UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

Before the Atomic Safety and Licensing Board

In the Matter of	)	
	)	
LONG ISLAND LIGHTING COMPANY	)	Docket No. 50-322-OL-3
	)	(Emergency Planning
(Shoreham Nuclear Power Station, Unit 1)	)	Proceeding)
	)	

LILCO'S TESTIMONY ON CONTENTIONS 60, 61, 63, and 64 (PROTECTIVE ACTION RECOMMENDATIONS)

PURPOSE

This testimony shows that protective action recommendations contemplated by the LILCO Transition Plan, and the methods by which those recommendations would be chosen, comply with NRC and New York State regulations and guidelines regarding protective actions. Selective sheltering and selective evacuation would be suggested only on the recommendation of New York State and are included in the Plan to provide flexibility to adapt to a State recommendation for selective sheltering or evacuation, should the State choose to respond to an emergency at Shoreham. Contrary to the intervenor's contentions, the LILCO Transition Plan states clearly the guidelines that would be used in recommending selective sheltering or evacuation for radiosensitive populations.

During an emergency at a nuclear power plant which results in an offsite release, the downwind population may be exposed to radioactive material of three forms: radioactive noble gases, radioactive halogen gases, and radioactive particulates. The LILCO Transition Plan has procedures developed pursuant to appropriate NRC regulations and guidelines that describe how the Local Emergency Response Organization (LERO) would make a protective action recommendation of sheltering or evacuation for a segment of the population. The recommendation is based upon conditions at the time of an accident and the comparative benefits that would be received by sheltering and by evacuating. The recommendation of sheltering would provide protection to boaters, transients in the EPZ, people in cars, and people inside buildings within the EPZ. But the recommendation will not result in zero dose. No protective action will result in zero dose at any nuclear power plant in New York State or in the country, and the NRC regulations do not contemplate that zero dose must be achievable with protective actions in order that nuclear power plants be allowed to operate, contrary to the intervenors' suggestions otherwise.

Nor do wind shifts on Long Island require that LILCO recommend evacuation out to 5 to 7 miles in the event any evacuation is recommended. The average wind speed on Long Island is 8 miles, and the wind variability at Shoreham, a coastal location, is lower than island or valley locations. In addition,

shifts in the wind would be taken into account by the Director of Local Response in making a protective action recommendation, and additional recommendations would be made if necessary in response to a shift in wind. The protective action recommendation under the LILCO Plan would be made for an area in the form of a keyhole. This keyhole would consist of a 360 degree area circling the plant out to 2 miles, plus (depending upon the projected doses) a 5 or 10 mile downwind sector consisting of certain zones. Most of the zones that would be affected by an evacuation out to 5 miles actually extend to about 7 miles.

Attachments

Attachment 1 -- LILCO Transition Plan, p. 3.6-5

Attachment 2 -- New York State Radiological Emergency Plan, pp. III-41-42

Attachment 3 -- EPA's Protective Action Evaluation, Part I: The Effectiveness of Sheltering as a Protective Action Against Nuclear Accidents Involving Gaseous Releases (EPA 520/1-78-001A) (1978), pp. 7-10, 18, 24

Attachment 4 -- EPA's Manual of Protective Action Guides (EPA 520/1-78-001A) Draft Appendix B: Planner's Evaluation Guide for Evacuation and Shelter, pp. i, ii, B-9, 10 and 12

Attachment 5 -- LILCO Transition Plan, OPIP 3.6.1

Attachment 6 -- LILCO Transition Plan, OPIP 3.8.2, p. 22 of 38

Attachment 7 -- LILCO Transition Plan, OPIP 3.3.2, p. 41 of 163

Attachment 8 -- LILCO Transition Plan, p. 3.6-6

Attachment 9 -- LILCO Transition Plan, Table 3.6.1

Attachment 10 -- New York State Plan, pp. III-43 through III-44

Attachment 11 -- Deposition of Edward P. Bennett, February 9, 1984, pp. 1-2, 46-47, 65

Attachment 12 -- Deposition of Richard Taylor, February 9, 1984, pp. 1-2, 24-26, 38

Attachment 13 -- LILCO Transition Plan, OPIP 3.5.1, pp. 1-9

Attachment 14 -- LILCO Transition Plan, Attachment 2.2.1

Attachment 15 -- LILCO Transition Plan 3.8.2, Attachment 5

Attachment 16 -- LILCO Transition Plan, Appendix A, Figure 3

Attachment 17 -- LILCO Transition Plan, OPIP 3.3.1, p. 7 of 10

Attachment 18 -- Shoreham FSAR, Table 2.3.2-1

Attachment 19 -- Wind Direction Variability Analysis for Shoreham and Other Sites

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LILCO'S TESTIMONY ON
CONTENTIONS 60, 61, 63, and 64
(PROTECTIVE ACTION RECOMMENDATIONS)

1. Q. Please identify yourselves.

A. My name is Matthew C. Cordaro. My address is Long Island Lighting Company, 175 East Old Country Road, Hicksville, New York 11801.

My name is Charles A. Daverio. My address is Long Island Lighting Company, 100 East Old Country Road, Hicksville, New York 11801.

My name is Michael L. Miele. My address is Long Island Lighting Company, Shoreham Nuclear Power Station, P.O. Box 628, Wading River, New York 11792

My name is Dennis S. Mileti. My address is Department of Sociology, Colorado State University, Fort Collins, Colorado, 80523.

My name is Richard J. Watts. My business address is Impell Corporation, 225 Broad Hollow Road, Melville, New York, 11747.

2. Q. Please state your professional qualifications.

A. [Cordaro] I am Vice President, Engineering, for LILCO. My professional qualifications are being offered into evidence as part of the document entitled "Professional Qualifications of LILCO Witnesses." I am sitting on this panel to provide the LILCO management perspective on emergency planning, and to answer any questions pertinent to management. My role in emergency planning for Shoreham is to ensure that the needs and requirements of emergency planning are being met, and that the technical direction and content of emergency planning are being conveyed to corporate management. I accomplish this by supervising the development and implementation of the offsite emergency response plan for Shoreham; the Manager of the Local Emergency Response Implementing Organization (LERIO) reports directly to me.

[Daverio] I am employed by LILCO as Supervisor of Emergency Planning and Regulatory Services, and have been working on emergency planning for LILCO over four years. I am also Assistant Manager of LILCO's Local Emergency Response Implementing Organization (LERIO). My professional qualifications are being offered into evidence as part of the document entitled "Professional Qualifications of LILCO Witnesses." As Supervisor of Emergency Planning and Assistant Manager of LERIO, I am responsible for implementing LILCO's Local Emergency Response Plan. As such, I am familiar with the issues surrounding protective action recommendations.

[Miele] I am employed by LILCO as the Radiation Protection Section Supervisor of the Nuclear Engineering Department. My professional qualifications are being offered into evidence as part of the document entitled "Professional Qualifications of LILCO Witnesses." I am responsible for the corporate overview of all technical aspects of LILCO's emergency planning for onsite and offsite radiological protection, and therefore am familiar with the issues surrounding protective action recommendations.

[Mileti] I am an Associate Professor of Sociology and Director of the Hazards Assessment Laboratory at Colorado State University. My professional qualifications are being offered into evidence as part of the document entitled "Professional Qualifications of LILCO Witnesses."

[Watts] I am the Health Physics Supervisor for the Radiological Services Section of Impell Corporation. My professional qualifications are being offered into evidence as part of the document entitled "Professional Qualifications of LILCO Witnesses." I have been retained by LILCO to serve as a Radiation Health Coordinator for LERO and have participated in LERO drills in this capacity. As such, I am familiar with the issues surrounding these contentions.

3. Q. What is the "Preamble to Contentions 60-83"?

A. The "Preamble to Contentions 60-83" (pages 119-20 of the contentions) reads as follows:

> Preamble to Contentions 60-83. 10 CFR Section 50.47(a)(1) requires a finding of reasonable assurance that adequate protective measures can and will be taken in the event of a radiological emergency. In addition, 10 CFR Section 50.47(b)(10) requires the development of a range of protective actions for the public; guidelines for the

choice of protective actions must be consistent with Federal guidance. Such guidance includes the Manual of Protective Action Guides ("PAGs") (EPA-520/1-75-001), which sets forth the threshold projected dose levels at which protective actions are to be commenced. The PAGs are embraced in NUREG 0654, Sections II.J.7 and J.9, and are referenced in the LILCO Plan, at Section 3.6, and OPIP 3.6.1. NUREG 0654, in Sections II.J.9 and J.10, requires that there be established "a capability for implementing protective measures based upon protective action guides and other criteria." (Emphasis added).

In Contentions 60-83, Intervenors contend that LILCO's plan does not provide reasonable assurance that adequate protective measures can and will be implemented to protect the population from the potential health hazards of an accident at Shoreham. Thus, (a) there is no reasonable assurance that the measures proposed in the LILCO Plan would, if taken, provide adequate protection from the potential consequences of an emergency at Shoreham; and (b) there is no reasonable assurance that the proposed measures could or would in fact be taken in the event of an emergency.

4. Q. What is the "Further Preamble to Contentions 60-62"?

A. The "Further Preamble to Contentions 60-62" reads as follows:

> Further Preamble to Contentions 60-62. The LILCO Plan provides that the protective action of sheltering may be recommended (Plan, at 3.6-5), and that it is "the preferred protective action if sufficient protection is offered by sheltering, or if no

> additional benefit is gained by evacuation." (OPIP 3.6.1, Section 3.2). Intervenors contend that as to the proposed protective action of sheltering, the LILCO Plan fails to comply with 10 CFR Section 50.47(a)(1) and NUREG 0654, Section II.J.9, because there is no assurance that sheltering, as a protective action, could or would be effectively implemented in the event of an emergency in a manner which would protect the public. Indeed, the facts indicate that many people will refuse to shelter and will, instead, choose to evacuate, and that many other persons, as a practical matter, will be unable to shelter. Thus, sheltering cannot be viewed as an adequate protective action, as LILCO appears to believe, for the reasons set forth in SC Contentions 60-62. [Footnote omitted.]

Contention 60: Selective Sheltering

5. Q. What is Contention 60?

A. Contention 60 reads as follows:

> Contention 60. At page 3.6-5 of the LILCO Plan, LILCO states:
>
> Th[e] protective action [of selective sheltering] may be ordered at projected doses below the accepted PAGs to minimize radioactive exposure, particularly to pregnant women and children.
>
> . . . .
>
> The Sheltering option may be recommended as an effective option for individuals who could not be safely evacuated. This

> would include individuals who have been designated medically unable to withstand the physical stress of an evacuation, as well as those individuals who require constant, sophisticated medical attention.
>
> The Plan fails to set forth guidelines to be used by command and control personnel: (a) in choosing to recommend the protective action of selective sheltering; or (b) in determining the individuals who should or would be subject to such a recommendation. Rather, as quoted above, the Plan contains only generalized statements which, in fact, provide no guidance at all. In addition, there are no procedures which indicate the means by which such a recommendation would or could be implemented. The Plan thus fails to comply with 10 CFR Sections 50.47 (a)(1), 50.47 (b)(10) and NUREG 0654, Sections II.J.9 and J.10.

6. Q. What are the legal standards cited in Contention 60?

A. The legal standards cited in Contention 60 are the following:

> 10 C.F.R. § 50.47(a)(1)
>
> No operating license for a nuclear power reactor will be issued unless a finding is made by NRC that the state of onsite and offsite emergency preparedness provides reasonable assurance that adequate protective measures can and will be taken in the event of a radiological emergency.

10 C.F.R. § 50.47(b)(10)

A range of protective actions have been developed for the plume exposure pathway EPZ for emergency workers and the public. Guidelines for the choice of protective actions during an emergency consistent with Federal guidance, are developed and in place, and protective actions for the ingestion exposure pathway EPZ appropriate to the locale have been developed.

NUREG-0654, II.J.9

Each State and local organization shall establish a capability for implementing protective measures based upon protective action guides and other criteria. This shall be consistent with the recommendations of EPA regarding exposure resulting from passage of radioactive airborne plumes, (EPA-520/1-75-001) and with those of DHEW (DHHS)/FDA regarding radioactive contamination of human food and animal feeds as published in the Federal Register of December 15, 1978 (43 FR 58790).

NUREG-0654, II.J.10

The organization's plans to implement protective measures for the plume exposure pathway shall include:

. . . .

m. The bases for the choice of recommended protective actions from the plume exposure pathway during emergency conditions. This shall include expected local protection afforded in residential units or other shelter for direct and inhalation exposure, as well as evacuation time estimates.

7. Q. Does the LILCO Transition Plan identify "selective sheltering" as a potential protective action?

A. Yes, at page 3.6-5 (Attachment 1 to this testimony).

8. Q. What is "selective sheltering"?

A. Selective sheltering is a protective action that may be ordered at projected doses below the Environmental Protective Agency's (EPA's) accepted PAGs (Protective Action Guides) to minimize radioactive exposure, particularly to pregnant women and children.

9. Q. Why does the LILCO Transition Plan include selective sheltering?

A. [Cordaro, Daverio, Miele, Watts] Revision 3 of the LILCO Plan states at 3.6-5 (Attachment 1 to this testimony) that selective sheltering for children and pregnant women or other persons deemed radiosensitive would not be implemented "without consultation with the N.Y. State Commissioner of Health." LILCO included selective sheltering in the Plan in order to be consistent with the New York State Radiological Emergency Plan page III-41 (Attachment 2 to this testimony) and to ensure that Local Emergency Response Organization (LERO) personnel would be familiar with the State terminology should New

York State decide to take an active role in an emergency response for Shoreham. In short, the Plan includes selective sheltering to provide the flexibility to adapt to a State recommendation for selective sheltering, should the State choose to respond to an emergency at Shoreham.

10. Q. What does the New York State Radiological Emergency Plan provide regarding selective sheltering?

A. [Cordaro, Daverio, Miele, Watts] The New York State Plan, page III-41 (Attachment 2), states as follows:

> In general, protective actions will be taken in accordance with the EPA PAG guidelines. The Commissioner of Health may recommend protective action at projected doses below these guidelines to minimize radioactive exposure, particularly of pregnant women and children. The Selective Sheltering Option will provide this flexibility. In addition, the Selective Sheltering Option may be recommended by the State Commissioner of Health as an effective option for individuals who could not be safely evacuated, if a Selective or General Evacuation may otherwise be recommended. This would include individuals who have been designated medically unable to withstand the physical and/or psychological stress of an evacuation, as well as those individuals who require constant, sophisticated medical attention.

11. Q. Under what circumstances, then, would LERO recommend selective sheltering?

A. [Cordaro, Daverio, Miele, Watts] Without instructions from the State Commissioner of Health or other State officials, LERO would not recommend selective sheltering for radiosensitive persons. If sheltering were advisable for any portion of the population that was considered radiosensitive, LERO would recommend sheltering for the entire population in the affected area. For a discussion of when and how LERO might recommend sheltering to those organizations such as hospitals, where evacuation might put residents at risk, see LILCO's testimony in response to Contention 72.

12. Q. Dr. Mileti, in other testimony you have said that the evacuation advisories at Three Mile Island, which were directed only at pregnant women and young children, were a message about risk to the entire population, and therefore it is only natural that other members of that population evacuated as well. Does this mean that selective sheltering is not a workable alternative?

A. [Mileti] No, selective sheltering is an option for response to emergencies at nuclear power plants.

Selective sheltering is applicable to emergency planning in two ways. First, selective sheltering could refer to "special" groups of people within a larger population that are taking some other protective action, for example, evacuating. This type of selective sheltering could apply, for example, to people who are too infirm to engage in evacuation (the way in which the LILCO Plan applies it). This application of selective sheltering is not complicated by being perceived as risk information for people in the area not advised to engage in this particular protective action, since those people would also be taking some (other) protective action.

Second, selective sheltering could refer to public advisories that certain demographic groups (for example, pregnant women and children) in a specific locality shelter while others in the same area are not advised to take any protective action. In this case, it is possible, given that the public would likely interpret such an advisory as a statement about the risk in a particular area, that other people not "demographically" included in the advisory would also shelter. However, when one is considering sheltering, it is hard to see how

additional persons sheltering would detract from public safety.

13. Q. The contention says that the Plan does not have any guidelines for choosing selective sheltering. Is this true?

A. [Cordaro, Daverio, Miele, Watts] No. The Plan does state guidelines for choosing selective sheltering for radiosensitive populations. It would be implemented (at the instruction of the State) "for projected doses below the accepted PAGs" (that is, below one rem whole body or five rem thyroid) for "pregnant women and children." (Attachment 1 to this testimony.) As to selective sheltering as a recommendation in lieu of evacuation for people under medical care, the guidelines followed are explained in LILCO's testimony in response to Contention 72.

14. Q. How would the option of selective sheltering be implemented?

A. [Cordaro, Daverio, Miele, Watts] The State (or LERO, if requested by the State) would issue a specific protective action recommendation of selective sheltering for radiosensitive persons via the

Emergency Broadcast System. Again, only at the State's direction, should it choose to respond during an actual emergency, would selective sheltering be recommended to a portion of the population when the remaining population in the same area took no protective action.

Contention 61: Sheltering

15. Q. What is Contention 61?

A. [Cordaro, Daverio, Miele, Watts] Contention 61 reads as follows:

> Contention 61. Intervenors contend that a protective action recommendation of sheltering would not or could not be implemented. Specifically, a substantial number of people who might be advised to shelter, as a practical matter, will be unable to do so because:
>
> A. A large number of homes and other structures in the EPZ are constructed of wood and have no basements. According to LILCO's shielding factors (Plan, Table 3.6.5), the protection offered by such shelter is limited, at most, to a reduction in dose of only 10 percent from that received with no shelter. As a practical matter, persons with access to such structures have little "shelter" available, and thus sheltering should not be considered as a protective action for these persons.

B. Persons who are traveling in their cars or other vehicles at the time of a sheltering recommendation may not be able to reach shelter fast enough to obtain any protection from a release of radioactive fission products. Vehicles offer essentially no protection from radioactive doses.

[Contention 61.C, dealing with implementing protective action recommendations at schools within the EPZ, is addressed in LILCO's testimony on schools.]

D. Transients who are on beaches, in parks or in other outdoor recreation areas will have no access to shelter. Contrary to the requirement of NUREG 0654 Section J.10.a, the Plan fails to identify public sheltering areas. (See FEMA Report, at 8).

E. Persons who are in boats in the EPZ will have no access to shelter.

Moreover, even if people were willing and able to follow a sheltering recommendation, there is no assurance that taking such action would provide any significant dose savings and thus prevent persons in the EPZ from receiving health-threatening radiation doses for the following reasons:

[Contention 61.F was not admitted by the Board.]

G. Many other homes in the EPZ, even if they provide more shielding than a wood house, will only reduce doses about 50 percent. In a severe accident, a 50-percent dose reduction will still result in health-threatening doses.

H. According to LILCO, the average sheltering factor available in

> the EPZ is 0.7, which means that, on the average, those who follow a sheltering recommendation will nonetheless receive 70 percent of the dose they would receive from the plume if they were outside the shelter.
>
> I. The cloud doses resulting from a release of radioactive fission products from the Shoreham plant could be so substantial that even taking into account the 30 percent average dose reduction provided by shelter in the EPZ, persons who follow a sheltering recommendation could still receive doses that would cause adverse health effects. [Footnote omitted.]
>
> Thus, sheltering is not an adequate protective action in the event of an emergency at Shoreham, and the Plan, therefore, fails to comply with 10 CFR Sections 50.47(a)(1) and 50.47(b)(10), and NUREG 0654 Section II.J.9.

16. Q. What are the legal standards for Contention 61?

A. [Cordaro, Daverio, Miele, Watts] The legal standards are the following:

> 10 C.F.R. § 50.47(a)(1)
>
> No operating license for a nuclear power reactor will be issued unless a finding is made by NRC that the state of onsite and offsite emergency preparedness provides reasonable assurance that adequate protective measures can and will be taken in the event of a radiological emergency.

10 C.F.R. § 50.47(b)(10)

A range of protective actions have been developed for the plume exposure pathway EPZ for emergency workers and the public. Guidelines for the choice of protective actions during an emergency consistent with Federal guidance, are developed and in place, and protective actions for the ingestion exposure pathway EPZ appropriate to the locale have been developed.

NUREG-0654, II.J.9

Each State and local organization shall establish a capability for implementing protective measures based upon protective action guides and other criteria. This shall be consistent with the recommendations of EPA regarding exposure resulting from passage of radioactive airborne plumes, (EPA-520/1-75-001) and with those of DHEW (DHHS)/FDA regarding radioactive contamination of human food and animal feeds as published in the Federal Register of December 15, 1978 (43 Fed. Reg. 58,790).

NUREG-0654, II.J.10

The organization's plans to implement protective measures for the plume exposure pathway shall include:

. . . .

Maps showing evacuation routes, evacuation areas, preselected radiological sampling and monitoring points, relocation centers in host areas, and shelter areas; (identification of radiological sampling and monitoring points shall include the designators in Table J-1 or an equivalent uniform system described in the plan);

Contention 61.A: Shielding Factors

17. Q. What types of radiation exposure might result from an accident at a nuclear power plant?

A. [Cordaro, Daverio, Miele, Watts] During an emergency at a nuclear power plant, the downwind population may be exposed to radioactive material of three forms, as follows:

(1) Radioactive noble gases. These are chemically inactive gases that travel in the plume and cause an external dose to the whole body.

(2) Radioactive halogen gases. These are chemically active gases, primarily iodine, that also travel in the plume. These gases, when inhaled, migrate through the blood and tend to concentrate in the thyroid. Thus, inhalation of these gases will result primarily in a thyroid dose.

(3) Radioactive particulates. These are dust-like particles that are deposited from the plume on to surfaces in the downwind area. These particulates may result in an external whole body dose. In addition, deposited particulates when disturbed may become airborne again and cause an internal dose if inhaled.

18. Q. How much less shielding does a person get if he is in a wooden home with no basement than if he is in a masonry home with a basement?

A. [Cordaro, Daverio, Miele, Watts] The relative whole body dose shielding benefit obtained by being inside a structure will differ for radiation emitted from the different types of radioactive material mentioned above. In general, the more substantial the structure, the more benefit it will provide. The thyroid dose comes from inhaled gases, however, and therefore the rate of air transfer through the structure becomes the critical factor. The thyroid dose sheltering factor presently used is based upon guidance from the 1978 version of EPA's Protective Action Evaluation (EPA 520/1-75-001). Since it is difficult to generalize about windows, doors, and ventilation types for the many different structures in a community, a constant air replacement rate is assumed in the 1978 EPA 520.

The following table shows the shielding benefits from different types of structures, based on the 1978 EPA 520 (see Attachment 3 to this testimony). The thyroid plume factors are based upon an assumed exposure duration of one hour.

Dose Reduction Factors

Structure	Gases Whole Body Plume	Thyroid Plume	Particulates Whole Body Surface Deposition
Outside	1.0	1.0	1.0
Wood, no basement	0.9	0.5	0.4
Wood, basement	0.6	0.5	0.1
Masonry, no basement	0.6	0.5	0.2
Masonry, basement	0.4	0.5	0.1
Large Building	0.2	0.5	0.05

A revised draft of portions of EPA's Manual of Protective Action Guides (EPA 520/1-75-001A), dated June 1983, has provided new guidance on thyroid dose shielding: 0.36 for structures of wood or masonry with or without a basement, and 0.06 for large buildings (see Attachment 4 to this testimony). The new model, which is more realistic, shows a greater benefit because it assumes a logarithmic air exchange rather than a linear exchange. These new values will be incorporated into the LILCO Transition Plan's protective action procedure OPIP 3.6.1 (Attachment 5 to this testimony).

19. Q. Because some people have no basements, or live in frame houses, would it make sense to eliminate sheltering as a protective action for (a) all the

people in the EPZ, (b) those people who have no basements or (c) those who do not live in masonry houses?

A. [Cordaro, Daverio, Miele, Watts] No, it would not. From the above table it can be seen that, generally, a wooden house without a basement offers less benefit than the basement of a masonry house. But for a release of short duration that is composed of particulates and gaseous iodines that could result in a thyroid inhalation dose, a wood frame house will provide a substantial sheltering benefit. Making protective action recommendations requires in part that one compare, based upon the circumstances of a particular accident, the dose that might be received by the population if it shelters to the dose if it evacuates. Thus, a recommendation for sheltering should not be discounted; all sheltering action would provide benefits to some extent. The comparison of doses that might be received under evacuation and under sheltering must be considered in making a recommendation.

Further, it is not feasible to evacuate a portion of the population based upon home structures, because of the confusion it would cause. The

protective action recommendations prepared under OPIP 3.6.1 (Attachment 5 to this testimony) use an average whole body plume shielding factor for Suffolk County of 0.7. This shielding factor is representative of the housing in the County.

Sheltering probably would be the appropriate protective action under the following conditions:

(1) If the projected dose is only slightly above the Environmental Protection Agency Protective Action Guides (EPA PAGs), or of short duration, and the area shelters will provide enough benefit to make evacuation unnecessary; or

(2) If the roads are hazardous due to weather and therefore evacuation cannot safely be accomplished; or

(3) If sheltering would result in lower doses when compared to the doses that might be received if people evacuate.

20. Q. Couldn't people without basements make their way to a neighbor's house or to a nearby public building?

A. [Cordaro, Daverio, Miele, Watts] We do not think it is reasonable to expect people already in a building to seek shelter in another building, for several reasons.

First, while theoretically it could be beneficial for people in homes without basements to seek sheltering in a basement elsewhere, as a practical matter it could cause confusion and result in a greater net dose, because people would be required to go outside to search for better shelter. While they were outside, they would have no protection from a plume and, for example, might receive a thyroid inhalation dose as well as a whole body dose.

Second, if sheltering is recommended because the roads are hazardous due to snow and ice, then it would not be advisable to have people leaving their homes to seek "better" shelter. In addition, as stated in the County's contention, automobiles offer limited protection from either whole body or thyroid doses. It is not advisable to have people driving around unnecessarily in the plume.

Third, in the public education program, LILCO explains where the best locations for sheltering are within a particular type of structure.

Consequently, LILCO has not included in its planning any notion that people should look around to seek the "best" building in which to shelter when sheltering is the recommended protective action.

Contention 61.B: Persons In Automobiles

21. Q. Suppose a person were traveling in his car at the time a sheltering recommendation is made. Might he be unable to reach shelter in time to avoid exposure to radiation?

A. [Cordaro, Daverio, Miele, Watts] If sheltering is recommended, people in cars will hear the sirens if they are in the 10-mile EPZ and so almost all will have immediate access to radios and will be able to respond. If the driver lives in the EPZ, he would be able to reach a place of shelter (his home) quickly. If the driver does not live in the EPZ, he could quickly seek shelter in a building. Even if the driver chose to drive out of the EPZ he would be traveling faster than the average wind speed experienced near the Shoreham plant. Consequently, in 30 minutes, a person would be able to drive to a point outside the EPZ from any point within it, assuming he must drive 10 miles and does so at 20 mph.

Contention 61.D: Shelter for Transients

22. Q. Does the plan identify buildings within the EPZ for transients seeking shelter in response to a protective action recommendation of sheltering?

A. [Cordaro, Daveric, Miele, Watts] No. In the LILCO Plan, LILCO has chosen not to identify specific public buildings for shelters within the EPZ for transients' use if sheltering is recommended to the population, because (1) it is not likely that non-residents would be able to find a particular building, and (2) residents should be encouraged to return to their homes which would make any subsequent evacuation easier.

23. Q. If a sheltering recommendation is made, what will transients do who are on the beaches, in parks, or in other outdoor recreation areas?

A. [Cordaro, Daverio, Miele, Watts] The EBS message on sheltering in the LILCO Transition Plan, OPIP 3.8.2, p. 22 of 38 (Attachment 6 to this testimony), instructs people not at home to seek shelter inside buildings. The transient population that would be located at parks and beaches would only be there during warm weather when roads would be

passable. Therefore, when the sirens are sounded the transient population will be able to mobilize rapidly and seek shelter in a building or return home.

Contention 61.E: Boaters

24. Q. If a sheltering recommendation is made, what will persons in boats do?

A. [Cordaro, Daverio, Miele, Watts] Sirens can be heard out to about two miles on the Long Island Sound, so some boaters will hear sirens. They will receive sheltering instructions over their radios. In addition, upon reaching an Alert, the Coast Guard in New Haven will be notified as indicated in OPIP 3.3.2 (Attachment __ to this testimony). If protective action recommendations are made, the Coast Guard will transmit messages to all boats via marine band radio, advising people to leave the area and explaining to them which areas should be avoided. Coast Guard boats will be dispatched to notify any remaining boaters to advise them to leave the area, and to restrict all marine traffic within the 10-mile EPZ.

Contentions 61.G, 61.H, and 61.I:
Protection Offered by Taking Shelter

25. Q. Contentions 61.G, H, and I allege that sheltering will not totally protect people from radiation exposure. Is this true?

A. [Cordaro, Daverio, Miele, Watts] Yes. Sheltering reduces the amount of radiation exposure, but it cannot totally eliminate a potential dose from being received by the population. As shown in NUREG-0654 guidelines, protective actions need not be recommended below a threshold level. When threshold levels are reached, the protective action recommended should provide the largest dose savings for the public, taking into account the circumstances at the time of the accident. But a protective action will not result in zero dose. The NRC regulations do not contemplate that zero dose must be achievable with protective actions in order that nuclear power plants be allowed to operate, contrary to the intervenors' assertions otherwise.

26. Q. Would this be true of every other emergency plan for power plants operating in New York State?

A. [Cordaro, Daverio, Miele, Watts] Yes. No power plant in New York State, or in the country, can use protective actions to achieve zero dose in the event of an accident.

Contention 63: Selective Evacuation

27. Q. What is Contention 63?

A. Contention 63 reads as follows:

> Contention 63. The LILCO Plan states at page 3.6-6:
>
> Selective Evacuation may be implemented to evacuate from the affected area of the plume exposure EPZ members of the general public who might have a low tolerance to radiation exposure. Specifically, this would include pregnant women and children 12 years and under.
>
> The Plan fails to set forth guidelines to be used by command and control personnel: (a) in choosing to recommend the protective action of selective evacuation; or (b) in determining, identifying and locating the individuals who should be subject to such a recommendation. In addition, there are no procedures which indicate the means by which such a recommendation could or would be implemented. The Plan thus fails to comply with 10 C.F.R. § 50.47(a)(1), 50.47(b)(10), and NUREG-0654 Sections II.J.9 and J.10.

28. Q. What are the legal standards cited in the Contention?

A. The legal standards are the following:

10 C.F.R. § 50.47(a)(1)

> No operating license for a nuclear power reactor will be issued unless a finding is made by NRC that the state of onsite and offsite emergency preparedness provides reasonable assurance that adequate protective measures can and will be taken in the event of a radiological emergency.

10 C.F.R. § 50.47(b)(10)

> A range of protective actions have been developed for the plume exposure pathway EPZ for emergency workers and the public. Guidelines for the choice of protective actions during an emergency consistent with Federal guidance, are developed and in place, and protective actions for the ingestion exposure pathway EPZ appropriate to the locale have been developed.

NUREG-0654, II.J.9

> Each State and local organization shall establish a capability for implementing protective measures based upon protective action guides and other criteria. This shall be consistent with the recommendations of EPA regarding exposure resulting from passage of radioactive airborne plumes, (EPA-520/1-75-001) and with those of DHEW (DHHS)/FDA regarding radioactive contamination of human food and animal feeds as published in the Federal Register of December 15, 1978 (43 Fed. Reg. 58,790).

NUREG-0654, II.J.10

> The organization's plans to implement protective measures for the plume exposure pathway shall include:
>
> . . . .
>
> m. The bases for the choice of recommended protective actions from the plume exposure pathway during emergency conditions. This shall include expected local protection afforded in residential units or other shelter for direct and inhalation exposure, as well as evacuation time estimates.

29. Q. What is selective evacuation?

A. This is a protective action that limits the evacuation to a portion of the population defined by other than by geographic location, usually radiosensitive persons such as pregnant women and children.

30. Q. What does the LILCO Transition Plan say about selective evacuation?

A. The LILCO Transition Plan at page 3.6-6 (Attachment 8 to this testimony) says the following about selective evacuation:

> Selective Evacuation
>
> Selective Evacuation may be implemented to evacuate from the affected area of the plume exposure EPZ members of the general public who might

> have a low tolerance to radiation exposure. Specifically, this would include pregnant women and children 12 years and under.
>
> This protective action strategy has been adopted from the New York State Radiological Emergency Preparedness Plan (III-53,54). It may be implemented for projected dose levels of 1 to 5 rems whole body or 5 to 25 rems to the thyroid, but not without consultation with the N. Y. State Commissioner of Health.

Thus, contrary to what the contention says, the Plan clearly states the guidelines for choosing selective evacuation as a protective action. The dose guidelines are "projected dose levels of 1 to 5 rems whole body or 5 to 25 rems thyroid." The persons affected are defined as "pregnant women and children 12 years and under."

31. Q. On what does LILCO base the guidelines for selective evacuation set out in the Plan?

A. [Cordaro, Daverio, Miele, Watts] These guidelines were taken directly from EPA's Protective Action Guides (PAG's). The PAG's (see Table 3.6.1 of the LILCO Transition Plan, which is Attachment 9 to this testimony) call for no action if the projected dose is less than 1 rem whole body (or 5 rem thyroid), and for mandatory evacuation if the

projected dose is 5 rem or above whole body (or 25 rem or above thyroid). Between 1 and 5 rem whole body (5 and 25 rem thyroid) the protective action is "shelter as a minimum," with a recommendation to "consider" evacuation, particularly for children and pregnant women. The comment to this dose is that "[i]f constraints exist, special considerations should be given for evacuation of children and pregnant women." Thus, the PAG's allow flexibility in the 1-5 rem whole body range and in the 5 to 25 rem thyroid range for selective evacuation.

32. Q. Dr. Mileti, you've said that when children and pregnant women were advised to evacuate at Three Mile Island, this sent a message to everyone else that they might be at risk also. Does this mean that selective evacuation is not a viable alternative?

A. [Mileti] No, selective evacuation advisories are one option for protective action during an emergency at a nuclear power plant. But it is important for those who might issue a public advisory for selective evacuation (the evacuation of only people with certain demographic characteristics from a specific locality while others in the same area are

not included) to understand that actual public response likely would not match the advisory.

If children twelve years of age or younger and pregnant women were advised to evacuate a specified locality, some others who are not pregnant or not twelve years of age or younger would also evacuate that area. This is because a selective evacuation advisory to certain demographic groups would also contain location-specific information regarding risk to everyone in that area. Some people would, consequently, define the area as "at risk." Those who are not included in the demographic group advised to evacuate under a selective evacuation but who are in the same locality, could personalize the risk and evacuate although it is not recommended that they do so.

Likely public response to a selective evacuation advisory during a nuclear power plant emergency does not preclude the option of issuing one. It does, however, suggest that those who might decide to issue such an advisory should be aware of the public response that the advisory would likely precipitate. In this way, decisions about public emergency information (including advisories) and

public safety could be reasonably matched to likely public response. I might also add that emergency planners for Long Island Lighting Company are well-aware of this likely public response to a selective (demographic) evacuation advisory for a specific location associated with a nuclear power plant accident.

33. Q. When would LILCO recommend the protective action of selective evacuation?

A. [Cordaro, Daverio, Miele, Watts] Revision 3 to the LILCO Plan states at 3.6-6 (Attachment 8 to this testimony) that the protective action of selective evacuation would not be implemented without "consultation with the N.Y. State Commissioner of Health." LILCO placed this provision in the Plan in order to maintain consistency with the New York State Plan and assure that LERO personnel familiar with the terminology that might be used if New York State participated in the emergency response. LILCO would recommend selective evacuation only if instructed to do so by New York State. In the absence of such an instruction, LILCO would recommend evacuation for a general population in a specific area.

34. Q. What procedures would be used to implement a recommendation of selective evacuation?

A. [Cordaro, Daverio, Miele, Watts] The State (or LERO, if requested by the State) would issue a specific recommendation of selective evacuation using the procedures outlined in the evacuation section of the State Plan at III-43 (Attachment 10 to this testimony). The public would be notified of the recommendation to evacuate selected segments of the population by the broadcasting of EBS messages advising the public of the recommended protective action.

Contention 64: Wind Shifts

35. Q. What is Contention 64?

A. [Cordaro, Daverio, Miele, Watts] Contention 64 reads as follows:

> Contention 64. The LILCO Plan proposes an EPZ consisting of 19 separate zones. In the event of a radiological emergency at Shoreham requiring evacuation of the EPZ, it is LILCO's intended strategy to evacuate all zones within two miles of the Shoreham plant, but only a portion of those zones outside of the two-mile radius. (See OPIP 3.6.1, Attachment 2). LILCO's plan, however, fails to account for the fact

that the wind shifts quickly on Long Island, with average wind speeds of approximately 10 miles per hour. Under such conditions, a shift in wind direction could quickly direct the plume over an area that was not in the original plume pathway, and thus not included in the initial evacuation order, before that area could be evacuated.

Intervenors contend that given wind conditions on Long Island, in the event any evacuation due to a radiological emergency is required, LILCO must evacuate at least a radius of five to seven miles around the plant. Any partial evacuation of only certain zones within a five to seven mile radius would expose the population of the nearby unevacuated zones to the risk of a sudden wind shift and consequent health-threatening exposure to radiation. Under these conditions, the LILCO evacuation plan fails to constitute an adequate protective action, as required by 10 CFR Sections 50.47(a)(1) and 50.47(b)(10).

36. Q. What are the legal standards for Contention 64?

A. [Cordaro, Daverio, Miele, Watts] The legal standards cited in Contention 64 are the following:

10 C.F.R. § 50.47(a)(1)

No operating license for a nuclear power reactor will be issued unless a finding is made by NRC that the state of onsite and offsite emergency preparedness provides reasonable assurance that adequate protective measures can and will be taken in the event of a radiological emergency.

10 C.F.R. § 50.47(b)(10)

> A range of protective actions have been developed for the plume exposure pathway EPZ for emergency workers and the public. Guidelines for the choice of protective actions during an emergency consistent with Federal guidance, are developed and in place, and protective actions for the ingestion exposure pathway EPZ appropriate to the locale have been developed.

37. Q. Contention 64 alleges that evacuation of certain zones is inadequate because the wind may shift quickly and that therefore at least a radius of five to seven miles must be evacuated if any evacuation at all is called for. Do you agree that, regardless of conditions at the time of an accident, LILCO should recommend in its Plan an evacuation of a radius of 5 to 7 miles from the plant whenever evacuation is recommended?

A. [Cordaro, Daverio, Miele, Watts] No, we do not. Evacuation recommendations should be made for a particular portion of the EPZ based on circumstances at the time of an accident. A blanket evacuation recommendation like that for everyone in the EPZ likely would not be necessary, and is not contemplated by NRC regulations.

38. Q. Do guidelines provided by New York State to nuclear plants require such evacuation out to 7 miles?

A. [Cordaro, Daverio, Miele, Watts] No. As explained by New York State's experts (see excerpts of depositions that are Attachments 11 and 12 to this testimony), there are situations where wind direction can be predicted, and thus unnecessary evacuation can be avoided. (Attachment 11 at 46.) Current meteorological conditions at the time of the accident should be used in deciding the appropriate protective action recommendation. (Attachment 12 at 25.)

39. Q. How is a protective action recommendation of evacuation made by the Local Emergency Response Organization to the public?

A. [Cordaro, Daverio, Miele, Watts] The offsite LERO organization independently calculates projected doses and derives a protective action recommendation. When the projected dose to the population exceeds the EPA Protective Action Guides, OPIP 3.6.1 (Attachment 5 to this testimony) is used to evaluate the most appropriate protective action based upon evacuation times, release direction and duration, sheltering factors, plant conditions, and other pertinent data.

These data are also evaluated by Shoreham onsite personnel who independently arrive at a protective action recommendation. If the recommendations are inconsistent, the Radiation Health Coordinator will investigate the basis of the site's recommendation. The Radiation Health Coordinator discusses his conclusions regarding protective actions with the Director of Local Response.

The Director then makes a protective action recommendation for specific zones in the EPZ. This recommendation is broadcast to the public via the EBS radio network.

40. Q. What information does the Director of Local Response receive, in addition to the information provided from the Radiation Health Coordinator, in determining what protective action recommendation to make to the public?

A. [Cordaro, Daverio, Miele, Watts] The LERO organization has its own field monitoring teams, OPIP 3.5.1 pp. 1-9 (Attachment 13 to this testimony), provided by DOE-Radiological Assistance Program team members, to evaluate actual doses from the field. In addition, meterological data are available from the National Weather Service and

Brookhaven National Laboratory. Extensive resources are also detailed in the DOE-RAP local radiological emergency response plan in Plan Attachment 2.2.1 (Attachment 14 to this testimony). If there is sufficient time, the Director would receive this information prior to making a recommendation.

41. Q. Would the protective action recommendation from LERO ever suggest evacuation out to 7 miles?

A. [Cordaro, Daverio, Miele, Watts] The protective action will take the form of a keyhole. This keyhole will be made up of a 360 degree area circling the plant plus a downwind wedge of at least 67 degrees. Depending on the projected doses the protective action recommendation will be one of the following:

(a) 2 miles.
(b) 2 miles plus a 5-mile downwind sector.
(c) 5 miles plus a 10-mile downwind sector.

These keyholes are described in the Plan at OPIP 3.8.2, Attachment 5 (Attachment 15 to this testimony).

The reason for the 2 or 5 mile circular area is so that in case of a change in wind direction, those areas near the plant will have already taken protective actions. As can be seen from looking at the zone map in the Plan at Appendix A, Figure 3 (Attachment 16 to this testimony), the zones affected by a five mile evacuation actually go out to about seven miles except in zone J. When weather forecast information indicates that the wind direction will change, the protective action is recalculated and if necessary a new protective action recommendation is issued.

42. Q. If between the time the Director of Local Response receives the onsite suggestion as to protective action and an actual announcement is made, the wind were to shift, would the Director of Local Response know about it?

A. [Cordaro, Daverio, Miele, Watts] The wind direction is one of the significant pieces of information on the New York State Radiological Data Form, contained in OPIP 3.3.1, p. 7 of 10 of the LILCO Plan (Attachment 17 to this testimony). Whenever any of the information changes the site personnel will transmit an updated form. If the wind shift

causes new zones to be affected, then the protective action will be modified and the EBS message will be changed to reflect the new conditions. It is important to note that efforts are continually made to anticipate future wind direction changes by consulting sources of weather forecast information.

43. Q. What would be recommended if the wind shifted after an evacuation of a certain area were already underway?

A. [Cordaro, Daverio, Miele, Watts] Once an evacuation of an area is started it would not be discontinued because of a wind shift. These people would be advised to return to the area only after the emergency has terminated. The additional persons susceptible to exposure as a result of the shift in wind would also be asked to move.

44. Q. Is the average wind speed approximately 10 miles an hour on Long Island?

A. [Cordaro, Daverio, Miele, Watts] The Shoreham FSAR, Table 2.3.2-1 (Attachment 18 to this testimony), reports that the average windspeed on Long Island, based on data from Suffolk County Air Force Base taken over 19 years, is 8 miles an hour.

45. Q. Does the wind shift quickly on Long Island?

A. [Cordaro, Daverio, Miele, Watts] As seen from Table 2 of the attached study entitled "Wind Direction Variability Analysis [for] Shoreham and Other Sites," Shoreham is considered a coastal location. Generally, coastal locations have lower wind variability than island or valley locations. In fact, even as compared to other coastal locations studied, Shoreham has a lower wind variation.

CONCLUSION

46. Q. Please summarize your testimony.

A. The protective action recommendations contemplated by the LILCO Transition Plan, and the methods by which those recommendations would be chosen, comply with NRC and New York State regulations and guidelines regarding protective actions. Selective sheltering and selective evacuation would be suggested only on the recommendation of New York State, and are included in the Plan to provide flexibility to adapt to a State recommendation for selective sheltering or evacuation, should the State choose to respond to an emergency at

Shoreham. Contrary to the intervenor's contentions, the LILCO Transition Plan states clearly the guidelines that would be used in recommending selective sheltering or evacuation for radiosensitive

During an emergency at a nuclear power plant which results in an offsite release, the downwind population may be exposed to radioactive material of three forms: radioactive noble gases, radioactive halogen gases, and radioactive particulates. The LILCO Transition Plan has procedures developed pursuant to appropriate NRC regulations and guidelines, that describe how the Local Emergency Response Organization (LERO) would make a protective action recommendation of sheltering or evacuation for a segment of the population. The recommendation is based upon conditions at the time of an accident and the comparative benefits that would be received by sheltering and by evacuating. The recommendation of sheltering would provide protection to boaters, transients in the EPZ, people in cars, and people inside buildings within the EPZ. But the recommendation will not result in zero dose. No protective action will result in zero dose at any nuclear power plant in New York State or in the country, and the NRC regulations do not

contemplate that zero dose must be achievable with protective actions in order that nuclear power plants be allowed to operate, contrary to the intervenors suggestions otherwise.

Nor do wind shifts on Long Island require that LILCO recommend evacuation out to 5 to 7 miles in the event any evacuation is recommended. The average wind speed on Long Island is 8 miles, and the wind variability at Shoreham, a coastal location, is lower than island or valley locations. In addition, shifts in the wind would be taken into account by the Director of Local Response in making a protective action recommendation, and additional recommendations would be made if necessary in response to a shift in wind. The protective action recommendation under the LILCO Plan would be made for an area in the form of a keyhole. This keyhole would consist of a 360 degree area circling the plant out to 2 miles, plus (depending upon the projected doses) a 5 or 10 mile downwind sector consisting of certain zones. Most of the zones that would be affected by an evacuation out to 5 miles actually extend to about 7 miles.

Attachment 1

and bed sheets can be employed as effective respiratory filters when folded several times and held over the mouth and nose.

Potassium Iodide (KI), which is used as a thyroid blocking agent, will be used only by those emergency workers who have previously been screened for its use. Adequate supplies of KI will be maintained by LILCO and distributed by the Local Emergency Response Organization through the authorization of the Health Services Coordinator, refer to KI Distribution, Procedure 3.6.2

Selective Sheltering

This protective action may be ordered at projected doses below the accepted PAGs to minimize radioactive exposure, particularly to pregnant women and children. The Selective Sheltering option will provide this flexibility.

This protective action strategy has been adopted from the New York State Radiological Emergency Preparedness Plan (III-50,51). It would not be recommended without consultation with N. Y. State Commissioner of Health.

Sheltering

The Director of Local Response upon the advice of the Manager of Local Response and/or the Radiation Health Coordinator may recommend the initiation of Sheltering actions for designated sectors of the population within designated zones. Public notification of the need to take shelter will be accomplished via the notification system described in Section 3.3.

The Sheltering option may be recommended as an effective option for individuals who could not be safely evacuated. This would include individuals who have been designated medically unable to withstand the physical stress of an evacuation, as well as those individuals who require constant, sophisticated medical attention.

Sheltering actions may be terminated when the likelihood of exposure has been reduced to appropriate levels.

Attachment 2

Attachment 2

NEW YORK STATE
RADIOLOGICAL EMERGENCY
PREPAREDNESS PLAN

(including Site Specific Plans)

NEW YORK STATE
RADIOLOGICAL EMERGENCY PREPAREDNESS PLAN

Prepared for
the Disaster Preparedness Commission
of the
State of New York
Mario Cuomo, Governor

By the Radiological Emergency Preparedness Group

- the activation of the State EOC and the appropriate district and county EOC's.

(2) Selective Sheltering

In general, protective actions will be taken in accordance with the EPA PAG guidelines. The Commissioner of Health may recommend protective action at projected doses below these guidelines to minimize radioactive exposure, particularly of pregnant women and children. The Selective Sheltering Option will provide this flexibility. In addition, the Selective Sheltering Option may be recommended by the State Commissioner of Health as an effective option for individuals who could not be safely evacuated, if a Selective or General Evacuation may otherwise be recommended. This would include individuals who have been designated medically unable to withstand the physical and/or psychological stress of an evacuation, as well as those individuals who require constant, sophisticated medical attention.

The implementation and execution of the Selective Sheltering Response Option will include the following:

- the appropriate local health officer, in conjunction with the special facilities administrators and other local officials will make an initial determination of the number of nonevacuative individuals and their medical care requirements. This will be compared with the sheltering and medical capabilities otherwise available to these individuals;

- if this preliminary disposition indicates that additional medical personnel, equipment, and/or supplies are needed, local and State officials will assist in acquiring whatever is needed;

- the local health officer will conduct an on-going assessment as to the possibility and desirability of evacuation for those persons initially determined to be non-evacuative. This assessment would be based on the availability of evacuation capabilities, which would minimize the medical risk to those persons; and

- when the projected dose rates, as translated into dose assessment, outside any facility reach the varous protective action levels, the County ODP, through the local health officer, will notify the facility and other local officials, who will begin the immediate implementation of sheltering for these persons.

(3) General Sheltering

For actual or projected off-site doses of 1 to 5 rem to

the whole body or 5 to 25 rem tc the thyroid, the protective action response option "General Sheltering" may be implemented for the affected areas of the plume exposure EPZ. This response option can also be implemented, for puff-type releases of lower doses, as a precautionary measure. For higher doses where evacuation would be indicated but where evacuation cannot be implemented, because of time constraints and/or impediments to highway movement, "General Sheltering" may be implemented in lieu of evacuation.

General Sheltering will be implemented by the local chief executive, upon the recommendation of the State Commissioner of Health.

Instructions of Genneral Sheltering are provided for each household, school, special care facility, group quarters, and place of business in the plume exposure EPZ. These instructions are contained in the emergency public information pamphlet distributed annually to the population within the plume exposure EPZ population.

Information of General Sheltering is initiated by the county public notification system, with explicit directions over the emergency broadcast system. Implementation can be affected for various Emergency Response Planning Areas (a subdivision of the plume exposure EPZ) or for the entire EPZ. Instructions to the public include directions to stay indoors; close and seal, where applicable, all doors and windows; and turn off air-conditioners.

Instructions on respiratory protection may be prescribed using common household items such as towels and handkerchiefs. The preponderance of General Sheltering will take place in residences and businesses. Levels of radioactive surface contamination will be measured for all affected areas. Areas requiring decointamination may require temporary relocation of persons within that area.

(4) Selective Evacuation

For actual or projected off-site dose levels of 1 to 5 rem to the whole body or 5 to 25 rem to the thyroid, the protective action response option Selective Evacuaton may be implemented, to evacuate from the affected areas of the plume exposure EPZ members of the general public who might have a low tolerance to radiation. Specifically, this would include pregnant women and children 12 years old and under.

Selective Evacuation will be implemented by the local chief executive, following consultation with and the recommendation of the State Commissioner of Health and with the coordination support of Director, Office of Disaster Preparedness.

Attachment 3

Attachment 3

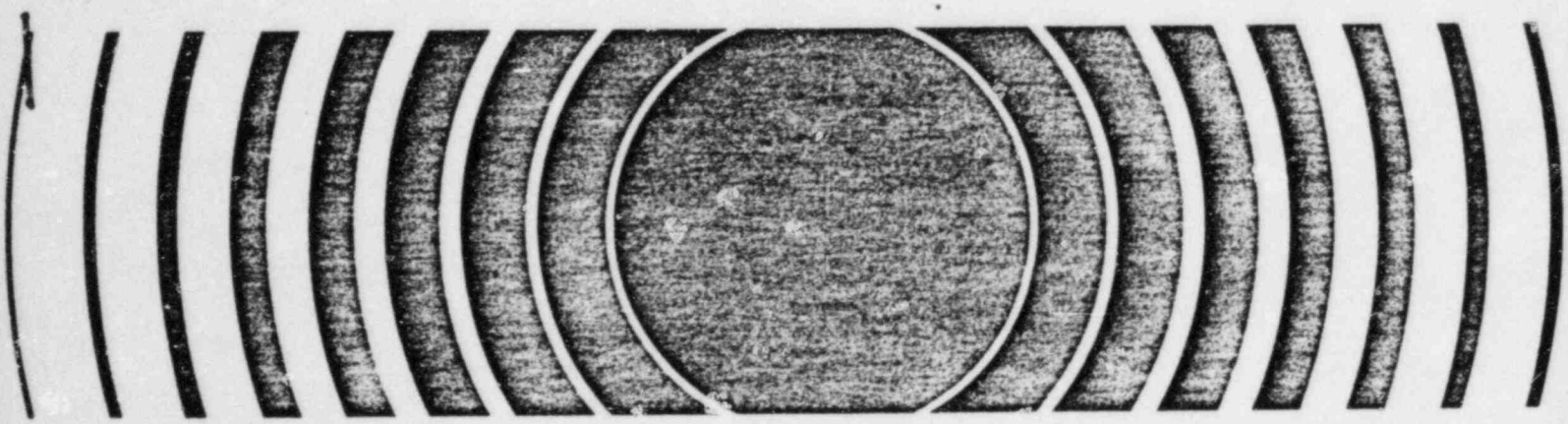
United States
Environmental Protection
Agency

Washington
DC 20460

EPA

Protective Action Evaluation Part I

The Effectiveness of Sheltering as a Protective Action Against Nuclear Accidents Involving Gaseous Releases



PROTECTIVE ACTION EVALUATION

PART I

THE EFFECTIVENESS OF SHELTERING AS A PROTECTIVE ACTION AGAINST NUCLEAR ACCIDENTS INVOLVING GASEOUS RELEASES

APRIL 1978

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Prepared for

U.S. Environmental Protection Agency
Office of Radiation Programs
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The entry of outside airborne radioactive cloud material is assumed to be dependent on the shelter-structure ventilation rate (forced, natural, or both) assuming constant homogeneous mixing based on simple one-compartment outside/inside air exchange. This type of stirred-tank mixing and ventilation model has been applied in studies of the relationship between indoor/outdoor pollutants (e.g., NO, NO_2, CO, and O_3) and has predicted concentration versus time profiles that are similar to those measured [6]. The radioiodine fallout deposition inside the shelter is then also assumed to be dependent on the ventilation rate as well as the fallout deposition velocity; these aspects are also discussed below.

Shelter Structure Ventilation

A review of literature on ventilation rates of homes and buildings indicates a wide variety of air change estimates ranging anywhere from ~0.1 to 6 per hour for single-family dwellings to ~1 to 9 changes per hour for large structures. The wide ranges are, of course, due to the various types of construction--whether the portals and windows were shut or sealed, and such environmental factors as wind speed, temperature differential, and humidity. Also, in some instances, it was not clear whether air change rates included internal forced-air systems.

A review by Handley and Barton [7] of published information on home ventilation rates resulted in their suggesting the use of the range from 0.5 to 1.5 air changes per hour for homes and 2.0 air changes per hour for modern high-rise apartment buildings. A check with commercial home air-conditioning and heating vendors seems to generally support those recommendations. For example, usually a 4-ton (1600 cfm) unit is recommended for a 1500-ft^2 single-family dwelling with from 10- to 20-percent outside air makeup. Such an installation results in from 0.8 to 1.6 air changes per hour with outside air. Of course, some systems are installed for complete internal recirculation with no outside air makeup other than normal expected structural leakage.

Municipal code requirements for building ventilation rates--for high-rise office buildings, large apartment complexes, auditoriums, etc.--also seem to support the value of two air changes per hour as suggested by Handley and Barton [7]. For example, a check with the

Health Division of the Los Angeles City Building and Safety Department [8] indicated internal air turnover time of from 5 to 10 min depending on occupancy requirements, with a representative value of about 7 min--with 15 percent outside air makeup as a comfort-level requirement--which corresponds to 0.9 and 1.8 air changes per hour and ~1.3 air changes per hour. Considering the above data, the rates for single-family dwellings and large structures are generally comparable, assuming internal forced-air systems.

In the absence of forced-air ventilation systems, home and building air change rates would be expected to vary much more widely--as indicated by the published data examined by Handley and Barton [7]. This conclusion is also supported by observations of Yocom, *et al.* [9] who note that particulate pollutant levels are lower in public buildings than in homes. The *ASHRAE Handbook of Fundamentals* [10] points to the lack of published data on air change rates for different buildings, exclusive of air provided for ventilation, when utilizing the air change method for estimating infiltration* requires experience and judgment. Table 2 gives *ASHRAE Handbook* values that may be used with reasonable precision in making infiltration estimates for residences with different room conditions.

Table 2

AIR CHANGES TAKING PLACE UNDER AVERAGE CONDITIONS IN RESIDENCES, EXCLUSIVE OF AIR PROVIDED FOR VENTILATION

Kind of Room or Building	Number of Air Changes Taking Place per Hour [a]
Rooms with no windows or exterior doors	1/2
Rooms with windows or exterior doors on one side	1
Rooms with windows or exterior doors on two sides	1 1/2
Rooms with windows or exterior doors on three sides	2
Entrance halls	2

[a] For rooms with weatherstripped windows or with storm sash, use two-thirds these values.

*The other is the "crack method" based on measured leakage characteristics of the building components and selected pressure differences.

Another approach in making air change estimates due to natural ventilation for houses is given by Coblentz and Achenbach [11], who suggest the following empirical relationship in which the air change rate is proportional to the outside wind speed and inside/outside temperature differential (i.e., without inside forced ventilation):

$$I \text{ (changes/hr)} = A + BW + C\Delta T \quad ,$$

where

A = air change rate for $W = 0$, $\Delta T = 0$ (0.12 to 0.18),

$B = 0.013$,

$C = 0.005$,

W = wind speed, mph,

$\Delta T = T_{inside} - T_{outside}$, °F .

Assuming the upper limit of $A = 0.18$ and $\Delta T = 20°F$ gives air change rates of about 0.35 per hour for a 5-mph wind speed and about 0.5 for 15- to 20-mph wind speeds, which appears to be somewhat on the low side compared with other data reviewed. This difference, however, may be due to new, well-built houses that made up part of Coblentz and Achenbach's field samples. In contrast, measured air change rates given by Megaw [12] for a hut structure that were made in conjunction with radioiodine penetration experiments were substantially higher, ranging anywhere from about 2 per hour to 8 per hour (the latter, however, for open windows). An examination of Megaw's data reveals an indication of air-change-rate proportionality with outside wind speed that, roughly, was about 0.5 (changes/hr) per (mi/hr). This figure corresponds to only an "eyeball" estimate from Megaw's data, which are complicated by variations in wind direction. Such variations would give rise to different pressure differential distributions due to asymmetric flow patterns, which would affect the internal air change rate.

Based on the above review of air change rates that might be expected for single-family dwellings (small structures) and various building structures that could be used as temporary public shelters, values of from 0.125 to 3 air changes per hour were assumed in performing shelter-structure effectiveness calculations. It was felt that ~0.125 changes

per hour might represent relatively "tight" structures (either large or small) and that ∿3 air changes per hour might represent a practical upper limit of structural ventilation. Of course, as indicated, much larger values of 6 to 9 air changes per hour have been measured; but it was felt that these values would represent extreme cases (e.g., open windows or portals), which do not represent practical cases if good planning is assumed.

Gaseous Fission-Product Ingress

The extent to which radioiodine will penetrate a structural shielding facility is dependent on the gross tightness of the structure, the ventilation rate, filtration, and the chemical and physical properties of the released material and the interacting species. Many of these facets of a gaseous fission-product release from a nuclear accident are currently unknown, particularly for radioiodine, which leads to difficulty in accurately predicting the ingress of gaseous radioactive material into shelter structures. For the rare gases (Xe and Kr), most are willing to accept virtually no effective "structural filtering," because of their inertness and stability as gaseous forms. Accordingly, in this study no effective filtering action has been included in estimating their internal structure concentrations.

For the halogens, which are here assumed to be all radioiodines, the case is more complicated and suffers from scarcity of experimental work on indoor/outdoor pollutant-level relationships dealing with the ingress of radioiodine into various potential sheltering structures. The radioiodines are of course particularly important sources due to their large contribution to the WB dose, as well as being totally responsible for the thyroid dose.

Three known chemical forms of radioiodine present as airborne gaseous species in power-station areas during and after handling defective fuel elements are elemental iodine (I_2), hypoidous acid (HOI), and organic iodides (CH_3I). The ratio of the three species would depend on the conditions under which an accidental release might take place. Elemental iodine is thought to be the primary form released from uranium-oxide fuel. It hydrolyzes rapidly in water, generating HOI, or

$$0.5 \times (0.9) + 0.5(0.38) = 0.64 \quad ,$$

where the attenuation for the walls (0.38) is based on a wall-mass thickness of

$$4 \text{ (in.)} \times 2.54 \text{ (cm/in.)} \times 2.7 \text{ (gm/cm}^3\text{)} = 28 \text{ gm/cm}^2 \quad ,$$

(assuming 8-in. concrete bricks with a 50-percent void volume).

Attenuation of cloud-gamma radiation for large structures such as office buildings and multistory structures could be significantly more than for simple structures such as single-family dwellings. Attenuation by 8-in.-thick solid concrete, either exterior walls or interior walls (e.g., fire-resistant stairwells) may be equivalent to mass thickness of around 45 to 50 gm/cm^2, corresponding to attenuation factors of 0.2 to 0.17 (Fig. 3). Table 3 summarizes representative cloud-gamma attenuation factors for the types of structures noted.

Table 3

REPRESENTATIVE CLOUD-GAMMA ATTENUATION FACTORS

Structure	Attenuation Factor
Wood frame house, no basement	0.9
Masonry house, no basement	0.6
Basement of wood house	0.6
Basement of masonry house	0.4
Large office or industrial building	0.2 or less

The above values do not suggest any substantial protection from external cloud-gamma radiation afforded by lightly constructed, frame single-family dwellings. In this study, however, estimates of sheltering effectiveness were made assuming somewhat more substantial gamma-attenuation protection, A(x) = 0.4 to 0.9 for small structures. For large

Table 4

REPRESENTATIVE REDUCTION FACTORS FOR SURFACE SOURCE

Structure and/or Location	Reduction Factor
1m above a hypothetical, infinite, smooth plane	1.00
1m above ordinary ground	0.70
1m above center of 50-ft roadway half contaminated	0.55
Cars, pickups, buses, and trucks on 50-ft road:	
Road fully contaminated	0.5
Road fully decontaminated	0.25
Trains	0.4
1- and 2-story wood frame homes (no basement)	0.4
1- and 2-story block or brick homes (no basement)	0.2[a]
Home basement--1 or 2 walls fully exposed:	0.1[a]
1 story, less than 2 ft of basement walls exposed	0.05[a]
2 story, less than 2 ft of basement walls exposed	0.02[a]
3- or 4-story structures, 5000 to 10,000 ft^2 per floor:	
First and second floors	0.05[a]
Basement	0.01[a]
Multistory structures, >10,000 ft^2 per floor:	
Upper floors	0.01[a]
Basement	0.005[a]

[a]Away from doors and windows.

Attachment 4

DRAFT

APPENDIX B

PLANNER'S EVALUATION GUIDE
FOR EVACUATION AND SHELTER

Contents

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to natural ventilation, internally controllable forced ventilation, or uncontrollable outside forces; primarily wind.

Assuming constant atmospheric and plume conditions and no effects from filtration, deposition, or radioactive decay, one can use the following model to roughly estimate the indoor concentration as a fraction of the outdoor concentration for different plume exposure periods and for different ventilation rates.

$$C_i = C_o(1 - e^{-Lt})$$

where C_i = concentration inside

C_o = concentration outside

L = ventilation rate (hr^{-1})

t = plume exposure time (hr)

Typical values for the ventilation rates are in the range of 0.1 to several air changes per hour. In the absence of data, an air exchange rate of 0.125/hr may be assumed for relatively air-tight structures such as well sealed residences, interior rooms with no windows and doors chinked or large structures with ventilation shut off. For structures with so special preparation except for closing the doors and windows, an air exchange rate of 1.0/hr may be assumed. Using the above model to calculate indoor concentrations relative to outdoor concentrations for one, two, and four complete air changes, the indoor concentrations would be about 64 percent, 87 percent, and 98 percent of outside concentrations, respectively.

It is apparent that staying in shelter for more time than that required for two air changes is not very effective for reducing inhalation exposure. The DRF for whole body dose shown in Table B-1 will become less effective (increase) with increasing plume exposure time because of the inside-outside air exchange. This relationship is shown in Figure B-1 for plume durations ranging from 0.5 to 6 hours. This effect is not dramatic for whole body dose because a major portion of the dose would be contributed from the large volume of the plume outside compared to the small volume inside the shelter. Therefore the shelter is a partial shield even if the concentration inside equals the concentration outside.

Contrary to the whole body DRF for sheltering, the inhalation DRF is entirely a function of the ratio of inside to outside air concentrations. Table B-2 shows dose reduction factors for inhalation exposure pathways as a function of plume exposure duration for the two typically used ventilation rates. Note that for tight structures, the inside concentration is about half the outside concentration after 6 hours whereas for other structures, generally typical of homes, the ratio of indoor to outdoor concentration reaches one half during the first hour of plume exposure.

The DRF in Table B-2 can be improved (reduced) by simple filtration over the mouth and nose using such common items as towels (three or more folded layers) or handkershiefs (8 or more folded

Table B-2. Typical inhalation dose reduction factors for different structures with time.

ventilation rate L(hr^{-1})	duration of plume exposure t (hr)	ratio of inside to outside concentration	DRF
0.125a	0.5	0.062	~~0.000~~ 0.03
	1	0.12	0.06
	2	0.22	0.12
	3	0.31	0.17
	4	0.40	0.20
	6	0.53	0.29
1.0b	0.5	0.40	0.20
	1	0.64	0.36
	2	0.87	0.56
	3	0.95	0.68
	4	0.98	0.75
	6	0.997	0.83

(a) Applicable to relatively "airtight" structures such as well sealed residences, interior rooms with no windows and doors chinked, or large structures with ventilation shut off.

(b) Applicale to structures with no special preparation except for closing of doors and windows.

Attachment 5

EPC _____

Approved: _____

Effective Date _____

OPIP 3.6.1 PLUME EXPOSURE PATHWAY PROTECTIVE ACTION RECOMMENDATIONS

1.0 PURPOSE

This procedure provides guidance for making protective action decisions to mitigate the consequences of a radiological release in the plume exposure pathway.

The resulting guidance derived by using this procedure is intended to assist the Director of Local Response in making a protective action decision. It is intended that sound judgment along with a personal assessment of the progress of events will be supplemented with the guidance found in this procedure.

2.0 RESPONSIBILITY

2.1 The Radiation Health Coordinator is responsible for advising on Protective Action Determinations based upon recommendations provided by SNPS and if time permits, an independent development of Protective Action Recommendations based upon dose projections or offsite radiological monitoring survey data.

2.2 The Radiation Health Coordinator is responsible for relaying Protective Action Recommendations from the DOE-RAP Team to the Director of Local Response following an independent and final review.

2.3 The DOE-RAP Team is responsible for performing protective action calculations and determining protective action recommendations using the procedures and worksheets contained in this OPIP or equivalent.

3.0 PRECAUTIONS

3.1 The dose-saving effectiveness of protective actions can be influenced by many variable factors such as expected duration of releases, involved population, weather conditions, projected evacuation times, and plant conditions. Whenever possible, these factors should all be considered prior to the recommendation of protective actions.

3.2 Sheltering is the preferred protective action if sufficient protection is offered by sheltering, or if no additional benefit is gained by evacuation. The evacuation of hospitals and nursing facilities should be sought as a last means since sheltering is the least disruptive to the patients.

4.0 PREREQUISITES

4.1 The Shoreham Nuclear Power Station has declared a General Emergency.

4.2 Dose projections have been completed in accordance with IRDAM, OPIP 3.5.2--Assessment and Dose Projection, or offsite dose levels have been measured in accordance with OPIP 3.5.1, Downwind Surveying, or with procedural equivalents.

5.0 ACTIONS

AIRBORNE RELEASE	- HP-85 OPERATIONAL - SECTION 5.1
AIRBORNE RELEASE	- HP-85 INOPERATIVE, MANUAL METHOD WITH TI-59 - SECTION 5.2
AIRBORNE RELEASE	- PROTECTIVE ACTIONS FOR SPECIAL FACILITIES - SECTION 5.3
WATERBORNE RELEASE	- SECTION 5.4

5.1 Airborne Release - HP-85 Operational

5.1.1 If the HP-85 has been set up, proceed to Step 5.1.2. Otherwise, perform the following steps:

a. Connect power cord to HP-85 and plug into outlet. Insert cassette into front slot and turn it on. (Power switch is located on the rear of the machine on the right hand side.) The system will load programs into memory and then respond with the following display:

```
SNPS - OFFSITE DOSE ASSESSMENT
PROGRAM Autost ***LILCO/ENTECH

K1:INFO   = PROVIDE COPY OF GENERAL
            INFORMATION AND COMMENTS
K2:CONTIN = CONTINUE

(SELECT OPTION - PRESS KEY)
-----------------------------------
INFO      CONTIN
```

b. Press K1 for information or push K2 to continue. The machine will repsond with information (if desired) and then display the following:

```
SNPS - OFFSITE DOSE ASSESSMENT
PROGRAM Autost ***LILCO/ENTECH

ENTER CURRENT DATE
MONTH/DAY/YEAR - MM/DD/YY
?
```

c. Enter the current date. Separate month, day and year by a slash or a space. Any incorrect entry by the user will have to be re-entered. The machine will then respond with:

```
ENTER CURRENT TIME (24-HR CLOCK)
HOUR:MIN - HH:MM
?
```

d. Enter the current time. Separate hour and minute by a slash or space. The machine will then echo the current date and time and ask the user to update or continue:

```
CURRENT DATE  10/01/83

CURRENT TIME  14:23

K1:UPDATE = RE-ENTER DATA
K2:CONTIN = CONTINUE

(SELECT OPTION - PRESS KEY)
 ----------------------------------
UPDATE      CONTIN
```

e. If K1 is pushed, go to Step 5.1.1.c and re-enter data. If K2 is pressed, the machine will respond with the following help message:

```
CHAINING TO PROGRAM ACCDOS

RUN PROGRAM 'ISOTOP' NEXT.  UNLESS
YOU WISH TO RESTART WITH DATA FROM A
FILE PREVIOUSLY SAVED.

(PRESS K4:GO TO CONTINUE)
 ----------------------------------
                              GO
```

f. Pushing K4 gives the main menu:

```
SNPS - OFFSITE DOSE ASSESSMENT
PROGRAM ACCDOS **LILCO/ENTECH
    (MOD 01 - 10/14/83)

K1:ISOTOP = SET UP ISOTOPICS
K2:CHIQS  = ATMOSP. DISPERSION
K3:DOSES  = COMPUTE DOSES
K4:SURVEY = OFFSITE TEAM REPORTS
K5:PROACT = PROTECTIVE ACTIONS
K6:UTILIT = DATA FILE HANDLING
K8:STOP   = STOP AND SAVE FILES
 ------------------------------------
 PROACT    UTILIT              STOP
 ISOTOP    CHIQS    DOSES      SURVEY
```

5.1.2 If survey team data is available, implement OPIP 3.5.1, Thyroid Dose Commitment Using TCS Air Sampler in Downwind Survey Procedure.

5.1.3 Return to the main menu (shown in Step 5.1.1.f above). Push K5 to run 'PROACT' program. The machine will display the following:

```
SNPS - OFFSITE DOSE ASSESSMENT
PROGRAM PROACT **LILCO/ENTECH

K1:ENTER DATA = SEASON/WEATHER
                CONDITIONS
K2:COMPUTE    = DOSES @ ACTIONS AT ONE
                LOCATION
K3:SUMMARY    = SUMMARY OF LAST TWELVE
                CASES
K4:ZERO       = ZERO PROJECTED DOSE/
                ACTION DATA
K8:STOP       = RETURN TO ACCDOS
 ------------------------------------
 ENTER                          STOP
 DATA    COMPUTE    SUMMARY     ZERO
```

5.1.4 Press K1 to enter data. The machine will respond with the following help message:

```
                    DATA ENTRY

CAUTION:  ENTERING NEW DATA WILL
INITIALIZE THE DOSE PROJECTION DATA
AND PROTECTIVE ACTION RECOMMENDATIONS.
ABORT AND LIST THIS DATA IF YOU WISH.
USING THE 'SUMMARY' OPTION, OR RETURN
TO 'ACCODS' AND SAVE THE WORKFILE
 ------------------------------------
 ABORT     CONTINUE
```

5.1.5 Press K2 to continue. The machine will prompt for data entry:

```
ENTER RELEASE DURATION (HOURS)
FROM START TO FINISH (A ZERO
ENTRY WILL DEFAULT TO 10 HOURS)
?
```

5.1.6 Enter release duration. The machine will echo the release duration and ask the user to update or continue:

```
SELECTED RELEASE DURATION = 10 HOURS

K1;UPDATE = RE-ENTER VALUE
K2:CONTIN = CONTINUE

(SELECT OPTION - PRESS KEY)
 ------------------------------------
 UPDATE     CONTIN
```

5.1.7 Press K2 to continue. The machine will ask for the following:

```
ENTER DATE OF RELEASE INITIATION
(PAST OR FUTURE)
MONTH/DAY/YEAR - MM/DD/YY
?
```

5.1.8 Enter date of release initiation. Separate month, day and year by a slash or a space. The machine will indicate the current time and ask for the time of release initiation:

```
THE CURRENT TIME IS  15:42

ENTER TIME OF RELEASE INITIATION
(PAST OF FUTURE - 24-HOUR CLOCK)
HOUR:MIN - HH:MM
?
```

5.1.9 Enter time of release initiation. Separate hour and minutes by a slash or a space. The machine will echo the release date and time, and ask the user to update or continue:

```
YOU HAVE ENTERED THE FOLLOWING:

RELEASE DATE:  10/01/83
RELEASE TIME:  14:00

K1:UPDATE = RE-ENTER DATA
K2:CONTIN = CONTINUE

 ------------------------------------
 UPDATE      CONTIN
```

5.1.10 Press K2 to continue. The machine will printout the following:

```
THE DATA PROVIDED INDICATES THAT
THE RADIOACTIVE RELEASE STARTED 1.713
HOURS AGO

K1:UPDATE = TRY AGAIN
K2:CONTIN = CONTINUE

(SELECT OPTION - PRESS KEY)
 ------------------------------------
 UPDATE      CONTIN
```

5.1.11 Press K2 to continue. The machine will display the following menu and printout instructions for guidance:

```
DO YOU NEED A PRINTED COPY OF THE
SEASON AND WEATHER DEFINITIONS?

(SELECT OPTION - PRESS KEY)
 ------------------------------------
 YES       NO
```

5.1.12 Press K1 for a copy of the conditions. The machine will then display the following menu:

```
SEASON AND WEATHER CONDITIONS

K1:SUMMER = SUMMER SEASON
K2:WINTER = WINTER SEASON
K5:NORMAL = NORMAL WEATHER
K6:ADVERS = ADVERSE WEATHER
K7:SEVERE = SEVERE WEATHER

(SELECT APPLICABLE CONDITIONS)
 ------------------------------------
 NORMAL     ADVERS     SEVERE
 SUMMER     WINTER
```

5.1.13 Select 'SUMMER' or 'WINTER' depending on the time of the year (K1 or K2). The machine will display the same menu with the remaining condition to be chosen:

```
SEASON AND WEATHER CONDITIONS

K5:NORMAL = NORMAL WEATHER
K6:ADVERS = ADVERSE WEATHER
K7:SEVERE = SEVERE WEATHER

(SELECT APPLICABLE CONDITIONS)
 ------------------------------------
 NORMAL     ADVRS      SEVERE
```

5.1.14 Select 'NORMAL,' 'ADVERS' or 'SEVERE' depending on weather conditions (K5, K6 or K7). Utilize guidance printed out. The machine will echo the conditions chosen:

```
YOU HAVE SELECTED THE FOLLOWING
SEASON AND WEATHER CONDITIONS:

SEASON:   WINTER
WEATHER:  ADVERSE

K1:UPDATE = REVISE SELECTION
K2:CONTIN = CONTINUE

(SELECT OPTION - PRESS KEY)
 ------------------------------------
 UPDATE      CONTIN
```

5.1.15 Press K2 to continue. The machine will respond with the following menu:

```
SNPS - OFFSITE DOSE ASSESSMENT
PROGRAM PROACT **LILCO/ENTECH

K1:ENTER DATA = SEASON/WEATHER
                CONDITIONS
K2:COMPUTE    = DOSES @ ACTIONS AT ONE
                LOCATION
K3:SUMMARY    = SUMMARY OF LAST TWELVE
                CASES
K4:ZERO       = ZERO PROJECTED DOSE/
                ACTION DATA
K8:STOP       = RETURN TO ACCDOS
 ------------------------------------
 ENTER                            STOP
 DATA    COMPUTE    SUMMARY       ZERO
```

5.1.16 Press K2 to compute protective actions. The machine will respond with the following:

```
DO YOU NEED A PRINTED COPY OF THE
CURRENT AVAILABLE RECEPTOR LOCATIONS
WITH DOSE RATE DATA?

(SELECT OPTION - PRESS KEY)
-----------------------------------
YES       NO
```

5.1.17 Select K1 or K2 as appropriate. The machine will display (or printout) the following:

```
CURRENTLY AVAILABLE DOSE RATES

                    DISTANCE      DOWNWIND
                    (MILES)       DEGREES

33-FT MET             ALL          180.0
150 FT MET            ALL          180.0
SURVEY A              4.0          180.0
SURVEY B              NONE           0.0
SURVEY C              NONE           0.0
SURVEY D              NONE           0.0
SURVEY E              NONE           0.0
SURVEY F              NONE           0.0

-----------------------------------------
PRESS K4:GO TO CONTINUE                GO
```

5.1.18 Press K4 to continue. The machine will now ask for the data source (RMS or HP-85):

```
SELECT SOURCE OF DOSE RATE DATA

K1:85B = HP-85B PREDICTIONS AND SURVEY
         DATA
K2:RMS = RMS (EMSP) PREDICTIONS AND
         SURVEY DATA

(SELECT OPTION - PRESS KEY)
 ------------------------------------
 85B      RMS
```

NOTE

IF IRDAM PROGRAM HAS BEEN USED FOR DOSE ASSESSMENT, USE RMS OPTION.

CAUTION

IF THE HP-85 HAS BEEN USED FOR DOSE PROJECTION, CONTINUE WITH THE FOLLOWING STEPS.

IF THE RMS HAS BEEN USED FOR DOSE PROJECTION, PROCEED TO STEP 5.1.27.

5.1.19 Enter K1. The machine will display the following:

```
ENTER DOWNWIND DIRECTION OF INTEREST
(0 to 360 DEGREES)
?
```

5.1.20 Enter plume direction (e.g., south = 180 degrees). The machine will display:

```
ENTER RECEPTOR DISTANCE (SELECT FROM
THE FOLLOWING SET

0.5     1.0     1.5     2.0
2.5     3.0     3.5     4.0
4.5     5.0     7.5     10

OR ENTER 'ALL' FOR ALL)
?
```

5.1.21 Enter ALL. The machine will display the following:

```
YOU HAVE SELECTED THE FOLLOWING
RECEPTOR DATA

DOWNWIND DIRECTION (DEG.)  180
RECEPTOR DISTANCE (MILES)  ALL

K1:UPDATE = RE-ENTER DATA
K2:CONTIN = CONTINUE
K3:ABORT  = RESELECT OPTION

(SELECT OPTION - PRESS KEY)
-----------------------------------
UPDATE     CONTIN     ABORT
```

5.1.22 Push K2 to continue. The machine will indicate on the CRT that it is computing protective actions. The machine will printout the following:

SNPS - OFFSITE DOSE ASSESSMENT
PROGRAM PROACT **LILCO/ENTECH

BASIC INFORMATION

	DATE	TIME
CURRENT	10/02/83	10:29
RBSVS SOURCE	10/02/83	10:01
ST. VENT SRCE	10/02/83	10:02
MET, X/Q DATA	10/02/83	10:04
DOSE CALC.	10/02/83	10:07
SEASON/WEATH.	10/02/83	10:15
START OF REL	10/02/83	09:00

RELEASE DURATION (HRS) = 10

SEASON: WINTER
WEATHER: ADVERSE

DIST	SRCE	DATE	TIME
.5	85B	10/02/83	10:28
1.0	85B	10/02/83	10:28
1.5	85B	10/02/83	10:28
2.0	85B	10/02/83	10:28
2.5	85B	10/02/83	10:28
3.0	85B	10/02/83	10:28
3.5	85B	10/02/83	10:28
4.0	85B	10/02/83	10:28
4.5	85B	10/02/83	10:28
5.0	85B	10/02/83	10:28
5.0	SURV	10/02/83	10:00
7.5	85B	10/02/83	10:28
10.0	85B	10/02/83	10:28

DIST (MI)	DIRECTION (DEG)	PLUME TRAVL (HRS)	EVAC. TIME (HRS)	EVAC. EXPO. (HRS)
.5	180.0	.10	3.75	5.12
1.0	180.0	.20	3.75	5.02
1.5	180.0	.30	3.75	4.92
2.0	180.0	.40	3.75	4.82
2.5	180.0	.50	4.42	5.39
3.0	180.0	.60	4.42	5.29
3.5	180.0	.70	4.42	5.19
4.0	180.0	.80	4.42	5.09
4.5	180.0	.90	4.42	4.99
5.0	180.0	1.00	4.42	4.89
7.5	180.0	1.50	4.83	4.00
10.0	180.0	2.00	4.83	4.30

DIS (MI)	OPTION	WH.BODY (REM)	CH.THYRD (REM)
.5	85B/SH	7.97E+001	1.92E+002
.5	85B/EV	5.83E+001	1.04E+002
1.0	85B/SH	3.59E+001	7.36E+001
1.0	85B/EV	2.57E+001	3.89E+001
1.5	85B/SH	2.55E+001	5.61E+001
1.5	85B/EV	1.79E+001	2.90E+001
2.0	85B/SH	2.01E+001	4.04E+001
2.0	85B/EV	1.38E+001	2.05E+001
2.5	85B/SH	1.67E+001	3.35E+001
2.5	85B/EV	1.29E+001	1.90E+001
3.0	85B/SH	1.44E+001	2.87E+001
3.0	85B/EV	1.09E+001	1.60E+001
3.5	85B/SH	1.28E+001	2.55E+001
3.5	85B/EV	9.50E+000	1.39E+001
4.0	85B/SH	1.13E+001	2.25E+001
4.0	85B/EV	8.23E+000	1.21E+001

4.5	85B/SH	1.02E+001	2.03E+001
4.5	85B/EV	7.30E+000	1.07E+001
5.0	85B/SH	9.35E+000	1.86E+001
5.0	85B/EV	6.54E+000	9.56E+000
5.0	SRV/SH	7.00E+000	2.18E+001
5.0	SRV/EV	4.89E+000	1.12E+001
7.5	85B/SH	6.62E+000	1.31E+001
7.5	85B/EV	4.54E+000	6.62E+000
10.0	85B/SH	5.18E+000	1.02E+001
10.0	85B/EV	3.18E+000	4.63E+000

PROTECTIVE ACTION RECOMMENDATION
(EVAC ZONES, SHELTER, OR OTHER)

DIST	ZONE	RMS/85B	SURVEY TM
.5	C	EVACUATE ABCDE	NO DATA
1.0	C	EVACUATE ABCDE	NO DATA
1.5	C	EVACUATE ABCDE	NO DATA
2.0	C	EVACUATE ABCDE	NO DATA
2.5	C	EVACUATE ABCDEGHI	NO DATA
3.0	C	EVACUATE ABCDEGHI	NO DATA
3.5	C	EVACUATE ABCDEGHI	NO DATA
4.0	C	EVACUATE ABCDEGHI	NO DATA
4.5	H	EVACUATE ABCDEGHI	NO DATA
5.0	H	EVACUATE ABCDEGHI	EVACUATE ABCDEGHI
7.5	N	EVACUATE A...JLMNO	NO DATA
10.0	M	EVACUATE A...JLMNOR	NO DATA

5.1.23 The printout indicates the following information in order:

a. Time each routine was performed
b. Release duration
c. Season and weather conditions
d. Time, locations and sources for protective action data
e. Plume travel time, evacuation times and exposure times for receptors mentioned above
f. Whole body and child thyroid shelter and evacuation
g. Protective action recommenations

5.1.24 The machine displays the following menu:

```
SNPS - OFFSITE DOSE ASSESSMENT
PROGRAM PROACT **LILCO/ENTECH

K1:ENTER DATA = SEASON/WEATHER
                CONDITIONS
K2:COMPUTE    = DOSES @ ACTIONS AT ONE
                LOCATION
K3:SUMMARY    = SUMMARY OF LAST TWELVE
                CASES
K4:ZERO       = ZERO PROJECTED DOSE/
                ACTION DATA
K8:STOP       = RETURN TO ACCDOS
 ------------------------------------
 ENTER                          STOP
 DATA    COMPUTE    SUMMARY     ZERO
```

5.1.25 If a split plume exists, repeat Steps 5.1.16 through 5.1.23.

5.1.26 Provide the printout to the Radiological Health Coordinator/DOE-RAP Team Captain for interpretation.

5.1.27 The display will show the following:

```
SELECT SOURCE OF DOSE RATE DATA

K1:85B = HP-85 PREDICTIONS AND SURVEY
         DATA
K2:RMS = RMS (EMSP) PREDICTIONS AND
         SURVEY DATA

(SELECT OPTION - PRESS KEY)
 ----------------------------------
 85B        RMS
```

5.1.28 Enter K2. The machine will ask for the following:

```
ENTER DOWNWIND DIRECTION OF INTEREST
(0 to 360 DEGREES)
?
```

5.1.29 Enter downwind direction of plume (e.g., south = 180 degrees). The machine will ask for the following:

```
ENTER RECEPTOR DISTANCE.  SELECT FROM
THE FOLLOWIG SET:

 0.5      1.0      1.5      2.0
 2.5      3.0      3.5      4.0
 4.5      5.0      7.5     10.

(ONE DISTANCE AT A TIME)
?
```

5.1.30 Select a distance for which RMS gives doses. The machine will echo data:

```
YOU HAVE SELECTED THE FOLLOWING
RECEPTOR DATA

DOWNWIND DIRECTION (DEG.)  180
RECEPTOR DISTANCE (MILES)  5

K1:UPDATE = RE-ENTER DATA
K2:CONTIN = CONTINUE
K3:ABORT  = RESELECT OPTION

(SELECT OPTION - PRESS KEY)
 ------------------------------------
 UPDATE     CONTIN     ABORT
```

5.1.31 Enter K2. The machine will ask for the following:

```
ENTER OFFSITE DOSE RATE DATA AS
PREDICTED BY THE RMS SOFTWARE

WHOLEBODY DOSE RATE (MR/HR):
?
```

5.1.32 Enter whole body dose rate. The machine will now ask for the following:

```
THYROID DOSE RATE (MR/HR):
?
```

5.1.33 Enter thyroid dose rate. Machine will echo both dose rates and ask the user to update or continue:

```
YOU ENTERED THE FOLLOWING RMS
DOSE RATE DATA (MR/HR):

WHOLE BODY:  1234
THYROID:     5678

K1:UPDATE   = RE-ENTER DATA
K2:CONTINUE = COMPUTE DOSES

(SELECT OPTION - PRESS KEY)
 ----------------------------------
 UPDATE     CONTINUE
```

5.1.34 Press K2 to continue. The machine will display the following data:

```
SNPS - OFFSITE DOSE ASSESSMENT
PROGRAM PROACT **LILCO/ENTECH

EVALUATION OF FOLLOWING LOCATION

DISTANCE (MILES)                5
DIRECTION (DEGREES)           180
RELEASE INITIATION (+or-)   -2.53
PLUME TRAVEL TIME (HRS)         1
EVACUATION TIME (HRS)        4.42
EVAC. EXPOSURE TIME (HRS)    5.94
EVACUATION ZONE                 H
 ------------------------------------
 PRESS K4:GO TO CONTINUE          GO
```

5.1.35 Press K4. The machine will display the following:

```
DOSES AND ACTION RECOMMENDATIONS

  SHELTER       EVACUAT.      EVAC. ZONE
  DOSE-REM      DOSE-REM      OR SHELTER

RMS CALCULATION
WB 8.64E+000    7.34E+000     ABCDEGHI
TH 5.39E+001    3.38E+001     ABCDEGHI

SURVEY TEAM
WB 7.00E+000    5.95E+000     ABCDEGHI
TH 2.18E+001    1.36E+001     SHELTER
 ------------------------------------
 PRESS K4:GO TO CONTINUE          GO
```

5.1.36 The machine has displayed doses and protective actions for the receptor location. Press K4. The machine will display the following menu:

```
SNPS - OFFSITE DOSE ASSESSMENT
PROGRAM PROACT **LILCO/ENTECH

K1:ENTER DATA = SEASON/WEATHER
                CONDITIONS
K2:COMPUTE    = DOSES @ ACTIONS AT ONE
                LOCATION
K3:SUMMARY    = SUMMARY OF LAST TWELVE
                CASES
K4:ZERO       = ZERO PROJECTED DOSE/
                ACTION DATA
K8:STOP       = RETURN TO ACCDOS
 ------------------------------------
 ENTER                           STOP
 DATA    COMPUTE    SUMMARY      ZERO
```

5.1.37 If more RMS receptor locations are to be entered, select K2 and repeat Steps 5.1.16 through 5.1.36.

5.1.38 When all receptors have been calculated, press K3 (SUMMARY). The machine will printout the following:

```
SNPS - OFFSITE DOSE ASSESSMENT
PROGRAM PROACT **LILCO/ENTECH

 ------------------------------------
          BASIC INFORMATION

                    DATE       TIME

 CURRENT          10/02/83     11:47
 RBSVS SOURCE     10/02/83     10:01
 ST. VENT SRCE    10/02/83     10:02
 MET, X/Q DATA    10/02/83     10:04
 DOSE CALC.       10/02/83     10:07
 SEASON/WEATH.    10/02/83     11:31
 START OF REL     10/02/83     09:00
```

RELEASE DURATION (HRS) = 10

SEASON: WINTER
WEATHER: ADVERSE

DIST	SRCE	DATE	TIME
5.0	RMS	10/02/83	11:32
5.0	SURV	10/02/83	10:00
4.0	RMS	10/02/83	11:45

DIST (MI)	DIRECTION (DEG)	PLUME TRAVL (HRS)	EVAC. TIME (HRS)	EVAC. EXPO. (HRS)
5.0	180.0	1.00	4.42	5.95
4.0	180.0	.00	4.42	6.37

DIST (MI)	OPTION	WH.BODY (REM)	CH.THYRD (REM)
5.0	RMS/SH	8.64E+000	5.39E+001
5.0	RMS/EV	7.34E+000	5.38E+001
5.0	SRV/SH	7.00E+000	2.18E+001
5.0	SRV/EV	5.95E+000	1.36E+001
4.0	RMS/SH	7.00E+000	1.90E+001
4.0	RMS/EV	6.37E+000	1.27E+001

PROTECTIVE ACTION RECOMMENDATION
(ZONES, SHELTER OR OTHER)

DIST	ZONE	RMS/85B	SURVEY TM
5.0	H	EVACUATE ABCDEGHI	EVACUATE ABCDEGHI
4.0	C	EVACUATE ABCDEGHI	NO DATA

5.1.39 The printout indicates the following information (in order):

a. Time each routine was performed
b. Release duration
c. Season and weather conditions
d. Time, location and sources for protective action data
e. Plume travel time, evacuation times and exposure times for receptors mentioned above
f. Whole body and child thyroid shelter and evacuation doses
g. Protective action recommendations

5.1.40 The machine displays the following menu:

```
SNPS - OFFSITE DOSE ASSESSMENT
PROGRAM PROACT **LILCO/ENTECH

K1:ENTER DATA = SEASON/WEATHER
                CONDITIONS
K2:COMPUTE    = DOSES @ ACTIONS AT ONE
                LOCATION
K3:SUMMARY    = SUMMARY OF LAST TWELVE
                CASES
K4:ZERO       = ZERO PROJECTED DOSE/
                ACTION DATA
K8:STOP       = RETURN TO ACCDOS
 ---------------------------------
 ENTER                          STOP
 DATA    COMPUTE    SUMMARY     ZERO
```

5.1.41 If a split plume exists, repeat Steps 5.1.36 through 5.1.40.

5.1.42 Provide the printout to the Radiological Health Coordinator/DOE-RAP Team Captain for interpretation.

5.2 Airborne Release - HP-85 Inoperative, Manual Method with TI-59

5.2.1 Obtain a copy of the Protective Action Recommendation Worksheet (Attachment 1).

5.2.2 Using TI-59 with the printer, perform the following steps for loading programs into the calculator:

a. Turn on calculator. Turn on printer. Ensure that the printer buttons marked TRACE, ADV, PRINT are not depressed. Presss CLR.

b. Press 3 2nd OP 17. Display will read 719.29. Press CLR.

c. Enter cards into the side slot on the calculator. Ensure that CLR has been pressed before entering each card. Display will read 1, 2, 3 or 4 for the corresponding card side entered.

d. Press CLR. Press RST.

5.2.3 Record the parameters used in OPIP 3.5.2, Dose Projection, on the worksheet.

a. Wind speed - Item 2a

b. Wind direction - Item 2b

5.2.4 Obtain the following from the Radiological Emergency Data Form and record on the worksheet:

a. Release duration - Item 1. If a value cannot be determined, utilize a default value of 10 hours.

b. Time of release start - Item 3.

c. Time of calculation - Item 4.

5.2.5 Utilizing results of IRDAM system, perform the following:

a. Record distances (Item 5) for which dose rates have been calculated.

b. Multiply dose rates by release duration (Item 1) and record doses in the appropriate locations on the worksheet:

1. Wholebody doses (Item 13)
2. Thyroid doses (Item 17)

5.2.6 Using Evacuation Zone Map located in the EOC, determine the evacuation zone (A-S) and affected downwind for the appropriate distance (Item 5) and wind direction (Item 2b).

5.2.7 Circle the appropriate weather conditions (Item 4) following for guidance:

CAUTION

SEASON AND WEATHER DEFINITIONS

SELECT OPTIONS USING THE FOLLOWING GUIDANCE:

1. SUMMER/WINTER SEASONS

SUMMER:	MEMORIAL DAY WEEKEND THROUGH LABOR DAY
WINTER:	REST OF THE TIME

2. NORMAL WEATHER CONDITIONS

SUMMER:	DRY ROADS. NO PRECIPITATION
WINTER:	DRY ROADS. NO PRECIPITATION

3. ADVERSE WEATHER CONDITIONS

SUMMER:	FOG; WET PAVEMENT
WINTER:	PASSABLE ROADS PARTIALLY COVERED BY SNOW OR ICE

4. SEVERE WEATHER CONDITIONS

SUMMER:	HURRICANE
WINTER:	BLIZZARD; IMPASSABLE ROADS OR DRIVEWAYS

5.2.8 Determine the evacuation time and record time in Item 10. The evacuation time is found as follows:

a. Using prevailing weather conditions (Items 9a and 9b), turn to the correct table of Attachment 2.

> **CAUTION**
>
> IF SEVERE WEATHER CONDITIONS EXIST, RECORD IN ITEM 10 AN EVACUATION TIME OF 24 HOURS.

b. Utilizing affected downwind sector (Item 8a), find the left-most value that contains the zone (Item 8b) and record the evacuation time on the worksheet.

5.2.9 Using TI-59 with printer, enter data as follows:

a. Enter windspeed (Item 2a), press STO 19.

b. Enter release duration (Item 1), press STO 08.

c. Enter distance to receptor (Item 5), press STO 09.

d. Enter time release has been in progress (Item 7c), time until release is expected to start (Item 7f), press STO 10.

> **CAUTION**
>
> IF ITEM 7f IS CHOSEN, ENTER IT AS A NEGATIVE NUMBER.

e. Enter evacuation time (Item 10), press STO 11.

f. Enter projected wholebody dose (Item 13), press STO 17.

g. Enter projected thyroid dose (Item 17), press STO 18.

5.2.10 Run protective action program by performing the following:

a. Press A. Projected doses are printed out. Prompting for monitoring team data is asked for. At this point, the calculator display will read 3637320211.

b. If monitoring team data is available, enter monitoring team dose rates (Items 14 and 18) on the worksheet.

c. Multiply dose rates by release duration and enter into appropriate space on worksheet (Items 15 and 18a).

d. The machine has prompted for monitoring team data (rem). Enter monitoring team data in the appropriate registers.

CAUTION
ENTRY OF MONITORING TEAM DATA INDICATES THAT IT IS MORE RELIABLE THAN THE PROJECTED DOSE. IF THIS IS NOT THE CASE, DO NOT ENTER MONITORING TEAM DATA.

e. Press B. All calculations are performed and resulting protective action is displayed.

f. Printer will output:

	Worksheet #
Most reliable wholdbody dose	16
Most reliable thyroid dose	19
Wholebody evacuation dose	20
Thyroid evacuation dose	21
Wholebody shelter dose	22
Thyroid shelter dose	23
Protective Action Recommendation	26

g. To display:

Wholebody indicated action - press RCL 27	24
Thyroid indicated action - press RCL 26	26

5.2.11 Record these items on the worksheet.

5.2.12 To re-run program, perform the following:

a. Press RST
b. Repeat Step 5.2.9 entering data which has changed
c. Perform Steps 5.2.10 and 5.2.11

5.2.13 If a split plume exists, repeat Steps 5.2.1 through 5.2.12 for the other plume direction.

5.2.14 Provide the worksheet to the RAP Team Captain and Radiological Health Coordinator for interpretation.

5.3 Protective Actions - Special Facilities

5.3.1 Schools

a. For an Alert or higher emergency classification school protective actions are recommended based upon the following table.

Protective Action for General Public		Protective Action for Schools in EPZ	Protective Action for Schools Outside EPZ With Students Who Live in EPZ
No protective actions recommended anywhere in EPZ	-	Early dismissal of students to their homes,	Early dismissal of all students to their homes.
Sheltering, but no evacuation recommended anywhere in EPZ	-	Shelter all schools with students living in the EPZ. Bring buses to schools.	Retain students, who live in the EPZ, at school when school day ends.
Evacuation recommended anywhere in EPZ	-	Relocate students to pre-designated centers outside EPZ.	Retain students, who live in the EPZ, at school when school day ends.

5.3.2 Hospitals and Nursing/Adult Homes

a. Obtain the list of hospitals and nursing homes from OPIP 3.6.5, Attachment 2. Determine which facilities are located in these zones along with their distance and downwind direction from SNPS.

b. Calculate location specific whole body and thyroid projections for these facilities. If appropriate send field monitoring teams to the facilities in the downwind direction.

c. Using the following shielding factor table calculate shelter dose to patients or residents, and staff

	Hospital	Nursing Home
Whole Body	0.2	0.4
Thyroid	0.5 for first 2 hrs.**	0.25 for first 1 hr.*
	1.0 greater than 2 hrs.	0.5 greater than 1 hr.

* Assumes only adult population, which has thyroid dose conversion factor equal to 1/2 of child. Child dose is used for general population and hospitals.

** Air filtration factor assumes ventilation control and shelter is taken in interior areas.

d. Discuss results of calculation with Radiation Health Coordinator, Director of LERO and Manager of LERO. Inform Special Facilities Evacuation Coordinator of protective action recommendation for these facilities.

e. The Special Facilities Evacuation Coordinator will contact each facility in affected zones and inform them of the protective action recommendations.

NOTE

WHEN DISCUSSING PROTECTIVE ACTIONS WITH THE HOSPITALS, REQUEST THAT A STAFF PHYSICIAN EXPERIENCED IN RADIOLOGY OR NUCLEAR MEDICINE BE CONSULTED BY HOSPITAL ADMINISTRATORS.

f. If facilities decide to evacuate, proceed in accordance with OPIP 3.6.5.

5.4 Waterborne Release

5.4.1 Complete the Waterborne Release Protective Action Recommendation Worksheet (Attachment 3) as follows:

a. Recorded projected doses (OPIP 3.5.2) on the worksheet.

b. Compare doses with the Waterborne Guidance Chart (Attachment 1, Part II).

5.4.2 Check worksheet for completeness and submit them to the Radiological Health Coordinator/DOE-RAP Team Captain for review.

6.0 REFERENCES

6.1 EPA - 520/1 - 75 - 001
6.2 EPA - 520/1 - 78 - 001B
6.3 Offsite Survey Map (OPIP 3.5.1, Attachment 11)

7.0 ATTACHMENTS

1. Protective Action Recommendation Worksheet

2. Evacuation Times by Wind Direction

3. Thyroid and Whole Body Guidance Charts

4. EPA PAG Guide

PROTECTIVE ACTION RECOMMENDATION WORKSHEET

PART I - AIRBORNE RELEASE

1. Release duration _____ hours

2. a. Wind speed _____ mph

   b. Wind direction _____ degrees

CAUTION

FOR GROUND RELEASE, USE 33 FOOT WIND SPEED AND DIRECTION READINGS. FOR ELEVATED RELEASE, USE 150 FOOT READINGS.

3. Time of release start (use 24-hour clock) _____ hours

4. Time of calculation (use 24-hour clock) _____ hours

5. Distance to receptor _____ _____ _____ _____ miles

6. Plume travel time

   item 5/item 2a _____ _____ _____ _____ hours

7. Time until exposure begins (choose a or d)

   a. If release has begun

   b. Difference (item 4 - item 3) = _____ hours

   c. Time (item 6 - item 7b) _____ _____ _____ _____ hours

PROTECTIVE ACTION RECOMMENDATION WORKSHEET
(continued)

Distance (from item 5) _____ _____ _____ _____ miles

d. If release will begin later

e. Difference
(item 3 - item 4) = _____ hours

f. Time
(item 6 + item 7e) _____ _____ _____ _____ hours

8. a. Affected Downwind Sector _____

b. Evacuation Zone
(A-S from Offsite Survey Map) _____ _____ _____ _____

9. Weather condition
(circle one for a, b, and c)

a. Normal Adverse Severe

b. Summer Winter

10. Evacuation time

(Use information recorded in items 8 and 9 along with Attachment 2 to determine evacuation time. See procedure Step 5.2.8.b _____ _____ _____ _____ hours

11. Exposure time

Item 10 - (item 7c or 7f) _____ _____ _____ _____ hours

PROTECTIVE ACTION RECOMMENDATION WORKSHEET
(continued)

CAUTION

IF ITEM 11 IS A NEGATIVE NUMBER, ENTER ZERO HOURS.

12.	Evacuation Exposure Period Smaller of item 1 or item 11	_____	_____	_____	_____	hours
13.	Projected whole body dose (IRDAM dose rate x item 1)	_____	_____	_____	_____	rem
14.	Monitoring team whole body dose rate	_____	_____	_____	_____	rem/hr
15.	Monitoring team whole body dose (item 14 x item 1)	_____	_____	_____	_____	rem
16.	Most reliable whole body dose (item 13 or item 15)	_____	_____	_____	_____	rem
17.	Projected thyroid dose (IRDAM dose rate x item 1)	_____	_____	_____	_____	rem
18.	Monitoring team thyroid dose rate	_____	_____	_____	_____	rem/hr
18a.	Monitoring team thyroid dose (item 18 x item 1)	_____	_____	_____	_____	rem
19.	Most reliabile thyroid dose (item 17 or item 18a)	_____	_____	_____	_____	rem

PROTECTIVE ACTION RECOMMENDATION WORKSHEET
(continued)

Distance (from item 5)	_____	_____	_____	_____	miles
20. Whole body evacuation dose (item 12 x item 16/item 1)	_____	_____	_____	_____	rem
21. Thyroid evacuation dose (item 12 x item 19/item 1)	_____	_____	_____	_____	rem
22. Whole body shelter dose (item 16 x 0.7*) * Average shelter protection factor	_____	_____	_____	_____	rem
23. Thyroid shelter dose (pick a or b)					
a. For release duration less than 1 hour (item 19 x 0.5)	_____	_____	_____	_____	rem
b. For release duration equal to or greater than 1 hour item 19 x $\left[1 - \frac{0.5}{\text{item 1}}\right]$	_____	_____	_____	_____	rem
24. Whole body indicating action - refer to whole body guidance chart (Attachment 3)* (Indicate no action, shelter, or evacuation)	_____	_____	_____	_____	
25. Thyroid indicated action - refer to thyroid guidance chart (Attachment 3)* (Indicate no action, shelter, or evacuation)	_____	_____	_____	_____	

PROTECTIVE ACTION RECOMMENDATION WORKSHEET
(continued)

Distance (from item 5) _____ _____ _____ _____ miles

26. Protective Action Recommendation (Most severe of item 24 or item 25) _____ _____ _____ _____

CAUTION
USE ATTACHMENT 4 IF ADDITIONAL TIME IS AVAILABLE FOR CONSIDERATION.

Approved by ED/RM _____

Time _____ Date _____

PART II - WATERBORNE RELEASE

27. Projected whole body dose (swimming) (OPIP 3.5.1) _____ rem

28. Projected skin dose (swimming) (OPIP 3.5.1) _____ rem

29. Projected whole body dose (boating) _____ rem

30. Protective Action Recommendation (use waterborne guidance chart below)

PROTECTIVE ACTION RECOMMENDATION WORKSHEET
(continued)

WATERBORNE GUIDANCE CHART

IF	THEN
Projected whole body or skin dose due to swimming (item 27 or 28) is equal to or greater than 1 rem	Instruct the U.S. Coast Guard to instruct all swimmers to reenter boats within a 1-mile distance of the plant. Sound sirens with EBS message for swimmers to leave water in beach areas.
Projected whole body dose due to boating (item 29) is equal to or greater than 1 rem	Instruct the U.S . Coast Guard to evacuate all boats and vessels within a 1-mile distance of the plant

Waterborne Protective Action Recommendation

_____

_____

_____

Approved by Radiation Health Coordinator _____

Time _____ Date _____

EVACUATION TIMES BY WIND DIRECTION

SUMMER (NORMAL CONDITIONS)

WIND DIRECTION (toward)	ZONES	TIME	ZONES	TIME	ZONES	TIMES
E	ABCDE	3.25	ABCDEJ	3.25	ABCDEFGH IJOPS	4.00
ESE	ABCDE	3.25	ABCDEIJ	3.83	ABCDEFGH IJOPS	4.00
SE	ABCDE	3.25	ABCDEHIJ	3.83	ABCDEFGH IJNOS	4.00
SSE	ABCDE	3.25	ABCDEHI	3.67	ABCDEFGH IJMNO	4.00
S	ABCDE	3.25	ABCDEGHI	3.67	ABCDEFGH IJLMNOR	4.00
SSW	ABCDE	3.25	ABCDEGH	3.67	ABCDEFGH IJKLMNR	4.58
SW	ABCDE	3.25	ABCDEFG	3.92	ABCDEFGH IJKLMR	4.58
WSW	ABCDE	3.25	ABCDEFG	3.92	ABCDEFGH IJKLQR	4.58
W	ABCDE	3.25	ABCDEFG	3.92	ABCDEFGH IJKQ	4.58

EVACUATION TIMES BY WIND DIRECTION
(continued)

SUMMER (ADVERSE CONDITIONS)

WIND DIRECTION (toward)	ZOMES	TIME	ZONES	TIME	ZONES	TIMES
E	ABCDE	3.92	ABCDEJ	3.92	ABCDEFGH IJOPS	5.08
ESE	ABCDE	3.92	ABCDEIJ	4.33	ABCDEFGH IJOPS	5.08
SE	ABCDE	3.92	ABCDEHIJ	4.33	ABCDEFGH IJNOS	5.08
SSE	ABCDE	3.92	ABCDEHI	4.17	ABCDEFGH IJMNO	5.08
S	ABCDE	3.92	ABCDEGHI	4.17	ABCDEFGH IJLMNOR	5.08
SSW	ABCDE	3.92	ABCDEGH	4.17	ABCDEFGH IJKLMNR	6.00
SW	ABCDE	3.92	ABCDEFG	5.00	ABCDEFGH IJKLMR	6.00
WSW	ABCDE	3.92	ABCDEFG	5.00	ABCDEFGH IJKLQR	6.00
W	ABCDE	3.92	ABCDEFG	5.00	ABCDEFGH IJKQ	6.00

EVACUATION TIMES BY WIND DIRECTION
(continued)

WINTER (NORMAL CONDITIONS)

WIND DIRECTION (toward)	ZONES	TIME	ZONES	TIME	ZONES	TIMES
E	ABCDE	3.08	ABCDEJ	3.08	ABCDEFGH IJOPS	3.58
ESE	ABCDE	3.08	ABCDEIJ	3.42	ABCDEFGH IJOPS	3.58
SE	ABCDE	3.08	ABCDEHIJ	3.42	ABCDEFGH IJNOS	3.58
SSE	ABCDE	3.08	ABCDEHJ	3.42	ABCDEFGH IJMNO	3.58
S	ABCDE	3.08	ABCDEGHI	3.42	ABCDEFGH IJLMNOR	3.58
SSW	ABCDE	3.08	ABCDEGH	3.42	ABCDEFGH IJKLMNR	4.17
SW	ABCDE	3.08	ABCDEFG	3.58	ABCDEFGH IJKLMR	4.17
WSW	ABCDE	3.08	ABCDEFG	3.58	ABCDEFGH IJKLQR	4.17
W	ABCDE	3.08	ABCDEFG	3.58	ABCDEFGH IJKQ	4.17

EVACUATION TIMES BY WIND DIRECTION
(continued)

WINTER (ADVERSE CONDITIONS)

WIND DIRECTION (toward)	ZONES	TIME	ZONES	TIME	ZONES	TIMES
E	ABCDE	3.75	ABCDEJ	3.75	ABCDEFGH IJOPS	4.83
ESE	ABCDE	3.75	ABCDEIJ	3.83	ABCDEFGH IJOPS	4.83
SE	ABCDE	3.75	ABCDEHIJ	3.83	ABCDEFGH IJNOS	4.83
SSE	ABCDE	3.75	ABCDEHI	4.42	ABCDEFGH IJMNO	4.83
S	ABCDE	3.75	ABCDEGHI	4.42	ABCDEFGH IJLMNOR	4.83
SSW	ABCDE	3.75	ABCDEGH	4.42	ABCDEFGH IJKLMNR	5.67
SW	ABCDE	3.75	ABCDEFG	4.75	ABCDEFGH IJKLMR	5.67
WSW	ABCDE	3.75	ABCDEFG	4.75	ABCDEFGH IJKLQR	5.67
W	ABCDE	3.75	ABCDEFG	4.75	ABCDEFGH IJKQ	5.67

THYROID GUIDANCE CHART

IF	THEN
Projected dose (Item 19) is less than 5 rem	No action
Shelter dose (Item 23) is less than 25 rem	Shelter*
Shelter dose (Item 23) is equal to or greater than 25 rem and evacuation dose (Item 21) is equal to or greater than shelter dose	Shelter*
Shelter dose (Item 23) is equal to or greater than 25 rem and evacuation dose (Item 21) is less than shelter dose	Evacuate

* Shelter is to be with ventilation control. Ventilation control means turning off air conditioners or fans, closing doors and windows thus preventing access of outside air. Proceed to a basement if available.

WHOLE BODY GUIDANCE CHART

IF	THEN
Projected dose (Item 16) is less than 1 rem	No action
Shelter dose (Item 22) is less than 5 rem	Shelter*
Shelter dose (Item 22) is equal to or greater than 5 rem and evacuation dose (Item 20) is equal to or greater than shelter dose	Shelter*
Shelter dose (Item 22) is equal to or greater than 5 rem and evacuation dose (Item 20) is less than shelter dose	Evacuate

* Shelter is to be with ventilation control. Ventilation control means turning off air conditioners or fans, closing doors and windows thus preventing access of outside air. Proceed to a basement if available.

EPA PAG GUIDE

Projected Dose (Rem) to the Population	Recommended Actions[a]	Comments
Whole body <1 Thyroid <5	No planned protective actions.[b] LERG may 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 exist, special consideration 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.
Projected Dose (Rem) to Emergency Team Workers		
Whole body 25 Thyroid 125	Control exposure of emergency team members to these levels except for lifesaving missions. (Appropriate controls for emergency workers, include time limitations, respirators, and stable iodine.)	Although respirators and stable iodine should be used where effective to control dose to emergency team workers, thyroid dose may not be a limiting factor for lifesaving missions.
Whole body 75	Control exposure of emergency team members performing lifesaving missions to this level. (Control of time of exposure will be most effective.)	

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

Attachment 6

EBS SAMPLE MESSAGES
(continued)

MESSAGE F - GENERAL EMERGENCY (SHELTERING)
(continued)

3. Sheltering is recommended for people in some planning zones. Sheltering is to remain indoors with all windows and doors closed. Air conditioners/heaters should be turned off, fires should be extinguished, and fireplace dampers closed. The people who should shelter are in planning zones (identify by zone letters and area description). People in the affected zones who are not at home should seek shelter inside buildings.

The 10-mile emergency planning zone circling Shoreham is roughly bounded by Main Street in downtown Riverhead to the east, Main Street in Port Jefferson to the west, and Sunrise Highway to the south. If you live within the 10-mile emergency planning zone, you would have received monthly newsletters and other emergency information.

If you are located within the 10-mile planning zone and do not have a Shoreham Public Emergency Procedures Brochure, public information and a map of the zone are included in a special insert of the Suffolk County Telephone Book and a more detailed map is in the local Yellow Book.

Posters with emergency information have been provided to motels, restaurants, gas stations, public parks, beaches, and recreational facilities.

If you are not within planning zones (identify), there is no reason for you to shelter. If you are outside the 10-mile emergency planning zone, there is no reason to take any action. If conditions change in the future, these recommendations may change and we will inform you immediately.

Once again, the Shoreham Nuclear Power Station is in a General Emergency. There has been a release of radiation into the air. It is advised that people in planning zones (identify) shelter, that is, remain indoors with outside ventilation sources closed off. People in the affected zones who are not at home are again advised to shelter inside buildings.

This message will be repeated every fifteen minutes over this station unless new information is available sooner. Keep tuned to this emergency broadcast station for the latest official information.

Attachment 7

SUPPLEMENTARY NOTIFICATIONS CALL CHECKLIST #4
(continued)

RESPONSIBLE EMERGENCY CALLER	AGENCY/MESSAGE	TELEPHONE NUMBER	NAME OF PERSON ACCEPTING CALL	TIME/INITIALS	VERIFICATION TIME/INITIALS
	NOTE: NOTIFY FOR ALERT OR HIGHER CLASSIFICATIONS.				
Support Services Coordinator	NEW YORK TELEPHONE COMPANY Message: Request that the telephone representative assigned to the Local Emergency Response Organization be notified to report to the Local EOC in Brentwood.	_____	_____	___/___	___/___
	NOTE: NOTIFY FOR ALERT OR HIGHER CLASSIFICATIONS.				
Evacuation Coordinator	UNITED STATE COAST GUARD Message: Give a summary of the situation and request clearance of boats from Island Sound within _____ miles (as directed by the Director of Local Response). Backup Method: Customer Service to SNPS Control Room to U.S. Coast Guard via the Federal Telephone System.	_____	_____	___/___	___/___

NOTE: Names and telephone numbers confidential and withheld from general publication.

Attachment 8

Selective Evacuation

Selective Evacuation may be implemented to evacuate from the affected area of the plume exposure EPZ members of the general public who might have a low tolerance to radiation exposure. Specifically, this would include pregnant women and children 12 years and under.

This protective action strategy has been adopted from the New York State Radiological Emergency Preparedness Plan (III-53,54). It may be implemented for projected dose levels of 1 to 5 rems whole body or 5 to 25 rems to the thyroid, but not without consultation with the N. Y. State Commissioner of Health.

Evacuation

Circumstances could develop which indicate the need for certain sectors of the general population to initiate an evacuation. The Director of Local Response, based upon recommendations as designated in Section 3.6-B, may call for the evacuation of sectors within the plume exposure EPZ of SNPS. The public will be notified of the need for an evacuation by the same methods as described in Section 3.3. Details of evacuation routes and traffic control points are specified in Appendix A.

Should a general evacuation be ordered, some or all of the zones within the plume exposure EPZ may be affected. The general public owning cars will be instructed via EBS radio to use the designated evacuation routes. As the evacuation proceeds, evacuation route spotters will report the progress to the local EOC. Overall direction of traffic control aspects of the evacuation will be through the Traffic Control Coordinator, refer to Traffic Control Procedure 3.6.3. At the direction of the Traffic Control Coordinator traffic control posts will be established and potential impediments to evacuation will be removed through the use of tow trucks or other heavy equipment.

Those persons without a means to evacuate will be transported by buses that will follow the pre-established routes identified in the public information brochure. The Transportation Support

Attachment 9

		Functions					
		Protective Action Decisions	Selective Sheltering	Sheltering	Selective Evacuation	Evacuation	Food, Milk, Water & Livestock Feed Contro
LERO	Director Local Response	P	P	P	P	P	P
	Manager of Local Response	S	S	S	S	S	S
	Health Services Coordinator	S	S	S	S	S	S
	Radiation Health Coordinator	S	S	S	S	S	S
	Evacuation Coordinator				S	S	
	Traffic Control Coordinator				S	S	
	Special Facilities Evacuation Coordinator				S	S	
	Transportation Support Coordinator				S	S	
	Support Services Coordinator				S	S	
	Relocation Center Coordinator				S	S	
	Logistics Support Coordinator				S	S	
	Security Coordinator				S	S	
	Emer. Medical Public Service Coord.				S	S	
	Sanitary Support Coordinator				S	S	

P = PRIMARY RESPONSIBILITY

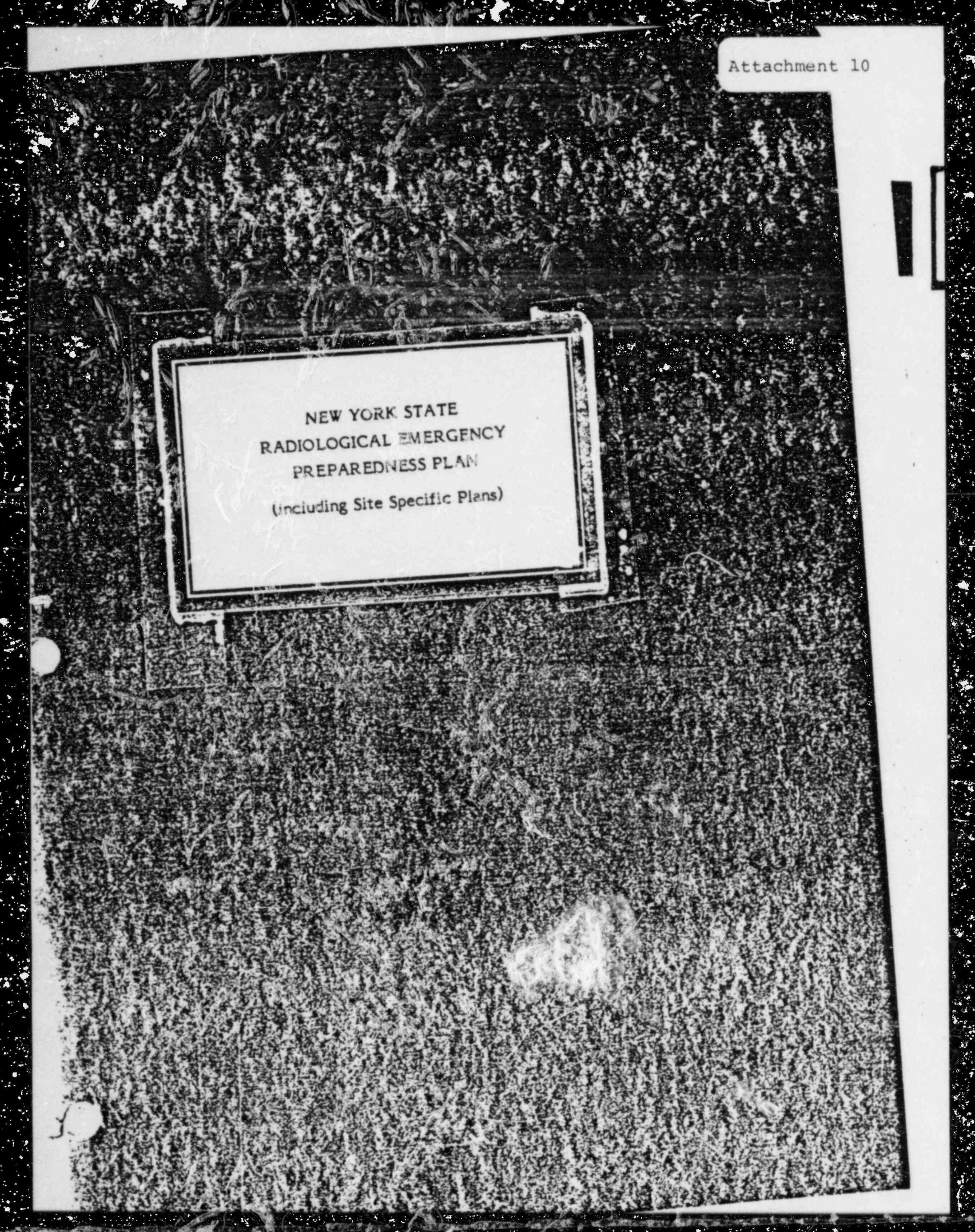
S = SUPPORTING RESPONSIBILITY

Figure 3.6.1

Protective Actions Function

Attachment 10

Attachment 10



NEW YORK STATE
RADIOLOGICAL EMERGENCY PREPAREDNESS PLAN

Prepared for
the Disaster Preparedness Commission
of the
State of New York
Mario Cuomo, Governor

By the Radiological Emergency Preparedness Group

Non-institutionalized mobility impaired persons can request transportation by calling telephone number(s) that will be announced over the emergency broadcast media. In addition, these impaired persons may be identified in advance by the submission of a mail-in postcard furnished as part of the emergency public information pamphlet, distributed annually to the plume exposure EPZ population.

Implementation of Selective Evacuation is initiated by the public notification system, with explicit directions over the broadcast media. Implementation can be effected for various Emergency Response Planning Areas (ERPA's) or for the entire EPZ. Instructions include the specific assignment of evacuatin routes and reception centers in the host area. Persons without personal transportation will be provided public transportation. Congregate care shelter, with appropriate medical facilities and personnel, will be provided in the host areas.

(5) General Evacuation

For actual or projected off-site doses in excess of 5 rem to the whole body or 25 rem to the thyroid, the protective action response option General Evacuation may be implemented for the affected areas of the plume exposure EPZ.

General Evacuation will be implemented by the local chief executive, following consultation with or upon the recommendation of the State Commissioner of Health, and with the coordination support of ODP. Each County within the plume exposure EPZ has a detailed evacuation plan and maps showing evacuation routes. Evacuation areas loction and relocation centers and Congregate Care Centers are also shown in County Plans. All maps and charts are included in Site Specific Sections of this Plan.

Non-institutionalized mobility impaired persons can request transportation by calling telephone number(s) that will be announced over the broadcast media. In addition, these impaired persons may be identified in advance by the submission of a mail-in postcard furnished as part of the emergency public information pamphlet, distributed annually to the plume exposure EPZ population.

This pamphlet also provides instructions on General Evacuaton for each household, school, special care facility, group quarters and place of business.

Implementation of General Evacuation is initiated by the county public notification system, with explicit direction over the broadcast media, EBS. Implementation can be effected for various ERPAs or for the entire EPZ.

Instructions to the public include the assignment of specific evacuation routes and reception centers. Public transportation will be provided to persons without transportation. Special traffic control procedures and mechanisms will be implemented to insure an efficient vehicle flow. Congregate Care Centers will be provided in host areas, including provisions for feeding, lodging, and medical care. Special care facilities, including hospitals and nursing homes, have specific evacuation procedures, including the acquiring of special transport vehicles. Each NFO has evacuation plans for onsite personnel. NFOs will coordinate evacuation procedures with local authorities to insure suitable off site locations. Normally on site personnel will use the evacuation routes that are used by public in the ERPA where Nuclear Power Plant is located. Evacuation routes are shown in County Plans and Site Specific Sections.

Evacuation from one county into another county or state will be coordinated by the New York State Office of Disaster Preparedness.

County evacuation plans are included in County REPPs. Summary tables including evacuation routes, reception centers, host areas, and evacuation times are included in Site Specific Section Part II, Section I.

(6) Thyroid Blocking Agents

Potassium Iodide (KI) in water soluble table form (130 mg) is recommended as an appropriate thyroid blocking agent for use by emergency workers, and staff and patients or inmates of facilities where evacuation is not possible or feasible.

Distribution to the general population is not recommended.

When emergency workers and the other persons listed above are likely to receive a projected dose of 25 REM to the thyroid, KI should be considered as a protective measure prior to receiving such a dose.

The State Commissioner of Health is the primary health officer responsible for recommending the use of KI. When time permits, the Commissioner will consult with appropriate local health officials. If the Commissioner is not available and time is of the essence, the affected local health officials shall be responsible for such recommendations.

6. EMERGENCY PERSONNEL -- RADIOLOGICAL EXPOSURE CONTROL

The Radiological Exposure Control procedure (Part III, Section I-G) has been developed to provide the State Commissioner of Health with the capability of controlling and minimizing the

Attachment 11

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION
Before the Atomic Safety and Licensing Board

In the Matter of:

LONG ISLAND LIGHTING COMPANY (Shoreham Nuclear Power Station, Unit 1)

Docket No. 50-332-OL-3 (Emergency Planning)

Hauppauge, New York
February 9, 1984

DEPOSITION OF EDWARD P. BENNETT, called for examination by counsel for LILCO in the above-entitled action, pursuant to notice, the witness having been duly sworn by NICHOLAS J. TORRE, a Notary Public in and for the State of New York, at the offices of the Suffolk County Executive, H. Lee Dennison Building, Veterans Highway, Hauppauge, New York, at 11:10 a.m., the proceedings being taken down by Stenotype by NICHOLAS J. TORRE, and transcribed under his direction.

TANKOOS REPORTING COMPANY, INC.
223 Jericho Turnpike
Mineola, New York 11501
(212)343-0171 (516)741-5235
(212)895-3109

APPEARANCES:

On behalf of Suffolk County and the Witness:

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Washington, D.C. 20036

On behalf of Long Island Lighting Company:

JAMES CHRISTMAN
GEORGE MARTIN
Hunton & Williams
707 East Main Street
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Richmond, Virginia 23212

ALSO PRESENT:

FABIAN PALOMINO - New York State
STUART GLASS, F.E.M.A.

If we have a large amount of heat, accompanying any release, the release, that release would be relatively buoyant and would go to much higher layer in the atmosphere, yet may still be well mixed within a layer and be characterized as ground level.

Q I think we can go to the next contention and probably finish up fairly quickly.

To ask you another question on this subject, do you agree with the statement, "Given wind conditions on Long Island, in the event any evacuation due to a radiological emergency is required, LILCO must evacuate at least a radius of five-to-seven miles around the plant"?

Do you agree with that statement or not?

A No, I do not.

Q Would you explain why you don't agree, sir?

A The reason is that there are, in fact, situations where wind direction can be reasonably predicted.

That is so as to preclude such evacuation of all zones.

Whether you have a gradient, a wind resulting from a given pressure gradient, where there is a relatively strong pressure gradient compared to what we discussed previously, of a weak pressure gradient, wind direction is persistent and can be forecast with good professional judgment.

Q Could you, if you had to or were asked to, sir, set up a plan such that one would know under what conditions one had to evacuate at least a radius of five-to-seven miles around a plant?

A I suppose given money, time and resources, I certainly could.

That is not to say that this is --

Q It would be complicated?

A It certainly would require the expenditure of resources, not only in designing such a plan but in carrying out the plan.

Q Moving over to snow removal, sir, which I believe in your view, you have looked mostly at Contention 97.B, and to the extent that the same subject is addressed in 66.D, I guess that would be incorporated into your studies or your analysis, analyses, if that be

C E R T I F I C A T E

I, NICHOLAS J. TORRE, a stenotype reporter and notary public, within and for the State of New York, do hereby certify:

That EDWARD P. BENNETT, the witness whose examination is hereinbefore set forth, was first duly sworn by me, and that transcript of said testimony is a true record of the testimony given by said witness.

I further certify that I am not related to any of the parties to this action by blood or marriage, and that I am in no way interested in the outcome of this matter.

IN WITNESS WHEREOF, I have hereunto set my hand this 6 day of, February, 1984.

Nicholas J. Torre

NICHOLAS J. TORRE

Attachment 12

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION
Before the Atomic Safety and Licensing Board

In the Matter of:

LONG ISLAND LIGHTING COMPANY (Shoreham Nuclear Power Station, Unit 1)

Docket No. 50-332-0L-3 (Emergency Planning)

Hauppauge, New York
February 9, 1984

DEPOSITION OF RICHARD TAYLOR, called for examination by counsel for LILCO in the above-entitled action, pursuant to notice, the witness having been duly sworn by NICHOLAS J. TORRE, a Notary Public in and for the State of New York, at the offices of the Suffolk County Executive, H. Lee Dennison Building, Veterans Highway, Hauppauge, New York, at 2:00 p.m. the proceedings being taken down by Steno'type by NICHOLAS J. TORRE, and transcribed under his direction.

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(212)895-3109

COMPUTER AIDED TRANSCRIPTION

APPEARANCES:

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Washington, D.C. 20036

On behalf of Long Island Lighting Company:

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P.O. Box 1535
Richmond, Virginia 23212

ALSO PRESENT:

FABIAN PALOMINO - New York State
STUART GLASS, F.E.M.A.

arrows.

Is that what you are talking about?

A Yes, that is what I am referring to.

Q And does that appear to be eight kilometers there, rather than eight miles?

A There is no scale on here.

Is there one some place else on here?

Q Look at all of the pages.

A I don't see a scale. The original document this came from had a scale. I believe that was in kilometers. There are numbers along here, but no units assigned to it.

Q Good enough. Can you identify, for the record, what document it was that that came out of?

A Yes, your special fuel limitation extension request for -- not sure of the plant.

That was information used, which had information on Shoreham on it.

Q That LILCO did. I am a different organization, actually.

Let me ask you if you agree with this statement: Contention 64, from that, "Given wind

conditions on Long Island, in the event any evacuation due to a radiological emergency was required, LILCO must evacuate at least a radius of five-to-seven miles around the plant."

Do you agree with that?

A No, because it is based on the current meteorological conditions at the time of an accident.

Must be based on that. It can't be a flat answer that they should evacuate five miles all of the time.

It must be based on current meteorological data at the time of the accident or incident.

Q How should that meteorological at the time be applied to determine the right thing to do about evacuation?

A Well, during the accident, an accident scenario, current meteorology is provided. It is up to the decision of the decision makers to determine that they are in a situation were the winds will be light and variable.

There is a possibility of a wind shift or

wind shifts, say, and it must be shown that the projected radiation doses are such that they would require evacuating a whole five-mile area.

Q So that, if you had to make a decision, you would want to look at the dose projections, under the conditions at the time?

A I would not make the decision.

Q This is hypothetical. If you had to, if you would --

MR. PALOMINO: Whoever would.

Q -- you would think that whoever makes the decision should look at the current dose projections given the meteorological conditions at the time?

A Given all of the inputs that go into the making of this assessment.

Q Do you feel that this variability of the wind at this site, Shoreham, makes emergency planning impossible?

A No.

Q If you were to recommend to the people doing the emergency planning for Shoreham how they should take into account this information that you have

C E R T I F I C A T E

I, NICHOLAS J. TORRE, a stenotype reporter and notary public, within and for the State of New York, do hereby certify:

That RICHARD TAYLOR, the witness whose examination is hereinbefore set forth, was first duly sworn by me, and that transcript of said testimony is a true record of the testimony given by said witness.

I further certify that I am not related to any of the parties to this action by blood or marriage, and that I am in no way interested in the outcome of this matter.

IN WITNESS WHEREOF, I have hereunto set my hand this 9 day of, February, 1984.

Nicholas J. Torre

NICHOLAS J. TORRE

Attachment 13

EPC _____

Approved: _____

Effective Date _____

OPIP 3.5.1 DOWNWIND SURVEYING

1.0 PURPOSE

To describe the procedure to be followed for the conduct of Offsite Radiological Surveys. DOE-RAP Team personnel may use their own procedures.

2.0 RESPONSIBILITY

The Offsite Radiological Survey (ORS) Team is responsible for implementation of this procedure or its technical equivalent.

3.0 PRECAUTIONS

Maintain frequent communications contact at regular intervals.

4.0 PREREQUISITES

4.1 An Alert or higher emergency classification has been declared at SNPS, the Local EOC is activated, and the communication links between DOE-RAP at the Brookhaven Area Office (BHO) and the Offsite Radiological Survey (ORS) Teams are established.

4.2 The ORS Teams have been mobilized in accordance with OPIP 3.3.3, Standby and Mobilization.

5.0 ACTIONS

5.1 Team Briefing

5.1.1 ORS Team members report to the staging area at BHO or the Local EOC for a briefing by the Environmental Survey Function (ESF) or the RAP Team Captain.

a. If direct deployment is required from the staging area at BHO, then the ESF will brief ORS Teams via telephone or radio communications from the Local EOC.

b. If the ORS Teams are not directly deployed from BHO, then the ORS Teams will pick up their Offsite Radiological Survey Kits and report to the Local EOC for their briefing unless otherwise instructed by the ESF or the RAP Team Captain.

5.1.2 Ensure that the ESF or the RAP Team Captain will include the following items (as a minimum) in the briefing for the ORS Teams:

a. Team identification
b. Communications equipment and channel
c. Protective equipment (including use of KI)
d. Authorized exposure limits
e. Survey locations
f. Survey equipment
g. Type of data (air sample, soil sample, water, vegetation, feed, dairy products, and foodstuffs)

5.1.3 The ORS Team members will complete Offsite Radiological Survey (ORS) Briefing Form, Attachment 1, from briefing information provided by the ESF or the RAP Team Captain.

5.2 Equipment Check/Team Preparation

5.2.1 Assemble protective equipment as checked off on the Offsite Radiological Survey (ORS) Briefing Form, Attachment 1, and obtain Offsite Radiological Survey (ORS) Kits from the staging area at BHO; two ORS Kits are located at BHO and two ORS Kits are kept at the Local EOC.

5.2.2 Perform equipment check using Offsite Radiological Survey (ORS) Kit Inventory, Attachment 3. Observe proper meter response and see that equipment calibration stickers are valid (see equipment operation attachments). Be sure to remove the control TLD from the ORS Kit and leave at the Local EOC or BHO, as directed by the ESF.

5.2.3 Log predeployment personnel dosimeter readings onto the Offsite Radiological Survey Briefing Form, Attachment 1, Item 11.

5.2.4 Use an AC source to check the TCS EAS-1 Air Sampler motor. Do not put on the filter canister.

5.2.5 If the ESF advises that potassium iodide (KI) administration is required, fill out Attachment 9, then take one KI tablet (130 mg) at this time. Inform the ESF or the RAP Team Captain when this is done.

5.2.6 Perform communication check with the ESF at the Local EOC. Maintain proper communication practices and always identify both parties, e.g., "Offsite Radiological Survey Team #1 to ESF."

5.2.7 Put on appropriate protective clothing (see Attachment 6, Donning Protective Clothing) and dosimetry equipment (see Attachment 8, Use of Direct-Reading Dosimeters and TLDs), as outlined in ORS Briefing Form, Attachment 1, Item 9.

5.2.8 Proceed to the survey vehicle. Check for a full tank of gas, operating cigarette lighter socket, lights, and operability of the battery. Start the engine and with it on, plug in the cable of the TCS EAS-1 Air Sampler, without the filter, into the cigarette lighter socket and observe sampler operating (it should sound like a small vacuum cleaner). If the emergency vehicle is not equipped with a cigarette lighter socket, use the vehicle battery with jumper cables to facilitate connection of the DC adapter directly to the battery terminals (ensure correct polarity when installing cables).

5.2.9 Inform the ESF that the Offsite Radiological Survey (ORS) Team is now ready and is starting its mission.

5.3 Survey

5.3.1 Proceed to the designated survey points, as listed on ORS Briefing Form, Attachment 1, Item 6b, using the Preselected Sampling Locations List, Attachment 10, and the Offsite Survey Map, Attachment 11, located in the ORS Kit.

5.3.2 While enroute to the survey point, keep the RO-2A and RM-14 with HP-270 probe on (see equipment operation, Attachments 4 and 5) and begin recording periodically any reading on the RM-14 greater than 1200 cpm (1 mR/hr) on the Offsite Radiological Survey Data Sheet, Attachment 2. Assign a number to any non-fixed points, mark the location on the map, then enter the point number assigned and the exposure rate on the ORS Data Sheet, Attachment 2.

5.3.3 Record any abnormal events or conditions which you observe on the Offsite Radiological Survey Data Sheet, Attachment 2.

5.3.4 If plume tracking is not required, proceed to Step 5.3.6.

5.3.5 Based on the survey data to be collected as indicated on the ORS Briefing Form, Attachment 1, Item 10, drive from point to point noting and reporting the following:

a. Plume boundaries are described by a dose rate of 1 mR/hr. (This is equivalent to approximately 1200 cpm on the RM-14 with HP-270 probe.)

b. Plume centerline is described as the point at which the RM 14 with HP-270 probe (open window) reading peaks and begins to decrease. Return to the peak concentration area.

c. At the plume centerline, report the maximum plume whole body dose rate measured with the RO-2A instrument at 4 feet above the ground and the measurement location to the ESC immediately after measurement (see Attachment 4, Operation of Eberline Model RO-2A). Mark the location on the map and ORS Data Sheet, Attachment 2.

d. If plume centerline air sampling is required, Attachment 1, Item 10 (2), collect an air sample using Step 5.3.7.

5.3.6 At the survey location, perform the following:

a. Obtain gamma (closed window of RO-2A) measurements at 3 inches and 4 feet above the ground

and record these readings on Attachment 2. (If the 4 foot reading is noticeably higher than the 3 inch reading, it should be assumed that the predominant gamma source is the airborne plume).

b. If readings increase with decreasing height above the ground, assume that the source is on the surface. In this case, take several smear samples (with gloves) over a 4" x 4" area of the ground and/or a soil sample when conditions permit.

c. Use a plastic bag for the soil sample and fill out a label to tag the bag. Label all samples with proper ID information: sample number, sample location, initials, date, time, and team ID.

d. When monitoring, periodically check beta (open window of RO-2A) reading at 3 inches and 4 feet above ground. Record any readings significantly different from the window-closed readings.

5.3.7 At the survey location, take an air sample, as required by the Radiological Survey Briefing Form, Attachment 1, Item 10 (2), as follows:

a. Leaving the vehicle engine running, plug in the TCS-EAS-1 air sampler. Run it for about a 1/2 minute, warm-up period without the filter/canister installed.

b. Open the TCS EAS-1 one quart can containing the canister. Inspect the canister for visible defects; the canister is not acceptable for use if the moisture check dot is blue.

c. Turn off the warmed-up sampler, center the canister over the suction opening on the side of the sampler. Stretch the elastic retainer over the outer end of the canister, making sure the fit is tight.

d. Position the air sampler 4 feet above the ground, as far away from the vehicle exhaust pipe as the cable will allow.

e. Adjust the flow rate to approximately 5 CFM. Set the timer to $\frac{25}{\text{CFM}}$ = 5 minutes.
(Rotate dial past the 5-minute mark, then turn back.)

f. Start the sampler and record the starting flow rate on the ORS Data Sheet, Attachment 2. Use a stop watch to verify the run time.

g. When the air sample time is completed, record the final flow rate reading on the ORS Data Sheet, Attachment 2. Carefully remove the canister from the sampler and put it in a plastic bag. Avoid contact with the white filter cloth wrapped around the outside and the bare filter. Be sure to record start/stop times and flow rates on the ORS Data Sheet, Attachment 2.

h. Connect the brass-shell GM-1 probe cable to the RM-14 count rate meter to "DETECTOR" input connection (see Attachment 5, Operation of Eberline Model RM-14). Switch "RESPONSE" to "SLOW". In this position, allow 20 seconds meter response time for each measurement.

i. Using the above setup, measure the background at 4 feet above the ground or inside the vehicle. Record this background cpm on the ORS Data Sheet, Attachment 2.

j. Insert the GM-1 probe into the center hole of the canister and adjust the scale of the RM-14 as necessary. Record the stabilized filter/canister reading (cpm) on the ORS Data Sheet, Attachment 2. Remove the GM-1 probe.

k. Carefully remove the white fiber cloth which is wrapped around the canister by pulling the red tape on the top rim of the canister. Hold the canister in the plastic bag while doing this to avoid contacting the cloth and to prevent silver zeolite crystal bits from falling out after the cloth wrapping is removed. Return the fiber cloth to the quart can.

l. Insert the GM-1 probe into the center hole of the canister and record the stabilized bare canister reading and time of measurement on the ORS Data Sheet, Attachment 2.

m. Place the bare canister with the plastic bag into the quart can and label the can with the following information:

Date and time of sample
Map location
Start and stop time
Starting and ending flow rate
Sample number (sequential)
Team ID

n. Place the quart can inside a plastic sample bag and ensure that a label is attached.

o. Report the ORS Data Sheet information for the air sample to the ESF.

5.3.8 Report dosimeter readings to the ESF at regular intervals (see OPIP 3.9.1, Dosimetry and Exposure Control).

5.3.9 Immediately report any equipment or supply shortages to the ESF.

5.3.10 Repeat Steps 5.3.2 through 5.3.8 as necessary for other survey locations.

5.3.11 When all survey and sampling activities are completed and the team receives no further requests from the ESF or the team is relieved by a second team, return to the Emergency Worker Decontamination Center, in Brentwood, unless instructed otherwise by the ESF or the RAP Team Captain.

5.3.12 Do not remove protective clothing or respirator until instructed by Emergency Worker Decontamination Facility personnel (see Attachment 6, Section 5.5, Removing Protective Clothing; Attachment 6, Section 5.7, Step-off Pad Use; Attachment 7, Section 5.5, Removing Respirator).

5.4 Decontamination/Sample Return

5.4.1 When all survey and sampling activities are completed, the team will return to the Emergency Worker Decontamination Facility, in Brentwood. The decontamination facility has the capability to decontaminate emergency workers and equipment in the event of a radiological release at SNPS.

5.4.2 When the ORS Teams arrive at the Emergency Worker Decontamination Facility, they notify the ESF of their arrival and proceed to the Vehicle Decontamination Area. The ESF or designee will meet the ORS Teams there and have the ORS personnel monitor the sample bags and data sheets with the RM-14 and HP-210 probe. If the plastic bags with the samples inside and/or the data sheet are not contaminated, then the ESF will bring them into the EOC for future analysis. If they are contaminated, then the ORS personnel will put the sample bags and/or data sheet into "clean" bags before being brought by the RAP Team Captain or designee into the EOC for future analysis.

5.4.3 The ORS Team members will then enter the Emergency Worker Decontamination Facility and follow the instructions of the monitoring and decontamination personnel. Be sure to take along your dosimeters, exposure record card, ORS Briefing Form, Attachment 1, and KI Record Sheet and Consent Form, Attachment 9. All other equipment will remain in the vehicle until the equipment and vehicle has gone through monitoring and decontamination.

5.4.4 Record post survey dosimeter readings on the ORS Briefing Form, Attachment 1.

5.4.5 The ESF or designee will examine all records, data sheets, and samples turned in by the ORS Teams, making copies of those items needed for dose assessment, and forward all samples for lab analysis.

5.4.6 Before the Offsite Radiological Survey Team returns the Offsite Radiological Survey Kit, make sure that all supplies and any contaminated equipment removed from service is replaced.

6.0 REFERENCES

6.1 OPIP 3.3.3, Standby and Mobilization

6.2 OPIP 3.9.1, Dosimetry and Exposure Control

6.3 OPIP 3.9.2, Radiological Monitoring and Decontamination of Emergency Workers and Evacuees

7.0 ATTACHMENTS

1. Offsite Radiological Survey (ORS) Briefing Form
2. Offsite Radiological Survey (ORS) Data Sheet
3. Offsite Radiological Survey Kit Inventory
4. Operation of Eberline Model RO-2A Ion Chamber
5. Operation of Eberline Model RM-14
6. Use of Protective Clothing and Step-Off Pads
7. Use of Full Face Respirators
8. Use of Direct-Reading Dosimeters and TLDs
9. Potassium Iodide Distribution
10. Preselected Sampling Locations
11. Offsite Survey Map

Attachment 14

FEDERAL RADIOLOGICAL MONITORING AND ASSESSMENT PLAN (FRMAP) SUPPORT FOR LOCAL RADIOLOGICAL EMERGENCY RESPONSE PLAN

I. Introduction

This attachment summarizes the DOE Federal Radiological Monitoring and Assessment Plan (FRMAP) capabilities that can be provided to LERO. Section II describes the specific capabilities and expected mobilization and travel times for the Brookhaven Area Office Region I coordinating office. Section III describes DOE FRMAP general capabilities including a brief discussion on how it is activated.

Region I specific capabilities and mobilization and travel times are based on discussions with the Brookhaven Area Office FRMAP Regional Coordinator. The general capabilities summary is based on two papers given at the American Nuclear Society Executive Conference on Emergency Preparedness in February, 1980 (References 1 & 2) and Report ERDA-60 (Reference 3).

The mobilization time, which is defined as the time required to load equipment and initiate travel, is usually about 2 hours. Travel times in this attachment are specific to the Shoreham Nuclear Power Station. These are best estimate mobilization and travel times based on a normal situation.

II. Region I Specific Capabilities and Mobilization and Travel Times

All major DOE laboratories and facilities maintain accident teams, which can be made available through the FRMAP to any nearby location. A number of specialized instruments have been developed to aid in the rapid assessment and mitigation of the

consequences of a major nuclear accident. The personnel involved with these responses have routine radiological-related duties on a daily basis at leading nuclear facilities thereby ensuring not only continuing experience and training, but also providing the conditions for keeping state-of-the-art equipment operable and calibrated.

Capabilities

Independent dose assessment of an emergency at Shoreham Nuclear Power Station (SNPS) will be performed by the DOE-RAP representative reporting from Brookhaven Area Office (BHO) .

The headquarters for the United States Department of Energy (DOE), Region I, DOE-RAP Team is located at BHO , approximately six miles from the Shoreham site.

LILCO has requested, due to the proximity and experience of the DOE-RAP personnel, that DOE-RAP assist in accident assessment during any event classification in which the Local EOC is activated. DOE has agreed to this request and will conduct the accident assessment effort for LERO.

BHO is notified by LILCO Customer Services by means of a commercial telephone. During off hours, BHO Security serves as the mechanism to provide notification for the on-call Duty Officer.

Since a DOE-RAP team representative will be one of the primary respondents to the Local EOC to assist in accident assessment, there is a dedicated telephone line for his use between the Local EOC and the BNL Emergency Operations Center. This link will be used to coordinate DOE-RAP team members who will receive direction from the Local EOC, and then subsequently used by that individual to mobilize additional resources of the Department of Energy at BHO , as required.

DOE-RAP provides assistance only. Although this is a federal program with highly developed expertise, this program will not assume the responsibility of LERO for the protection of the health and welfare of its citizens. A DOE-RAP representative from the Brookhaven Area Operations Office will report to the Local EOC in Brentwood, Long Island, to assist the Director of Local Response in accident assessment and radiological exposure control functions.

Brookhaven Area Office can provide support to the LERO to accomplish the following goals:

- Alpha, beta, and gamma radiation surveys
- Radiation monitoring of air, food, water, milk, and personnel
- Gamma spectrometry and radionuclide identification
- Airborne radioiodine sampling and analysis to concentrations as low as 5x10E-08 microcuries per cubic centimeter
- Radiological control advice
- Medical advice
- Laboratory analysis
- Support by Government laboratories such as Bettis, Knolls, Argonne, and Oak Ridge
- Communications

FRMAP Teams have state-of-the-art high and low-range alpha, beta, and gamma radiation survey equipment as well as sodium iodide scintillation spectrometry analysis equipment.

The Brookhaven Area Office (BHO) is located six miles from the Shoreham Nuclear Power Station in Suffolk County.

III. DOE FRMAP General Capabilities

NEST/AMS

The Nuclear Emergency Search Team (NEST) is maintained in a constant state of readiness for assistance in emergencies. NEST is a DOE operation and consists of personnel and equipment drawn from Andrews Air Force Base, the Lawrence Livermore Laboratory (LLL), Los Alamos Scientific Laboratory, Sandia Laboratories, and EG&G, Inc., a DOE Contractor/Laboratory. This capability incorporates a broad spectrum of technical expertise, special instruments, and the logistics support base to respond rapidly to large scale emergencies. Included in NEST responses are special radiation detection systems, a comprehensive communication system, logistics support hardware, the Aerial Measuring System (AMS), airborne radiation surveillance systems, aerial photographic capabilities, multispectral scanner systems, and background survey files. Atmospheric Release Advisory Capability (ARAC), an atmospheric modeling system computer linked to the National Weather System and the USAF Global Weather System, can be utilized to support a major emergency.

RESPONSE EQUIPMENT

The special response team is organized to deploy most rapidly those personnel and equipment that are immediately required. If the situation is of major proportion, added equipment in the following categories is available.

Airborne Systems

Helicopters and fixed-wing aircraft are equipped with gamma and neutron detection equipment. Gamma spectral data is recorded with position information derived from measurements of several exposure rates and principal isotope identification. On the ground the

recorded data can be converted to equivalent exposure rate at one meter above the ground and plotted as isopleths on maps or aerial photographs for immediate use by the responsible authorities.

Aerial photography is performed with large format cameras. A twelve channel Daedalus Scanner is available for very sensitive thermal mapping or similar diagnostic or assessment applications.

Standard Health Physics Instruments

Packages of standard health physics instruments are available with current calibrations. Team scientists select the appropriate instruments for the predominant isotopes. A TLD reader and 250 TLD's are included. A variety of alarming dosimeters are carried by personnel working close to the incident site. Also included are air samplers, portable counting equipment, battery powered analyzers, and source handling equipment. Anti-contamination clothing and breathing apparatus are also available.

Communications

An extensive communications system is deployed with the special team. A memorandum of understanding between DOE and AT&T assures rapid telephone response for the communications system connection. The switching hardware for a twelve line telephone system and radios for HF and VHF transmissions are installed in an airline cargo pod. In addition, the system contains a portable microwave system to provide video, data, audio, telephone, and control communication between a field command post and an incident site which may be up to 50 miles apart. Telephone with HF backup is the primary longer distance communication system. On-scene communication is assured with VHF radio, repeaters, and pagers.

Included in the communication array are all the basic support elements to establish a field command post. This includes typewriters, telecopiers, copy machines, status boards, etc.

All of the equipment and systems described above are packaged for deployment within two hours of a request. Existing airlift agreements between DOE and the Military Airlift Command assure rapid response. Most of the equipment can also be flown on commercial widebody aircraft and trucked the final distance to a site if time so dictates.

Backup Support

There are many specialized systems located throughout DOE national laboratories which could be made available for specialized needs or extreme emergency situations. The members of the special regional DOE field teams and the DOE Headquarters Emergency Action Coordinating Team are prepared to locate special equipment, arrange transportation, and logistically support the equipment onsite if risk to the public and national priorities so require.

ARAC

The ARAC system, located at LLL, is a system for computer based atmospheric modeling system which is real-time linked to the National Weather Service and the USAF Global Weather System. To insure accurate modeling for small areas around a fixed site, meteorological data from the site is required. In addition, topographic data is added for the site environs. Many calculational models are available to the field team. Source terms may be discrete (explosion), continuous (plume), or patterns if particulates are present. Software is available to make dose assessments and to accumulate these if the release is continuing over a period of time. ARAC can also predict plume patterns which may be extremely valuable for evacuation planning, locations where air monitoring should be emphasized, or planning releases which are under limited control. Finally, aerial teams can continuously compare and update ARAC data with actual in-plume measurements to assist in improving source term estimates. Communication with ARAC is via computer terminal and telecopier. Because

of its relatively long deployment time of approximately 48 hours, ARAC could only be used as a back-up to LERO's offsite dose projection done at the Local EOC.

If the Brookhaven Area Office determines it is needed, the NEST/AMS and ARAC capability of DOE FRMAP is activated by Brookhaven by calling the DOE Headquarters at the Emergency Operations Center in Germantown, Maryland. NEST/AMS capability exists at nearby Andrews Air Force Base and would not require the travel time from Las Vegas. ARAC meteorologists could also be sent to the site from other nearby locations in the southeastern part of the U.S.

REFERENCES

1. DOE Emergency Response Resources For A Major Incident, John F. Doyle, EG&G, Inc., Energy Measurements Group Assistant NV Program Manager for AMS/NEST, paper given at American Nuclear Society Executive Conference on Emergency Preparedness, San Antonio, Texas, February 11, 1980.

2. Nuclear Accidents Response, L. Joe Deal, Department of Energy, paper given at American Nuclear Society Executive Conference on Emergency Preparedness, San Antonio, Texas, February 11, 1980.

3. ERDA - 60, Energy Research and Development Administration Radiological Assistance Plan, Division of Operational Safety - Headquarters, July, 1975.

DEPARTMENT OF ENERGY

EQUIPMENT INVENTORY

FIELD KITS

Instrument Kit (3 each)

Quantity		Description
1	-	Victoreen Radector III, beta-gamma (Ion Chamber)
1	-	Victoreen CDV-700 count rate meter with end window, thin wall and underwater GM probes
1	-	Alpha scint. probe
1	-	Battery operated air sampler and filters
4	-	200 MR self-reading dosimeters
4	-	200 R self-reading dosimeters
1	-	Dosimeter charger
6	-	TLD dosimeters

Misc. - Stop watch, flashlight, tape ruler, check sources and batteries

Field Kit (1 each)

Quantity		Description
1	-	1/16 x 5 inch diameter scint. with thin window
1	-	Eberline PRM-5 pulse rate meter
1	-	Eberline RASP-1 Ruggedized alpha probe

1	-	Eberline SPA-3, 2 inch scint. probe
1	-	Eberline HP-210 beta window pancake GM probe

Misc. - Spare parts, tape ruler, check sources, voltmeter, spare batteries, cables and gloves.

Super Field Kit (1 each)

Quantity		Description
1	-	1/16 x 5 inch diameter scint. with thin window
1	-	Eberline SAM-2 mini scaler and rate meter
1	-	RD-22, 2 x 2 inch scint. probe

Misc. - Rechargeable battery pack for SAM-2, tape ruler, and cables.

Multi Channel Analyzer Kit (1 each)

Quantity		Description
1	-	Davidson Model 4106 M.C.A. (4096 Channels)
1	-	Digital Cassette Recorder
1	-	Silent 700 Printing Terminal
1	-	Inverter Power Supply and Power Cord

M.C.A. Detector Systems

Quantity		Description
1	-	Bicron 3 x 3 NaI Detector
1	-	Canberra 2005 Preamp
1	-	Canberra 2012 Amplifier
1	-	Canberra 3002 H.V. Supply
1	-	ORTEC High Purity Ge Detector
1	-	ORTEC 572 Amplifier
1	-	ORTEC Mini NIM BIN and Low Voltage Supply
1	-	Beta and Gamma Reference Source Set
1	-	30 Liter Dewar

Environmental Radiation Monitor (1 each)

Reuter Stokes RSS-111, Range 0-5000 micro R/hr.

Porta-Air Sampler Kit (5 each)

Quantity		Description
1	-	Portable (AC/DC) field iodine air sampler
1	-	Victoreen CDV-700 count rate meter with 6306GM probe and shield
5	-	Sample canisters (silver loaded silica-gel)
5	-	Sample canisters (TEDA charcoal)

Misc. - 1 copy sampling procedure, technical report, battery adapter cable, 25 ft. extension cable, screwdriver.

Porta-Air Sampler Supply Kit (1 each)

Quantity		Description
17	-	Sample canisters (silver loaded silica-gel)
4	-	Sample canisters (TEDA charcoal)
2	-	One gallon can (silver loaded silica-gel)
1	-	Roll particulate paper
1	-	Beaker
2	-	Screwdrivers
2	-	Scissors
1	-	CDV-700 and 6306 probe

Misc. - Blank labels, pre-marked labels, plastic bags.

Environmental Air Sampler (18 each)

Contains AC powered pump, lapsed time meter, flow gauge, hose, filter holder, rain cover, filter stand and power cord, 5 sample canisters, 6 particulate filters, padlock, chain.

High Volume Air Samplers (2 each)

Staplex particulate monitors.

Data or Reference Kit - Color Code - Dark Brown Attache Case (2 each)

- Road Maps
- Radiation Handbooks and RAP Manual
- Data Pads, Graph Paper, Pencils, Ruler
- Masking Tape and Rope Tape
- Signs and Tags
- Small Sample Containers
- Tape Measure
- Pocket Knife
- Polaroid Camera and Film
- Smear Books and Filter Paper
- Calculator and Charger
- Small Plastic Bags

Protective Clothing Kit - Color Code - Brown (4 kits for 2 people each)

- Head Covers
- 1/2 Face Respirators and Filters (2 A.O., 2 MSA, 2 Wilson)
- Gloves (Heavy Plastic and Autopsy) (2 sizes)
- Coveralls (Medium and Large)
- Shoe Covers (Medium and Large)
- Splash Suit and 1 Poncho
- Tape (Wide, masking)
- Wash and Dry Packets
- Plastic Bags (Medium and Large)

Sample Collection Kit - Color Code - Green (4 each)

- Plastic Bags (3 sizes)
- Sample Containers - Bottles (3-5 sizes)
- Sample Containers - Can (3-5 sizes)
- Masking Tape
- Grease Pencils
- Trowel
- Tags
- Scissors
- Tongs

Run Bags - (3 each)

Each bag contains rain suit, coat, gloves, hat, socks, underwear, toilet articles, rain boots, and coveralls.

Gasoline Powered Generators

2500 Watt, 115 Volts, AC (One each)
500 Watt, 115 Volts, AC (Two each)
Gasoline Can, 5 gallon (3 each)
Filter Funnel (3 each)

INDIVIDUAL ITEMS

Survey Instruments:

Quantity	Type	Description
3	Victoreen 471A	Wide range beta-gamma (Ion Chamber)
3	Victoreen CDV-720	Wide range beta-gamma (Ion Chamber)
1	Teletector 6112	Beta-gamma with telescoping probe (GM)
1	Victoreen CDV-715	Gamma (Ion Chamber)
2	Victoreen CDV-700	Count rate meter (GM)
1	Victoreen CDV-700	Count rate meter, scint. and GM
3	Eberline E120	Count rate meter (GM)
1	Victoreen Radector II	Beta-gamma (Ion Chamber)
3	Nucor CS-40A	Wide range beta-gamma (Ion Chamber)
2	Ludlum 12-S	Micro R meter (scint.)
1	Eberline PRM-5-3	Lin-Log Pulse Rate Meter with PG-2 low energy gamma scint probe
1	Eberline PAC-4G-3	Lin-Log Gas proportional survey meter with AC-21 alpha probe
1	Eberline PAC-4G-3 (Floor Monitor Mount)	Lin-Log Gas proportional survey meter with AC-21 alpha probe, AC-21B beta probe

1	Eberline PAC-ISA	Alpha scint. detector, SPA-1 probe with sample tray
4	Eberline PAC-4S	Lin-Log alpha scint. detector
1	Ludlum 12	Count rate meter with alpha scint.
2	LFE Corp NP2	Neutron detector (Snoopy)

Scalers and Detectors:

1	Eberline PS-1	Portable Scaler
1	Eberline PS-2	Portable Scaler (2 High Voltage adj.)
2	Eberline MS-2	Portable Scaler and rate meter
2	Eberline SH-3	GM counter with sample tray
1	Eberline SH-5	Gas Flow counter with sample tray
1	Eberline HP-210	Beta window pancake GM probe
2	Eberline SH-4	Holder with sample tray for HP-210 probe
1	Eberline FC-2	Lab. type, lead shielded, gas flow proportional counter and gas cylinder

Equipment for Use on Emergency Truck

Road Maps
RAP Manual
First Aid Kit
Tool Kit (Fundamental)
Jumper Cable
Fire extinguisher
Flares (9)
Blankets (2)
Shovel
Flashlight
Plastic Tarpaulin
Flood light

Miscellaneous Protective Clothing

Coveralls - 12 pair
Head covers, cotton - 18
Apron, rubberized - 1
Leather gloves, lead lined - 1 pair
Leather work gloves - 4 pair
Cotton work gloves - 5 pair
Rubber gloves - 5 pair
Plastic gloves, disposable - 150 pair
Shoe covers, rubberized - 24 pair
Shoe covers, canvas - 3 pair
Shoe covers, light plastic - 20 pair
Shoe covers, heavy plastic - 8 pair
Rubbers, yellow toe - 2 pair
Rain boots, rubber - 2 pair
Tarpaulin, canvas - 3
Respirator (A.O.), 1/2 face - 1
Respirator (M.S.A.), 1/2 face with spare filters (Type H) - 22 pair
Respirator filters (Wilson) Type R12 - 16 pair
Protective eye glasses, plastic - 6 pair

Miscellaneous Items

Portable communications transceivers (5)	1
Portable AM/FM broadcast receivers (2)	2
Binoculars - 2 pair	3
Radiation signs and tags (assorted)	4
Ribbon Tape	5
Rope	6
Pads	7
Pencils	8
Reinforced filament tape	9
Plastic bags	10
Plastic bottles, 100ML - 100 each	11
Marinelli beakers	12
Spare TEDA charcoal, and silver loaded silica-gel	13
Vacuum drying oven for silica-gel	14
Battery packs for Eberline scalers (4 each)	15
Spare type R51 filters for battery operated air samplers	16
Sample canisters for env. air samplers - (200)	17
Particulate filters for env. air samplers - (300)	18
	19
	20

Attachment 15

Attachment 15

DESCRIPTION OF PLANNING ZONES/AREAS FOR SUFFOLK COUNTY

Wind Direction (From)	Zones	Area Description
////////////	0 - 2 Miles	
All	A, B, C, D, & E	The area in East Shoreham east of Woodville Road and Ridge Road, south to Whiskey Road. The area north of Whiskey Road and east of Ridge Road. The area north of 25 between William Floyd Parkway and 25A. The area in Wading River west of Hulse Landing Road.
////////////	0 - 5 Miles	
ESE	A - E, F	The area north of 25A between Pipe Stave Hollow Road in Miller Place and Hulse Landing Road in Wading River. Plus the area north of 25 between William Floyd Parkway and 25A. The area north of Whiskey Road, east of Ridge Road.
E ENE NE	A - E, F, G	The area in Miller Place east of Pipe Stave Hollow Road and north of 25A. The area east of Miller Place-Yaphank Road between 25A and 25. The area north of 25 between Miller Place-Yaphank Road and 25A, plus the area between Smith Road and William Floyd Parkway. The area north of 25 between William Floyd Parkway and 25A. The area in Wading River west of Hulse Landing Road.
NNE	A - E, G, H	The area east of Woodville Road in East Shoreham. The area east of Miller Place-Yaphank Road between 25 and 25A. The area between Smith Road and William Floyd Parkway. The area north of the LIE between William Floyd Parkway(Exit 68) and Exit 69. The area in Wading River north of 25 and west of Hulse Landing Road.

DESCRIPTION OF PLANNING ZONES/AREAS FOR THE SUFFOLK COUNTY
(continued)

Wind Direction (From)	Zones	Area Description
////////////	0 - 5 Miles (continued)	
N	A - E, G, H, I	The area east of Woodville Road in East Shoreham. The area east of Miller Place-Yaphank Road between 25 and 25A. The area between Smith Road and William Floyd Parkway. The area north of the LIE between William Floyd Parkway (Exit 68) and Edwards Avenue (Exit 71). The area west of Hulse Landing Road in Wading River.
NNW	A - E, H, I	The area in East Shoreham east of Woodville Road and Ridge Road, as far south as Whiskey Road. The area north of Whiskey Road, east of Ridge Road. The area north of the LIE between the Willam Floyd Parkway (Exits 68) and Exit 71. The area west of Hulse Landing Road in Wading River.
NW	A - E, H, I, J	The area in East Shoreham east of Woodville Road and Ridge Road, as far south as Whiskey Road. The area north of Whiskey Road, east of Ridge Road. The area north of the LIE between the William Floyd Parkway (Exit 68) and Exit 71. Avenue (Exit 71). The area west of Edwards Avenue, including Wildwood State Park.
WNW	A - E, I, J	The area in East Shoreham east of Woodville Road and Ridge Road, as far south as Whiskey Road. The area north of Whiskey Road. The area north of 25 between William Floyd Parkway and Wading River-Manorville Road. The area north of the LIE between Exit 69 and Edwards Avenue (Exit 71). The area west of Edwards Avenue, including Wildwood State Park.

DESCRIPTION OF PLANNING ZONES/AREAS FOR THE SUFFOLK COUNTY
(continued)

Wind Direction (From)	Zones	Area Description
////////////	0 - 5 Miles (continued)	
W WSW	A - E, J	The area in East Shoreham east of Woodville Road and Ridge Road, south to Whiskey Road. The area north of Whiskey Road, east of Ridge Road. The area north of 25 between William Floyd Parkway to Edwards Avenue. The area west of Edwards Avenue, including Wildwood State Park.
All	A - J	The area in Miller Place east of Pipe Stave Hollow Road and north of 25A. The area east of Miller Place-Yaphank Road between 25A and 25. The area north of 25 between Miller Place-Yaphank Road and 25A, plus the area between Smith Road and William Floyd Parkway. The area north of the LIE between William Floyd Parkway (Exit 68) and Edwards Avenue (Exit 71). The area west of Edwards Avenue, including Wildwood State Park.
////////////	0 - 10 Miles	
N	A - J, L, M, N, O, R	The area in Miller Place east of Pipe Stave Hollow Road and north of 25A. The area east of Miller Place-Yaphank Road. The area east of Port Jefferson-Patchogue Road between 25 and the LIE. The area north of the Sunrise Highway between Gerard Road and Old Moriches-Riverhead Road. The area east of Old Moriches-Riverhead Road within the Town of Brookhaven. The area south of Old Country Road, west of Mill Road. The area west of Edwards Avenue, including Wildwood State Park.

DESCRIPTION OF PLANNING ZONES/AREAS FOR THE SUFFOLK COUNTY
(continued)

Wind Direction (From)	Zones	Area Description
//////////	0 - 10 Miles (continued)	
NNW	A - J, M, N, O	The area in Miller Place east of Pipe Stave Hollow Road and north of 25A. The area east of Miller Place-Yaphank Road, Middle Island Road, Yaphank-Middle Island Road, and Gerard Road to Sunrise Highway. The area north of Sunrise Highway between Gerard Road and Old Moriches-Riverhead Road. The area east of Old Moriches-Riverhead Road within the Town of Brookhaven. The area south of Old Country Road, west of Mill Road. The area west of Edwards Avenue, including Wildwood State Park.
NW	A - J, N, O, S, P	The area in Miller Place east of Pipe Stave Hollow Road and north of 25A. The area east of Miller Place-Yaphank Road between 25 and 25A. The area east of William Floyd Parkway south to Sunrise Highway, plus the area in Upton between Smith Road and William Floyd Parkway. The area north of the Sunrise Highway between William Floyd Parkway and Old Moriches-Riverhead Road. The area west of Old Moriches-Riverhead Road to Osborne Avenue in Riverhead. The area west of Doctor's Path and Pennys Road.
WNW W	A - J, O, P, S	The area in Miller Place east of Pipe Stave Hollow Road and north of 25A. The area east of Miller Place-Yaphank Road between 25 and 25A. The area north of 25 between Middle Island Road and William Floyd Parkway, plus the area between Smith Road and William Floyd Parkway in Upton. The area north of the LIE from Exit 68 to Exit 69. The area north of the Sunrise Highway from Chichester Avenue to Old Moriches-Riverhead Road. The area west of Old Moriches-Riverhead Road to Osborne Avenue in Riverhead. The area west of Doctor's Path and Pennys Road.

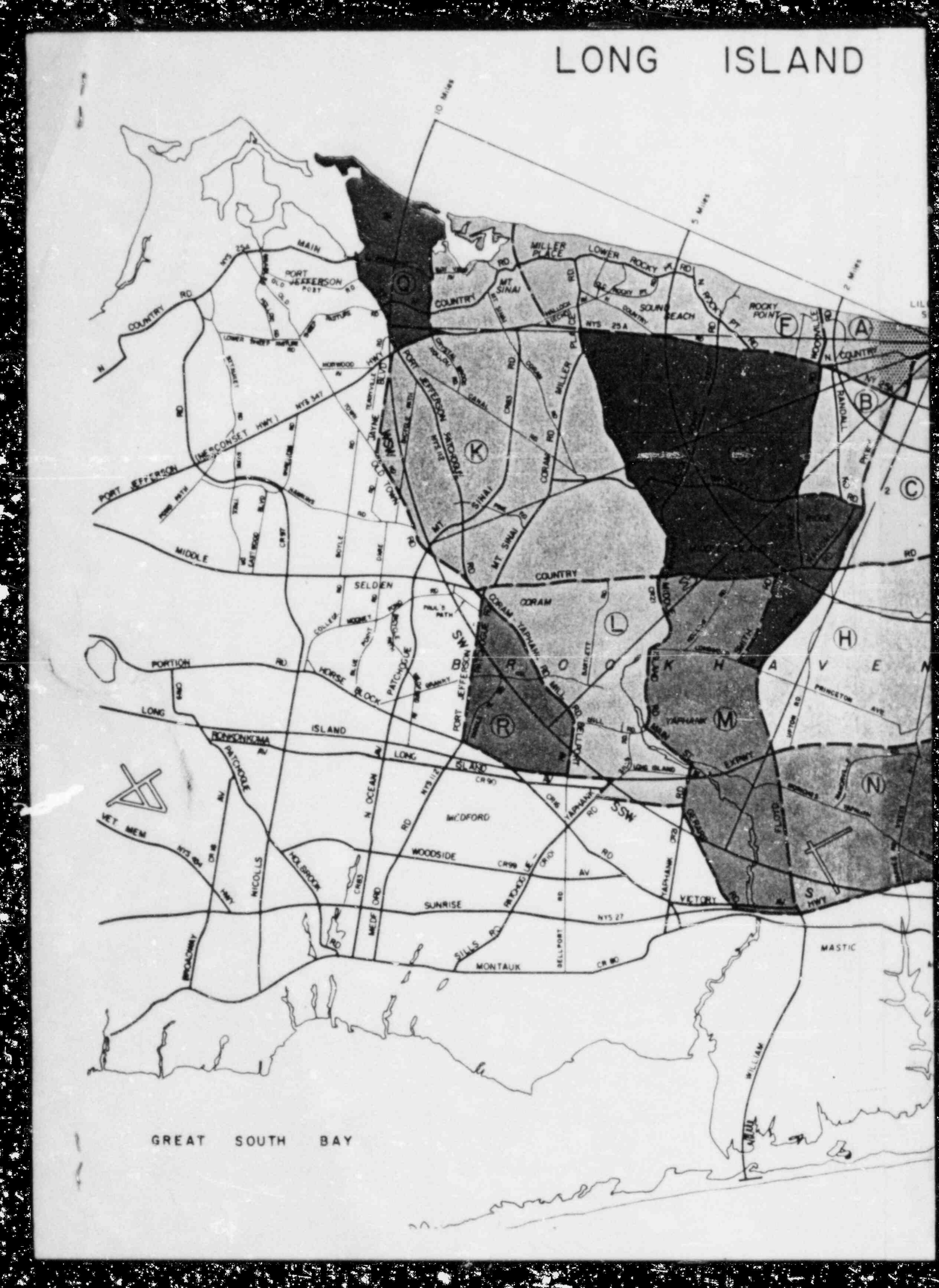
DESCRIPTION OF PLANNING ZONES/AREAS FOR THE SUFFOLK COUNTY
(continued)

Wind Direction (From)	Zones	Area Description
////////////	0 - 10 Miles (continued)	
WSW	A - J, P	The area in Miller Place east of Pipe Stave Hollow Road and north of 25A. The area east of Miller Place-Yaphank Road between 25A and 25. The area north of 25 between Miller Place-Yaphank Road and 25A, plus the area between Smith Road and William Floyd Parkway. The area north of the LIE between William Floyd Parkway (Exit 68) and Edwards Avenue (Exit 71). The area north of Old Country Road between Edwards Avenue and Roanoke Avenue. The areas west of Doctor's Path, north of Middle Road, and the area west of Pennys Road.
E ESE	A - J, K, Q	The area east of Main Street in Port Jefferson, east of Jayne Boulevard, and Old Town Road to 25. North of 25 between Old Town Road and William Floyd Parkway, plus the area between Smith Road and William Floyd Parkway in Upton. The area north of the LIE between the Willam Floyd Parkway (Exit 68) and Edwards Avenue (Exit 71). The area west of Edwards Avenue, including Wildwood State Park.
ENE	A - J, K, Q, L, R	The area east of Main Street in Port Jefferson, east of Jayne Boulevard, Old Town Road, and Port Jefferson-Patchogue Road to Horse Block Road. North of the LIRR tracks between Horse Block Road and Yaphank Road in West Yaphank. West of Yaphank-Middle Island Road in Gordon Heights. The area north of 25 from Middle Island Road to William Floyd Parkway, plus the area between Smith Road and William Floyd Parkway in Upton. The area north of the LIE from the the William Floyd Parkway (Exit 68) to Edwards Avenue (Exit 71). The area west of Edwards Avenue, including Wildwood State Park.

DESCRIPTION OF PLANNING ZONES/AREAS FOR THE SUFFOLK COUNTY
(continued)

Wind Direction (From)	Zones	Area Description
////////////	0 - 10 Miles (continued)	
NE	A - J, Q, K, L, R, M	The area east of Main Street in Port Jefferson, east of Jayne Boulevard, Old Town Road, and Port Jefferson-Patchogue Road. North of the LIE between Exits 64 and 66. The area north of Sunrise Highway between Gerard Avenue and William Floyd Parkway in Yaphank. The area north of the LIE from William Floyd Parkway (Exit 68) to Edwards Avenue (Exit 71) and the area west of Edwards Avenue, including Wildwood State Park.
NNE	A - J, K, L, M, N, R	The area in Mt. Sinai east of Crystal Brook Hollow Road. The area east of Jayne Boulevard, Old Town Road, and Port Jefferson-Patchogue Road. North of the LIE between Exits 64 and 66. The area north of Sunrise Highway between Gerard Avenue and William Floyd Parkway in Yaphank. The area north of the LIE from William Floyd Parkway (Exit 68) to Edwards Avenue (Exit 71) and the area west of Edwards Avenue, including Wildwood State Park.

Attachment 16


LONG ISLAND
10 MILES
5 MILES
2 MILES
MAIN
COUNTRY RD
PORT JEFFERSON
MT SINAI
MILLER PLACE
LOWER ROCKY PT. RD
ROCKY POINT
SOUND BEACH
NYS 25A
NORWOOD AV
PORT JEFFERSON YAPHANK
MIDDLE
SELDEN
CORAM
PORTION RD
HORSE BLOCK
LONG ISLAND
PATCHOGUE
N. OCEAN
MEDFORD
WOODSIDE
SUNRISE
MONTAUK
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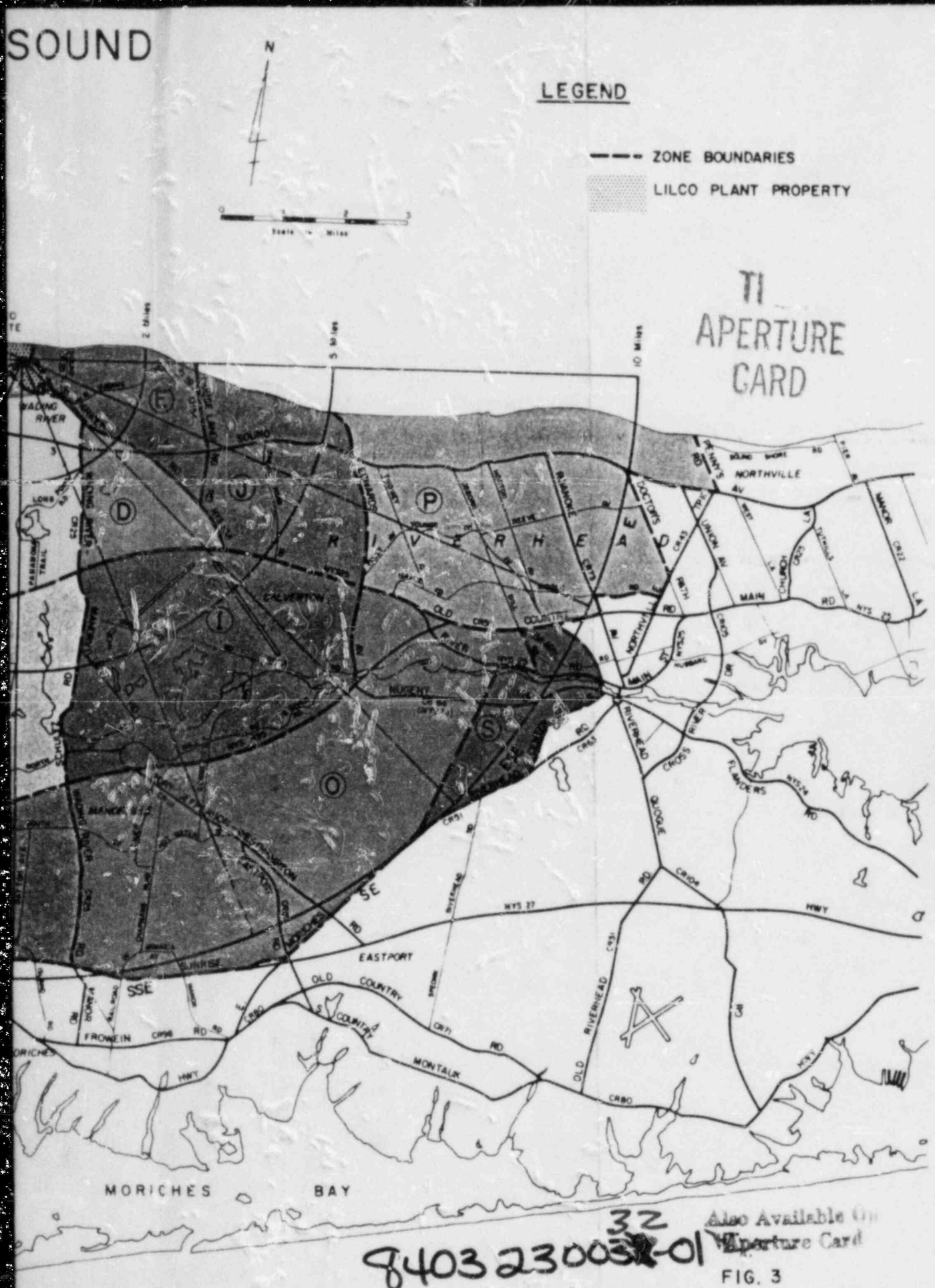

FIG. 3

EVACUATION AREA BY ZONES
AND ZONE DESIGNATIONS

Attachment 17

RADIOLOGICAL EMERGENCY DATA FORM

PART I - GENERAL INFORMATION

1. Date and Time of Message Transmittal:
   Date _____ Time _____ (24-hour clock)

2. Facility providing information:
   A Indian Point Unit No. 2
   B Indian Point Unit No. 3
   C Ginna Station
   D Nine Mile Point Unit No. 1
   E FitzPatrick Plant
   F Shoreham Station
   G Other _____

3. Reported by:
   A Name _____
   B Title _____

4. This ... A is ... an exercise.
   B is NOT

5. Emergency Classification
   A Unusual Event
   B Alert
   C Site Area Emergency
   D General Emergency

6. This classification occured at
   Date _____ Time _____ (24-hour clock)

7. Brief Event Description/
   Initiating Condition: _____
   _____
   _____
   _____
   _____
   _____

8. There has:
   A NOT been a release of radioactivity.
   B been a release of radioactivity to the ATMOSPHERE.
   C been a release of radioactivity to a BODY OF WATER _____.
   D been a GROUND SPILL release of radioactivity.

9. The release is:
   A continuing
   B terminated
   C NOT applicable.

10. Protective Actions:
    A There is NO need for Protective Actions outside the site boundary.
    B Protective Actions are under consideration.
    C Recommended Protective Actions:
      Shelter within _____ miles/or _____ sectors/or ERPA's.
      Evacuate within _____ miles/or _____ sectors/or ERPA's.

11. Weather:
    A Wind speed _____ miles per hour or _____ meters per second.
    B Direction (from) _____ degrees.
    C Stability class (A-G)___
    D General Weather Condition (if available)
      _____

Message received by _____

Attachment 18

TABLE 2.3.1-1

EXTREME WIND SPEEDS (MPH)
SUFFOLK COUNTY AFB(1)

Month	Peak Gust (mph)
January	58
February	61
March	60
April	58
May	43
June	40
July	44
August	100(2)
September	76
October	48
November	62
December	61

(1) Peak wind gusts recorded at Suffolk County AFB for 10 yr period 1960-1969

(1) Peak wind gust of 100 mph recorded with passage of Hurricane Carol in August 1954.

Attachment 19

WIND DIRECTION VARIABILITY ANALYSIS
SHOREHAM AND OTHER SITES
LONG ISLAND LIGHTING COMPANY

The Shoreham site experiences wind direction shifts, as do all other nuclear plant sites. The variability of the wind at Shoreham and eight other nuclear plant sites has been studied to determine the relative magnitude of variability from site to site. This variability analysis utilized meteorological data for each site, a computer program which determined the degree of wind direction persistance (i.e. invariability) of the data, and a manual calculation procedure which converted the computer output into a measure of wind direction variability. The results of this evaluation clearly show that the winds are less variable at Shoreham than at the other sites.

Data from nine different nuclear power plant sites formed the basis for this study. These sites were chosen to represent a cross section of meteorological and topographical conditions throughout the eastern United States. The site names, locations, and governing topographical characteristics are shown in Table 1. Nuclear power plant sites were selected over government weather stations to take advantage of the high quality of instruments and data inherent in nuclear-related data collection programs.

In order to assure that a reasonably long period of data was considered, one complete year of hourly wind direction observations was analyzed for each site. The year chosen met two criteria - the data must be of very high data recovery (i.e. very little missing data), and the data must have been used by the utility (and approved by the Nuclear Regulatory Commission) in the design of nuclear safety-related systems and equipment. In some instances, a second year of data was analyzed independently, to assess the variation of variablity from one year to another.

Wind direction observations at all sites were made at approximately 10 meters above ground level; this is the standard set by the meteorological community and the NRC. In addition, Shoreham data from 150 ft above ground level were also studied to examine the variation of variability with height.

Each year of data at each site was analyzed independently. The first step in the analysis procedure consisted of using a computer program to determine how frequently the wind persisted in (i.e. did not shift out of) any 45° compass sector. The results of this analysis were then subjected to a procedure which yielded the percentage of time that the wind direction shifted at least into the adjacent 45° sector (at least, because shifts of more than one sector can occur within one hour). Appendix A contains a detailed explanation of this analysis procedure.

The final results of the wind variability study are depicted in Table 2. Several important conclusions can be drawn from these results:

1. Winds at Shoreham are less variable than at almost every other site.

2. Winds at Shoreham are slightly less variable at 150 ft above the ground than at 10 meters.

3. Winds at coastal sites vary less than at inland sites.

4. There is no difference in variability when different data year periods are used (i.e., see various sites contained in Table 2 that utilize different 1-year data periods).

TABLE 1

SITES USED IN WIND VARIABILITY ANALYSIS

Site Name	Location	Topography
Shoreham	Brookhaven, NY	Coastal
Davis-Besse	Oak Harbor, OH	Coastal
River Bend	St. Francisville, LA	Inland Plain
Beaver Valley	Shippingport, PA	Valley
Millstone Point	Waterford, CT	Coastal
Zimmer	Moscow, OH	Valley
North Anna	Mineral, VA	Inland
Turkey Point	Florida City, FL	Coastal
Pilgrim	Plymouth, MA	Coastal

TABLE 2

PERCENTAGE OF TIME THE AVERAGE HOURLY WIND DIRECTION (DETERIMINED 45° SECTOR INCREMENTS) SHIFTED AT LEAST INTO ADJACENT SECTOR

Sites	Year	Percent
Inland Locations		
River Bend (33-ft)	1/1/78-12/31/78	45
North Anna (33-ft)	1/1/78-12/31/78	39
Valley Locations		
Zimmer (33-ft)	1/1/78-12/31/78	42
Beaver Valley (33-ft)	1/1/76-12/31/76	40
Beaver Valley (33-ft)	1/1/78-12/31/78	40
Coastal Locations		
Millstone Point (33-ft)	1/1/74-12/31/74	33
Millstone Point (33-ft)	1/1/78-12/31/78	32
Pilgrim (33-ft)	1/1/75-12/31/75	29
Turkey Point (33-ft)	1/1/81-12/31/81	28
Shoreham West (33-ft)	1/1/74-12/31/74	27
Shoreham West (33-ft)	9/27/73-12/31/73 1/1/75-9/30/75	27
Davis-Besse (33-ft)	1/1/82-12/31/82	26
Shoreham (150 ft)	9/27/73-12/31/73 1/1/75-9/30/75	25

Appendix A

WIND VARIABILITY ANALYSIS PROCEDURE
SHOREHAM NUCLEAR POWER STATION

The percentage (P) of time the average hourly wind direction (determined in 45° sector increments) shifted at least into the adjacent sector was determined from the following equation:

$$P = \frac{(T-M) - (S + C)}{(T-M)} \times 100\%$$

where,

T = total number of hours in the year analyzed

M = number of missing hours of meteorological data

S = number of hours when the average hourly wind direction (determined in 45°sector increments) did not shift into the adjacent sector, and

C = number of calm hours.

A computer program which utilized a year of average hourly wind direction data was used to determine values of "M", "S", and "C" for each data base. The value of "S" represents the sum of the hours when the average hourly wind direction did not shift into the adjacent sector for espisodes of varying duration which occurred during the year analyzed. Values of the variables for each data base are summarized in Table A-1.

To help in the explanation of how the values presented in Table A-1 were determined, a hypothetical day of 24 average hourly wind direction values (presented in Table A-2) was analyzed. The episodes when the average hourly wind direction did not shift into the adjacent sector (wind persistence episodes) and the total number of missing and calm hours are summarized in Table A-3. Using the data presented in Table A-3, the following values were determined for the aforementioned equation:

$T = 24$

$M = 2$

$S = [(2x2)+(3x2)+(4x2)] - 6 = 12$

("6" represents the first hour of each of the 6 wind persistence episodes. The first hour of a persistence episode represents a shift of at least one sector from the previous hour.)

$C = 3$

$P = 32\%$

Table A-1

Input Data Used In Analysis

Site	Data Period	T	M	S	C	P
Shoreham West	1974	8760	140	6255	16	27%
Davis Besse	1982	8760	44	6439	0	26%
River Bend	1978	8760	78	4227	531	45%
Beaver Valley	1976	8784	649	4842	76	40%
Millstone Point	1974	8760	260	5528	163	33%
Zimmer	1978	8760	170	4640	322	42%
North Anna	1978	8760	85	5249	12	39%
Turkey Point	1981	8760	113	6243	8	28%
Pilgrim	1975	8760	55	6176	13	29%
Shoreham West	Sept 73-Dec 73 Jan 75-Sept 75	8856	454	6118	15	27%
Shoreham West*	Sept 73-Dec 73 Jan 75-Sept 75	8856	571	6184	4	25%
Beaver Valley	1978	8760	396	4999	42	40%
Millstone Point	1978	8760	421	5559	89	32%

* Data is from the 150-ft tower level whereas all other data is from the 33-ft tower level.

Table A-2

Hypothetical Day of 24 Average Hourly Wind Direction Values

Hour	Wind Direction
1	Missing
2	Missing
3	N
4	N
5	N
6	N
7	E
8	E
9	E
10	S
11	E
12	E
13	S
14	S
15	S
16	E
17	E
18	W
19	W
20	W
21	W
22	Calm
23	Calm
24	Calm

Table A-3

OCCURRENCE OF WIND PERSISTENCE EPISODES

PERIOD - HYPOTHETICAL DAY

HOURS OF PERSISTENCE

WIND FROM	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	TOTAL
N	0	0	1	0																				0	1
NE	0	0	0	0																				0	0
E	2	1	0	0																				0	3
SE	0	0	0	0																				0	0
S	0	1	0	0																				0	1
SW	0	0	0	0																				0	0
W	0	0	1	0																				0	1
NW	0	0	0	0																				0	0
TOTAL	2	2	2	0																				0	6

NUMBER OF 999 OCCURRENCES = 2 = Missing

NUMBER OF 997 OCCURRENCES = 3 = Calms

NUMBER OF 888 OCCURRENCES = 0

MAXIMUM RUN LENGTH = 4