

UNITED STATES OF AMERICA  
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of )  
 )  
THE CLEVELAND ELECTRIC ) Docket Nos. 50-440  
ILLUMINATING COMPANY ) 50-441  
 )  
(Perry Nuclear Power Plant, )  
Units 1 and 2) )

AFFIDAVIT OF  
GARY WINTERS  
ON CONTENTION B

County of Dauphin )  
 ) ss.  
Commonwealth of Pennsylvania )

GARY WINTERS, being duly sworn, deposes and says:

1. I am presently a Project Coordinator and Emergency Planning Specialist for the Emergency Management Services Department of Energy Consultants. My business address is 2101 North Front Street, Harrisburg, Pennsylvania 17110. My responsibilities include coordination of offsite resource inventory and assessment efforts involving Lake, Ashtabula and Geauga Counties with respect to the Perry Nuclear Power Plant. Project activities have included the interview of response agency/facility administrators for resource information, preparation of county resource documents and analysis of

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offsite resource capability to respond to an accident at the Perry Plant. A current statement of my professional qualifications and experience is attached hereto. I have personal knowledge of the matters stated herein and believe them to be true and correct. I make this affidavit in support of Applicant's Motion For Summary Disposition of Contention B.

2. The purpose of this affidavit is to explain the consideration of potential evacuation route impediments (such as snow and disabled vehicles) in offsite plans for the Perry plume exposure pathway Emergency Planning Zone ("EPZ") as well as the ability of the counties in the EPZ to handle extreme conditions of inclement weather. As indicated in the plans and procedures, resources such as tow trucks and snowplows are utilized to keep evacuation routes clear. See, e.g., Lake County Plan,<sup>1/</sup> § J-08; Ashtabula County Plan,<sup>2/</sup> § J.4.2; Geauga County, Ohio Radiological Emergency Response Plan Standard Operating Procedure.

3. The jurisdictions within the EPZ are particularly well prepared to handle snow. Because the agencies charged with responsibility for snow removal within the EPZ are equipped and staffed to keep the roads passable in a normal

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<sup>1/</sup> Lake County Emergency Response Plan for the Perry Nuclear Power Plant, (Rev. 3, October 1984).

<sup>2/</sup> Ashtabula County Radiological Emergency Preparedness Plan (May 10, 1984).

"snowbelt" snowfall, normal snow conditions require no special consideration in emergency planning for the Perry EPZ.

4. Of the 22 road departments within the EPZ, most could keep roads passable with no assistance even during a blizzard. During an emergency, the county governments have the authority to coordinate the response of the various political subdivisions within a county. Lake County Plan, § A-08; Ashtabula County Plan, § B.5; Geauga County Plan,<sup>3/</sup> § B-4. Municipal road departments are included in the group of local departments subject to county-level coordination. The County Engineers are charged with maintaining roads within the EPZ in usable condition, and will coordinate impediment removal efforts. Lake County Plan, § J-08; Ashtabula County Plan, Appendix 6; Geauga County Plan, Appendix 4. Thus, in the unlikely event of an emergency at Perry during a blizzard, the resources of all road departments throughout Lake, Ashtabula, and Geauga Counties would be made available to augment the resources of any road departments within the EPZ which might need assistance in keeping roads passable.<sup>4/</sup> With the

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<sup>3/</sup> Geauga County Radiological Emergency Response Plan (including Change No. 2 dated July 1984).

<sup>4/</sup> Indeed, under particularly inclement weather conditions (i.e., snow accompanied by high winds), only the downwind sector of the plume EPZ is likely to be affected by an emergency at Perry. Therefore, should evacuation be indicated in such conditions, the snow removal resources of the three counties could be concentrated on the sector of the EPZ to be evacuated.

assistance of these road departments from outside the EPZ, the few road departments within the EPZ which may need assistance will have sufficient snow removal resources to keep the roads clear in a blizzard.

5. A partial survey<sup>5/</sup> of road departments within the three counties revealed an impressive inventory of snow removal equipment. The 23 road departments surveyed in Lake County have a combined total of 139 large trucks with snow plows, 117 salt/cinder spreaders, 32 front-end loaders, and 13 graders. The 12 road departments surveyed in Ashtabula County have a combined total of 88 large trucks with snow plows, 58 salt/cinder spreaders, 22 front-end loaders, and 15 graders. The 11 road departments surveyed in Geauga County have a combined total of 64 large trucks with snow plows, 58 salt/cinder spreaders, 16 front-end loaders, and 11 graders. Additional snow removal equipment is available locally, from the other road departments within the three counties.

6. Still more snow removal equipment (if needed) would be provided from Ohio Department of Transportation resources outside the three counties, upon the request of one of the three County Engineers. State Plan,<sup>6/</sup> §§ II.A.4.b(5)(d),

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<sup>5/</sup> The survey did not canvass all road departments within the three counties -- only those serving municipalities with a response role specified in the county plans. Therefore, additional snow removal equipment (beyond that identified in the survey) is locally available to the counties.

<sup>6/</sup> State of Ohio Plan For Response to Radiological Emergencies at Licensed Nuclear Facilities (1984 ed.).

II.A.4.b(5)(e)3, V.2.e(4).

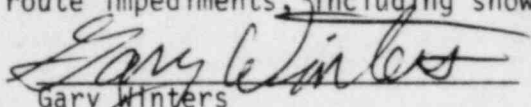
7. Sunflower's further argument that the Perry facility should be required to go to low power or no power operation during extreme conditions of inclement weather is also inconsistent with the snow removal capabilities within the three counties and the frequency of major snowstorms in this area. According to Miller & Weaver, Research Bulletin 1044: Snow in Ohio (Ohio Agricultural Research and Development Center, 1971), based on 29 years of data, the frequency of snow fall in excess of eight inches for the locations within the plume EPZ is 0.92 mean days per season (Painesville) and 0.85 mean days per season (Geneva). The frequency of snow fall in excess of twelve inches is 0.21 mean days per season (Painesville) and 0.20 mean days per season (Geneva). The frequency of snow falls in excess of 12 inches together with high winds is undoubtedly even less frequent.

8. Interviews with the County and State road departments indicate that with snowfalls of eight inches or less, the roads can be kept passable with existing resources. The road departments also indicated that under "worst case" weather conditions (i.e., 12 or more inches of snow in 12 hours with high winds), all evacuation routes could be kept open without resources from outside the three counties by marshalling the available resources within the counties in the EPZ area. This does not consider resources from outside the three counties

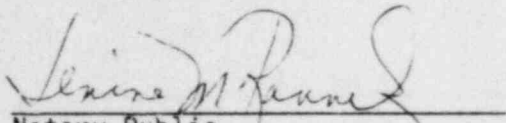
which would be available through the Ohio Department of Transportation.

9. This information demonstrates that even extreme conditions of inclement weather would not make evacuation impossible for any substantial periods of time. Although there have been instances (for example the "Blizzard of '78") when some roads in the area near the plant remained snowed in for a few days, in these few cases there was no attempt to marshal available resources to clear a particular area. Our review of the available resources and interviews with County and State road departments indicate that even in the "Blizzard of '78," all evacuation routes could have been kept open by focusing the available resources on these routes.

In summary, the offsite emergency plans for Perry reflect adequate consideration of potential evacuation route impediments, including snow.

  
Gary Winters

Subscribed and sworn to before  
me this 4th day of February, 1985.

  
Notary Public

My Commission Expires: **JENINE M. PANNELS, NOTARY PUBLIC  
HARRISBURG, DAUPHIN COUNTY  
MY COMMISSION EXPIRES DEC. 12, 1988  
Member, Pennsylvania Association of Notaries**



# ENERGY CONSULTANTS

Riverside Office Center 3 • 2101 N. Front St. • Harrisburg, PA 17110  
(717) 236-0031

Resume Current 01-11-85

## GARY A. WINTERS

### Education

1975 Bachelor of Science - Law Enforcement  
Pennsylvania State University  
University Park, Pennsylvania

### Experience

9-81 to Present Energy Consultants  
Harrisburg, Pennsylvania

Planner/Trainer, Emergency Management Services. Responsible for provision of direct consultant services to assist state and local governments and industry in emergency management planning, procedure preparation and program accreditation/licensing. Recent project assignment has included coordinating and performing a detailed audit of the offsite emergency preparedness program in support of the Perry Nuclear Power Plant Atomic Safety and Licensing Board hearings. Assignment as project coordinator involved responsibility for development of audit criteria; plan/procedure review; documentation of program weaknesses; and resource verification. Prior project assignments have included:

- Development of four county radiological emergency response plans in support of the Callaway Plant;
- Development of local emergency response agency implementing procedures in support of the Waterford 3 Steam Electric Station; and
- Revision of a county radiological emergency response plan in support of the Beaver Valley Power Station.



4-76 to 9-81

Dauphin County  
Harrisburg, Pennsylvania

Juvenile Court Probation Officer. Managed caseloads, investigated cases of delinquency, prepared legal documents, and testified in court hearings; coordinated the delivery of human services to delinquent youth among various public and private institutions. Advanced to Assistant Supervisor of Predispositional Services.

9-67 to 10-70

U.S. Army  
12th U.S. Army Security Agency Field Station  
Chitose, Japan

Non-Morse Intercept Operator for the U.S. Army Security Agency. Advanced to search operator, Specialist 5, quality controller, and shift leader. Received a "top secret" security clearance.

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(Perry Nuclear Power Plant, )  
Units 1 and 2) )

AFFIDAVIT OF  
GARY WINTERS  
ON CONTENTION H

County of Dauphin )  
 ) ss.  
Commonwealth of Pennsylvania )

GARY WINTERS, being duly sworn, deposes and says:

1. I am presently a Project Coordinator and Emergency Planning Specialist for the Emergency Management Services Department of Energy Consultants. My business address is 2101 North Front Street, Harrisburg, Pennsylvania 17110. My responsibilities include coordination of offsite resource inventory and assessment efforts involving Lake, Ashtabula and Geauga Counties with respect to the Perry Nuclear Power Plant. Project activities have included the interview of response agency/facility administrators for resource information, preparation of county resource documents and analysis of offsite resource capability to respond to an accident at the Perry Plant. A current statement of my professional qualifications and experience is attached hereto. I have

*D. W. Winters*  
*8502110055*

personal knowledge of the matters stated herein and believe them to be true and correct. I make this affidavit in support of Applicants' Motion For Summary Disposition of Contention H.

2. The purpose of this affidavit is to note the consistency of local emergency response plans with regulatory guidance on radiation exposure levels for emergency workers, and the availability of respirators for emergency workers.

I. Regulatory Guidance on Radiation Exposure Levels

3. All of the local emergency response plans establish radiation exposure limits for emergency workers that conform to EPA guidance.<sup>1/</sup> See Lake County Plan,<sup>2/</sup> Attachment K-3; Ashtabula County Plan,<sup>3/</sup> Appendix 32; Geauga County Plan,<sup>4/</sup> Appendix 34. In each case, the exposure limits for emergency workers are:

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<sup>1/</sup> EPA-520/1-75-001, Manual of Protective Action Guides and Protective Actions for Nuclear Incidents (September 1975, rev. June 1980) Tables 2.1 and 2.2.

<sup>2/</sup> Lake County Emergency Response Plan for the Perry Nuclear Power Plant, (Rev. 3, October 1984).

<sup>3/</sup> Ashtabula County Radiological Emergency Preparedness Plan (May 10, 1984).

<sup>4/</sup> Geauga County Radiological Emergency Response Plan (December 1983) (including Change No. 2 dated July 1984).

- a. For other than lifesaving missions:  
Projected Whole Body Gamma Dose - 25 rem  
Projected Thyroid Dose - 125 rem
- b. For lifesaving missions:  
Projected Whole Body Gamma Dose - 75 rem  
Projected Thyroid Dose - No limit

4. A decision chain for authorization of an emergency worker to exceed the exposure limits established in the local emergency plans is provided in each of the plans. Lake County Plan, § K-03; Ashtabula County Plan, § K.4; Geauga County Plan, § K-4. In each local plan, the decision chain provides that the emergency worker's department head will discuss the need with direction and control personnel of local emergency operations (i.e., the County Commissioners) who, in consultation with the Ohio Department of Health, will concur with, or disapprove, the increased exposure.

## II. Respirators

5. While NUREG-0654 Evaluation Criterion J.6.a expressly provides for the availability of "individual respiratory protection" for onsite emergency workers, there is no comparable NUREG-0654 criterion providing for respirators for offsite emergency workers.

6. In any event, respirators are available for use by emergency workers. The table below represents a partial inventory<sup>5/</sup> of self-contained breathing apparatus ("SCBA")

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<sup>5/</sup> The inventory of respiratory equipment did not include all fire departments within the three counties -- only those

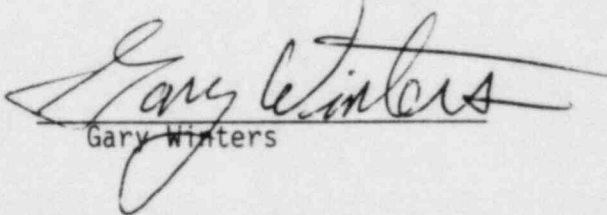
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available to the three counties through municipal fire departments in the counties.

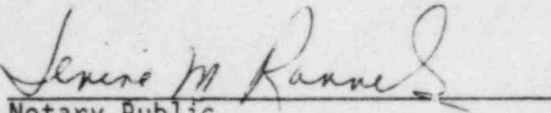
Self-Contained Breathing Apparatus  
Partial Listing: Fire Departments within the Three Counties

County	SCBA	Extra Tanks	Cascade Refill Systems	Compressors
Lake	353	345	17	3
Ashtabula	132	125	8	1
Geauga	165	186	8	1

7. In summary, the local emergency response plans establish radiation exposure limits for emergency workers in conformance with applicable regulatory guidance. Further, respirators are available for use by emergency workers.

  
Gary Winters

Subscribed and sworn to before me this 4th day of February, 1985.

  
Notary Public

My Commission expires

JENINE M. RANNELS, NOTARY PUBLIC  
HARRISBURG, DAUPHIN COUNTY  
MY COMMISSION EXPIRES DEC. 12, 1988  
Member, Pennsylvania Association of Notaries

(Continued)

serving municipalities with a response role specified in the county plans. Therefore, additional respiratory protection equipment (beyond that identified in the inventory) is locally available to the counties.



# ENERGY CONSULTANTS

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Resume Current 01-11-85

## GARY A. WINTERS

### Education

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### Experience

9-81 to Present Energy Consultants  
Harrisburg, Pennsylvania

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Dauphin County  
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9-67 to 10-70

U.S. Army  
12th U.S. Army Security Agency Field Station  
Chitose, Japan

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Units 1 and 2) )

AFFIDAVIT OF  
DANIEL D. HULBERT  
ON CONTENTION I

County of Lake )  
 ) ss  
State of Ohio )

Daniel D. Hulbert, being duly sworn, deposes and says:

1. I am presently Emergency Planning Coordinator, Perry Plant Technical Department, The Cleveland Electric Illuminating Company. My business address is 10 Center Road, Perry, Ohio 44081. In my position, I am responsible for developing, maintaining, and evaluating the Perry Nuclear Power Plant (PNPP) Emergency Plan, including coordinating emergency preparedness among various PNPP departments and developing emergency planning documents and specification of response requirements. These responsibilities include the plans and instructions governing protective action recommendations such as off-site evacuation. A current statement of my professional

~~DPE~~  
8502010163



and technical qualifications is attached hereto. I have personal knowledge of the matters stated herein and believe them to be true and correct. I make this affidavit in support of Applicants' Motion for Summary Disposition of Contention I.

2. Contention I is based on Sunflower's claim that Applicants' emergency plan does not contemplate evacuation beyond five miles of the plant. Sunflower also argues that "the State of Ohio and the three affected counties evidently have adopted these fallacious fundamentals lock, stock, and syndrome ...." Sunflower Alliance's Particularized Objections to Proposed Emergency Plans in Support of Issue No. 1, dated August 26, 1984, at 16.

3. The PNPP Emergency Plan has consistently had a plume exposure pathway EPZ of about ten miles, as called for by 10 C.F.R. § 50.47(c)(2). See PNPP Emergency Plan, Rev. 3 at § 2.3 and Figure 2-4. All off-site plans have adopted the same EPZ. Ashtabula Plan, App. 5; Geauga Plan, App. 2; Lake Plan, § 2, Figure 2-1; State Plan, Figures II-J-2 to -4, II-J-17.

4. Without any revision to the 10 mile planning basis in the PNPP Emergency Plan, The Cleveland Electric Illuminating Company in a letter dated March 10, 1982, suggested to the NRC that the NRC consider reevaluating the size of the 10 mile plume exposure pathway emergency planning zone. The NRC responded by letter dated April 13, 1982 that it believed that it was "premature to rethink the size of the emergency planning zone." Sunflower's claim that CEI is trying to unilaterally

change the concept of a 10 mile plume exposure pathway EPZ, Sunflower August 26, 1984 Objections, p. 15, is simply wrong.

5. Contrary to Sunflower's claim, the PNPP Emergency Plan does contemplate protective actions beyond five miles. The primary process for determining protective action recommendations, including recommendations for evacuation, is described in § 6.4.2 of the PNPP Emergency Plan, as further detailed in Emergency Plan Implementing Instructions. Projected doses are calculated based upon radiological release rate information and meteorological conditions. The projected doses are then compared to the U.S. Environmental Protection Agency's Protective Action Guideline values ("PAG's") to determine the appropriate protective action recommendations. Since these recommendations are determined from dose calculations, and the Protective Action Guidelines recommend evacuation when projected doses exceed guideline values, the methodology of § 6.4.2 obviously does not limit evacuation recommendations to 5 miles.

6. Sunflower's contention is based on an alternate procedure for recommending protective actions described in § 6.4.3 of the PNPP Emergency Plan. This procedure is based on an assessment of potential releases based primarily on the Primary Containment Radiation Monitoring system, with additional verification provided by core and containment status indications. These readings are compared with curves shown on Figure 4-1 of the PNPP Emergency Plan. Although the specific

protective action recommendations associated with the Figure 4-1 curves extend only to 5 miles (PNPP Emergency Plan, p. 6-11), the Plan explicitly states at that same page that

"assessment activities will continue to determine if additional protective actions should be recommended."

Also on the same page, the Emergency Plan states

"Recommended protective actions may be extended depending on meteorological conditions, population distribution, and condition of roads and major traffic ways."

In addition, all three County plans have been developed to implement protective actions throughout the entire plume exposure pathway EPZ, not just five miles. Ashtabula Plan, § J.2; Geauga Plan, § J-2; Lake County Plan, § J-04.

7. To avoid any possible confusion, Applicants have stated that Section 6.4.3 of the PNPP Emergency Plan will be amended in Revision 4 to add the following:

Additional Protective Action recommendations will be made for the entire EPZ as indicated by assessments performed in accordance with the [Emergency Plan Implementing Instructions]. Possible protective action recommendations made by PNPP may range from no action necessary, to the evacuation of the entire 10 mile Emergency Planning Zone. Recommended protective actions may be extended or modified depending on population distribution, meteorological conditions, and conditions of roads and major traffic ways, following discussions with County and State officials.

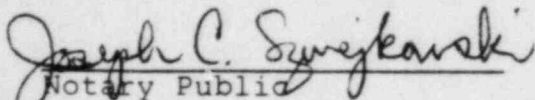
See letter from Murray Edelman, Vice President-Nuclear Group, CEI, to B.J. Youngblood, Division of Licensing, NRC, dated January 16, 1985 (emphasis added).

8. Sunflower incorrectly stated that its concern was shared by the NRC Staff as indicated by a January 11, 1984 letter to Applicants. Sunflower Alliance's Particularized Objections to Proposed Emergency Plans in Support of Issue No. 1, dated August 26, 1984, at page 14. None of the comments of the Staff in its January 11, 1984 letter had anything to do with the 5 mile evacuation issue raised by Contention I.

9. In summary, Applicants' emergency plan, as well as the emergency plans of Lake, Ashtabula and Geauga Counties and the State of Ohio contemplate evacuation beyond a 5 mile radius of the Perry plant.

  
DANIEL D. HULBERT

Subscribed and sworn  
to before me this 30<sup>th</sup> day  
of JANUARY, 1985.

  
Notary Public

JOSEPH C. SZWEJKOWSKI  
Notary Public, State of Ohio, Cuyahoga County  
My Commission Expires: ~~My Commission Expires July 14, 1986~~

UNITED STATES OF AMERICA  
NUCLEAR REGULATORY COMMISSION

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Units 1 and 2) )

AFFIDAVIT OF  
DANIEL D. HULBERT  
ON CONTENTION J

County of Lake )  
 ) ss  
State of Ohio )

Daniel D. Hulbert, being duly sworn, deposes and says:

1. I am presently Emergency Planning Coordinator, Perry Plant Technical Department, The Cleveland Electric Illuminating Company. My business address is 10 Center Road, Perry, Ohio 44081. In my position, I am responsible for developing, maintaining, and evaluating the Perry Nuclear Power Plant (PNPP) Emergency Plan, including coordinating emergency preparedness among various PNPP departments and developing emergency planning documents and specification of response requirements. These responsibilities include the development of Emergency Action Level ("EAL") indications. A current statement of my professional and technical qualifications is attached hereto. I have personal knowledge of the matters stated herein and believe them to be true and correct. I make

*D.H.*  
*8502010192*

this affidavit in support of Applicants' Motion for Summary Disposition of Contention J.

2. Contention J states that the Emergency Action Level indications in the Perry Emergency Plan are incomplete. The contention was based on Sunflower's reading of Table 4-1 of the Perry Emergency Plan, Rev. 3, in which according to Sunflower critical measurements or standards are left incomplete. Sunflower Alliance's Particularized Objections to Proposed Emergency Plans in Support of Issue No. 1, dated August 20, 1984, page 16.

3. Emergency Action Levels (EAL's) describe specific plant conditions at which one of the four Emergency Classifications (Unusual Event, Alert, Site Area Emergency, General Emergency) are to be declared. Table 4-1 of the Perry Emergency Plan, Rev. 3, sets forth more than 200 individual EAL indications.


4. Of the 200 individual EAL indications, only 13 were "incomplete" in Revision 3 of the Perry Emergency Plan. Table 4-1, EAL, §§ 1.3.1.e(1) and (2), II.1.a(1), III.11.a, b and c; IV.6.a(2), b. In each case, the value to be included later was not available at the time Revision 3 of the Plan was issued, because the value could only be determined after the detailed technical data became available.

5. In each of the 13 cases where a value was to be added later, a comparable value was specified. For example, Table 4.1, EAL § 1.3.a.1 states:


Off-gas pretreatment process radiation monitor high alarm with indication of (1) increase of (later) mrem/hr in 30 min. (equiv. to 100,000 uCi/sec).

6. In each of the 13 cases, the "missing" values have been developed based upon additional detailed information which became available after Revision 3 was issued and will be included in Revision 4 to the Perry Emergency Plan.

7. In summary, the few EAL's with "missing" values already have comparable values specified and the "missing" values will be included in the PNPP Emergency Plan prior to fuel load.

  
\_\_\_\_\_  
DANIEL D. HULBERT

Subscribed and sworn  
to before me this 30<sup>th</sup> day  
of JANUARY, 1985.

  
\_\_\_\_\_  
Notary Public

**JOSEPH C. SZWEJKOWSKI**

Notary Public, State of Ohio Cuya Cty

My Commission Expires: My Commission Expires July 14, 1986

Name: Daniel D. Hulbert, Emergency Planning Coordinator, Perry Plant  
Technical Department

Formal Education and Training:

Electrician's Mate School, U. S. Navy, 1973-1974  
Nuclear Power Training, U. S. Navy, 1974-1975  
Engineering Laboratory Technician School, U. S. Navy, 1975  
One-Week Basic BWR Systems (PDP), 1980  
Fifteen-Week Davis-Besse Nuclear Power Station (Emergency Planning), 1980  
Eight-Week Davis-Besse Nuclear Power Station (Evacuation Time Estimates),  
1981  
One-Week Electrical Fundamentals II, 1981  
One-Week Planning for Nuclear Emergencies Course, Harvard School of Public  
Health, 1982

Experience:

1979 - Present: The Cleveland Electric Illuminating Company

Joined CEI as an Engineering Technician and assigned to development of the PNPP Emergency Plan. Assisted in the preparation of the Davis-Besse Nuclear Power Station Emergency Plan, implementing procedures, and the Davis-Besse education time estimates. Participated in several Emergency Plan exercises at other Nuclear Power Plants as an official Exercise Observer. In 1982 promoted to present position of Emergency Planning Coordinator. Reports directly to the Technical Superintendent, Perry Plant Technical Department.

1973 - 1979: U. S. Navy

Electrician's Mate - Qualified as Engineering Laboratory Technician, Electrical Operator and Shutdown Reactor Operator on a S5W Class Submarine. Duties included operation and maintenance of electrical systems, chemistry controls for both primary and secondary plant, and routine and emergency health physics coverage. Assignments included one tour on an S5W Submarine and one tour assigned to the Radiological Controls Division of a Submarine Tender.



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Units 1 and 2) )

AFFIDAVIT OF  
RICHARD R. BOWERS  
ON CONTENTION M

County of Lake )  
 ) ss:  
State of Ohio )

Richard R. Bowers, having duly sworn, deposes and says:

1. I am presently Corporate Health Physicist, The Cleveland Electric Illuminating Company (CEI). My business address is 10 Center Road, Perry, Ohio 44081. In my position, I have technical overview responsibilities for both the operational health physics program and the engineering health physics program. In this position I provide consulting assistance to these two groups as well as perform reviews of their programs. A current statement of my professional and technical qualifications is attached hereto. I have personal knowledge of the matters stated herein and believe them to be true and correct. I make this affidavit in support of Applicants' Motion for Summary Disposition of Contention M.

~~Dated~~  
850 2050714

2. There is no regulatory requirement or guidance requiring fixed, independent off-site monitoring systems around a nuclear power plant. To assure that every possible accidental release would be monitored, a very large and complex system would be required. For Perry, approximately 103 fixed monitoring locations would be needed to be sure that the plume would be tracked. The cost for installation and operation of such a system would be substantial. Guidance from the Federal Emergency Management Agency indicates that fixed monitoring systems are not recommended. As stated in in FEMA-REP-2, Guidance on Off-Site Emergency Radiation Measurement Systems (September 1980), page 4-15:

"The Task Force considered the concept of making field measurements of the distribution of radionuclide concentrations in the plume with a system of fixed monitoring locations as a method of estimating the dispersal of the plume and for projecting exposure patterns. This concept was rejected because of the large number of sophisticated detectors and the telemetry necessary for such a system. At least 150 detector locations would be required out to a distance of approximately 8 miles from the site for good spatial distribution. Both radioiodine and direct gamma measurements would have to be made and telemetered to the EOC in order to get the necessary information for making a dose projection. The maintenance, repair and calibration of such systems would be very costly and hard to justify in view of the accident probability."

3. A more effective method for evaluating accidental releases is to use mobile survey teams. These teams can move to the area where meteorological conditions (both wind speed and

direction) indicate the plume is located, and make measurements to define the precise plume location and the radiation levels associated with it. The mobile survey teams can use instruments to measure the whole body dose directly, and can take special air samples to evaluate radioiodine concentrations. As the plume moves, the survey teams can follow it. Data from these actual field measurements are fed back into the dose projection models to make the projections more accurate.

4. In addition to the mobile survey teams used by CEI, the State of Ohio also fields mobile survey teams to monitor the actual conditions downwind. See Affidavit of Ronald W. Smith on Contention M. These State monitoring teams, and any monitoring personnel supplied by the Counties, provide an independent monitoring assessment. The reference in NUREG-0654, p. 58 which discusses assessment of radiological hazards, includes:

"This shall include activation, notification means, field team composition, transportation, communication, monitoring equipment and estimated deployment times,"

thus indicating the use of mobile monitoring teams to perform the assessment. FEMA-REP-2, page 4-17 also states:

"Portable instrumentation is expected to be the most cost-effective category of instrumentation for measuring exposure rate patterns from an airborne release from a nuclear incident. The plume from such a release may cover a large area and its shape may be continuously changing with the prevailing meteorology. Therefore, a

flexible system using a limited number of measuring devices is much more cost effective than the large number of fixed detectors with their associated telemetry required to obtain the same information."

5. The use of mobile monitoring teams provides the most effective, as well as efficient, method to track and measure offsite doses during an accidental release. A fixed radiation monitoring system is not logical from a technical viewpoint, and is not called for by any regulation or regulatory guidance.

6. In any event, there currently are two fixed independent radiation monitoring systems in place around Perry. In addition to the 25 thermoluminescent dosimeters (TLD) monitors placed and maintained by CEI throughout the plume exposure pathway Emergency Planning Zone (EPZ), the State of Ohio and the NRC have 27 and 25 TLD monitors respectively, arranged in rings within the plume exposure pathway EPZ, to measure the doses from accidents as well as any doses from normal plant operation, if any measurable doses are produced. Although these devices cannot give instantaneous indications, they would be valuable to measure the doses during an accident. They could be (and typically are) changed during an accident to evaluate doses during various stages of an accident.

7. In summary, there is no regulatory requirement or guidance for fixed, off-site independent radiation monitoring systems. Fixed systems would be much less desirable than the flexible, mobile systems available at Perry.

Richard R Bowers  
Richard R. Bowers

Subscribed and sworn before  
me this 31 day of January, 1985.

Bethany M Reese  
Notary Public

My Commission Expires:

BETHANY J. REESE  
Notary Public - STATE OF OHIO  
My Commission expires 3/11/88  
(Recorded in Lake County)

*Now known as  
Bethany M Reese*

Name: Richard R. Bowers, Corporate Health Physicist

Formal Education:

Bachelor of Science in chemistry, The Pennsylvania State University, 1955

Experience:

1984-Present: Cleveland Electric Illuminating Company

As Corporate Health Physicist, responsible for overview of operational, engineering, and environmental radiological control programs. Responsible to provide policy, criteria, standards, measurement methodologies, and evaluations for radiological and radiological environmental protection programs and practices.

1970-1984: NUS Corporation

As Manager of the Health Physics Services Department, responsible for management and technical direction/review of radiation protection consulting projects for utility clients. Projects included development of operational radiation protection programs, health physics procedures, radiological emergency plans, health physics training, and decommissioning programs as well as plant/system ALARA reviews, radiation protection equipment evaluations, and reviews of health physics programs.

1963-1970: Niagara Mohawk Power Corporation

As Health Physics and Chemistry Supervisor, responsible for setup and management of the radiation protection program at Nine Mile Point 1. Trained and supervised technicians, administered environmental monitoring program, developed radiological emergency plan, wrote health physics and chemistry procedures, and purchased and set up health physics/chemistry equipment.

As Radiological Engineer, assisted in the design of Nine Mile Point 1. Assisted with general plant layout and designed plant shielding. Designed health physics and chemistry facilities. Designed installation details of process and effluent monitors.

1955-1963: E. I. duPont de Nemours and Co.

As Health Physics Engineer at the Savannah River Plant, supervised technicians in separations plants, fuel fabrication facilities, and production reactors.

Professional Memberships:

Health Physics Society

Certification:

Comprehensive Health Physics-American Board of Health Physics-1963  
Power Reactor Health Physics-American Board of Health Physics-1980

UNITED STATES OF AMERICA  
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of )  
 )  
THE CLEVELAND ELECTRIC ) Docket Nos. 50-440  
ILLUMINATING COMPANY ) 50-441  
 )  
(Perry Nuclear Power Plant, )  
Units 1 and 2) )

AFFIDAVIT OF  
RONALD W. SMITH  
OF CONTENTION M

County of Lake )  
 ) ss:  
State of Ohio )

Ronald W. Smith, being duly sworn, deposes and says:

1. I am presently Government Affairs Representative, Community Relations Section, The Cleveland Electric Illuminating Company ("CEI"). My business address is 10 Center Road, Perry, Ohio 44081. In my position, my duties include assisting State and county governments with their emergency planning and preparedness and coordinating those efforts with each other and with CEI. Included in these efforts is the coordination of the State of Ohio's off-site radiological monitoring capability. A current statement of my professional and technical qualifications is attached hereto. I have personal knowledge of the matters stated herein and believe them to be true and correct. I make this affidavit in support of Applicants' Motion for Summary Disposition of Contention M.

2. Contention M states that Independent Radiation Data Monitoring Systems should be installed within the 10-mile

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Emergency Planning Zone (EPZ). Sunflower's argument is that each of the three counties within the plume exposure pathway EPZ should have fixed radiation monitors, meteorological equipment and telemetering equipment. Sunflower Alliance's Particularized Objections to Proposed Emergency Plans in Support of Issue No. 1, dated August 20, 1984, pages 17-18.

3. There is no regulatory requirement that each jurisdiction within the plume exposure pathway EPZ have independent radiation monitoring systems or that such systems be fixed. The NRC/FEMA guidance says that

Each organization, where appropriate, shall provide for off-site radiological monitoring equipment in the vicinity of the nuclear facility.

NUREG-0654, Criterion H.7 (p. 54) (emphasis added). This equipment need not be stationary; it can be portable.

NUREG-0654, Criterion I.7 states that

Each organization shall describe the capability and resources for field monitoring within the plume exposure pathway Emergency Planning Zone which are an intrinsic part of the concept of operations of the facility.

This criterion does not require that each organization have its own capability, but rather that each organization describe the monitoring capability on which it will rely.

4. In the case of the Perry facility, the State of Ohio has extensive independent radiological assessment capability, including off-site radiological monitoring equipment.<sup>1/</sup> The

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<sup>1/</sup> Each of the three plume exposure pathway EPZ counties relies on the State's field radiation monitoring

(Continued next page)



State's system consists of three key elements: (1) a centralized command and control facility in the State emergency operations center (EOC) in Columbus which includes a dedicated computer system for analysis and evaluation of radiological data and related dose rates for the key isotopes and for converting parameters for these isotopes (State Plan § II-Part I 2a(3) and 3g (3)); (2) three fully equipped field radiological monitoring teams capable of high, mid and low range gamma radiation readings, alpha and beta radiation detection, air sampling for radioiodine and particulates (State Plan, Figure II-H-1); environmental sampling (State Plan § II, Part H 5a), and aerial survey of a radioactive plume (State Plan § II, Part I 2d (2)); (3) a radio communication system for the immediate and simultaneous transmission of data from the field teams to the State EOC in Columbus, the PNPP emergency operations facility (EOF), the Lake County EOC, the Ashtabula County EOC, and the Geauga County EOC.

5. The three field monitoring teams take radiological readings and environmental samples such as water, soil, and

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(Continued)

capability to demonstrate compliance with NUREG-0654 Criterion I.7. Lake Plan, § I-02; Ashtabula Plan, § I.2; Geauga Plan, § I-2. FEMA has found, in its Interim Report, that each of the three plans has complied with this criterion.

vegetation at preselected monitoring points (State Plan, Figure II-J-36). By moving from point to point in areas where the plume is projected to be, the teams' measurements, when assembled at the State EOC, form a "picture" of a radiation plume. The preselected monitoring points are located systematically throughout the entire plume exposure pathway EPZ which allows for systematic monitoring in any area deemed appropriate. Also, monitoring teams conduct aerial surveys by flying over the areas of the projected path of the plume. In this way the teams' data is compiled to define the actual midpoint and boundaries of the plume as well as the intensity of radiation present.

6. Each monitoring team carries portable (hand-carried) and mobile (in-vehicle) radios which operate on the Disaster Service Agency Direction and Control frequencies (transmitting at 150.10 MHz and receiving at 150.70 MHz). Field data is relayed directly to the county EOCs and the EOC instantaneously through a repeater system in the communications van. Data is also relayed to the State EOC through the communications van. (State Plan, Figure II-E-9).

7. Each radiological monitoring team has the following equipment (State Plan, Figure II-H-1):

- CDV-715 Survey meter; range-05 R/hr to 500 R/hr  
(high and mid level gamma radiation  
measurement)

- CDV-700 Survey meter; range-0 mR/hr to 50 mR/hr  
(low level gross gamma radiation  
measurement and beta radiation detection)
- PRM-7 Scintillator detector; range-.005 mR/hr to  
5 mR/hr (very low level gamma radiation  
measurement)
- PRS-1P Base rate meter and scaler used with the  
following four probes:
  - SPA-3 Scintillator probe; range-0 to  
999,999 CPM (detects radioiodine  
and is used to monitor the silver  
zeolite cartridge used in air  
sampling)
  - HP-210 Geiger-Mueller Tube; range-0 to  
200 mR/hr (low level gross gamma  
radiation and beta radiation  
detector)
  - AC-3-7 Scintillator; range-0 to 999,999  
CPM (alpha radiation detector)
- RAS-1 Regulated Air Sampler with silver zeolite  
cartridges.

The equipment used by State radiological monitoring teams affords fully effective field monitoring for detection and measurement of any release from a nuclear power plant.

8. The State Radiological Response teams are sufficient in number, suitably equipped with radiological equipment, and have the communications capability to provide effective radiation plume tracking that is independent of the PNPP field radiation monitoring teams. The State teams are notified on declaration of an Unusual Event (the lowest level of emergency classification) and are activated and dispatched on declaration of an Alert. The State teams were fully exercised during the emergency exercise held on November 28, 1984.

9. Additionally, the Federal Government responds to nuclear power plant incidents with a full cadre of field monitoring teams. The Department of Energy (DOE), the Environmental Protection Agency, and the Nuclear Regulatory Commission each have field radiological monitoring capability that matches that described here for the State of Ohio. DOE coordinates field data (collected via radio transmission from the Federal Government response teams) at a central point called the Federal Radiological Monitoring and Assessment Center and in turn relays its consolidated information and recommendations to the State and county EOCs and the EOF.

10. The independent radiological monitoring capability of the State of Ohio is more than adequate to meet the requirements of Criterion H.7 of NUREG-0654. There is no reason why it is appropriate for the three plume exposure pathway EPZ counties to be required to have their own off-site radiological monitoring equipment.

11. Sunflower's August 20, 1984 objections also cite to page 58 of NUREG-0654 as a basis for contention. The only possible source on that page for Sunflower's reference is Criterion I.10 which states

Each organization, where appropriate, shall provide methods, equipment and expertise to make rapid assessments of the actual or potential magnitude and locations of any radiological hazards through liquid or gaseous release pathways.

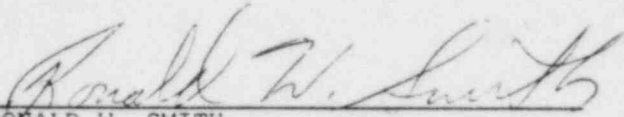
NUREG-0654, page 58 (emphasis added). With the capabilities described above, there is no reason why it is appropriate to require the three counties to have independent radiological monitoring systems.

12. Sunflower also suggests that a resolution by the trustees of Jefferson Township provides a basis for this contention. That resolution states the Township's resolution to

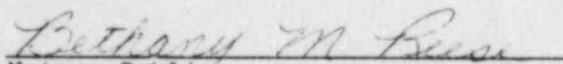
[R]equest and support the installation and maintenance of independent monitoring facilities and procedures at and around the Perry Nuclear Power facility.

Sunflower August 20, 1984 Objections, page 18. Jefferson Township, although located in Ashtabula County, is well outside the plume exposure pathway EPZ. And the radiation monitoring capabilities described above would meet the requirements of the Township's resolution.

13. In summary, there are independent radiation monitoring systems for the plume exposure pathway EPZ. These systems are capable of detecting and measuring the release from a nuclear power plant and meet all regulatory guidance.

  
RONALD W. SMITH

Subscribed and sworn before  
me this 30 day of January, 1985.

  
Notary Public

My Commission Expires:

BETHANY J. REESE  
Notary Public - STATE OF OHIO  
My Commission expires 3/11/88  
(Recorded in Lake County)

*you know as  
Bethany M. Reese*

RESUME

Name: Ronald W. Smith

Position: Government Affairs Representative, Community Relations Section  
Perry Nuclear Power Plant, Perry, Ohio 44081

EDUCATION: The Wharton School, University of Pennsylvania,  
Philadelphia, PA  
Master of Governmental Administration 1976

The Pennsylvania State University, University Park, PA  
Master of Science 1964

Indiana University of Pennsylvania, Indiana, PA  
Bachelor of Science 1963

EXPERIENCE:

April 1984 to present: Cleveland Electric Illuminating Company  
Perry Nuclear Power Plant

Head of the Emergency Planning Unit in the Community Relations Section. Provide consulting services and direct assistance to off-site emergency response agencies, especially state and county disaster services agencies. Duties include: facilitation of coordination of plans (on-site to off-site and among off-site plans) and development of plans and procedures that adhere to Federal Government regulations and guidance and will also work in practice; coordination of training efforts among state, county, utility, and consultant personnel who provide training to off-site agencies; liaison with Ohio Disaster Services Agency and FEMA on planning and preparedness matters, training efforts, and exercise arrangements; supervise company employed consultants who provide emergency planning and preparedness assistance to counties.

1980 to April 1984: Planner and Emergency Management Specialist with the Pennsylvania Emergency Management Agency, Harrisburg, PA

Developed a new state level plan for off-site emergency response to accidents at Three Mile Island Nuclear Station and other nuclear power plants in Pennsylvania. Wrote major portions of eleven county plans that surround nuclear power plants. Developed policies and procedures related to nuclear power plant accidents for the state,

risk counties, risk municipalities, and risk institutions. Organized, participated in, and evaluated several large scale exercises designed to test the effectiveness of the radiological emergency response plans and to train the hundreds of participants. Assisted numerous state agencies in developing disaster response plans. Initiated, developed and conducted training sessions related to response to nuclear power plant accidents for state employees, county and municipal emergency personnel.

1974 - 1980: Program Analyst with the Legislative Budget and Finance Committee, Harrisburg, PA

Researched and evaluated programs funded by the General Assembly. Gathered descriptive information with appropriate statistical data and organized and analyzed this information to ascertain strengths and weaknesses of administrative procedures as well as adherence to legislative intent. Wrote formal in-depth reports on such studies which included descriptive information and data, findings, and recommendations. Duties included follow through action to help implement the study recommendations.

1974 - Prior: Education specialist in the Staff Development and Improvement section of the Pennsylvania Bureau of Correction, Camp Hill Pa. Special Education teacher with Harrisburg City Schools and Dauphin County Schools, Harrisburg, Pa.

MILITARY: United States Army active duty 1964-1966 with 48th Medical Battalion, 2AD, Fort Hood, Texas  
Commander of a field hospital that provided emergency and short term medical care. Company and Battalion Chemical-Radiological-Biological Warfare Officer.



February 5, 1985

UNITED STATES OF AMERICA  
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of )  
 )  
THE CLEVELAND ELECTRIC ) Docket Nos. 50-440  
ILLUMINATING COMPANY ) 50-441  
 )  
(Perry Nuclear Power Plant, )  
Units 1 and 2) )

AFFIDAVIT OF  
ROGER E. LINNEMANN  
ON CONTENTION P

County of Philadelphia )  
 ) ss  
Commonwealth of Pennsylvania )

Roger E. Linnemann, being duly sworn, deposes and says:

1. I am Vice Chairman and Chief Medical Officer, Radiation Management Corporation ("RMC"), University City Science Center, Philadelphia, Pennsylvania. I am also Clinical Associate Professor of Radiology, University of Pennsylvania School of Medicine and Visiting Associate Professor of Clinical Radiology, Northwestern University Medical School. I am licensed to practice medicine and surgery in Pennsylvania, Illinois and Minnesota and am certified by the American Board of Radiology and the American Board of Nuclear Medicine. I have represented the Commonwealth of Pennsylvania in the

~~DONE~~ 8502110034

Medical Liaison Officer's Network, a national organization of physicians established by the U.S. Environmental Protection Agency and the Department of Defense to consult on radiation problems associated with federal installations. As Chief Medical Officer of RMC, I am responsible for the training which RMC has provided to hospitals in the area surrounding the Perry Nuclear Power Plant. I am also familiar with the capability of hospitals to treat injured individuals who are contaminated with radioactive materials, as well as individuals suffering from radiation exposure. A current statement of my professional qualifications is attached hereto. I have personal knowledge of the matters stated herein and believe them to be true and correct. I make this affidavit in support of Applicants Motion for Summary Disposition of Contention P.

2. Radiation injuries result from either exposure to radiation or contamination by radioactive materials. In the case of radiation exposure, the patient suffers injury from the energy deposited in the cells during the period of radiation, but the patient is not radioactive and presents no hazard to response personnel. Contamination results from loose radioactive particles adhering to the body. An exposure hazard remains until these particles are removed. Radioactive contamination is easy to detect and decontamination is easily accomplished by removing contaminated clothes and bathing the affected area.

3. Should a patient be exposed and injured, no special emergency facilities are needed. The patient can be handled as any other injured patient. If the patient is contaminated, procedures are implemented to reduce exposure and control the spread of any contamination. However, these procedures are not unique to radiation injury cases; similar steps are taken for chemical contamination or septic cases.

4. The characteristics of radiation injury make it one of the easiest medical emergencies to handle. Radiation injuries are seldom if ever immediately life-threatening. The consequences unfold over a period of time with predictable sequence. Therefore, treatment of any life-threatening traumatic injury or serious illness always takes precedence over treatment of the radiation injury. Once the patient is resuscitated and stabilized, he can be decontaminated and placed in a regular hospital bed. There is then time for assessment and treatment of the radiation injury. No special equipment is needed (such as lead-lined operating rooms, radiation resistant equipment, etc.) because of the nature of the radiation exposure and the conditions of treatment. Any contaminated materials would be disposed of following the same procedures used for nuclear medicine departments; no special equipment would be needed to handle this disposal.

5. Even in the extremely unlikely event of an accident at a nuclear plant with substantial off-site release of radiation, there would not be the need for any large number of

hospital beds for an injured population. Such an accident would not involve the generation of large numbers of traumatic casualties. The only way in which an off-site population can be affected is through overexposure to radiation.

6. The characteristics of a radiation release mitigate against the possibility that an individual would receive the level of exposure (about 150,000 millirem over a period of a few hours) which would require hospitalization. Distance, dispersion and absorption of radiation by other materials (by shelter, for example) make it unlikely that anyone off-site would receive a large enough exposure to initiate the first symptoms of radiation sickness (about 75,000 millirem), let alone hospitalization. Given the relative ease of decontamination (changing clothes and bathing), overexposure from contamination is also unlikely. To cause a redness to the skin from fission product radiation would require a total dose of about 800,000 millirem; one would literally have to leave caked radioactive dirt on the skin for hours to deliver these kinds of doses.

7. Based on these considerations, one could reasonably expect that the medical responsibilities of a major nuclear power plant accident would be the treatment of a few injured plant workers who were also contaminated or exposed, and a larger number of the public who might be slightly contaminated. These cases could readily be handled by present medical resources.

8. The emergency plans relating to the Perry Nuclear Power Plant identify Lake County Memorial Hospital East, Lake County Memorial Hospital West, Geauga Community Hospital and Ashtabula County Medical Center as the local hospitals designated to handle members of the general public who may have radiation uptake or exposure. Lake County Plan, § L-03; Ashtabula County Plan, § L.3; Geauga County Plan, § L-2. The Perry Emergency Plan (§ 5.3.3.2) designates Lake County Memorial Hospital East as the hospital to receive highly-contaminated-injured persons from on-site for initial treatment and decontamination. (If Lake County Memorial Hospital East were being evacuated due to an accident at Perry -- it is within the 10 mile EPZ -- these persons would be taken directly to Lake County Memorial Hospital West.) Definitive, long-term care for contaminated injuries and significant radiation overexposure is available through RMC's arrangements with Northwestern Memorial Hospital in Chicago, and the Hospital of the University of Pennsylvania, Philadelphia.

9. RMC has provided extensive training to personnel of both Lake County Memorial Hospitals (East and West), Ashtabula County Medical Center and Geauga Community Hospital. The training program has as its objectives to first insure that immediate emergency medical care is provided to an injured individual and, secondly, to perform appropriate decontamination and contamination control techniques. The topics of the training include the biological effects of

ionizing radiation, personnel protective actions, use of emergency room equipment and supplies for the contaminated patient, contamination control techniques, and decontamination and bioassay procedures. Eighty-five hospital personnel have been trained, including fifteen physicians, fifty-three nurses, eleven nuclear medicine and radiology personnel, and 6 emergency medical technicians.

10. In the event of multiple contaminated and injured personnel, the support hospitals would be able to handle the increased numbers. Since hospitals already have procedures to handle mass casualty situations (for example, a bus accident), these can easily be applied to handle multiple injured contaminated patients. Incoming patients would be triaged on the basis of their injuries, since traumatic injury always takes precedence over contamination. If additional treatment rooms are necessary, the designated Radiation Emergency Area can readily be expanded. However, multiple injuries would be very rare. In my fifteen years experience at twenty-five nuclear power plant sites, only two cases involved multiple injuries -- in each case involving two employees each.

11. In addition to these four hospitals, there are some fifty hospitals in the counties around the 10 mile EPZ which can receive and care for most radiological accident cases. These are listed in the State Plan, Fig. II-L-2. They should be capable of dealing with contaminated and exposed individuals, including those who have been otherwise injured.

Thirty-seven of these hospitals have diagnostic and/or therapeutic radioisotope facilities. This requires that they are able to handle contaminated and injured patients which could result from injuries within their own facilities.

12. The State has indicated that all of the hospitals listed in the State Plan are accredited by the Joint Commission on Accreditation of Hospitals. Standard V of the Commission's Accreditation Manual for Hospitals (1984) requires each hospital to have procedures for:

The emergency management of individuals who have actual or suspected exposure to radiation or who are radioactively contaminated. Such action may include radioactivity monitoring and measurement; designation and any required preparation of space for evaluation of the patient, including, as required, discontinuation of the air circulation system to prevent the spread of contamination; decontamination of the patient through an appropriate cleansing mechanism; and containment, labeling, and disposition of contaminated materials. The individual responsible for radiation safety should be notified.

Given the existing emergency room facilities of all the hospitals identified in the State plan and the radioisotope facilities in 37 of them, these facilities would be able to handle any conceivable patient load arising from an accident at the Perry facility. Because there are many hospitals available, and because the radiation health effects which might be observed are seldom if ever life threatening, the present plans and procedures are more than adequate to handle the medical consequences of an accident at the Perry plant.





ROGER E. LINNEMANN, M.D.

EDUCATION

University of Minnesota, Minneapolis, MN; B.A. (Cum Laude) 1952

University of Minnesota, Minneapolis, MN; B.S., M.D. 1956

Walter Reed Army Hospital, Washington, D.C.; Internship 1956-57

Walter Reed Army Hospital, Washington, D.C.; Residency 1962-65

Certified by American Board of Radiology 1964

Certified by American Board of Nuclear Medicine 1972

Licensed to practice medicine in (1) Commonwealth of Pennsylvania,  
(2) Illinois; and (3) Minnesota

Sandia Base, New Mexico; Nuclear Weapons Orientation Course 1961

Walter Reed Army Institute of Research, Washington, D.C.; Medical  
Aspects of Nuclear Warfare 1962

PROFESSIONAL EXPERIENCE

1981-present	Vice Chairman and Chief Medical Officer, Radiation Management Corporation
1969-1981	President/Chief Executive Officer, Radiation Management Corporation
1974-present	Clinical Associate Professor of Radiology, University of Pennsylvania School of Medicine
1977-present	Visiting Associate Professor, Clinical Radiology, Northwestern University Medical School
1969-1974	Assistant Professor, Clinical Radiology, University of Pennsylvania School of Medicine
1968-1969	Nuclear Medical Consultant, Philadelphia Electric Company
January-August 1968	Assistant Professor, Radiology, University of Minnesota School of Medicine (investigated use of isotopes in kidney function evaluation)
1957-1968	Employed by United States Army:

- 1965-1968 Commanding Officer, Nuclear Medicine Research Detachment, Europe; Radiological Health Consultant, US Army-Europe. (responsible for plans, procedures and training of military hospitals and personnel in the evaluation, evacuation and treatment of radiation casualties. In January 1966 sent to Palomaris, Spain for evaluation of medical and environmental aspects of the mid-air collision involving nuclear weapons)
- 1961-1962 Research Associate, Department of Radiobiology, Walter Reed Army Institute of Research, Washington, D.C. (investigated use of anti-radiation drugs in treatment of cancer)
- 1957-1961 General Medical Officer, Europe

PROFESSIONAL APPOINTMENTS

- 1982-present American Medical Association Counsel on Scientific Affairs Subcommittee on the Management of Radiation Accident Victims
- 1979-present Health Physics Society Standards Committee
- 1978-present General Dynamics Electric Boat Division Radiological Health Consultant
- 1973-present University of Pennsylvania Radiation Safety Committee
- 1970-present The American Nuclear Society Subcommittee for Writing Emergency Procedures Standards
- 1969 & 1975 Atomic Energy Commission ad hoc Committee on Medical Aspects of Radiation Accidents
- 1966-present American College of Radiology:
- 1969-present Commission on Radiologic Units, Standards of Protection
- 1969-present Committee on Radiation Exposure of Women
- 1969-present Committee on Radiological Aspects of Disaster Planning
- 1967-1978 International Affairs Committee
- 1965-1968 U.S. Delegate to NATO Radiation Protection Committee and Medical Aspects of Nuclear Warfare Committee
- 1971 present Department of Defense and Environmental Protection Agency Medical Liaison Officer's Network (MLON)-State of Pennsylvania Representative

## PROFESSIONAL MEMBERSHIPS

American College of Radiology  
American Public Health Association  
American Medical Association  
Society of Nuclear Medicine  
Philadelphia Roentgen Ray Society  
Pennsylvania Medical Society  
College of Physicians of Philadelphia  
Radiological Society of North America, Inc.  
American Institute of Physicists/American  
Association of Physicists in Medicine  
American College of Nuclear Physicians

## AWARDS AND HONORS

- 1978 Association of Medicine & Security, Madrid, Spain  
(Honorary Member)
- 1968 University of Minnesota Radiological Research Scholar  
(National Research Council)
- 1968 United States Army Legion of Merit

## PUBLICATIONS

- Linnemann, Roger E. "The Acute Radiation Syndrome and its Impact on the Chain of Evacuation". Medical Bulletin, U.S. Army Europe:22, No. 12 December 1965)
- Linnemann, Roger E. and Robert T. Wangemann. "Medical Support of Nuclear Weapons Accidents". Medical Bulletin, U.S. Army Europe (November 1967)
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- Linnemann, Roger E., Loken, Merle K. and Colin Markland. "Computerized Compartmental Renograms to Study Kidney Function" Journal of Urology:103, pp. 533-537 (May 1970)
- Linnemann, Roger E. and J.W. Thiessen. "Regional Approach to the Management of Radiation Accidents" Journal of the American Public Health Association:61 No. 6, pp. 1229-1235 (June 1971)

Linnemann, Roger E. and Robert H. Holmes. "Nuclear Accidents and Their Management" Emergency Medical Care, pp. 281-292, Spitzer, Stanley and Wilbur W. Oaks (eds.) New York: Brune and Stratton, Inc. (1971)

Linnemann, Roger E. "Medical Aspects of Power Generation" Impulse Massachusetts: Electrical Council of New England (June 1975)

Linnemann, Roger E. "Bugs in the Nuclear Fuel Cycle" Spectrum, p. 59, Gadi Kaplan (ed.) Piscataway, NJ: The Institute of Electrical and Electronic Engineers, Inc. (September 1975)

Linnemann, Roger E. and Fred A. Mettler, Jr. "Emergency Medical Assistance Programs for Nuclear Power Reactors" International Atomic Energy Agency Symposium on the Handling of Radiation Accidents, IAEA-SM-215/22, Vienna Austria (1977)

Linnemann, Roger E. "Why ALARA?" Transactions of 1979 American Nuclear Society Conference, Atlanta, GA (June 3-7, 1979), Vol. 32, TANS AO 32 1 83 ISSN 0003-018x (1979)

Linnemann, Roger E., Hackbarth, C.J. and Ray Crandall. "The Contaminated and Injured Patient" Proceedings of Twenty-Fourth Annual Meeting of the Health Physics Society, July 9-13, 1979 (Philadelphia, PA)

Linnemann, Roger E. "The Three Mile Island Incident in 1979: The Utility Resposne" The Medical Basis for Radiation Accident Preparedness, K.F. Hubn and S.A. Fry (eds), Elsevier/North-Holland, pp. 501-509 (1980)

Linnemann, Roger E. "Initial Management of Radiation Injuries" Journal of Radiation Protection, 5, No. 1, pp. 11-25 (December 1980)

Linnemann, Roger E. "Facilities for Handling the Contaminated Patient" Radiation Accident Preparedness: Medical and Managerial Aspects, Science-Thru-Media Company: New York 1980)

Linnemann, Roger E., Eugene Saenger, Gould A. Andrews and Niel Wald. "A Systems Approach to the Initial Management of Radiation Injuries" Systems Approach to Emergency Medical Care, Appleton-Century-Crofts: New York (1980)

Linnemann, Roger E., Stephen M. Kim and Frazier L. Bronson. "Three Mile Island: Medical and Public Health Aspects of a Radiation Accident" Journal of Radiation Protection, 6, No. 1, pp. 45-54 (October 1981)