TEXAS

EMERGENCY MANAGEMENT

PROCEDURES

PROCEDURE 2

ACCIDENT ASSESSMENT – INGESTION PATHWAY

Radiological Emergency Procedures of the Radiation Control Program
Texas Department of State Health Services

PROCEDURE 2

ACCIDENT ASSESSMENT – INGESTION PATHWAY

APPROVAL AND IMPLEMENTATION

This procedure is hereby approved for implementation and supersedes all previous editions.

06/02/2005
Date

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DATE OF CHANGE	*INITIALS AND DATE ENTERED*
03/22/2004	Revised entire document
06/02/2005	Administrative changes

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ACCIDENT ASSESSMENT: INGESTION PATHWAY

I. Purpose

This procedure identifies planning considerations for responding to accidental releases of radioactive materials that could enter the human food chain. This procedure is specific to activities of the Radiation Control Program (RCP), which are directed toward evaluation of the extent of actual or potential food chain contamination and toward preventing or mitigating the impact of such contamination.

II. References

A. 25 Texas Administrative Code § 289

B. Manual of Protective Action Guides and Protective Actions for Nuclear Incidents, May 1992 (EPA 400-R-92-001)

C. Accidental Radioactive Contamination of Human Food and Animal Feeds: Recommendations for State and Local Agencies. U.S. Department of Health and Human Services, Food and Drug Administration (1998)

D. Procedure 1: Accident Assessment: Plume Exposure Pathway

E. Procedure 10: Monitoring and Sampling Airborne Gamma Releases

F. Procedure 11: Monitoring and Sampling Alpha Releases

G. Procedure 22: Recovery Operations

III. Discussion

Recommendations on accidental radioactive contamination of human food and animal feeds were issued in 1982 by the Food and Drug Administration (FDA). These recommendations resulted in “Emergency Protective Action Guides” and “Preventive Protective Action Guides.” New scientific information and a change in radiation protection philosophy resulted in changes to the Protective Action Guides (PAGs) in 1998. This guidance is provided in reference C, replaces the Preventive and Emergency PAGs with one set of PAGs for ingestion pathway. The PAGs are 0.5 rem (5 mSv) for committed effective dose equivalent (CEDE) or 5 rem (50 mSv) committed dose equivalent to an individual tissue or organ, whichever is more limiting. These PAGs correspond to “intervention levels of dose”. “Intervention levels of dose” are radiation doses at which introduction of protective actions should be considered. Food with

concentrations below the Derived Intervention Level (DIL) is permitted to move in commerce without restriction. Food with concentrations at or above the DIL is not normally permitted into commerce. However, State and local officials have flexibility in whether or not to apply restrictions in special circumstances, such as permitting use of food by a population group with a unique dependency on certain food types.

The Federal Drug Administration (FDA) calculated DILs for nine radionuclides based on the five different groups (See Table 1). For each radionuclide, DILs were calculated for six age groups using PAGs, dose coefficients, and dietary intakes relevant to each radionuclide and age group.

The nine radionuclides comprise five radionuclides groups, each having common characteristics. The five groups are: Sr-90; I-131; Cs-134 + Cs-137; Ru-103 + Ru-106; and Pu-238 + Pu-239 + Am-241. An accident could involve more than one of the five groups.

Protection of the more vulnerable segments of the population and the practicality of implementation were major considerations in the selection of the recommendations. These considerations lead to the single DIL for each radionuclide group based on the most limiting PAG and age group. Table 1 presents these DILS. Any concentration that is equal to or exceeds the DILs warrants protective actions.

IV. Response Activities

A. Protective Actions

Protective actions are steps taken to limit the radiation dose from ingestion by avoiding or reducing the contamination that could occur on the surface of, or be incorporated into, human food and animal feeds. Such actions can be taken prior to and/or after confirmation of contamination. The protective actions for a specific accident are determined by the particulars of the situation and once initiated they continue at least until the concentrations are expected to remain below the DILs.

1. Protective actions, which can be taken within the area likely to be affected, and prior to confirmation of contamination consist of (See Attachment 1):

   a. Simple precautionary actions to avoid or reduce the potential for contamination of food and animal feeds, and

   b. Temporary embargoes to prevent the introduction into commerce

of food, which is likely to be contaminated.

Protective actions can be taken before the release or arrival of contamination if there is advance knowledge that radionuclides may accidentally contaminate the environment.

For accidents at Department Of Energy (DOE) facilities, the DOE has established three emergency classes: Alert, Site Area Emergency, and General Emergency. These classes are comparable to the Emergency Action Levels, of the same names, established by the United States Nuclear Regulatory Commission (NRC). DOE covers incidents considered as Unusual Events by NRC licensees as Unusual Occurrences. Simple precautionary actions include modest adjustment of normal operations prior to arrival of contamination. These will not guarantee contamination in food will be below the DILs but the severity of the forthcoming problem would be significantly reduced. Typical precautionary actions include covering exposed products, sheltering livestock; and providing protected feed and water.

2. Protective actions which should be implemented when the contamination in food equals or exceeds the DILs consist of (see Attachment 2):

   a. Temporary embargoes to prevent the contaminated food from being introduced into commerce, and

   b. Normal food production and processing actions that reduce the amount of contamination in or on food to levels below the DILs.

      A temporary embargo to prevent the introduction into commerce of food from a contaminated area should be considered when the amount equals or exceeds the DILs. The temporary embargo would continue until measurements confirm that concentrations are below the DILs.

      Normal food production and processing procedures that could reduce the amount of radioactive contamination in or on the food could be simple, e.g., such as holding to allow for radioactive decay, or removal of surface contamination by brushing, washing, or peeling or could be complex. The blending of contaminated food with uncontaminated food is not permitted because this is a

violation of the Federal Food, Drug and Cosmetic Act.

3. Protective actions for animal feeds confirmed as contaminated:

Protective actions to reduce the impact of contamination in or on animal feeds, including pasture and water, should also be taken on a case-by-case basis. Protective actions that could be taken when animal feeds are contaminated include the substitution of uncontaminated water for contaminated water and the removal of lactating dairy animals and meat animals from contaminated feeds and pasture with substitution of uncontaminated feed. Sheltering livestock could also be effective. State and local officials would determine the protective actions, with assistance from growers, producers, and manufacturers.

V. Outside Assistance

Sample collection teams will consist of RCP staff members and representatives from other Texas agencies as necessary. In addition, representatives from the Texas Department of Agriculture or local agricultural community representatives may be utilized. If necessary, sample collection assistance may also be requested from other states, the U.S. Department of Energy, other federal agencies, either nuclear power generating utility, or commercial firms under contract to any of the above.

Table 1
Recommended Derived Intervention Level (DIL)
or Criterion for Each Radionuclide Group[(a),(b)]

All components of the Diet

Radionuclide Group	(Bq/Kg)	Pci/Kg
Sr-90	160	4300
I-131	170	4600
Cs-134 & Cs-137	1200	32000
Pu-238 & Pu239 & Am-241	2	54
Ru-103 & Ru-106[8]	$\frac{C3}{6800} + \frac{C6}{450} < 1$	$\frac{C3}{180{,}000} + \frac{C6}{12{,}000} < 1$

Notes:

(a) The DIL for each radionuclide group (except for Ru-103 & Ru-106) is applied independently (see discussion in Appendix D of Reference C. Each DIL applies to the sum of the concentrations of the radionuclides in the group at the time of measurement.

(b) Applicable to foods as prepared for consumption. For dried or concentrated products such as powdered milk or concentrated juices, adjust by a factor appropriate to reconstitution, and assume the reconstitution water is not contaminated. For spices, which are consumed in very small quantities, use a dilution factor of 10.

(c) Due to the large difference in DILs for Ru-103 and Ru-106, the individual concentrations of Ru-103 and Ru-106 are divided by their respective DILs and then summed. The sum must be less than one. C3 and C6 are the concentrations, at the time of measurement, for Ru-103 and Ru-106, respectively (see discussion in Appendix D of reference C).

INGESTION PATHWAY PREVENTIVE PROTECTIVE ACTIONS

Food Type	Area of Impact	Protective Action
Milk	Farms	1. Remove lactating dairy animals from contaminated pasturage, move the animals into a barn or other controlled areas, and provide uncontaminated feed (had been stored in-doors or covered out of doors). 2. Provide animals with uncontaminated water. Sources may be covered wells or cisterns, or closed storage tanks. Do not use surface water such as streams, ponds or open reservoirs. 3. Store milk for a prolonged period at a reduced temperature. 4. Dispose of contaminated milk by dumping it on pastureland.
	Processor	1. Withhold contaminated milk from the market to allow decay of short-lived radionuclides. This may be achieved by storing frozen fresh milk, or frozen concentrated products. 2. Store milk for a prolonged period at a reduced temperature in conjunction with a special pasteurization process using ultra high temperatures. 3. Divert the production of fluid milk for the production of dry whole milk or evaporated milk. 4. Attempt to store all incoming shipments in separate tanks and segregate milk not originating in the ingestion pathway EPZ.
Drinking Water	All	1. Do not use surface water (streams or ponds) for human and animal consumption. 2. Limit the ingestion of potable water (either for drinking or cooking) until the source has been checked and approved for consumption.

INGESTION PATHWAY PREVENTIVE PROTECTIVE ACTIONS

Food Type	Area of Impact	Protective Action
Drinking Water	All	3. Water stored in closed containers prior to the incident may be ingested. This includes refrigerator storage, closed tanks, covered wells, etc. 4. Bottled water, canned beverages, and juices may be used as water sources.
Fresh Fruit and vegetables (includes crops in the field, in transit to market, roadside stands, and in homes.	Commerce	1. Remove surface contamination by washing, brushing, scrubbing, or peeling. 2. Foods which have been in sealed packages, cans, cartons, barrels, etc. since before the incident need no treatment.
	Public	1. If stored in the open, remove surface contamination by washing, brushing, scrubbing, or peeling. 2. Foods in sealed packages, or in pantries or refrigerators, or which are otherwise protected need no special treatment.
Shellfish and Fin Fish	Commercial Aquaculture, Fishing Firms and Charter Boats	1. Suspend fishing/harvesting operations until resumption is recommended. 2. Check the catch/harvest made on the day of the advisory.[a] 3. Keep the catch/harvest covered until it is transported outside the area of possible contamination.
Animal Feeds	Dairy Farms and Poultry Farms	1. Use feed that has been stored indoors.
General	Public	1. Preserve food before it becomes contaminated by canning, freezing, or dehydration.

(a) RCP will determine method of checking at the time of the event.

INGESTION PATHWAY PREVENTIVE PROTECTIVE ACTIONS

Food Type	Area of Impact	Protective Action
General	Public	2. Store food to permit decay of short-lived radionuclides. 3. Cooked or raw food may be stored in a refrigerator, pantry, box, or other closed container.
Meat and Meat Products	Commerce	1. Delay slaughter of animals used for food. 2. Store meat and meat products to allow decay of short-lived radionuclides. 3. Divert contaminated meat to non-human consumption. 4. Dispose of meat and meat products in which the radioactivity cannot be reduced to levels that are acceptable for use.

Note: The Food and Drug Administration does not consider dilution as an acceptable means of achieving contamination levels which are below the preventive or emergency response levels.

INGESTION PATHWAY EMERGENCY PROTECTIVE ACTIONS

Food Type	Area of Impact	Protective Action
Milk	Farms	1. Remove lactating dairy animals from contaminated pasturage, move the animals into a barn or other controlled areas, and provide uncontaminated feed (had been stored in-doors or covered out of doors). 2. Provide animals with uncontaminated water. Sources may be covered wells or cisterns, or closed storage tanks. Do not use surface water such as streams, ponds, or open reservoirs. 3. Store milk for a prolonged period at a reduced temperature. 4. Dispose of contaminated milk by dumping it on pastureland.
	Processor	1. Withhold contaminated milk from the market to allow decay of short-lived radionuclides. This may be achieved by storing frozen fresh milk or frozen concentrated products. 2. Store milk for a prolonged period at a reduced temperature in conjunction with a special pasteurization process using ultra- high temperatures. 3. Divert the production of fluid milk for the production of dry whole milk, butter, or evaporated milk. 4. Attempt to store all incoming shipments in separate tanks and segregate milk not originating in the Ingestion Pathway EPZ.
	Public	1. Fresh milk on hand prior to the advisory and stored in closed containers may be used. Dry or canned milk in closed containers may also be used. 2. Do not use milk from any dairy animals which have had access to contaminated food or water.

INGESTION PATHWAY EMERGENCY PROTECTIVE ACTIONS

Food Type	Area of Impact	Protective Action
Drinking Water	Farms	1. Do not use surface water for human or animal consumption. Surface water may be used for sanitary and non-consumption purposes. 2. Other water sources identified as contaminated should not be consumed, but may be used for other purposes. 3. Water stored in closed tanks or vessels prior to the advisory may be consumed.
	Commerce	1. Water identified as contaminated should not be used for processing materials (consumable, containers) which will enter the food chain. 2. Contaminated water may be used for other industrial and commercial operations if so advised.
	Public	1. Secure outlets of wells for water identified as contaminated. Do not use reservoir water identified as contaminated. Do not use water for consumption that has not been checked. It approved, this water may be used for sanitary and other purposes. 2. Use alternate sources of liquid such as water drawn and stored in closed containers prior to the advisory, bottled or canned beverages and juices, and water provided by emergency organizations. 3. Arrange for alternate water supplies from outside the affected area to be transported into areas requiring them.
Other Food	Commerce	1. Prevent introducing a food type into commerce if it has been identified as being contaminated. 2. Consider other sources of food originating outside the Ingestion Pathway EPZ. 3. Do not process or vend unpackaged food if the operations area has been identified as contaminated.

INGESTION PATHWAY EMERGENCY PROTECTIVE ACTIONS

Food Type	Area of Impact	Protective Action
Other Food	Public	1. Restrict diet to foods stored in closed containers prior to the advisory, or to packaged and sealed foods. 2. Fresh fruits and vegetables should be thoroughly washed, brushed, scrubbed, or peeled.
General	All	1. Restrict diet to foods identified as not contaminated or originating outside of the affected portion of the Ingestion Pathway EPZ. 2. Stay alert for public information bulletins.
Meat and Meat Products	Commerce	1. Delay slaughter of animals used for food. 2. Store meat and meat products to allow decay of short-lived radionuclides. 3. Divert contaminated meat to non-human consumption. 4. Dispose of meat and meat products in which the radioactivity cannot be reduced to levels that are acceptable for use.

Note: The Food and Drug Administration does not consider dilution as an acceptable means of achieving contamination levels which are below the preventive or emergency response levels.