

Radiological Emergency Information for Farmers, Growers, and Food Producers



**50 Harry S. Truman Parkway
Annapolis, MD 21401
410-841-5700**

www.mda.maryland.gov

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Preface

This information is intended to help farmers better understand the effects of radioactive contamination on plants, soil, water and animals, and the basic needs and care of animals should a radiological accident occur within the State of Maryland. The information contained within this pamphlet applies primarily to communities near nuclear power stations but may also be applied to communities that may be affected by a transportation accident involving radioactive or nuclear materials on a major road or highway. Information is shared on what you may be asked to do if an incident occurs causing an area to be exposed to radioactive contamination.

In the event of an emergency, your first concern should be ensuring the safety of you and your family. State officials using the EAS (Emergency Alert System) will notify the public of necessary protective steps. If the accident is of such severity that it will also affect farming in your area, instructions for farmers' needs will also be issued over EAS. This information will provide you with an explanation of the actions that you may be advised to take to protect farm animals and farm products.

Comprehensive emergency plans have been prepared cooperatively by local government and state emergency management officials to advise you should the need arise. For example, in the case of a nuclear power station accident, this includes a 10-mile area around the plant site. For the agricultural industry, plans have been made to include a 50-mile zone from the plant, with the emphasis on protecting dairy products and crops. Teams of trained personnel have been organized to implement emergency procedures and assist all residents during an emergency.

Introduction

The use of nuclear fuel for the generation of electricity has a very safe history in the United States.

The commercial nuclear plants in the United States have accumulated a combined total of more than 1,000 years of operation to provide energy for residential, commercial, industrial, and agricultural uses. The Calvert Cliffs Nuclear Power Plant is the only nuclear power plant in Maryland but the Peach Bottom Nuclear Power Station in Pennsylvania operates close to the Maryland border on the Susquehanna River.

The accident at Three Mile Island in 1979 caused no health effects to residents and no adverse effects to the agricultural community, but the incident did provide valuable information and experience to the nuclear industry and to federal, state, and local emergency management organizations. Today, extensive and well-tested emergency plans for nuclear plants are in place at the utility, county, state and federal levels.

This brochure has been prepared specifically for the agricultural community. It contains information about radiation, and possible actions you might be asked to take to protect your farm products in the unlikely event of a nuclear accident. In the remote possibility that an accident involving radiation would affect your farm products, state and county officials would activate the Emergency Alert System to issue instructions specific to the agricultural community.

Radiation and You

Radiation is energy in the form of waves or particles and is part of our everyday lives. Our planet receives radiation from outer space and from the sun.

Other naturally occurring radioactive materials are present in the soil, in the structures where we live, and in the food and water we consume. Radioactive gases are present in the air we breathe, too. It is no surprise that our bodies are radioactive. In fact, 80% of the radiation we receive comes from natural sources. These natural forms of radiation are referred to as "background radiation."

We also experience radiation in other forms such as medical and dental X-rays and increased cosmic rays during jet airplane flights. Each of us receives 100-350 units of radiation called millirem each year.

Radiation is one of the by-products of splitting the atom. The other is heat – which produces the steam to drive the turbine and produce electricity. Radiation comes in three forms: alpha particles, beta particles, and gamma rays.

Alpha Particles can travel only a few inches in air and can be stopped by a sheet of paper or the outer layer of a person's skin. These particles are only harmful if swallowed or inhaled.

Beta Particles can travel only a few feet in air and while they can pass through paper they can be stopped by aluminum foil or glass. As with Alpha particles these particles are only harmful if swallowed or inhaled.

Gamma Rays are high energy rays similar to those used to produce medical x-rays. This type of radiation is very penetrating and requires shielding of concrete, lead, or water to absorb the energy.

It should be noted that residents living near a nuclear power plant receive much less radiation from the plant than they do from other sources. A resident living within one mile of a nuclear plant receives only about .02 millirem of radiation from the plant each year. In fact, a nuclear plant adds so little radiation to the environment that it is difficult to measure it against the background radiation.

How Are Radioactive Materials Spread and How Are You Affected?

Radioactive materials that could be released from a nuclear power plant include particles and gases. Both are spread by the wind. Particles would eventually fall to the ground, with the heavier particles close to the plant and lighter ones farther away.

Weather conditions are an important factor. Under some conditions, the particles might travel up to 50 miles, but strong winds that could carry the particles long distances also disperse the radioactive material and lower the concentration. Rain could bring the particles to the ground more quickly and thus increase the concentration in an area.

The degree of harm, which may come from radiation, depends on the nature of the radioactivity, the length of exposure, how much of the body is exposed, and whether radioactive material has been ingested. Radiation exposure can be reduced in three ways - greater distance from the source, shorter time exposure, and sheltering in a building or other means of cover.

Studies have shown that no major health effects are seen until the level of radiation reaches 100 rem (100,000 millirem). The average person receives only 100-350 millirem of radiation each year from all sources.

What Is Contamination and How Long Does It Last?

Contamination refers to the undesired presence of radioactive materials.

If any surface, including skin or outer clothing is contaminated, the contamination can be removed by washing. This is called decontamination.

Radiation is greatest when it is initially released, but rapidly decreases. Particles reaching the ground soon after the release are more radioactive, while those that remain airborne for a longer period have lost much of their activity before coming to rest.

In an accident that would release radiation into the environment, farm equipment, animals, crops and the soil could become contaminated. People will be given specific instructions depending on the amount and type of radiation released.

How Would You Learn of a Nuclear Incident?

If the accident would affect residents within 10 miles of the plant, sirens would be sounded to alert residents to tune their radio or TV to an Emergency Broadcast System (EBS) station for information and instructions. These instructions could include taking shelter indoors, evacuation, or protective actions regarding fruits and vegetables, milk, water, and livestock.

Residents within 50 miles of the plant could also receive instructions regarding protective actions for fruits and vegetables, milk, water, and livestock. The agricultural community would receive these instructions in several ways. The Emergency Broadcast System (EBS) stations would carry these general instructions. Also, residents could be alerted by county Emergency Management Coordinators and agricultural extension agents.

A less severe incident might not require protective actions by the general public but could involve agricultural protective actions to minimize impact on the human food chain.

Emergency Planning Zones

There are two Emergency Planning Zones (EPZ) referred to in a radiological emergency:

Plume Exposure Pathway EPZ

An approximate 10-mile radius around a nuclear power plant. If there is a release of radioactive materials, evacuation or sheltering could be recommended.

Ingestion Exposure Pathway EPZ

An approximate 50-mile radius around a nuclear power plant. Evacuation or sheltering of people is not expected beyond a 10-mile area.

The safety of the food supply within the ingestion zone could become a concern. There could be internal exposure if you eat or drink contaminated products. Eating and drinking contaminated products could have harmful long-term health effects. State authorities, county authorities, farms, and food-related industries (including processing, transportation, and storage) would participate in a joint effort to identify and prevent contaminated food from reaching the public.

Nuclear Power Plants affecting Maryland

The large “outer ring” is a 50-mile radius, and the smaller “inner Ring” is a 10-mile radius. Darkened counties are those within the 10-mile radius. If a ring contains only part of a county, the entire county is considered as potentially impacted by the plant.

There are six nuclear power plants in or near Maryland that affect and/or provide power to Maryland citizens.

- Calvert Cliffs Nuclear Power Plant, Calvert County, Maryland
- Peach Bottom Atomic Power Station, York County, Pennsylvania
- Three Mile Island Nuclear Generating Station, Dauphin County, Pennsylvania
- Limerick Generating Station, Montgomery County, Pennsylvania
- Hope Creek Nuclear Generating Station, Salem County, New Jersey
- North Anna Nuclear Generating Station, Louisa County, Virginia

Protective Actions and Technical Guidance

State and local governments are responsible for evaluating and recommending food chain protective actions based on Food and Drug Administration guidelines. State emergency workers would collect field samples of milk, forage, crops, processed food, water, etc. to determine the location and extent of contamination.

Two levels of protective response apply to all food pathways. Preventive protective actions would minimize contamination of food products, while emergency protective actions would isolate contaminated food to prevent consumption and introduction into commerce.

The following guidelines describe steps you might be asked to take in the unlikely event of an emergency involving a release of radiation.

Protecting Your Farm

You may be asked to shelter your farm animals and give them protected feed and water. This will help prevent contamination from harming your animals, and from later entering the human food supply.

Checking for contamination at home gardens and small-scale farms may not begin for weeks after the emergency. Homegrown produce should be tested for radioactive contamination before it is consumed. Home gardeners and small-scale farmers should wait for a field monitoring team to help them, or for further instructions from local and state agriculture and health agencies.

Sheltering Animals

If you are advised to shelter animals, remove them from pasture and house them in a farm building. You may not have enough shelter available for all animals, so priority should be given to your most valuable livestock. It is important to remember that any shelter is better than none and that animals need adequate space and ventilation.

Some farm buildings provide better protection than others due to heavier construction. Placing earth, hay, sacked feed or fertilizer, concrete blocks, or other materials over and around exposed shelter walls will increase shielding effectiveness. Natural shelters such as caves, ravines, forests, and wood lots offer

some protection. Cattle could be penned in such structures as cattle underpasses or bridges if available. Cattle confined in pens would shield each other to a limited extent.

Possible livestock shelters:

- Barns
- Milking parlors
- Machine sheds
- Garages
- Corncribs
- Poultry buildings
- Swine buildings

An important sheltering factor is ventilation. Avoid using fans. However, if it becomes necessary, set the fan on a very low speed to minimize bringing in outside air. It is better to provide adequate space to the more valuable animals than to try to provide shelter to all animals and lose them from overcrowding.

State and local emergency response agencies will have more advice for decontaminating farm animals.

Giving Animals Protected Feed

You may be advised to place animals on protected feed and water that have not been stored in the open or exposed to radioactive contamination. Radioactive particles are like dust settling from the air. Therefore, a cover would prevent feed from being contaminated. The use of feed should be limited to those under cover or otherwise protected. Grain in permanent indoor storage, hay in a barn and silage in a covered silo may be considered protected. A haystack in an open field can be protected with a tarpaulin, plastic sheet, or similar covering. Large, rolled bales of hay in the open should be used only when absolutely necessary and only if the outer layers are removed and discarded.

You will be notified if the forage growing in your area is considered harmful. As a precautionary measure until clearance is provided, do not let animals graze, particularly dairy stock. If no stored feed is available, animals can survive for a period of time on water.

Types of protected feed include:

- Grain stored in protective bins
- Hay stored in a barn or covered shed
- Ensilage stored in a covered silo
- Hay bales covered by a tarp or barrier plastic or bales with the outer layers discarded

Giving Animals Protected Water

Even if you have no protected feed during a radiological emergency, animals can live for several days on water alone. Water from enclosed wells or other covered or underground sources will normally be safe for livestock. It is unlikely these water supplies will be affected.

Water from a covered well, tank, cistern or from a freely running spring is best. To prevent contamination from radioactive particles, do not add water to covered tanks unless the water is from a protected well or spring. Use all the water originally present in the tanks first.

Open water troughs should be drained, rinsed, and refilled after notification that radioactive materials have settled to the ground. The same procedure should be followed after windy weather spreads dust in the area.

Water in an exposed pond would be contaminated but the level of activity would fall rapidly and the water may be safe within a few days. Such water could be used for surface irrigation and to wash down buildings and unsheltered livestock. Surface water should be safe within a few days after emissions. The surface water in ponds and rivers would tend to be safer sooner if there is no rain. Otherwise, if possible, obtain drinking water for livestock from another source.

Protecting Water Sources

Open sources of water, such as rain barrels and tanks should be covered to prevent contamination. State and local health experts will check open sources of water and tell you whether they are safe.

Filler pipes should be disconnected from storage containers supplied by runoff from roofs or other surface drain fields. This will help prevent contamination from entering the storage containers.

Intake valves on water systems should be closed when you suspect the water source may be contaminated. This will prevent distribution or irrigation until the water source is tested and found to be safe.

Protection from Contaminated Soil

If state officials find that the soil is contaminated above established safety levels, proper soil management procedures can reduce contamination to safe levels. Idling – the non-use of land for a specific period of time – may be necessary. In situations involving highly contaminated soil, removal and disposal of the soil may be more appropriate.

Growing alternative non-food crops may also be recommended in some situations.

Deep-plowing the soil can move radioactive substances below the plant root level, prevent plants from taking up contaminated nutrients, and allow the level of radioactivity to decrease with the passage of time.

Protecting Your Crops

The following specific actions may be advised to reduce the danger of ingesting adulterated food products.

Milk

Remove all dairy animals from pasture and shelter them if possible and provide them with protected food and water. Sampling teams from the Maryland Department of the Environment will come to your farm to take milk, and possibly feed and water samples, for laboratory analysis to determine whether any of these products are adulterated.

If dairy products are contaminated, it will be recommended that milk and milk products be withheld from the market. It is possible, however, for milk products contaminated with very low levels of radioactive materials to be safe for human consumption.

The Maryland Department of Agriculture will advise as to which protective actions are appropriate.

Vegetables and Fruits, Including Grapes

Wash, scrub, peel, or shell locally grown fruits and vegetables, including roots, tubers, and grapes to remove surface contamination.

Meat and Meat Products

If there is a release of radioactive materials into the environment, you may be advised to place meat animals on protected feed and water, and, if possible, provide them with shelter. If livestock consume feed and water contaminated with radioactive materials, some of the contamination will be absorbed into their bodies and could then enter the human food supply through meat and meat products.

Poultry and Poultry Products

Poultry raised outdoors, especially those kept for egg production, should be monitored by taking samples and performing lab tests to determine the presence of radioactive contamination. Poultry raised indoors and given protected food and water are not likely to be contaminated. If adulteration is verified, the Maryland Department of Agriculture may advise that poultry and eggs not be eaten.

Grains

If grains are permitted to grow to maturity, most contamination will probably be removed by the wind and rain. Milling or polishing will probably remove any remaining contamination. Sampling and laboratory analysis will determine if the grain is safe to use. When harvested, adulterated and unadulterated grains should be stored separately.

Bees

Honey and beehives will need to be sampled and analyzed by the Maryland Department of the Environment if radioactive contamination is detected in the area.

Protecting Food Products

Food and Milk Processors, Warehouses and Commodity Terminals

Windows and vents should be closed. Vacuum systems should be shut down, as should compressed air systems. Any system that draws air from the outdoors to the inside should be shut down. Your facility will be notified directly by the Maryland Department of the Environment, if the food products in your facility are affected. If samples are collected, the Maryland Department of Agriculture officials will notify you which products can be released for sale.

Protection of Packaged Food Products

Food in finished packaging should not be harmful to eat if the outer wrappings are discarded. Radioactivity will travel as fine particles that may coat the outside of the food product container.

Summary

The information contained in this pamphlet applies to all areas of Maryland. Be familiar with the probable effect and potential effects of radiation contamination on your farming operation. If it should occur, listen for EAS messages on your local radio and television stations.

If you are warned that a radiological emergency exists, do the following:

- Arrange for the safety of you and your family
- Shelter all farm animals, especially dairy cattle, and feed and water livestock from stored feed and protected water
- Bring feed into building, or cover it if outdoors
- Store as much water as possible for livestock. Cover wells, rain barrels and tanks
- Delay grazing of animals on contaminated pasture
- Place food or water in a closed area inside a house where it cannot be contaminated

Uncovered food brought in from a contaminated area should be cleaned. Eggs, potatoes, melons and root crops that are clean can be eaten. Green vegetables should be carefully washed and their outer layers removed if they were exposed to radiation. Peas and beans require normal cleaning.

You should protect yourself against radioactive contamination by:

- Washing hands thoroughly before you eat
- Wear clothing such as coveralls, gloves and hats while working outside. The clothing should cover all portions of your body. Remove outer clothing before going inside.
- As much as possible, avoid activities that can re-suspend contamination, such as plowing, digging, burning, or mowing. Wear a dust mask or a folded, dampened cloth over your nose and mouth to reduce the quantity of radioactive materials inhaled when such activities cannot be avoided.
- Shower after completing outdoor activities
- Wash outer clothing

Governmental agencies will conduct assessments of land and crop damages and will advise you on how farm activities should be continued following a radiological accident.

If you desire to discuss this subject further or conduct a meeting in your community on this topic, contact your local Extension Office, any local USDA agency representative, your Emergency Coordinator or the Maryland Department of Agriculture.

Appendix A - Livestock Requirements

* The following charts are extracted from ASAE (American Society of Agricultural Engineers) Standards 1986.

Water Requirements per Animal per Day

Ample Supply*		
Animal	Liters	Gallons
Cattle	64.0	17.0
Hogs	9.5	2.5
Sheep	5.8	1.5
Poultry		
-Layers and Broilers-	0.24	0.06
-Turkeys-	1.26	0.30
Limited Supply**		
Animal	Liters	Gallons
Cattle	26.5	7.0
Hogs	4.8	1.2
Sheep	3.8	1.0
Poultry		
-Layers and Broilers-	0.20	0.05
-Turkeys-	0.50	0.12

* Average requirements at a temperature of 27°C (80 °F)

** Water rationing facilities required

Limited Feed Requirements for livestock per day

Animal	Feed	Amt.of Feed % of body wt.
Cow, lactating	Hay	2
Cow, dry	Hay	1
Calf, less than 9 mo.of age	Hay	1
	40% protein supplement	0.2
Sheep, ewe	alfalfa hay	1
Sheep, lamb 27 kg. (60 lbs)	alfalfa hay	1.5
Sow, pregnant	corn	0.4
	35% protein supplement	0.2
Sow, lactating	corn	1
	35% protein supplement	0.2
Hog, 45kg. (100 lbs.)	corn	1.5
Hog, 91kg. (200 lbs.)	corn	1
Laying hen	mash	2
Turkey, 5 kg (10 lbs.)	mash	1.7
Turkey, 11 kg (25 lbs.)	mash	1.3

* Equivalent feeds may be substituted. Hay should be at least one-half legume or equivalent in protein content.

Limited Space for Animals in Fallout Shelters

Animal	Space per Animal	
	Sq. M.	Sq. Ft.
Cow	1.9	20
Calf	1.1	12
Sheep, ewe	0.93	10
Sheep, lamb 27 kg. (60 lbs)	0.37	4
Sow, lactating	3.0	32
Hog, 45kg. (100 lbs.)	0.37	4
Hog, 91kg. (200 lbs.)	0.56	6
Chicken	0.06	0.7
Turkey, 5 kg (10 lbs.)	0.14	1.5
Turkey, 11 kg (25 lbs.)	0.19	2

* These charts were originally captured from ASAE Standards 1986, and compared to ANSI/ASAE EP282.2 FEB 04. These were approved in 1993, and reaffirmed MAR 2004 by American National Standards Institute

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For more information, please contact the MDA Public Information Office
 50 Harry S. Truman Parkway
 Annapolis, Maryland 21401
 Baltimore/Annapolis:
 410-841-5700