation arising from man's natural environment including cosmic rays and radiation occurring from the natural radioactive elements.

Buffer Zone: An area adjacent to a restricted zone, to which residents may return, but for which protective measures are recommended to minimize exposure to radiation.

Chief Elected Official: A County Executive, the Chairman or other presiding Officer of the county legislative body, the Mayor of a city or village, or the Supervisor of a town.

Contaminated, injured, or exposed individuals: individuals who are; contaminated, contaminated and otherwise physically injured, or exposed to radiation.

Contamination (Radioactive): Deposition of unwanted radioactive material on the surfaces of structures, areas, objects, or personnel.

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

Dose: A generic term that means absorbed dose, dose equivalent, effective dose equivalent, committed dose equivalent, committed effective dose equivalent, or total effective dose equivalent.

Dose Rate: The radiation dose delivered per unit of time. The dose rate is measured, for example, in Roentgen per hour (R/hr).

Dosimeter: A personal monitoring instrument that measures radiation exposure to gamma or X-Ray Radiation. (Direct-Reading-Dosimeter DRD or Electronic Dosimetry)

Embargo: A legal order which restricts the movement, distribution, and/or sale of food stuffs.

Emergency Coordination Center (ECC): The State ECC in Albany is a secure area with a wide range of communications capability that provides an operating area for those agencies involved in emergency response to man-made or natural disasters.

Emergency Operations Center (EOC): A secure facility with a wide range of communications capability that provides an operations/coordination center for those agencies involved in emergency response to man-made or natural disasters.

Emergency Planning Zone (EPZ): The area surrounding a nuclear power plant site for which offsite planning is required. For nuclear power plants, the EPZ is defined as an area with a radius of about ten (10) miles for the plume exposure pathway and a radius of about fifty (50) miles for the ingestion exposure pathway.

Emergency Response Planning Area (ERPA): A subdivision of the plume exposure (10-mile) emergency planning zone.

Evacuation: The removal of the public from an area.

Exposure: A measure of the ionization produced in air by X-ray or gamma radiation. The Roentgen (R) is the unit of exposure. The term "dose," sometimes used interchangeably with exposure, actually refers to absorbed radiation.

Exposure Rate: The amount of gamma radiation that an individual would receive in one hour as measured in air (typically expressed in units of milliroentgens per hour or Roentgens per hour).

Federal Radiological Monitoring Assessment Center (FRMAC): An operating center, usually located at an airport or other large facility near the scene of a radiological emergency from which the Federal field monitoring and assessment assistance is directed and coordinated. This center need not be located near the onsite or Federal-State centers as long as its operations can be coordinated with them.

General Emergency: Indicates that events are in process or have occurred that involve actual or imminent substantial core degradation or melting, with potential for loss of containment integrity. Releases can reasonably be expected to exceed EPA PAG exposure levels offsite, beyond the immediate site area.

Incident Command System (ICS): A standardized on-scene emergency management concept specifically designed to allow its user(s) to adopt an integrated organizational structure equal to the complexity and demands of single or multiple incidents, without being hindered by jurisdictional boundaries.

Ingestion Emergency Planning Zone (IPZ): For planning purposes, the area surrounding a site, where the principal exposure from an accident would be from the ingestion of contaminated water or foods. For nuclear power plants the ingestion EPZ is an area of about a fifty (50) mile radius around a nuclear plant.

Ionizing Radiation: Any radiation capable of displacing electrons from atoms or molecules, thereby producing ions. (For example, radiation produced by x-ray equipment.)

Joint Information Center: The facility used as the central point for dissemination of information by county, State and licensee representatives to the news media. This facility is located offsite, and is the only location which allows media access to authorized spokespersons during an emergency.

KI (potassium iodide): A prophylactic drug that can be used effectively to block the uptake of radioiodine by the thyroid gland.

Monitoring: The measurement of radiation levels, usually with a portable survey instrument.

National Atmospheric Release Advisory Center (NARAC): Provides tools and services to the Federal Government that map the probable spread of hazardous material accidentally or intentionally released into the atmosphere. NARAC provides atmospheric plume predictions in time for an emergency manager to decide if taking protective actions is necessary to protect the health and safety of people in affected areas.

National Response Framework (NRF): presents the guiding principles that enable all response partners to prepare for and provide a unified national response to disasters and emergencies - from the smallest incident to the largest catastrophe. The *Framework* establishes a comprehensive, national, all-hazards approach to domestic incident response.

Noble Gases: The chemically inert radioactive gases that are released during an accident at a nuclear power plant.

Nuclear Reactor: A facility in which nuclear fission may be sustained and controlled in a self-supporting nuclear reaction.

Personnel Monitoring Center (PMC): Those facilities or locations where individuals and equipment will be monitored for radioactive contamination and decontaminated if necessary.

Plume Exposure Pathway: For planning purposes, the area surrounding a site where the principal exposure sources are: (a) whole body exposure to gamma radiation from the plume and from deposited material, and (b) inhalation exposure from the passing radioactive plume. For nuclear power plants the plume EPZ is defined as an area with a radius of about ten (10) miles.

Projected Dose: The estimated or calculated amount of radiation dose to an individual from exposure to the plume and/or deposited materials, over a period of time, in the absence of protective action.

Protective Action: Any action taken to protect the public health in response to a radiological emergency.

Protective Action Guide (PAG): Projected dose to an individual in the general population that warrants the implementation of protective action. Specific PAGs have been recommended in terms of the level of projected dose that warrants the implementation of evacuation/shelter-in-place, relocation, and limiting the use of contaminated food, water, or animal feed.

Radiation Badge: A permanent record dosimeter used to measure an individual's exposure to ionizing radiation.

Radioactive Materials: Material containing atoms having excess energy. It contains excited, unstable atoms that are disintegrating, emitting radiation.

Recovery: The process of reducing radiation exposure rates and concentrations of radioactive materials in the environment to levels acceptable for unconditional occupancy or use.

Re-entry: Temporary entry of individuals into a restricted zone under controlled conditions.

Release: Escape of radioactive materials into the environment.

Relocation: A protective action, taken in the post-emergency phase, through which individuals not evacuated during the emergency phase are asked to vacate a contaminated area to avoid chronic radiation exposure from deposited radioactive material, or for those previously evacuated their continued exclusion from those contaminated areas.

REM: The unit of dose equivalent in body tissue. It is a measure of radiation exposure that indicates the potential impact on human cells.

Response: The emergency phase in which public protective actions are carried out.

Restricted Zone: An area of controlled access from which the population has been evacuated or relocated, or is being asked to shelter-in-place.

Return: Reoccupation of areas cleared for unrestricted residence or use by previously evacuated or relocated populations.

Sampling: Collecting specimens of materials (e.g. soil, vegetation, or radioiodine in the air) at field locations.

Shelter-In-Place: An action taken to minimize exposure to radiologically contaminated air by going indoors or staying inside, turn off heating or air conditioning systems, close windows and doors, monitor the Emergency Alert System (EAS) and prepare to evacuate. The intent is for members of the public to remain where they are, or seek shelter close by, but NOT TO return home to shelter.

Site Area Emergency: Indicates that events are in process or have occurred that involve actual or likely major failures in the plant functions needed for protecting the public. Releases are not expected to exceed EPA PAG exposure levels, except near the site boundary.

State Warning Point (SWP) A location designated during an emergency by an offsite government agency for the purposes of receiving and promulgating warning information 24 hours a day, 7 days a week. This location is typically referred to at the County level as the Warning Point (WP).

Survey Meter: A portable instrument used to detect and measure ionizing radiation.

Traffic Control: All activities accomplished for the purpose of facilitating the evacuation of the general public in vehicles along specific routes.

Pathways for Ingestion

