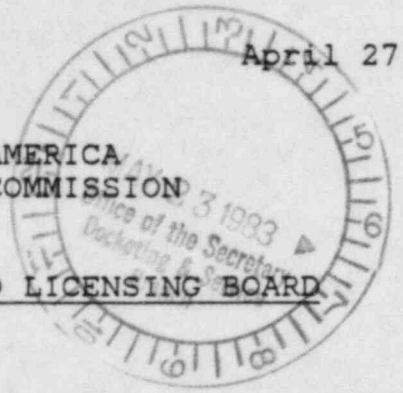
April 27, 1983



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 10 (MEDICAL TREATMENT)

City of Philadelphia	)	
	)	ss.
Commonwealth of Pennsylvania	)	

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 10 (Medical Treatment) in this proceeding.

2. The purpose of this affidavit is to establish that adequate facilities for the handling of contaminated and injured and exposed people from either an accident on-site and/or accident off-site exists in the area of the Callaway Plant, consistent with the requirements of 10 C.F.R. Section 50.47(B)(12).

STATEMENT OF THE ISSUE

3. Medical response resources would be required for basically two types of problems in the event of a radiological emergency at the Callaway Plant: (1) the contaminated and injured patient; and (2) the externally exposed person. Radiation injuries result from either exposure to radiation or contamination by radioactive materials. It is important to clearly understand the difference in order to develop realistic procedures for responding to radiation accidents.

4. In the case of radiation exposure, the radiation passes through the body as it does in medical x-rays. The patient suffers injury as a result of the energy deposited in the cells during the period of radiation, but the patient is not radioactive and presents no hazard to response personnel.

Once the body has been irradiated, a predictable clinical course ensues which is directly correlated with exposure dose and dose rate. This clinical course cannot be interrupted and will evolve over a period of days and weeks.

5. Contamination, on the other hand, results from loose radioactive particles adhering to the body. By definition, these particles emit radiation, and so exposure hazards remain until these particles are removed. Fortunately, radioactive contamination is easy to detect with instruments, and decontamination is easily accomplished through removal of clothes and bathing of the affected areas. Again, whatever exposure is suffered through contamination will follow a predictable clinical course based on the exposure level of the dose and the dose rate. This course cannot be interrupted and will evolve over a period of time.

6. It is most important for medical response personnel to be able to differentiate between the exposed and traumatically injured or the contaminated and injured patient. Should the patient be exposed and injured, no special emergency facilities are necessary. The patient that has been exposed to an external radiation source does not give off radiation, is not a radiation hazard to rescue or hospital personnel, and can be handled and treated as any other traumatically injured patient in a normal emergency room setting.

7. If, however, it is determined that the patient is injured and contaminated, procedures are modified to reduce

attendant exposure and to control any spread of contamination. These procedures are not unique to medical radiological response planning. They are philosophically the same as used in dealing with chemical contamination or septic cases.

8. Because of the characteristics of radiation injuries they are one of the easiest medical emergencies to handle. Radiation injuries are seldom if ever life-threatening. The consequences of exposure unfold over a period of time with predictable sequence. Therefore, treatment of the traumatic injury 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 time then for assessment and treatment of the radiation injury.

9. A "disaster" at a nuclear power plant differs significantly from the usual sense of disaster. Nuclear power plants do not blow up like atomic bombs. Therefore, unlike many disasters, there is no loss of facilities or communications, or generation of large numbers of traumatic casualties. From a medical and public health point of view this makes planning for and responding to nuclear facility accidents much easier.

10. Most importantly, I do not see a need for large numbers of hospital beds for an injured population. The only way in which an off-site population can be affected by an accident is through overexposure to radiation. This conclusion can best be understood by summarizing the basic principles that

come into play. A "Rem" is the unit to describe the biological effect of ionizing radiation. To measure smaller doses of radiation, dose equivalents are often expressed in millirems. One Rem equals 1,000 millirems. The measurements during an accident are usually expressed in terms of dose rates, that is, so many millirems per hour. Being exposed to a constant level of 30 millirems per hour, for example, would result in a total dose of 30 millirems after an hour's time.

11. The table below shows an acute dose-effect relationship for total body exposures from penetrating radiation delivered over a period of a few hours:

75,000 millirem - symptom threshold

150,000 millirem - hospitalization

600,000 millirem - fatality without treatment

To put these figures in perspective, the average dose from natural background radiation to the United States population is about 100 millirem per year. The average annual dose to the United States population from medical diagnostic activities is also about 100 millirems per year. A single chest x-ray exposes the patient to a dose of about 10 millirems. At Three Mile Island, the population within the radius of 50 miles received a cumulative average exposure over 10 days of 1.5 millirem.

12. The characteristics of a release of radiation from an accident and those of radiation itself mitigate against the possibility that anyone off-site would receive anywhere near a

dose of radiation resulting in symptoms of radiation sickness, much less a hospitalization dose. Radioactive atoms would be released in the form of an invisible plume. To a person at a specific location on the ground there are a number of factors working simultaneously that reduce both the dose and dose rate from exposure to this plume. During a release the medically significant exposure is due to the penetrating gamma radiation from the passing plume. This exposure, however, is limited to the time the plume is over a specific location (a function of meteorology). The exposure is further limited by the dispersion of the radioactive atoms (reducing the intensity) as the plume moves away from its source. Since radiation intensity falls off dramatically with distance, the exposure is limited by the height of the plume and the distance over which a ray must travel from its source in the nucleus of an atom to the ground. Finally, since radiation is absorbed by all materials, moving under cover will also reduce a person's exposure. For example, the first floor of an ordinary house can reduce the outside exposure by 50%.

13. Given a public education program and the disaster response program that is already in place in Missouri (which has demonstrated its ability to warn and move large numbers of people under more life-threatening conditions than radiation: floods, chlorine gas, fires, etc.), I see no reason for anyone off-site receiving a large enough exposure to initiate the first symptoms ~~of radiation sickness, much less~~ hospitalization.

14. In the event of an accident at Callaway involving the release of substantial radiation off-site, what I do see is the possibility that there would be large numbers of people who would be slightly contaminated and lightly exposed to radiation. To the extent monitoring of individuals for contamination is appropriate, it does not need to be and should not be done at hospitals. It can be done at the predetermined reception and care centers. The local emergency plans now call for monitoring to be done in this manner.

15. There should be no "skin burns" as a result of radioactive atoms depositing on a person's skin. The skin is one of the more resistant organs to radiation damage. To effect a redness ("sunburn") with fission product radiation requires a total dose of about 800,000 millirem to an area of the skin; to cause skin breakdown, about 1,500,000 millirem to an area of the skin. One would literally need to have visibly caked highly radioactive dirt on the skin for hours to deliver these kinds of doses. Consequently, simple instruction to remove outer clothing and shower within a reasonable time will suffice to prevent skin damage.

16. In lieu of observable signs and symptoms, the affected population needs to be identified and selective medical tests performed along with environmental dosimetry and demographic studies of the population and area within the exposure boundaries to determine the actual exposure. This need not be done immediately, but can be performed in an unhurried, organized manner in the days following the accident.

17. In the case of serious exposure levels, medical testing that should be considered includes: history and physical examination, complete blood counts, thyroid uptake studies, chromosome analysis of the circulating lymphocytes, whole body counts and bioassay as required. Depending on the suspected dose and the nature of the exposure, these tests could be done on a selective basis.

ON-SITE RADIATION INJURIES

18. All nuclear reactors including the Callaway Plant must develop adequate emergency programs prior to actual operation. This medical emergency program must demonstrate three basic levels of care: adequate rescue and first aid at plant site; emergency treatment at a nearby hospital; and definitive evaluation and treatment at a large medical center equipped to do so. This system must be capable of handling the contaminated injured and/or seriously ill patient which might occur as a result of an accident on-site. This type of patient suffers the only kind of radiation injuries that require special procedures and facilities for handling at the plant, in the course of transportation by ambulance groups, and handling in the emergency room at the hospital. The Callaway Plant is in the process of becoming part of a national emergency medical assistance program which was developed by Radiation Management Corporation in 1968. The RMC system is being tailored to the needs of the Callaway Plant. In this system the procedures,

facilities, equipment and supplies for first aid and rescue at the Callaway Plant are being developed. In addition, training and exercises will be provided annually to maintain efficiency. The local ambulance group, Callaway County Ambulance District will be trained, equipped, and have procedures for transporting contaminated and injured patients to the Callaway Memorial Hospital. The system also includes a selection of a special area at the hospital for the reception of the contaminated and injured patient so that the traumatic injury or serious illness can be attended to while the contamination is controlled to this one part of the hospital. The procedures for training and annual exercises will be reviewed and conducted to maintain this proficiency at the Callaway Memorial Hospital. Finally, RMC will back up this support at both the plant and the Callaway Memorial Hospital with 24 hour medical and health physics expertise to consult on any type of radiation injury that may occur at the Callaway Plant. This expertise consists of radiation medical physicians, certified health physics technicians and special instrumentation which can be transported immediately upon notification to the Callaway Plant or the Callaway Memorial Hospital. In addition, RMC maintains laboratory support for evaluation of a patient's exposures. If necessary, and in due time, the patient can be transported to Northwestern Memorial Hospital in Chicago, and/or the Hospital of the University of Pennsylvania in Philadelphia for definitive evaluation and treatment. RMC's support system has been

in operation for some 20 nuclear power sites throughout the country for the past 14 years and has demonstrated its ability to function adequately for problems that have existed. RMC has the largest experience in the country (if not in the world) in handling radiation problems at nuclear power plant sites. Our experience shows that in the fifteen years of operating the emergency medical assistance program at each site about one contaminated/injured or ill patient is transported to a hospital such as Callaway Memorial Hospital once approximately every 5 to 10 years. An outline for the Callaway Memorial Hospital training program is attached as Exhibit "B" and will be conducted upon completion of the facility requirements for handling the contaminated and injured patient. The hospital staff will be trained annually as well as exercised in conjunction with the plant and the support ambulance group.

19. Semi-annually the equipment at the hospital, ambulance and the plant will be audited to insure its readiness in the event of a radiation injury. In addition, appropriate staff of the hospital will be invited periodically to the annual program conducted by RMC in association with Northwestern University Medical School in Chicago or the University of Pennsylvania School of Medicine of Philadelphia. This seminar is a one or two day seminar for physicians and nurses and is designed to maintain proficiency in the emergency evaluation and treatment of radiation injuries. The definitive care centers at both Northwestern Memorial Hospital in Chicago

and the Hospital of the University of Pennsylvania in Philadelphia are also trained and exercised annually to insure that their state of readiness for emergency response and definitive evaluation and care is maintained. It is my opinion that one hospital prepared as described, such as the Callaway Memorial Hospital, would be adequate to handle the radiation injuries expected from the Callaway Plant. The hospital is approximately 10 miles from the plant and it is highly unlikely that its operations would be disrupted from any accident that may occur at the plant.

HOSPITAL CARE FOR OFF-SITE PERSONNEL

20. As described above, the most likely accident from any nuclear power plant site is that a large number of people may be slightly contaminated and slightly exposed as a result of an accident at a nuclear power plant. As indicated above, it is highly unlikely that this external exposure would be severe enough to initiate acute symptoms in patients (nausea and vomiting). These doses are highly unlikely in an off-site release of radiation and especially could not occur if the population has been informed about radiation and shelter and shielding from radiation. In the event that some members of the population do receive high doses of radiation, the medical problem would be such that it would not overwhelm resources normally present in the counties surrounding the nuclear power plant. At most, these patients would suffer from nausea and

vomiting which can be treated on an outpatient basis. These symptoms would relent within 24 to 48 hours and the patients would not require hospitalization. If the exposure turns out to be severe enough to require hospitalization, this can be done in two to three weeks at centers that are equipped for treating temporary bone-marrow depression. Most large medical centers are equipped to do this. The few people requiring this treatment could be treated at University Medical Center, Columbia, Missouri, Northwestern University in Chicago, the Hospital of the University of Pennsylvania in Philadelphia, and other major medical centers. Arrangements for this type of treatment could be made in a timely manner without jeopardizing the patient's health and could be done on an ad-hoc basis after an accident has occurred. There is no need, in my opinion, to set up any special arrangements with centers to treat these types of patients.

21. As indicated above, the population will have their exposure evaluated over the course of the subsequent few days or weeks. Medical tests are available which can be done by the hospitals in the area or sent to special laboratories such as Northwestern University in Chicago and the University of Pennsylvania in Philadelphia. The population would be adequately evaluated within a few days and definitive care can be arranged within an appropriate time period.

22. Because nuclear power plants do not explode like atomic bombs we should not expect to see off-site traumatic

injuries from blasts or burns as a result of an accident from a nuclear power plant. It is theoretically possible that normal traumatic injuries can occur as the result of an accident at a nuclear power plant (for example, an automobile accident on a highway or the normal routine traumatic injuries that may occur in a community). Though this accident may be complicated by contamination it is likely that the contamination would be a nuisance problem and not a major medical problem. The handling of this accident would be in the normal routine manner used to handle any traumatic accident in the community and the patient would be taken to the nearest hospital. It is unlikely that you would have a number of traumatic accidents occur at the same time as an accident at a nuclear power plant site.

23. In summary, I am of the opinion that Callaway Memorial Hospital could adequately handle any off-site contaminated and injured patients that may result from the course of an accident at a nuclear power plant site. Furthermore, other hospitals in the area (St. Mary's Health Center, Boone County Hospital, and the University of Missouri Medical Center) will also be able to respond to a contaminated and injured patient. This is a requirement of the Joint Committee of Hospital Accreditation for all hospitals in the country. In addition, these hospitals will have an opportunity for additional training for response to the radiation accident victim through participation in Union Electric's Off-Site Training Program. In conclusion, there is adequate off-site support for

anticipated medical problems arising as a result of an accident at the Callaway Plant.

AMBULANCE SUPPORT

24. In the event of an off-site release of radiation all emergency services will operate in the counties surrounding Callaway Plant. Their primary duty will be to respond to normal requests (such as fire department for fire, police for accidents and ambulances for emergency medical services). The Callaway County Ambulance District will be adequately trained to handle contaminated and injured patients that would occur at the site. As indicated above, they will be trained and exercised annually. This training will also suffice for them to handle any type of contaminated and associated accidents that would occur off-site during the course of a major accident at the Callaway Nuclear Power Plant. Their priority of treatment in this case would be for the traumatic injury and the contamination would be ignored. As in the normal course of operations, they would take the patients to the closest hospital adequate for the treatment of traumatic injury. In most cases, this would be Callaway Memorial Hospital. However, all hospitals must have plans for handling contaminated and injured patients in accordance with the Joint Committee for Accreditation. In addition to the Callaway County Ambulance District, the off-site training program provides training for all ambulance services that potentially will be required to

respond to radiological emergencies as a result of an accident at the Callaway Plant.

25. In conclusion, upon completion of the planned training program, the Callaway Memorial Hospital will provide adequate local medical resources available for handling all types of radiation injury including the contaminated and injured patient in the event of a radiological emergency at the Callaway Plant. This hospital capability will be supported by expertise that is readily available on a 24-hour basis to assist in the evaluation of the radiation status of the patient and to assist in the transportation of the contaminated patient to a definitive care center where complete evaluation and treatment of patients will occur.

Roger E. Linnemann

Subscribed and sworn to before me
this 29th day of April, 1983

Notary Public

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

My Commission Expires _____.

EXHIBIT A

CURRICULUM VITAE

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

ROGER E. LINNEMANN, M.D.
Vice Chairman
Radiation Management Corporation
3508 Market Street
University City Science Center
Philadelphia, PA 19104
(215)243-2950

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
1967-1978	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 Elekrizitatswerk (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 Ringhauls Nuclear Power Plant

1978 Deutsche Gesellschaft fur 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 Associacion de Medicina y Seguridad en el Trabajo de Unesa para la Industria Electrica (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 Strahlenschutzaerzte (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)

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 et al. #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

THE HANDLING OF A RADIOACTIVELY CONTAMINATED AND INJURED PERSON AT A NUCLEAR POWER FACILITY

HOSPITAL PERSONNEL

PROGRAM OF INSTRUCTION

Topic	Time	Objective
INTRODUCTION	30 minutes	To explain the need for special procedures when dealing with the contaminated and injured patient and to present an overview of the lecture.
DETECTION, PROTECTION, AND INSTRUMENTATION	30 minutes	To familiarize the audience with radiation instruments and provide personal protective actions which can be used to minimize radiation exposure.
HOSPITAL FACILITIES	60 minutes **	To define the specific facilities and equipment required to handle and treat the contaminated and injured patient(s).
HANDLING AND TREATING THE INJURED AND CONTAMINATED PATIENT	30 minutes	To present the specific procedures for dealing with the injured and contaminated patient, including decontamination and sample taking.
DEMONSTRATION: USE OF SPECIAL EQUIPMENT AND PROCEDURES	60 minutes ***	To provide an opportunity for attendees to become familiar with the techniques and equipment used for patient care while minimizing attendant exposure and controlling contamination.

NOTE: ** 15 minute break after Hospital Facilities
*** Health Physics Technicians from Callaway should participate in this portion of the presentation
Total presentation time is 3 hours, 45 minutes

THE HANDLING OF A RADIOACTIVELY CONTAMINATED AND INJURED PERSON AT A NUCLEAR POWER FACILITY

HOSPITAL PERSONNEL

LECTURE OUTLINE

INTRODUCTION

- Introduction of self and firm
- Need for Radiation Emergency Area
- Overview of Lecture

DETECTION, PROTECTION AND INSTRUMENTATION

- Introduction to survey instrumentation
- Contamination vs Exposures
- Personal Protective Actions
  - time
  - distance
  - shielding

HOSPITAL FACILITIES

- Floor plan requirements
- Special supplies
- REA set-up
- Considerations for use

HANDLINC AND TREATING THE INJURED AND CONTAMINATED PATIENT(S)

- Administrative Procedures
- Role of the health physicist
- Patient care
- Contamination control techniques
- Sample taking
- Decontamination procedures
- Moving the patient

DEMONSTRATION: USE OF SPECIAL EQUIPMENT AND PROCEDURES

- Contents and use of sample taking kit
- Contents and use of decontamination supplies
- Donning protective attire
- Contamination control techniques
- Decontamination techniques
- Interaction with plant health physicist
- Patient transfer procedures
- Attendant exit procedures