

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION



BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of)
UNION ELECTRIC COMPANY) Docket No. STN 50-483 OL
(Callaway Plant, Unit 1))

AFFIDAVIT OF ROGER E. LINNEMANN, M.D.
ON REED CONTENTION 8 (RADIATION DETECTION EQUIPMENT)

City of Philadelphia)
Commonwealth of Pennsylvania) ss.

ROGER E. LINNEMANN, being duly sworn, deposes and says as follows:

1. I am a medical doctor with particular expertise in the area of radiological health. I am certified by the American Board of Radiology and the American Board of Nuclear Medicine. I am Clinical Associate Professor of Radiology at the University of Pennsylvania School of Medicine and a visiting Clinical Associate Professor of Radiology at Northwestern

University School of Medicine. I am also Vice Chairman of Radiation Management Corporation ("RMC"), a consulting firm which I established in 1968 to provide emergency medical expertise and support in the event of an accident involving injury to employees of nuclear power plants and to provide routine radiological health consulting on radiation health and safety to workers in nuclear facilities. Presently, RMC's Emergency Medical Assistance Program provides 24-hour emergency support to some 20 nuclear power plant sites throughout the country. Additionally, we have laboratory capability to measure radiation in the working environment of a nuclear power plant as well as in the outside environment. We did extensive analysis of the environment around Three Mile Island during the TMI-2 accident. This analysis included, among other things, Iodine concentrations in the food pathway chain. On behalf of Union Electric Company, RMC is currently developing a training program for medical personnel who might be called upon in the event of a radiological emergency at the Callaway Plant. This program involves the developing of the proper facilities, supplies, equipment and personnel at the Callaway Memorial Hospital to enable the hospital to provide emergency treatment and care of the radiation injury as well as the contaminated and injured patient. In addition, plant personnel will be trained in the first aid and rescue of radiation injuries, and the local ambulance support will be trained in the transportation of radiation injuries. This will be annual training

combined with an exercise to maintain proficiency at the Callaway Memorial Hospital in the event of a radiation injury occurring at the site. A summary of my professional qualifications and experience is attached hereto as Exhibit "A". I have personal knowledge of the matters stated herein and believe them to be true and correct. I make this affidavit in response to Reed Contention 8 (Radiation Detection Equipment) in this proceeding.

2. The purpose of this affidavit is to respond to the concern expressed by Mr. Reed in Contention 8 regarding the absence of an off-site facility in Missouri for evaluating personal exposures to radiation or biological uptake of radionuclides.

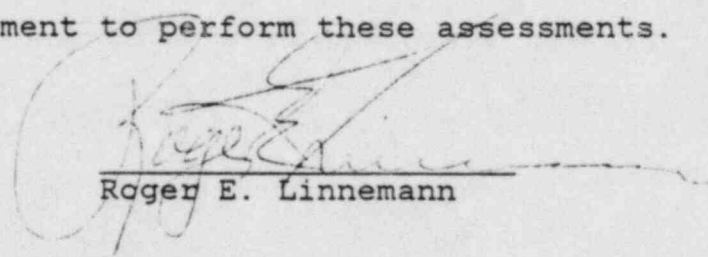
3. The evaluation of external exposure of the population (the public or emergency workers) in the event of a radiological emergency at the Callaway Plant resulting in releases of radiation will be accomplished in the following manner: An excellent estimation of the exposure can be obtained by the Union Electric Company environmental monitoring system that is in place prior to the accident. These estimates will be verified by State field monitoring teams as well as Union Electric Company teams. Using this information and the specific location of the individual, one can obtain a good estimate of external exposure. Laboratory analyses of blood can also be used to determine external exposures. Initially, these blood tests (complete blood count) can and will be

performed by any standard hospital laboratory. More specialized tests, for example chromosome analyses, could be done on a selective basis and under very unusual circumstances of high exposure. This test need not be done immediately, but can be performed in due time (days to weeks) by specialized laboratories to which the samples can be dispatched by mail. However, this would only be appropriate in the event of extremely high exposures, which are not anticipated and furthermore would be avoided because of the ability to take appropriate protective action, e.g., evacuation.

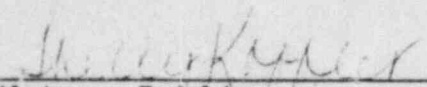
4. Potential internal contamination of the population would occur primarily through inhalation. Survey for this can be accomplished by the use of portable thyroid counters available from RMC to measure radioactive iodine in the thyroid gland at designated locations around the Callaway area if necessary. The primary method for determining the amount and location and types of radionuclides that may be internally incorporated is through whole body counting. It is not necessary, in my opinion, that the State of Missouri have a whole body counter. Portable whole body counters are available as close as Chicago, through RMC, and others can be obtained in Pennsylvania and California. These can be brought to the area of the Callaway Plant as necessary, in accordance with prior arrangements that Union Electric has made with RMC. It is not necessary that whole body counting be done immediately. It can be done in an organized fashion over the next few days or more

following the accident and the results can be back-extrapolated to the date of the accident. This was done very effectively at Three Mile Island. Analysis of excreta (urine, feces) is another method of analyzing the internal incorporation of radionuclides. However, with the radiation releases to be expected in a nuclear plant accident, whole body counting is the far superior method for evaluating internal incorporation of radionuclides. If necessary, however, excreta analyses can be performed on a selective basis.

5. In conclusion, the State of Missouri and local governments have available to them the necessary equipment, laboratory facilities and expertise to evaluate in a timely manner both external and internal radiation exposures to the population. There is therefore no need for any additional radiation detection equipment to perform these assessments.


Roger E. Linnemann

Subscribed and sworn to before me
this 2nd day of April, 1983.


Notary Public

My Commission expires My Commission Expires March 23, 1985
SHELLY KOFFLER
Notary Public, Phila., Phila. Co.

CURRICULUM VITAE

ROGER E. LINNEMANN, M.D.
Vice Chairman
Radiation Management Corporation

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Vice Chairman
Radiation Management Corporation
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Philadelphia, PA 19104
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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 1956-1957

Walter Reed Army Hospital, Washington, D.C.; RESIDENCY (Radiology) 1962-1965

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

US Department of Agriculture Graduate School (Evening), Washington, D.C.
Russian Language 1963-1965

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 Medicine Consultant, Philadelphia Electric Company

PROFESSIONAL EXPERIENCE (Continued)

Jan-Aug 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

Languages: German, Russian

PROFESSIONAL APPOINTMENTS

1982-present American Medical Association Council 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

1978-present Edison Electric Institute Utility Radiation Standards Group

1973-present University of Pennsylvania Radiation Safety Committee

1973-present The Atomic Industrial Forum, Inc. Public Affairs & Information
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 and Protection

1969-present Committee on Radiation Exposure of Women

1969-present Committee on Radiological Aspects of Disaster Planning

1967-1976 International Affairs Committee

1965-1968 U.S. Delegate to NATO Radiation Protection Committee & Medical
Aspects of Nuclear Warfare Committee

PROFESSIONAL APPOINTMENTS (Continued)

1971-present Department of Defense & 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
American Council on Germany
Union League of Philadelphia

AWARDS & 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

PRESENTATIONS

1980 Korea Women's Association (Seoul, Korea)
presented paper, "Energy: The Basis for Health in Developing
and Developed Countries", at International Symposium on the
Expulsion of Environmental Pollution

1980 Korean Association for Radiation Protection (Seoul, Korea)
presented seminar on emergency management of radiation injuries

1980 Ministry of Health (Madrid, Spain)
presented paper, "Definitive Treatment of Radiation Injuries",
at First Seminar on Assistance to Those Wounded by Radioactive
Elements and Ionizing Radiations

PRESENTATIONS (Continued)

- 1979 Reinisch-Westfalisches Elektrizitätswerk (Essen, Germany)
presented paper, "Energy: The Basis for Health in Developing
and Developed Countries", at The Seventh Energy Workshop
- 1978 The Swedish State Power Board (Vallingby, Sweden)
presented seminar, "Management and Treatment of Radiation
Injuries", and conducted radiation emergency medical
exercise at the Ringhals Nuclear Power Plant
- 1978 Deutsche Gesellschaft für Wiederaufarbeitung (Hannover, Germany)
appeared before the Prime Minister and Parliament of
Lower Saxony as an International expert to testify on the
safety of a reprocessing plant at Gorleben, Germany
- 1978 International Atomic Energy Agency (Vienna, Austria)
presentation at Symposium on Late Effects of Ionizing
Radiation
- 1978 Asociación de Medicina y Seguridad en el Trabajo de
Unesa para la Industria Eléctrica (Madrid, Spain)
presented one-day seminar entitled, "Primary Management
of Radiation Injury"
- 1977 International Atomic Energy Agency (Vienna, Austria)
presented paper, "Emergency Medical Assistance Programs
for Nuclear Power Reactors", at Symposium on Handling of
Radiation Accidents
- 1967 University of Freiburg Institute of Radiobiology (Freiburg,
Germany); presented seminar on diagnosis and treatment of
radiation injuries

PUBLICATIONS

1. Linnemann, Roger E. "Berlin: The Young-Old City". Senior Citizen (September 1961)
2. Linnemann, Roger E. "This Way to Berlin". The American Benedictine Review:14, No. 4 (December 1963)
3. 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)
4. Linnemann, Roger E. and Robert T. Wangemann. "Medical Support of Nuclear Weapons Accidents". Medical Bulletin, U.S. Army Europe (November 1967)
5. Linnemann, Roger E. and O. Messerschmidt. "Erholungsvorgaenge bei Grosstieren nach Ganzkoerperbestrahlung", :dem 6, Jahrbuch von der vereinigung Duetscher Strahlenschutzaeerzte (1968)
6. Linnemann, Roger E. "Command Radiation Guidance". Military Medicine: 33, pp. 771-716 (September 1968)
7. Loken, Merle K., Linnemann, Roger E. and George S. Kush. "Evaluation of Renal Function Using a Scintillation Camera and Computer". Radiology: 93, No. 1, pp. 85-94 (July 1969)
8. 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)
9. 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)
10. 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)
11. Linnemann, Roger E., Rasmussen, N.C. and F.K. Pittman. Nuclear Energy: Issues and Answers. Atomic Industrial Forum, Inc. in cooperation with Pennsylvania Power & Light Company (April 1973)
12. Linnemann, Roger E. "Accentuate the Positive". Trial: 10, No. 4, p. 13 (July/August 1974)
13. Linnemann, Roger E. "Accentuate the Positive". Congressional Record: 109, pp. 4964-4967. Washington, D.C." United States of America Proceedings and Debates of the 93rd Congress, Second Session (July 23, 1974)
14. Linnemann, Roger E. and J.W. Thiessen. Editorial, "In Defense of Radiation and Cells". The New York Times (May 23, 1974)

(Continued)

Roger E. Linnemann - Publications

15. Linnemann, Roger E. Nuclear Radiation and Health. Springville, NY Nuclear Fuel Services, Inc. (September 23, 1974)
16. Linnemann, Roger E. Editorial, "In Defense of Nuclear Power Plants", The Philadelphia Inquirer, p. 11A (March 6, 1975)
17. Linnemann, Roger E. "Nuclear Power Plants Pose Minimal Health Risks", Perspective. News Bureau of the University of Pennsylvania, Philadelphia, PA (February 1975)
18. Linnemann, Roger E. "Medical Aspects of Power Generation". Impulse. Massachusetts: Electrical Council of New England (June 1975)
19. 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)
20. 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)
21. Linnemann, Roger E. "Why ALARA?" Transactions of 1979 American Nuclear Society Conference, Atlanta, GA (June 3-7, 1979), Vol. 32, TANS AO 32 1 832 ISSN 0003-018x (1979)
22. 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)
23. Linnemann, Roger E. "The Three Mile Island Incident in 1979: The Utility Response". The Medical Basis for Radiation Accident Preparedness, K.F. Hubner and S.A. Fry (eds.), Elsevier/North-Holland, pp. 501-509 (1980)
24. Linnemann, Roger E. "Initial Management of Radiation Injuries". Journal of Radiation Protection, 5, No. 1, pp. 11-25 (December 1980)
25. Linnemann, Roger E. "Facilities for Handling the Contaminated Patient". Radiation Accident Preparedness: Medical and Managerial Aspects, Science-Thru-Media Company: New York (1980)
26. Linnemann, Roger E. "A Systems Approach to the Initial Management of Radiation Injuries". Systems Approach to Emergency Medical Care, Appleton-Century-Crofts: New York (1980)
27. 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. 45-52 (October 1981)

PROFESSIONAL TESTIMONY

in progress	Union Electric Company Emergency Planning/Licensing Hearings for Callaway Nuclear Power Plant
in progress	Long Island Lighting Company Emergency Planning Hearings for the Shoreham Nuclear Power Station
in progress	Texas Utilities Generating Company Emergency Planning Hearings for the Comanche Peak Steam Electric Station
in progress	Pennsylvania Power & Light Company Susquehanna Steam Electric Operating License Hearings
in progress	Florida Power & Light Company Turkey Point Steam Generator Repair Hearings
in progress	John Benek v. Pennsylvania Power Company <u>et al.</u> #199 of 1977 Eminent Domain
1981	Southern California Edison Company Emergency Planning Hearings for the San Onofre Nuclear Generating Station
1979	Gorleben Nuclear Fuels Reprocessing Plant Hearings before the Prime Minister and Parliament of Lower Saxony, Hanover, Germany
1979	Florida Power & Light Company Turkey Point Nuclear Station Operating License Hearings
1971	Long Island Lighting Company Shoreham Nuclear Power Station Operating License Hearings
1970	Baltimore Gas & Electric Company Calvert Cliffs Nuclear Power Plant Operating License Hearings
1970	Northeast Utilities Service Company Millstone Nuclear Power Station Operating License Hearings