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UNITED STATES OF AMERICA  
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of  
Commonwealth Edison Company  
Byron Station, Units 1 and 2

)  
)  
) Docket nos. 50-454 and 50-455  
) Operating License  
)

PREPARED DIRECT TESTIMONY OF  
HENRY H. WOODARD  
ON BEHALF OF ROCKFORD LEAGUE OF WOMEN VOTERS

REGARDING

CONTENTION 106

SEISMOLOGY

February 1983

## I. INTRODUCTION

Q. 1. What is your name and position?

A. Henry H. Woodard, Chairman of Geology Dept., Beloit College

Q. 2. What are your qualifications and experience?

A. I have been Chairman of the Geology Department at Beloit College, Wisconsin since 1955. I have an A.B. degree in Geology from Dartmouth College and and M.A Degree in Geology from Dartmouth College. I also have a Ph.D. degree in Geology from the University of Chicago. I have worked for the U.S.G.S. and have been consultant and done research for geological work in the U.S. and 30 different countries.

My current research is on structural geology and metamorphism of precambrian rocks in the eastern contact zone of the Vermilion Batholith in northern Minnesota; mineralogic development of the basal unit of the St. Peter Sandstone along along the eastern flank of the Wisconsin Arch; the relationship between sanidine feldspar and lead-zinc mineralization in the Mississippi Valley-type deposits of western Wisconsin and south-central Missouri. A complete list of my experience, research and a partial list of Professional Papers is attached.

## II. STATEMENT OF CONTENTION

Q.3 What is the purpose of your testimony?

A. The purpose of this testimony is to respond to contention 106 as admitted by the Board as follows:

There exist serious seismic related site problems discovered subsequent to the construction permit herein which indicate that the seismic design for Byron is not such

that there exists assurance that these problems are adequately resolved in accordance with applicable regulations, including, but not limited to, 10 CFR 50.57 (a) (3) (i), 50.57 (a) (6) and 10 CFR Part 100, Appendix A. Specifically, the Rockford League of Women Voters contends that due to the lack of reliable information regarding the causes of earthquakes which have been experienced in northern Illinois, Edison should be required to perform strain gauge tests on faults cutting basement rock located in the northern Illinois region where earthquakes of Modified Mercalli VII or greater intensity are expected to occur.

Further, recent evidence from the central portion of the U.S. shows that neither the Byron designated safe shut down earthquake peak ground acceleration value of 0.20 g nor the operating basis earthquake peak ground acceleration value of 0.09 g are sufficiently conservative. Ground acceleration significantly greater than both of these values are possible at the Byron site.

In addition, it is not known if the recently discovered Plum River Fault is a capable fault. This fault is known to approach the Byron site within 5.3 miles and may even be closer if the fault extends farther to the east.

The results of my review of some of the important matters encompassed by this contention are summarized in the following paragraphs.

### III. DISCUSSION OF ISSUES

Seven "strong" earthquakes have been generated in northern Illinois since the first one was recorded in 1804. According to various records summarized by Heigold (1972<sup>1</sup>) none of the

earthquakes exceeded VIII on the Modified Mercalli scale. Very little is known about the origin of any of these seven earthquakes. Theory of earthquake generation within most parts of the central United States is poorly developed but most geologists and seismologists assume that the earthquakes are generated on old fault structures which are present within the crystalline basement rocks of the earth's crust. At least two of these old basement structures are known to exist within the near vicinity of the Byron nuclear power station site, the Sandwich Fault zone and the Plum River fault zone. One of these, the Plum River fault zone, is known to exist within 5.3 miles of the site. The Byron site is a few miles north of the apparent junction of these two differently oriented fault zones.

If theory is correct regarding the generation of earthquakes in northern Illinois then presumably either of these two extant major zones could produce earthquakes. One way of testing the possibility of this would be to collect information from basement rocks on either side of these fault zones to see if differential strain developed in opposite sides. Rapid relief of differential strain developed in opposite sides of fault zones is what causes the generation of most earthquakes. To my knowledge no such strain data are known from either the Plum River or the Sandwich fault zones. In fact, there probably isn't any such data available from anywhere in the basement rocks of northern Illinois.

Data from an earthquake swarm from the central U.S. recently have been collected near Conway, Arkansas (Johnston, 1982)<sup>2</sup>. This data suggests that MM intensities are not satisfactory for determining seismic design characteristics of engineering projects.

Specifically, on July 5, 1982 an earthquake was recorded

which had a magnitude of 3.8 (approximately equal to MM IV-V). The S waves of this earthquake generated peak horizontal acceleration values at the recording station of  $0.59 g^2$ . This is far in excess of either the Safe Shutdown value of  $0.20g$  or the Operating Basis value of  $0.9g$  designed into the Byron nuclear power station.

No ground acceleration data are available for any of the seven earthquakes that have occurred recently in northern Illinois, and until such data are available, the effect on the Byron structure of potential earthquakes ranging in intensity from IV to VIII on the Modified Mercalli scale remains unknown.

#### References Cited

1. Heigold, P.C., 1972, Notes on the earthquake of September 15, 1972 in northern Illinois: Illinois State Geological Survey, Environmental Geology Note # 59.
2. Johnston, A.C., 1982, Arkansas earthquake laboratory: EOS, v. 63, # 50, December 14, 1982.

Q. 4. Why is this issue one of importance in the licensing process for Byron?

A. Current regulations (CFR 50.57 (A) (3) (i) and CFR 50.57 (a) (6) require that conservative seismic design values be used for siting of nuclear power plants and the subsequent building of plant structures and equipment. The seismic design for Byron needs to be reevaluated and also there is a potential need to reevaluate calculations for Class 9 accidents which are required to be considered in Emergency Planning.

According to 10 CFR Part 100, Appendix A, if the Plum River Fault is a capable fault and is within 5 miles of the Byron

nuclear power station site boundary, the plant must be built to a stronger seismic design.

#### IV. RECOMMENDATIONS

A careful reevaluation of the seismology of the Byron plant site should be made, using strain gauge tests and other current information.

A site specific PRA for Byron may be needed.

Although the major plant structures are completed, some modifications could be made if the seismic design is not conservative enough.

The analysis of Class 9 accidents required for Emergency Planning could be evaluated.

## BIOGRAPHICAL SKETCH

WOODARD, HENRY HERMAN, JR.

Education

A.B. Geology, Dartmouth College	1948
M.A. Geology, Dartmouth College	1949
Ph. D. Geology, University of Chicago	1955

Professional Experience

- 1) LT, U.S. Navy 1945- 1952
- 2) Teaching Fellow, Dartmouth College 1948- 1949
- 3) Instructor, Illinois Institute of Technology 1950
- 4) Instructor, Northwestern University 1951- 1952
- 5) Instructor to Professor, Beloit College 1953- 1983
- 6) Chairman, Dept. of Geology, Beloit College 1955- 1983
- 7) Geologist, US Geological Survey, Lake Lahontan Project, Nevada 1947- 1948
- 8) Geologist and Party Chief, Newfoundland Geological Survey, NW Coast Project 1955
- 9) Geological work in more than 30 different countries dealing chiefly with major structural features, igneous activity, metamorphism and active volcanism 1962-1983
- 10) Leader of field parties to most major geological areas of North America and to several localities overseas 1958- 1983
- 11) Consultant on several projects in the Northern and Southern Wi. area dealing with local geological conditions and their influence on groundwater flow and contamination, and possible production of various mineral substances 1952- 1983

Current Research

- 1) Structural geology and metamorphism of precambrian rocks in the eastern contact zone of the Vermillion Batholith, northern Minnesota 1971- 1983
- 2) Mineralogic development of the basal unit of the St. Peter Sandstone along the eastern flank of the Wisconsin Arch.
- 3) Relationship between sanidine feldspar and lead-zinc mineralization in the Mississippi Valley-type deposits of western Wis. and south-central Missouri.
- 4) Chemical and mineralogical zonation in rocks of Montezuma Basin, central Colorado.

Partial list of Professional Papers:

- 1951 The geology and paragenesis of the Lord Hill Pegmatite, Stoneham, Maine: American Mineralogist, v. 36, p. 869-883
- 1951 Report on the Geology of a portion of the Spencer Lake Area, Maine: Report of the State Geologist, Maine Development Commission, p. 68-77.
- 1957 Geology of Port Saunders-Castor River area, West Coast: Newfoundland Geological Survey, Report, No. 10, 45 p.
- 1957 Diffusion of Chemical elements in some naturally occurring silicate inclusions; Journal Geology, v. 65, p. 61-84.

- 1968 Contact alteration in the north wall of the Cape Neddick gabbro, Maine: *Journal of Geology*: v. 76, p. 191-204.
- 1972 Syngenetic Sanidine beds from Middle Ordovician Saint Peter Sandstone, Wisconsin: *Journal of Geology*, v. 80, p. 323-332.
- 1972 (with Krueger, H.W.) Potassium-argon dating of sanidine-rich beds in the St. Peter Sandstone, Wisconsin: *Geological Society of America, Abstracts with Programs*, v. 4, no. 7, p. 568-569.
- 1974 Syngenetic sandine beds from Middle Ordovician St. Peter Sandstone, Wisconsin: a reply: *Journal of Geology*, v. 82, p. 116-119.
- 1978 Field excursion to the Big Island and Maui, Hawaii: *Department of Geology, Beloit College*, 275 p.
- 1980 (with Flemming, A, Heinz, D., and Lee, R.) Geology of the southwestern contact zone of the Vermilion Batholith, Minnesota: *Institute on Lake Superior: Geology, 26th Annual Proceedings and Abstracts*.
- 1981 Southeastern Arizona geology field trip guide book: *Department of Geology, Beloit College*, 3rd Ed., 100 p.
- 1982 (With Burrell, S. and Stenstrom, R.) Field guide to the geology of Samoa, Tonga and New Zealand: Vol I, Samoa, Tonga and North Island, 250 p., Vol. II, South Island, 109 p; *Department of Geology, Beloit College*.
- 1982 (With Wirth, K., and Crouse, G.) Geology of the Friday Bay quadrangle, Minnesota: *Institute on Lake Superior Geology, 28th Annual Proceedings and Abstracts*.
- 1983 Geologic field guide to the central and southern Appalachian Mountains: *Department of Geology, Beloit College*, 9th Ed., 150 p.
- 1983 (with Daszuba, J. ) Folded rocks in the eastern contact zone of the Vermilion Batholith: *Institute on Lake Superior Geology, 29th Annual Proceedings and Abstracts (in press)*.
- 1983 Geologic field guide to part of central Wisconsin: *Department of Geology, Beloit College*, 9th Ed., 12 p.

UNITED STATES OF AMERICA  
NUCLEAR REGULATORY COMMISSION

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'83 FEB 22 P2:28

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

REG. & SERVICE  
BRANCH

In The Matter of )

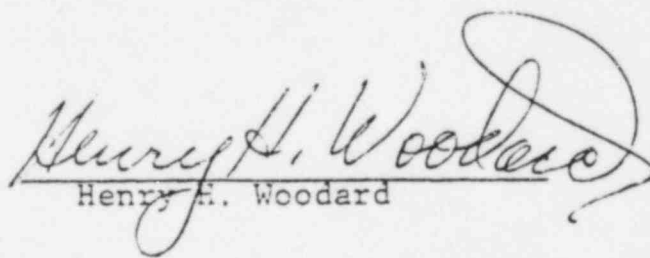
COMMONWEALTH EDISON COMPANY )

(Byron Nuclear Power Station,  
Units 1 & 2) )

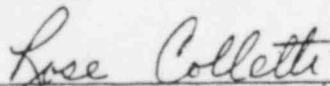
Docket Nos. 50-454 OL  
50-455 OL

AFFIDAVIT OF HENRY H. WOODARD

Attached is the Direct Testimony of Henry H. Woodard on behalf of the Rockford League of Women Voters regarding Contention 106 Seismology. The testimony is true and accurate to the best of my knowlege, information and belief.

  
Henry H. Woodard

Subscribed and sworn to before  
me this 15<sup>th</sup> day of Feruary, 1983

  
NOTARY PUBLIC - Winnebago County

My commission expires July 18, 1984

SERVICE LIST

COMMONWEALTH EDISON COMPANY--BYRON STATION  
Docket Nos. 50-454 and 50-455

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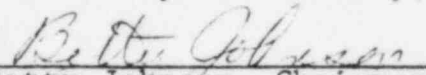
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CERTIFICATE OF SERVICE

I hereby certify that copies of the testimony of Dr. Henry Woodard in the above captioned proceeding have been served on the service list by deposit in the United States mail, first class, this 15th day of February, 1983.

  
Betty Johnson, Chairman of the  
Byron Nuclear Power Plant Intervention Com.  
of the League of Women Voters of Rockford, IL