12/11/82

UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of	)	
	)	
DETROIT EDISON COMPANY	)	Docket No. 50-341
	)	
(Enrico Fermi Atomic Power Plant, Unit 2)	)	

AFFIDAVIT OF GERALD R. DAVIDSON
REGARDING CONTENTION 5

STATE OF ILLINOIS)
COUNTY OF COOK)

GERALD R. DAVIDSON, being duly sworn, says:

1. I am employed by Sargent & Lundy, 55 East Monroe Street, Chicago, Illinois 60603. Sargent & Lundy is an architect-engineering firm which designs nuclear power plants. I work in the Shielding and Radiological Safety Section of the Nuclear Safeguards and Licensing Division. My professional qualifications are attached to this affidavit.

2. I specialize in the area of radiation monitoring instrumentation for normal and accident conditions. Also, I recently served as cochairman of an industry-wide task force which evaluated the use of continuous, remotely readable environs radiation monitors for postaccident assessment.

3. Contention 5 states:

> The design of the radiation monitoring system is insufficient and incomplete as specified below to adequately monitor radiation releases (a) to demon-

strate, during normal operation, conformance with Part 20 and Appendix I to 10 CFR Part 50 and (b) to implement the offsite protective actions following accidents set forth in the Applicant's emergency plan. The deficiencies of the radiation monitoring system are:

(a) There is no continuous monitoring system on the lake (for air and water) that can be read remotely; and (b) there is no continuous monitoring system at the site boundary that can be read remotely.

4. The purpose of my affidavit is to address those aspects of Contention 5 related to implementing offsite protective actions following accidents.

5. Guidelines for implementing offsite protective actions are stated in Tables J-2 and J-3 of the Fermi-2 Radiological Emergency Response Plan. The design of the Fermi-2 radiation monitoring system includes provisions which enable determination of the radiological parameters needed to apply these guidelines.

6. For gaseous plume exposure, the guidelines are based on dose rates at the site boundary and on projected offsite doses. To determine these parameters, the station has continuous radiation monitors at gaseous effluent release points. The monitor readings determine source terms (radioactivity release rates). This source information is combined in a conservative way with meteorological data to calculate the dose rates and doses required by the guidelines.

7. For ingestion pathways, the guidelines are based on ground contamination levels and on radioactivity concentrations in food and water. Continuous radiation monitors at liquid

effluent release points provide data from which radioactivity concentrations in water can be estimated. In addition, continuous water samplers are provided for the Fermi-2 potable water intake and for the city of Monroe water intake. Laboratory facilities and portable equipment for radiological emergency field teams are also provided. These enable determination of the other needed radiological parameters. The use of samplers and field teams rather than continuously readable monitors for these purposes is acceptable since exposures by the ingestion pathway will be delayed by considerable times (many hours to many days).

8. In my opinion the design of the Fermi-2 radiation monitoring system includes adequate provisions to enable determination of the radiological parameters needed to apply the guidelines for implementing offsite protective actions.

9. The Intervenor contends that the design is deficient in that continuous, remotely readable environs radiation monitors are not provided. Therefore, I have examined the question of whether such monitors would provide a significant additional benefit with regard to implementing offsite protective actions.

10. Continuous, remotely readable environs monitors can provide an alternative to effluent monitors for assessing offsite radiation and radioactivity. Instead of measuring the radioactivity release rate and its dispersion parameters (such as wind direction and speed), one can measure the actual pattern of dispersed radioactivity. However, this

approach has three significant deficiencies:

(a) In general, projection of the dose rate at a distant location will require a measured, calculated, or assumed radioactivity release rate. However, many field measurements are needed to provide the release rate information that can be obtained by one source measurement. Determining the release rate by direct measurement at a release point is easier and quicker than inferring the rate from the radiation pattern produced in the field.

(b) The information provided about releases by field measurements is delayed. This is because of the time it takes for radioactivity to travel from an effluent point to a field point.

(c) A radiation monitor in the field provides a far less sensitive means of detecting a release than a monitor at the release point.

11. Furthermore, there are no major advantages to field measurements with regard to projection of dose rates at distant locations. Such projections are likely to be no more accurate than projections based on measurements at effluent points. This is because of the uncertainties typical of dispersion parameters and because local fluctuations in dispersion can perturb measurements at any particular field location.

12. Others have recognized the deficiencies of continuous, remotely readable environs radiation monitors for post-

accident assessment of airborne radioactivity releases. One such group is the Federal Interagency Task Force on Offsite Emergency Instrumentation for Nuclear Incidents. Its conclusions are published in the report "Guidance on Offsite Emergency Radiation Measurement Systems, Phase 1 - Airborne Release" (FEMA-REP-2, September 1980).

13. FEMA-REP-2 identifies two potential applications. One is initial detection of an airborne release. With regard to this application, the report concludes:

> The use of offsite monitors for the purpose of initial detection of an airborne release in not recommended.

The following reasons are cited:

> Such a system would not give early warning of a release .... Measurement of a release could be achieved more rapidly and more accurately by facility sampling.

14. The second potential application examined in FEMA-REP-2 is plume exposure rate verification. With regard to this application, the report states:

> 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 .... The maintenance, repair and calibration of such systems would be very costly and hard to justify in view of the accident probability.

15. An industry-wide task force established by the National Environmental Studies Project of the Atomic Industrial Forum has also reviewed the use of continuous, remotely readable monitors for postaccident assessment of airborne releases. Results of the review are contained in

the report "Evaluation of an Environs Exposure Rate Monitoring System for Postaccident Assessment" (AIF/NESP-023, in press), which was prepared for the task force by the Nuclear Environmental Services Division of Science Applications, Inc. (SAI).

16. The SAI report examines the feasibility of using data from an environs monitoring system to project dose rates at other locations. It concludes:

> Making accurate projections would be extremely difficult and in some cases impossible because it would require accurately knowing:
>
> a. either plume centerline dose rate or location of the plume centerline relative to the detectors;
>
> b. effective heights of all releases (monitored and unmonitored);
>
> c. energy compositions of releases;
>
> d. shine contributions to detector dose rates due to contained sources (e.g., airborne activity on BWR refueling floor);
>
> e. meteorological stability class;
>
> f. local meteorological phenomena (e.g., looping, fumigation).

17. The SAI report examines how a system of this type would have performed had it been installed around Three Mile Island-2 during the March 1979 accident there. The report finds that meteorological fluctuations would have caused large fluctuation in readings of the fixed detectors. These fluctuations could cause confusion in following the course of the accident:

> Peak readings of a 16-detector system would change a factor of 10 or more without any significant change in release rate. This would complicate the problems of following accident trends ....

18. I have reviewed the above reports and agree with the conclusions cited here.

19. The difficulties that I have discussed with regard to assessment of airborne releases would apply whether the detectors were located on land or water. There would be additional problems with detectors installed on Lake Erie. Storms and ice floes could damage the detectors and considerably complicate their installation, calibration, maintenance and repair. Data from detectors on Lake Erie would be much less reliable and confirmation of such data much more difficult.

20. Problems similar to those discussed in paragraphs 10, 11, 13, 14, 16, 17, and 19 would apply to assessment of water contamination by water radioactivity detectors installed in Lake Erie.

21. In summary, I consider the present design of the Fermi-2 radiation monitoring system adequate to enable determination of the radiological parameters needed to apply the guidelines for implementing offsite protective actions following accidents. The ability to determine these parameters

would not be significantly enhanced by installation of the continuous, remotely reading monitors cited by the Intervenor.

Gerald R. Davidson

Gerald R. Davidson

Subscribed and sworn to before me
this day of , 1981.

Notary Public

My Commission expires:

PROFESSIONAL QUALIFICATIONS

GERALD R. DAVIDSON

RADIOLOGICAL SAFETY AND SHIELDING SECTION

NUCLEAR SAFEGUARDS AND LICENSING DIVISION

SARGENT & LUNDY

CHICAGO, ILLINOIS

I joined Sargent & Lundy in 1978. I am presently a Shielding Project Engineer responsible for the design of nuclear power plant radiation monitoring systems. I perform design calculations relating instrument readings to offsite radiation doses. I also prepare technical specifications, develop design concepts and evaluate commercially available instrumentation.

Much of my recent effort has involved determining the requirements imposed on radiation monitoring systems by potential accident scenarios. I have calculated instrument parameters required for implementation of a nuclear power station emergency plan. I was responsible for a comprehensive evaluation of the post-accident suitability of radiation monitoring systems at two operating nuclear stations. I developed technical specifications for in-containment postaccident radiation monitors, for a postaccident coolant and atmosphere sampling system, and for stack effluent monitors for normal and accident use. I co-authored a report for the Nuclear Safety Analysis Center (NSAC) entitled "Designing for Postaccident Radiological Conditions." I was an invited speaker at the NSAC Workshop on In-Containment Postaccident Radiation Assessment held in September, 1981. There I delivered a paper on accident classification techniques for boiling water reactors.

I have been active in the area of environs radiation monitoring around nuclear power plants. I am cochairman of the Atomic Industrial Forum/National Environmental Statement Project Task Force on Environs Radiation Monitoring. I am a member of the Atomic Industrial Forum Working Group on Environs Radiation Monitoring Instrumentation. I provided assistance to a Sargent & Lundy client in evaluating the role of continuously readable environs radiation monitors and in assessing commercially available instrumentation. In addition, prior to joining Sargent & Lundy, I worked from 1976 to 1978 in the Nuclear Sciences Section of Nalco Environmental Sciences, Northbrook, Illinois. There I supervised laboratory operations and prepared reports assessing the radiological environmental impact of operating nuclear stations.

My background includes a B.A. in physics in 1962 from Harvard University, Cambridge, Massachusetts. I received an M.S. in physics in 1964 and a Ph.D. in physics in 1972, both from the University of Pennsylvania, Philadelphia, Pennsylvania. My

thesis research used nuclear physics measuring techniques for studies of materials. I performed similar research at Bell Telephone Laboratories, Murray Hill, New Jersey, from 1970 to 1972 and at Argonne National Laboratory, Argonne, Illinois, from 1972 to 1976.

My publications include the following items related to nuclear power plant radiation monitoring:

- "Designing for Postaccident Radiological Conditions" (coauthor), NSAC-17, December 1980;
- "A PWR Containment Air Monitoring System (CAMS) for Normal and Accident Conditions" (coauthor), IEEE Trans. Nuc. Sci. NS-27, February 1980;
- "Design Alternatives for Plant-Wide Digital Radiation Monitoring Systems" (coauthor), IEEE Trans. Nuc. Sci. NS-26, February 1979.

I authored seven radiological environmental monitoring reports for operating nuclear stations. Finally, I authored or coauthored twelve publications on research which involved the use of nuclear physics analytical techniques.

I am a member of the American Nuclear Society, the American Physical Society, and the Health Physics Society.

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NUCLEAR REGULATORY COMMISSION

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In the Matter of	)	
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THE DETROIT EDISON COMPANY,	)	Docket No. 50-341
et al.	)	(Operating License)
(Enrico Fermi Atomic Power	)	
Plant, Unit No. 2)	)	

CERTIFICATE OF SERVICE

I hereby certify that I have this 11th day of December, 1981, served the foregoing document, entitled "Applicants' Response in Support of Staff Motion for Summary Disposition of Contention 5", by mailing copies thereof, first class mail, postage prepaid, and properly addressed, to the following persons:

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