THE TOLEDO EDISON COMPANY
DAVIS-BESSE NUCLEAR POWER STATION
EMERGENCY PLAN SUPPORTING PROCEDURES
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Unit No. 1

Administrative Procedure AD 1827.12

Protective Action Guidelines

NUCLEAR SAFETY RELATED

Record of Approval and Changes

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1. PURPOSE

To define a specific set of guidelines to be followed in determining protective actions to be taken in the event of emergencies involving radioactivity releases at the Davis-Besse Nuclear Power Station (DBNPS).

2. REFERENCES

2.1 10 CFR 20, Standards for Protection Against Radiation

2.2 10 CFR 100, Reactor Site Criteria

6 2.3 USAEC TID-14844, Calculation of Distance Factors for Power and Test Reactor Sites

2.4 AD 1808.00, Industrial Security Plan

2.5 Davis-Besse Nuclear Power Station Emergency Plan

2.6 AD 1827.10, Emergency Off-Site Dose Estimates

2.7 SAND 77-1725, Public Protection Strategies for Potential Nuclear Reactor Accidents - Sheltering Concepts with Existing Public and Private Structures

2.8 EPA Guidelines - September 1975, EPA-520/1-75-001

2.9 U.S. Food and Drug Administration, Federal Register, Vol. 43, No. 242, Dec. 15, 1978

2.10 Reg Guide 1.109, Calculation of Annual Doses to Man from Routine Releases of Reactor Effluents for the purpose of Evaluating Compliance with 10 CFR Part 50 Appendix I

3. DEFINITIONS

6 3.1 Decision Dose

That value of projected thyroid dose above which evacuation is beneficial.

3.2 Evacuation Dose

That dose that a potential evacuee would receive if he were openly exposed during the evacuation.

3.3 Evacuation Exposure Period

The period during which the evacuee is exposed to the radioactive plume.

6 3.4 Off-Site

The area outside the Owner Controlled Area as defined in AD 1808.00, Industrial Security Plan.

3.5 Projected Exposure Time

That period of time in which the population surrounding DBNPS will be exposed to radiation as a result of an accidental airborne radioactive release. Projected Exposure Time starts when the airborne radioactivity released crosses the Owner Controlled Area Boundary and ends when radiation levels off-site return to normal.

3.6 Sheltering Dose

That dose that an individual would receive if he were to remain within a shelter having ventilation control during the passage of the plume. The method of calculating the sheltering dose is significantly different for the whole body and thyroid dose. This is because a ventilation controlled shelter, i.e. door, windows and ventilation shut, provides thyroid protection for only two hours. After two hours the inhibitant receives the full thyroid dose. For the whole body exposure there is no limit on the resident's time in the shelter.

4. RESPONSIBILITIES

4.1 In the event an emergency is declared at DBNPS that involves the release of radioactivity or radiation, the Emergency Duty Officer (EDO) and his assisting personnel shall use the calculating methods found in AD 1827.10, Emergency Off-Site Dose Estimates, to calculate the instantaneous radiation exposure rates for various off-site locations. (In the event of an emergency during off-normal hours, this calculation is performed by the Shift Supervisor while acting as EDO until such time as he is relieved by the EDO.) The results of these calculations shall be utilized as specified in Section 6. for evacuation and shelter recommendations, and compared with the guidelines given in Sections 5. and 7. to determine the proper protective actions required to protect the health and safety of Station personnel and the general public. The EDO shall then implement those actions for Station personnel and communicate the recommended off-site actions to the Ottawa County Sheriff's Department (or the State and County Emergency Operations Centers if they have been activated).

6

4.2 In order to simplify evacuation instructions for the

6 public, evacuation "subareas" (see Figure 1) have been established by municipal and geographical boundaries. When making evacuation decisions in an emergency situation, the EDO shall consider the time available (based on plume travel speed) to evacuate the affected subarea(s), in comparison to the estimated evacuation times as given in Table 1. The data sheets used in Section 6. assist in this process.

5. PROTECTIVE ACTION GUIDELINES

5.1 Recommended Protective Actions to avoid whole body and thyroid dose from exposure to a gaseous plume:

Projected Dose (Rem) to the Population	Recommended Actions[a]	Comments
Whole body <1 Thyroid <5	No planned protective actions.[b] Issue an advisory to seek shelter and await further instructions. Monitor environmental radiation levels.	Previously recommended protective actions may be reconsidered or terminated.
Whole body 1 to <5 Thyroid 5 to <25	Seek shelter as a minimum. Consider evacuation. Evacuate unless constraints make it impractical. Monitor environmental radiation levels. Control access.	If constraints exists, special considera- should be given for evacuation of children and pregnant women.
Whole body 5 and above Thyroid 25 and above	Conduct mandatory evacuation. Monitor environmental radiation levels and adjust area for mandatory evacuation based on these levels. Control access.	Seeking shelter would be an alternative if evacuation were not immediately possible.

(a) These actions are recommended for planning purposes. Protective action decisions at the time of the incident must take existing conditions into consideration.

(b) At the time of the incident, officials may implement

4 low-impact protection actions in keeping with the principle of maintaining radiation exposures as low as reasonably achievable.

5.2 Guidelines for protection against ingestion of contamination:

I. Ground Contamination

A. Action Levels

1. Projected whole body dose above the ground ≧1 rem

2. Ground Contamination levels ≧2000 uCi/m^2 at t = 1 hr post-accident

3. Exposure rate ≧12 mR/Hr at 1 meter above ground at t = 1 hr post-accident

B. Recommended Protective Actions

1. Evacuation of affected areas

2. Restriction of entry to contaminated off-site areas until radiation level has decreased to State approved levels

II. Food and Water Contamination

A. Action Levels

Nuclide*	Concentration in Milk or Water (0.5 rem WB or bone: 1.5 rem thyroid) Preventive Level (uCi/l)	Concentration in Milk or Water (5 rem WB or bone: 15 rem thyroid) Emergency Level (uCi/l)	Total Intake via all Food & Water Pathways Preventive (uCi)	Total Intake via all Food & Water Pathways Emergency (uCi)	Pasture Grass (Fresh Weight) Preventive (uCi/kg)	Pasture Grass (Fresh Weight) Emergency (uCi/kg)
I-131 (thyroid)	0.012	0.12	0.09	0.9	0.27	2.7

* If other nuclides are present, Reg. Guide 1.109 will be used to calculate the dose to the critical organ(s). Infants are the critical segment of the population

Nuclide*	Concentration in Milk or Water (0.5 rem WB or bone: 1.5 rem thyroid) Preventive Level (uCi/l)	(5 rem WB or bone: 15 rem thyroid) Emergency Level (uCi/l)	Total Intake via all Food & Water Pathways Preventive (uCi)	Emergency (uCi)	Pasture Grass (Fresh Weight) Preventive (uCi/kg)	Emergency (uCi/kg)
Cs-137 (Whole Body)	0.34	3.4	7.0	70	3.5	35
6 Sr-90 (bone)	0.007	0.08	0.2	2.0	0.7	7.0
Sr-89 (bone)	0.13	1.3	2.6	26	13	130

B. Recommended Protective Actions

Preventive	Emergency
1. Removal of lactating dairy cows from contaminated pasture and substitution of uncontaminated stored feed. 2. Substitute source of uncontaminated water. 3. Withhold contaminated milk from market to allow radioactive decay. 4. Divert fluid milk to production of dry whole milk, butter, etc.	Isolate food and water from its introduction into commerce after considering: a. availability of other possible actions; b. importance of particular food in nutrition; c. time and effort to take action; d. availability of other foods.

5.3 Representative shielding factors from gamma cloud source:

Structure or Location	Shielding Factor(a)	Representative Range
Outside	1.0	--
Vehicles	1.0	--
Wood-frame house(b) (no basement)	0.9	--

Structure or Location	Shielding Factor[a]	Representative Range
Basement of wood house	0.6	0.1 to 0.7[c]
Masonry House (no basement)	0.6	0.4 to 0.7[c]
Basement of masonry house	0.4	0.1 to 0.5[c]
Large office or industrial building	0.2	0.1 to 0.3[c, d]

(a) The radio of the dose received inside the structure to the dose that would be received outside the structure.

(b) A wood frame house with brick or stone veneer is approximately equivalent to a masonry house for shielding purposes.

(c) This range is mainly due to different wall materials and different geometries.

(d) The shielding factor depends on where the personnel are located within the building (e.g., the basement or an inside room).

5.4 Selected shielding factors for airborne radionuclides:

Wood house, no basement	0.9
Wood house, basement	0.6
Brick house, no basement	0.6
Brick house, basement	0.4
Large office or industrial building	0.2
Outside	1.0

5.5 Representative shielding factors for surface deposited radionuclides:

Structure or Location	Representative Shielding Factor[a]	Representative Range
1 m above an infinite smooth surface	1.00	--
1 m above ordinary ground	0.70	0.47-0.85

Structure or Location	Representative Shielding Factor[a]	Representative Range
1 m above center of 50-ft roadways, 50% decontaminated	0.55	0.4-0.6
Cars on 50-ft road:		
Road fully contaminated	0.5	0.4-0.7
Road 50% decontaminated	0.5	0.4-0.6
Road fully decontaminated	0.25	0.2-0.5
Trains	0.40	0.3-0.5
One and two-story wood-frame house (no basement)	0.4[b]	0.2-0.5
One and two-story block and brick house (no basement)	0.2[b]	0.04-0.40
House basement, one or two walls fully exposed:	0.1[b]	0.03-0.15
One story, less than 2 ft of basement, walls exposed	0.05[b]	0.03-0.7
Two stories, less than 2 ft of basement, walls exposed	0.03[b]	0.02-0.05
Three- or four-story structures, 5000 to 10,000 ft^2 per floor:		
First and second floors:	0.05[b]	0.01-0.08
Basement	0.01[b]	0.001-0.07
Miltistory structures, >10,000 ft^2 per floor:		
Upper floors	0.01[b]	0.001-0.02
Basement	0.005[b]	0.001-0.015

(a) The ratio of dose received inside the structure to the dose that would be received outside the structure.

(b) Away from doors and windows.

6 5.6 Small Children and Pregnant Women

Any time the projected whole body dose is expected to exceed 500 mrem or the projected thyroid dose is expected to exceed 1.5 rem, advise the Ottawa County Sheriff's

6 Department to conduct an evacuation in the area of exposure of families in which there are pregnant women or small children.

5.7 Distribution of Potassium Iodide Tables

1. The EDO will direct Station personnel to take a KI tablet if, (a) the known iodine concentration will exceed 1 x 10^{-5} uCi/cc for greater than one hour, or (b) the total known dose to an adult thyroid will exceed 10 rems.

2. Base the distribution of KI on actual thyroid doses, not projected doses. KI is 90% effective if administered within one hour after the uptake, and 50% effective if administered within 4 hours after uptake.

3. Call Radiation Management Corporation if KI is administered for further directions regarding usage.

5.8 General Population

6 Protective actions should be recommended as developed by Data Sheet 1 and 2. Additional guidance is as follows:

ACCIDENT PHASE	EXPOSURE PATHWAYS	EXAMPLES OF ACTIONS TO BE RECOMMENDED
EMERGENCY PHASE[1] (0.5 to 24 hours)*	Inhalation of gases, radioiodine, or particulate	Evacuation, shelter, access control, respiratory protection, prophylaxis (thyroid protection)
	Direct whole body exposure	Evacuation, shelter, access control
	Ingestion of milk	Take cows off pasture, prevent cows from drinking surface water, discard contaminated milk, or divert to stored products such as cheese

1 Emergency phase - Time period of major release and subsequent plume exposure.

ACCIDENT PHASE	EXPOSURE PATHWAYS	EXAMPLES OF ACTIONS TO BE RECOMMENDED
INTERMEDIATE PHASE[2]	Ingestion of fruits and vegetables	Wash all produce, or impound produce, delay harvest until approved, substitute uncontaminated produce
	Ingestion of water	Cut off contaminated supplies, substitute from other sources, filter, demineralize
(24 hours to 30 days)*	Whole body exposure and inhalation	Relocation, decontamination, fixing of contamination, deep plowing
LONG TERM PHASE[3]	Ingestion of food and water contaminated from the soil either by resuspension or uptake through roots	Decontamination, condemnation, or destruction of food; deep plowing, condemnation, or alternate use of land
(over 30 days)*	Whole body exposure from deposition material or inhalation of resuspended material	Relocation, access control, decontamination, fixing of contamination, deep plowing

[2] Intermediate phase - Time period of moderate continuous release with plume exposure and contamination of environment.

[3] Long Term Phase - Recovery period.

* "Typical" Post-accident time periods.

6. PROCEDURE

6.1 Whole Body Dose

6 Complete Data Sheet 1.

6.2 Thyroid Dose

Complete Data Sheet 2.

DATA SHEET 1
Evacuation vs Shelter Decision Algorithm
For Whole Body Exposure

1. Evacuation Subarea from Figure 1 _____

2. Approximate Distance to Population of Interest
(1, 2, 5, or 10 miles) _____miles

NOTE: Use the furthest distance in which the projected exposure levels calculated in AD 1827.10 are above the Protective Action Guidelines given in Section 5.

3. Calculate Whole Body Dose Rate:

(D=MR/HR from Step 14, Data Sheet 1 of AD 1827.10,
Emergency Off-site Dose Rate Estimate)= _____mR/HR

4. Release Duration (If not known assume 10 hrs.) _____hours

5. Projected dose = $\frac{\text{dose rate x duration}}{1000} = \frac{\text{Items 3 x 4}}{1000}$ = _____REM

6. Wind Speed _____MPH

7. Plume Travel Time = $\frac{\text{Distance (item 2)}}{\text{Wind Speed (item 5)}}$ = _____hours

8. Time since, or till, beginning of release.

a. If release has begun:
Release has been in progress _____hours

b. If release will begin later:
Release will start in _____hours

9. Time till exposure begins:

a. If release has begun:
Time = Item 7 - Item 8a = _____hours

NOTE: Show minus sign in answer if Item 8a is greater than Item 7.

b. If release will begin later:
Time = Item 7 + Item 8b = _____hours

10. Evacuation Weather Conditions:

Normal Adverse Severe (Circle One)

DATA SHEET 1 (Continued)

11. Use information from Items 1 and 10 to get Estimated Evacuation Time from Table 1. _____hours

12. Exposure Time:
Item 11 - Item 9 = _____hours

NOTE: If Item 9 is negative, keep in mind that minus a negative number gives a positive result. If Item 9 is larger than Item 11, enter zero hours.

13. Evacuation Exposure Period (EEP):
Take the smaller of Exposure Time (Item 12) or Release Duration (Item 4) _____hours

14. Projected Dose (Item 5) _____REM

15. Evacuation Dose = EEP hours (Item 13) x Dose Rate (Item 3) = _____REM

16. Sheltering Dose =
Projected Dose x Structure Shielding Factor (from 5.3) = _____REM

17. Using the above information and following table, determine the protective actions to be recommended:

IF		THEN	
a.	Projected Dose less than 1 rem	a.	NO ACTION
b.	Sheltering Dose less than 5 rem	b.	SHELTER
c.	Sheltering Dose greater than 5 rem, and Evacuation Dose less than Sheltering Dose	c.	EVACUATE
d.	Sheltering Dose greater than 5 rem and Evacuation Dose greater than or equal to Shelter Dose	d.	SHELTER

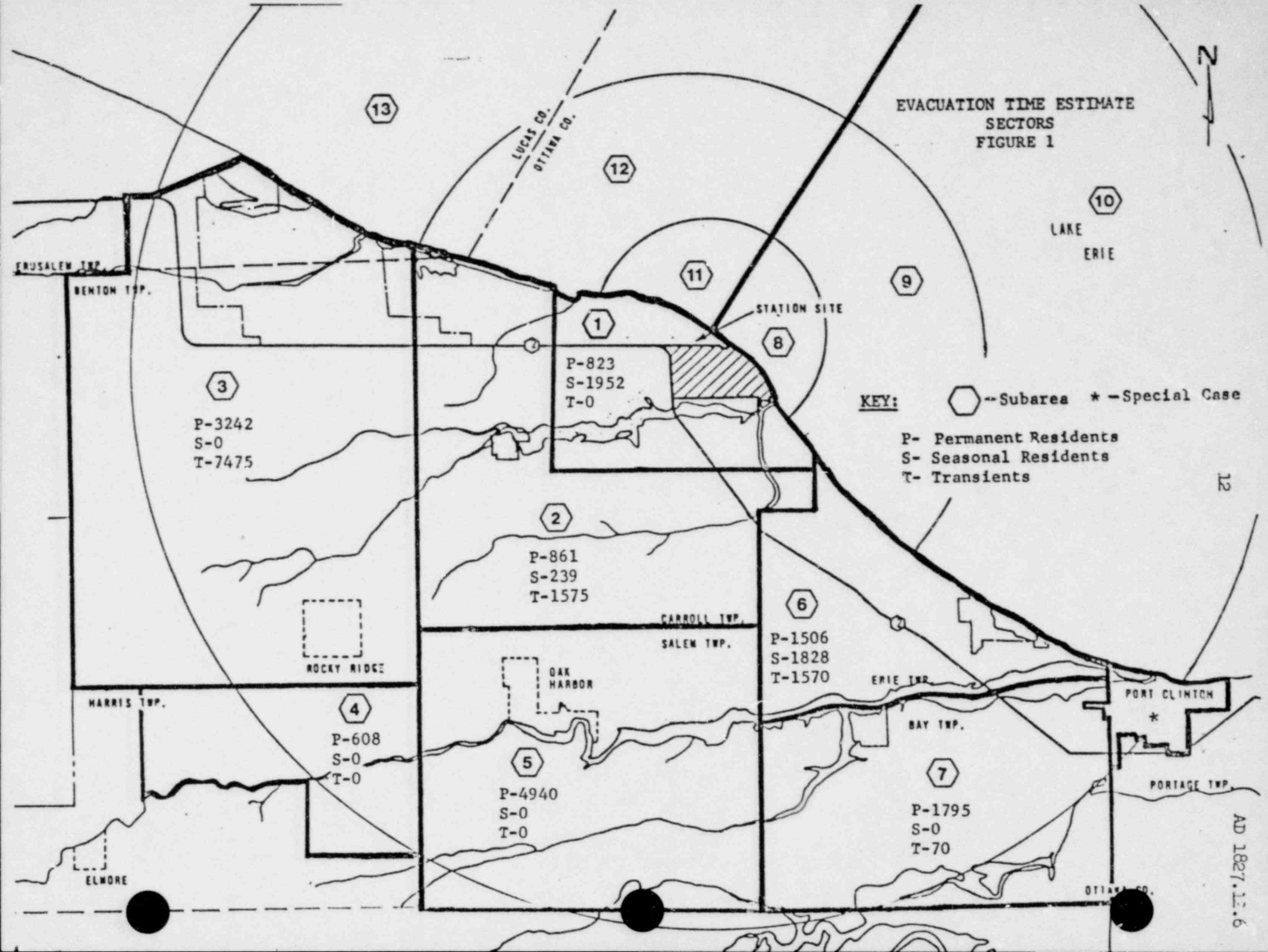
EVACUATION TIME ESTIMATE
SECTORS
FIGURE 1
KEY:
--Subarea
* -Special Case
P- Permanent Residents
S- Seasonal Residents
T- Transients
LUCAS CO.
OTTAWA CO.
LAKE ERIE
STATION SITE
JERUSALEM TWP.
BENTON TWP.
HARRIS TWP.
ROCKY RIDGE
CARROLL TWP.
SALEM TWP.
OAK HARBOR
ERIE TWP.
BAY TWP.
PORT CLINTON
PORTAGE TWP.
ELMORE
OTTAWA CO.
1
P-823
S-1952
T-0
2
P-861
S-239
T-1575
3
P-3242
S-0
T-7475
4
P-608
S-0
T-0
5
P-4940
S-0
T-0
6
P-1506
S-1828
T-1570
7
P-1795
S-0
T-70
8
9
10
11
12
13
N
12
AD 1827.12.6

TABLE 1
Evacuation Time Estimates

Land Sub-Areas	Population*	Normal	Adverse	Severe**
1	2,775 823 823	2 hr. 55 min.	4 hr. 10 min.	15-20 hr.
2	2,675 861 861	3 hr. 5 min.	4 hr. 50 min.	30-40 hr.
3	10,717 3,242 3,242	3 hr. 35 min.	6 hr. 30 min.	35-45 hr.
4	608 608 608	2 hr. 50 min.	4 hr. 15 min.	10-15 hr.
5	4,940 4,940 4,940	3 hr. 30 min.	4 hr. 30 min.	40-45 hr.
6	4,940 1,506 1,506	3 hr. 30 min.	5 hr. 10 min.	30-40 hr.
7	1,865 1,795 1,795	4 hr.	6 hr. 25 min.	50-60 hr.
TOTAL EPZ	28,484 13,775 13,775	5 hr. 15 min.	10 hr. 55 min.	75-100 hr.

Lake Sub-Areas	Boaters	Normal	Adverse	Severe
8 thru 13	Varies	4 hr.	N/A	N/A

Special Case	Population	Normal	Adverse	Severe
Port Clinton	10,328 7,229 7,229	4 hr. 45 min.	6 hr.	24-30 hr.

*Population varies due to location and transient resident variations due to season and unfavorable weather conditions.

**Time ranges are provided due to the uncertain nature of severe weather conditions (e.g., during a severe snow fall or blizzard, the time it takes to evacuate can vary depending on the direction and speed of the wind).

DATA SHEET 2
Evacuation vs Shelter Decision Guide
For Thyroid Dose

1. Evacuation subarea from Figure 1 _____

2. Complete Data Sheet 1

3. Release Duration from Data Sheet 1, Item 4 (If not known assume 10 hours) _____hours

4. Evacuation Exposure Period (EEP) from Data Sheet 1, Item 13 _____hours

5. Calculated Thyroid Dose Rate (Step 12, Data Sheet 2, AD 1827.10) _____mR/HR

6. Projected Thyroid Dose = $\frac{\text{Item 3 x Item 5}}{1000}$ = _____REM

7. Decision Dose is that value of Projected Thyroid Dose above which evacuation is beneficial. The Decision Dose depends on the Release Duration as follows:

Release Duration (hours)	Decision Dose (rem)
2	75
3	45
4	38
5	34
6	32
8	30
12	28
24	27
above 24	25

Decision Dose = _____REM

8. Using the above information and following table, determine the protective actions to be recommended:

IF		THEN	
a.	Projected Thyroid Dose less than 5 rem	a.	NO ACTION

DATA SHEET 2 (Continued)

IF		THEN	
b.	Projected Thyroid Dose less than 25 rem	b.	SHELTER* FOR CHILDREN AND WOMEN OF CHILD-BEARING AGE
c.	Projected Thyroid Dose greater than 25 rem, but less than the Decision Dose	c.	SHELTER*
d.	Projected Thyroid Dose greater than Decision Dose, then	d.	Perform action as follows:
	1. If EEP less than Release Duration		1. EVACUATE
	2. If EEP equal to Release Duration		2. SHELTER*

*SHELTER is to be with VENTILATION CONTROLLED.

END