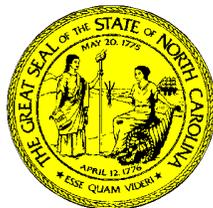


# Emergency Information For Farmers and Food Processors



## In Case of a Radiological Accident at a Nuclear Power Plant



**Developed  
by**

**North Carolina Emergency Management  
in cooperation with**

**NC Cooperative Extension  
and  
North Carolina Department of Agriculture & Consumer  
Services**



**FEMA**

## **Preface**

The information in this pamphlet is designed to provide information for farmers and growers on the probable and potential effects of radiation on farming operations. 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.

This guide will also be useful to processors and distributors of products from within an affected area or accident site. This information also applies to communities near nuclear power station, and communities which may be affected by a transportation accident involving radioactive materials on one of our major highways. Information is shared on what you may be asked to do if an incident occurs causing an area to be exposed to contamination.

In the event of an emergency, your first concern will be 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 will also affect the farming in your area, instructions for farmer's needs will also be issued over EAS. This will provide you with an explanation of the actions that you may be advised to take to protect farm animals and products.

Comprehensive emergency plans have been prepared cooperatively by local and state emergency management officials to advise you should the need arise.

## **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 Brunswick Nuclear Power Plant, the Harris Nuclear Power Plant, and the McGuire Nuclear Power Station are nuclear power plants in our state and the Catawba Nuclear Power Station in South Carolina operates close to the North Carolina border.

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.

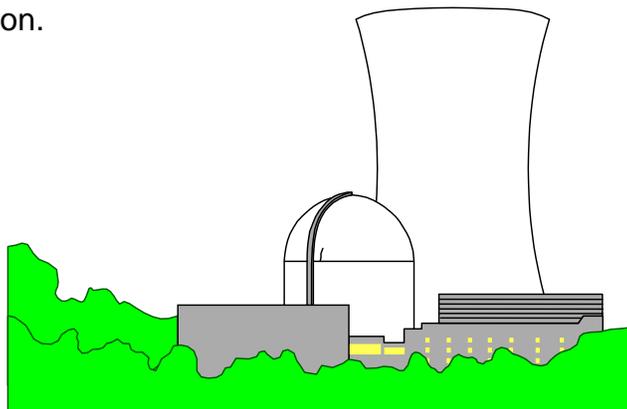
Radiation is one of the by-products of splitting the atom. The other is heat – which produces the steam to drive the turbine and produce electricity. Radiation comes in three forms: alpha particles, beta particles, and gamma rays.

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.

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. 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.

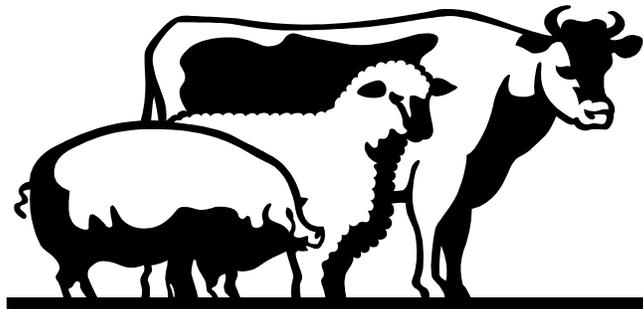
## **What Is Contamination And How Long Does It Last?**

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.

### **The Ingestion Pathway**

A circular area of about 50 miles around a nuclear plant is called the Ingestion Pathway. Some parts of this area could be affected by an accident involving a release of radiation.

The principal exposure to radiation contamination that must be considered in the ingestion pathway is through the consumption of contaminated foods such as milk, fresh fruits, and vegetables, processed meat products and water. When large enough amounts of radioactive particles or gases enter the body, cells can be damaged. Therefore, it is important to prevent contamination from entering the human food chain.

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.

### **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.

## **Protection of Farm Animals and Products**

### **Concern for Animal Feed and Water**

Animal consumption of contaminated feed and water is of primary concern because some radioactive material could be absorbed by their bodies through this means. If these animals or milk from these animals were consumed, radiation would enter the human food chain causing human exposure. The reason for preventing farm animals from eating contaminated feed or drinking contaminated water is thus to prevent possible human radiation exposure.

### **Sheltering Guidance**

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.

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.



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.

It is important to remember that any shelter is better than none and that animals need adequate space and ventilation. Plan to give your most valuable animals the best shelter and care.

### **Protected Water Supply**

The best sources of water are a covered well, tank, cistern, or running spring. Protect standing water by covering the surface at the outset of an emergency. Do not add water to covered storage unless it is from a protected source. Use all the original water in protected storage before adding more.

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.

### **Protected Animal Feed**

Radioactive particles are like dust settling from the air. Therefore, a cover would prevent feed from being contaminated. The use of feeds 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.

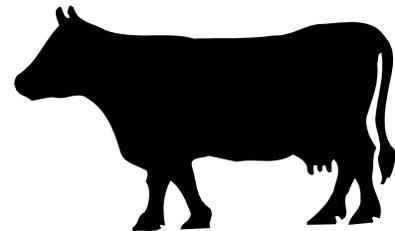


You will be notified if the forage growing in your area is considered harmful. As a precautionary measure until clearance is provided, do not let animals graze, particularly dairy stock. If no stored feed is available, animals can survive for a period of time on water.

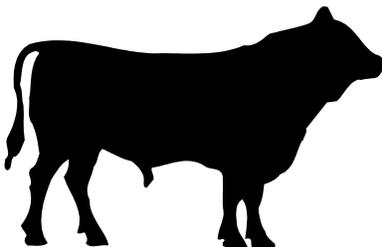
### **Protection of Dairy Goats and Cows and Beef Cattle**

Dairy goats and cattle should be moved indoors first, because radioactive material easily transfers to milk. Make a special effort to prevent dairy animals from becoming contaminated by providing clean feed and water. There is little radiation danger to the dairy animals themselves, but more in the foods produced for human consumption such as milk and other dairy products.

State emergency personnel will be monitoring milk on farms and at other points on its way to market. If your milk is sampled, you will be informed whether it contains radioactive materials.



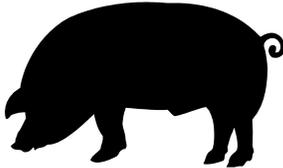
Beef cattle should be restrained from grazing on contaminated pastures. Where it cannot be avoided, supplementing grazing with protected feeds will limit the amount of ingested contamination. If possible, feed cattle protected stacked hay, silage, or grain.



To the extent possible, prevent cattle from drinking from ponds, lakes, rivers, and streams. Water from covered sources such as springs and wells would be essentially free of contamination.

## **Protection of Swine**

Swine raised in buildings will have readily available protection from contamination. Breeding stock and the most valuable animals should receive priority care.

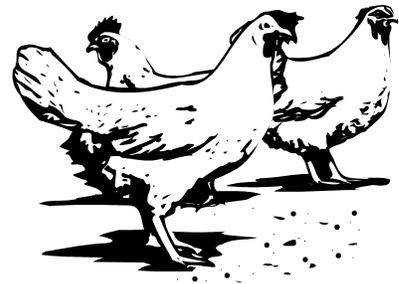


Adequate space is important and ventilation systems should be run at the lowest possible level. Since water is the primary necessity for hogs, it is important that it come from a protected source. Stored feed should also have adequate protection from contamination. If it is available, use prepared rations until the supply is exhausted and only then switch to stored grain.

## **Poultry Care**

Eggs and poultry products are important food sources and should be protected to prevent human consumption of radioactive materials.

Poultry are somewhat more resistant to radiation than other farm animals. Other factors, which contribute to a lower concern for these animals are the confined shelters in which they are raised, and the use of stored feed.



Close building openings and operate ventilating systems at the lowest possible level. Many of the same feed and water measures used for livestock apply to poultry as well.

## **Long Term Animal Care**

In the very unlikely event that an evacuation of your area is needed, leave animals with as much protected food and water as conditions permit. If your absence is for a longer period than the initial supplies would last, reentry to the evacuated zone to care for livestock may be permissible as determined by emergency management officials. In this case, you must conform to all rules regarding emergency workers, including the use of protective equipment and instrumentation, and limitation of your stay in the area. Your agricultural extension agent can advise you of the emergency status and how it affects your farm.

## **Animal Sickness**

Even for the worst case accident and radiological release, it is unlikely that the type and level of emissions would cause animal illness. It is even more unlikely that a worst case event would cause the death of any animals.

Any unexplained illness or deaths would more likely be the result of changes in routines of livestock feeding and patterns of grazing.

In the event of death or illness of any farm animal, contact the North Carolina Department of Agriculture (NCDA) or your agricultural extension agent immediately. The NCDA is prepared to examine your animal and to assist in the diagnosis of problems.

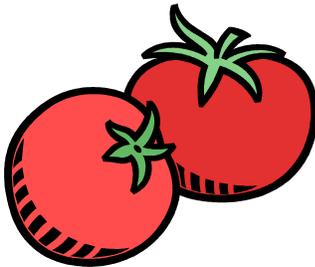
### **Decontamination of Animals and Buildings**

Soap and water will remove contamination from animal hides. However, when using this method to decontaminate animals, wear protective clothing similar to that used in pesticide application. Take precautions to keep yourself from becoming contaminated. If you believe your clothes have become contaminated, remove them and wash them as you normally would in the washing machine. Any contamination would remain in the water and would not contaminate the washing machine.

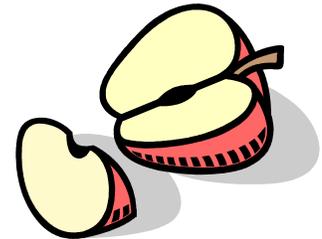
Agricultural extension agents will advise you of the decontamination procedures for your farm.

### **Fruits and Vegetables**

Exposure of growing fruits and vegetables to radioactive particles results in external contamination. Leaves, pods and fruits that are surface contaminated can be cleaned before being eaten. Normal washing is the effective removal method, but should be done in a place other than the kitchen so as to prevent possible contamination of those foods and dishes.



Underground crops absorb little contamination. The standard washing method would be sufficient to prepare these foods for consumption.



At a time of a radiological emergency, ripe fruits may be lost due to the personnel hazard involved in harvesting. Fruits that need not be immediately picked can be saved if gathered after the contamination has decayed.

### **Contamination of the Land**

Even in the most serious conceivable incident, it is anticipated that most land would be returned to normal agricultural use within several weeks after having been contaminated. The exact length of time that the land remains contaminated would depend on the amount and type of radioactive deposition.

The NC Department of Agriculture & Consumer Services and the NC Division of Radiation Protection are prepared to monitor and sample your land and advise regarding the correct measures.

## **Recommended Protective Actions**

### **For Farmers**

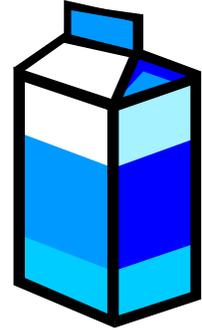
- When you go outside, wear clothing that covers all portions of the body, similar to what you would wear when applying pesticides; for example: boots, gloves, coveralls, or long sleeved shirts, and long pants.
- Wear a protective mask or place a folded (preferably dampened) cloth over your mouth and nose when working outside to prevent inhalation of radioactive materials.
- Remove outer clothing.
- Wash hands thoroughly before preparing or eating food.
- Wash, scrub, peel, or shell any fresh fruits and vegetables before eating them.
- Remove dairy animals from pasture, shelter if possible, and provide them protected feed and water.
- Do not slaughter any animals
- Do not use fresh milk from your dairy animals, vegetables from your garden, or eggs from your chickens.
- Do not engage in dust-producing activities such as cultivating, disking, baling, or harvesting.
- Do not process or distribute agricultural products until they have been sampled by appropriate government officials and found to be free of contamination.
- Do not transport or market contaminated food products.
- Do not fish or hunt.
- Specific instructions will depend on the distance of your farm or facility from the nuclear power plant and the prevailing winds.

## For Food Supply

### Milk

Remove all dairy animals from pasture, shelter if possible, and provide them with protected food and water. State or local government officials may come to your farm to take milk, food, and water samples for laboratory analysis to determine whether any of these products are contaminated.

If dairy products are found to be contaminated, it may be recommended that milk and milk products be withheld from the market. It is possible, however, for milk products contaminated with certain radioactive materials to be safe for human consumption after proper storage over a period of time. This will allow for decay of the radioactive materials. The decay may be achieved by freezing and storing fresh milk, concentrated milk, or concentrated milk products. Storage of milk for prolonged periods of time at reduced temperature is also possible provided ultrahigh temperature pasteurization techniques are used during processing. Using fluid milk for the production of butter, cheese, dry milk, or evaporated milk may also be possible.



You will be advised by state and local government officials as to what protective actions are appropriate.

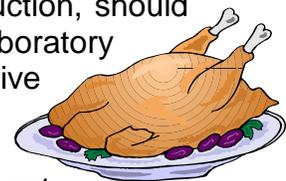
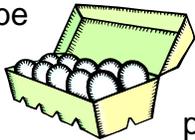
### Meat and Meat Products

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



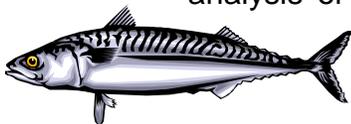
### Poultry and Poultry Products

Poultry raised outdoors, especially those kept for egg production, should be monitored by taking samples and performing laboratory tests to determine the presence of radioactive contamination. Poultry raised indoors and given protected feed and water are not likely to be contaminated. If contamination is verified, State and local government officials may advise that poultry and eggs should not be consumed.



### Fish and Marine Life

Fish and other marine life raised in ponds may continue to be harvested unless appropriate State and local government officials have determined through laboratory analysis of samples that they are contaminated. Samples of fish, water, and marine life from open bodies of freshwater and saltwater should also be analyzed to ensure that they are safe to consume.



## Honey

Honey and beehives will need to be sampled and analyzed by appropriate State and local government officials if radioactive contamination is detected in the area. You will be instructed by local government officials on how to handle the hives and honey.



## **For Soils and Grains**

### **Soils**

If State and local government officials determine that the soil is contaminated, proper soil management procedures can be implemented to reduce contamination to safe levels. Idling, the non-use of the land for a specific period of time, may be necessary in some cases. However, in situations involving highly contaminated soil, removal and disposal of the soil may be more appropriate.

Planting alternative crops may also be recommended in some situations. Crops such as cotton and flax could be substituted for food crops because they contribute little or no radioactive material to the human diet.

Deep plowing the soil will 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

State and local government officials will advise you on the best actions to take to minimize the effects of contamination in the soil.

### **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, contaminated and uncontaminated grains should be stored separately.

## **For Water Supplies**

### **Water**

Open sources of water should be protected. Cover open rain barrels and tanks to prevent contamination. Covered wells and other covered or underground sources of water will probably not become contaminated. Radiation contaminants deposited on the ground will travel very slowly unless soils are sandy. It is unlikely that underground water supplies will be affected.

Filler pipes should be disconnected from storage containers that are supplied by run-off from roofs or other surface drain fields. This will prevent contaminants from entering the storage container.

Close water intake valves from any contaminated water sources to prevent distribution (e.g. irrigation) of contaminated water.

## Food Processing and Marketing

### Marketing Animal Food Products

Do not destroy any animal foods unless storage has made them inedible. You will receive specific instructions from state authorities. Milk should be safe to use if it is from dairy animals that have been adequately sheltered and protected.

Livestock that have been exposed to external contamination can be used for food if they have been adequately washed and then monitored by state authorities prior to slaughter. Meat animals that have internal contamination cannot be slaughtered until the state authorities advise the owner that it is safe to do so.

If milk pickups and deliveries are interrupted because of an emergency, officials will be in touch with milk transport firms to provide instructions. There may be delays in pickups, which will require holding milk for longer than normal periods. If the delay is too great for the adequate storage of all milk produced, you should have alternate storage or processing plans. It is possible that some milk may have to be discarded.



## **Guidance for Food Processors, Transporters, and Distributors**

The following precautions should be observed in the area identified as the ingestion pathway during a radiological accident. Depending on the amount of radioactive materials released into the atmosphere and the prevailing weather conditions, people, animals, crops, land, and water near the site of the radiological emergency could be affected. Initial concern would be the condition of fresh milk from dairy animals grazing on pasture and drinking from open sources of water. Sampling for contamination could occur at the farm, the transfer station or the processing plant.

If food was being processed at a facility, exposed to the atmosphere while in transit, or transported prior to clearance by state authorities, firms will receive notification of embargo from the NC Department of Agriculture. Radioactive contamination of milk and other food products can occur during processing or transportation. This can result from exposure to radioactive materials on the ground or in the air, and from contact with contaminated products.

A later concern would be the possible contamination of vegetables, grains, fruits, and nuts. The severity of the impact of the contamination would depend on the time of year. The time immediately prior to or during harvest is the most critical. Crops will be sampled and analyzed by appropriate government officials to ensure that they are safe to eat.

An additional concern would be the possible impact of the contamination of livestock and poultry. Pasture, feed and water sources, as well as meat products and poultry products will be sampled and analyzed to ensure that the meat and poultry are safe to eat.

Following a radiological emergency, government officials may restrict the movement of food products and withhold them from the marketplace if they are found to be contaminated. These products should not be released until they are considered safe for consumption, or until a decision is made to dispose of them. You will be instructed how to safely handle and dispose of contaminated food products. Foods determined by laboratory analyses to be contaminated will be subject to disposal in accordance with NC Radiation Protection Section procedures. Such foods may be moved only with specific instructions.

## **Economics**

Under the worst conditions, radioactive contamination could reduce the economic productivity of your farm. As previously mentioned, you may suffer loss of some farm and dairy items due to spoilage during the period of time that a radiological emergency is in progress. However, following an accident, radioactive contamination might reduce the competitive economic value of your farm products. This would be due to public reluctance to purchase farm products that are suspected of having been grown in an area that has been affected by a radioactive release from a nuclear power plant or some other source. State authorities will advise you on the contamination level that your farm experienced and the marketability of your farm products. An insurance pool has been established by the utility companies to help individuals recover from the losses caused by a radiological disaster.

## **Summary**

If you are warned that a radiological emergency exists, do the following: make arrangements for the safety of your family and farm.

### **For the farm:**

- Shelter all farm animals, particularly dairy cattle and dairy goats.
- Feed and water livestock from stored feed and protected water
- Bring feed into buildings or cover outdoor feed supplies.
- Store as much water as possible for livestock.
- Cover wells, rain barrels, and tanks.

### **For the family:**

- Place food and water inside a closed area in your house where it cannot be contaminated. Uncovered food brought in from a contaminated area should be cleaned.
- Eggs, potatoes, and melons that are cleaned may be eaten.
- Green vegetables should be carefully washed. Remove the outer layers if they were exposed to contamination.
- Peas and beans require normal cleaning.
- Wash hands thoroughly before eating.

### **For farm work:**

- Wear protective clothing (similar to that used for pesticide application) when working outdoors for the first few days following the emergency. Remove outer clothing before entering your home or other clean area. Shower thoroughly and immediately after finishing work.
- Wear a dust filter over your nose and mouth when cultivating dry earth or if harvesting corn or feed grains.

# Livestock Requirements

## Limited Feed Requirements \*

<b>Animal</b>	<b>Feed</b>	<b>Amount of Feed Per Day (%of body weight)</b>
<b><u>Cattle</u></b>		
Cow, lactating	Hay	2
Cow, dry	Hay	1
Calf, less than 9 months of age	Hay, plus 40% protein supplement	2/0.2
<b><u>Sheep</u></b>		
Ewe	Alfalfa Hay	1
Lamb, 27 kg (60 lbs.)	Alfalfa Hay	1.5
<b><u>Swine</u></b>		
Sow, pregnant	Corn, plus 35% protein supplement	0.4/0.2
Sow, lactating	Corn, plus 35% protein supplement	1/0.2
Hog, 45 kg (100 lbs.)	Corn	1.5
Hog, 91 kg (200 lbs.)	Corn	1
<b><u>Poultry</u></b>		
Laying Hen	Mash	2
Turkey, 5kg (10 lbs.)	Mash	1.7
Turkey, 11kg (25 lbs.)	Mash	1.3

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

## Water Requirements Per Animal Per Day\*

### Ample Supply

<u>Animal</u>	<u>Liters</u>	<u>Gallons</u>
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 \* \*

<u>Animal</u>	<u>Liters</u>	<u>Gallons</u>
Cattle	26.5	7.0
Hogs	4.8	1.2
Sheep	3.8	1.0
Poultry		
Layers and Boilers	0.20	0.05
Turkeys	0.50	0.12

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

\* \* Water rationing facilities required

## Limited Space In Fallout Shelters

	<u>Space Per Animal</u>	
<u>Animal</u>	<u>Square Meters</u>	<u>Square Ft</u>
<b>Cattle</b>		
Cow	1.9	20
Calf	1.1	12
<b>Sheep</b>		
Ewe	0.93	10
Lamb, 27 kg (60 lbs.)	0.37	4
<b>Swine</b>		
Sow, lactating	3.0	32
Hog, 45 kg (100 lbs.)	0.37	4
Hog, 91 kg (200 lbs.)	0.56	6
<b>Poultry</b>		
Chicken	0.06	0.7
Turkey, 5 kg (10 lbs.)	0.14	1.5
Turkey, 11 kg (25 lbs.)	0.19	2