STATEMENT OF POSITION
OF
PROFESSOR RUSTUM ROY
ON BEHALF OF THE
STATE OF ILLINOIS

A F F I D A V I T

My name is Professor Rustum Roy. I am Professor of Solid State Technology and Director of the Materials Research Laboratory at Pennsylvania State University in University Park, Pennsylvania. My resume, which details my credentials and professional activities is attached to this affadivit.

S T A T E M E N T

This statement will be limited to those portions of the Department of Energy (DOE) Statement of Position (Position) related to 1) waste packaging 2) transportation of spent fuel and 3) densification.

I. Waste Packaging Materials

A. The DOE Position, Page II-159, reads, in pertinent part:

> ". . .it is obvious that much remains to be learned about individual package components."

Insofar as the DOE has determined that a large number of waste package options exist that need further testing and development, the DOE Position is correct.

However, the statements made in the DOE postion on glasses and cement are misleading and insufficient. The DOE Position, pp. II - 146 and 147, reads as follows:

> "II.E.1.5.3.4 Glasses
>
> Many glasses and glass-ceramic materials may be suitable as candidates for waste barriers in the form of canisters, overpacks, or hole

sleeves. In general, glasses offer easier fabricability than ceramics, with perhaps slightly less desirable chemical and physical properties when compared to the most stable ceramic forms (337). Although easily discolored, glasses, like ceramics, are very radiation resistant materials (352-357). Because of their chemical stability (leach resistance and low solubility) as well as radiation and thermal stability, glasses have been extensively investigated as a waste form material (358-364). Natural glasses are well known and recognized to have weathered well (365). Also, a glass-ceramic material, Corning's spodumene glass-ceramic Code 9617, has received preliminary evaluation as a canister material for disposal of spent fuel in a granite environment (346, 349); these early results indicate a corrosion rate of only about 0.01 cm/1,000 yr.

II.E.1.5.3.5 Concrete

Concrete or grout cast in place to form a massive barrier appears promising in sleeve applications. Work on cementatious borehole plug materials shows those materials have very low permeabilities (366). Used as monolithic concrete hole sleeve, such materials would be inexpensive and extremely resistant to water ingress. Ordinary hydration-type concretes may be limited unless shielding by other package components can be used to mitigate radiolysis effects. Also temperature levels must be kept below the maximum tolerated by a given concrete type. However, as noted above, work with certain concrete material has shown promise (367-371)."

The problems with the above cited sections of the DOE Position are:

1. Glasses, for such applications, including canister, hole sleeve and overpack do not offer easier fabricability than ceramics or concrete.

2. DOE fails to state whether or not the technology exists to fabricate one piece of glass into a hole sleeve.

3. Natural glasses do not weather well. No glass, natural or otherwise, weathers well in a warm, moist environment. DOE fails to state the types of glasses to be used or the kind of environment including the temperature condition and the hostrock (other than granite) that the glass would be placed in.

4. Although the technology exists to overcome the problem of radiolysis associated with concrete, DOE not only does not discuss this solution, but also leaves the impression that the solution does not exist.

5. Temperature levels "must be kept below the maximum tolerated by a given concrete type" (DOE Statement p. II-147). However, the DOE fails to include what that temperature is, what the given type of concrete is, and that in most cases, the maximum temperature tolerated by a given type of concrete is higher than that tolerated by glasses in a wet environment.

B. The testing methods of waste package containment - by retrieval from the repository - are not only costly, but allow for water to enter the repository. The repository should be closed, exposing the waste container to the forces and elements within the repository over a period of time. The risks of this type of testing may not outweigh any of the benefits.

II. Interim Spent Fuel Storage

A. TRANSPORTATION

The DOE proposed that, to the maximum extent possible, spent fuel should be transferred directly from the reactor to repository rather than from reactor to AFR to repository. However, the problems associated with regularly transporting large quantities of radioactive material to diverse points to a selected repository location has not been adequately addressed, if addressed at all.

Furthermore, the DOE Position does not adequately treat the fact that at some point between the reactor and the repository the spent fuel must be processed, i.e., completely prepared for final disposal by encapsulation. An analysis of the relative costs and benefits of processing at various sites (the reactor itself, the AFR, the repository or a separate location) is missing from the DOE Statement of Position.

B. DENSIFICATION

Although the DOE Position tangentially addresses (DOE Statement p. V-22) this subject, it fails to adequately assess the viability of using a currently available methods, whereby densification (reracking), a process in which spent fuel is packed closer together, would be used to expand the capacity of existing and future AFRs. The DOE omits describing not only currently available technology, but also any possible future enhancements. It is unclear whether or not this omission was inadvertent, leaving the possibility that a closer examination might uncover major difficulties, or whether the DOE considered reracking technology so well developed as to be routine. In any case, because of these omissions, the DOE Position discussion of densification and research on materials and configuration for maximum reracking potential is insufficient. Thus, the DOE conclusion that the needs for AFR storage capacity can be satisfied by the year 2007 (DOE Statement p. V-26) would be affected by the considerations discussed above.

I certify that I have read the foregoing and that it is true to the best of my knowledge and belief.

Subscribed and Sworn to
Before me this 3rd
day of July, 1980

Paula M Mourant
Notary Public

PAULA M. MOURANT, Notary Public
State College, Centre Co., Pa.
My Commission Expires July 3, 1983

My Commission Expires:

RUSTUM ROY

Biographical Data

Birth

July 3, 1924; Ranchi, Bihar Province, India

Education

St. Paul's School, Darjeeling, India, 1934-39; Cambridge School Certificate, 1939
Patna University, 1940-44: B.Sc. (Hons) in Chemistry, 1942
M.Sc. in Physical Chemistry, 1944
The Pennsylvania State University, 1946-48: Ph.D. in Ceramics, 1948

Work Experience

The Pennsylvania State University: Postdoctoral fellow, 1948-49
Government of India, Central Glass and Ceramic Research Institute, Calcutta, India:
Senior Scientific Officer, 1950
The Pennsylvania State University:
Research Associate, 1950-51
Assistant Professor, 1951-54
Associate Professor, 1954-57
Professor of Geochemistry, 1957-present
Professor of the Solid State, 1967-present
Chairman, Solid State Technology Program, 1960-67
Director, Materials Research Laboratory, 1962-present
Science, Technology and Society Program, 1969-present; Chairman, 1977-present
Science and Public Affairs Office, 1969-present

Professional Activities

Life Fellow of the Mineralogical Society of America
Fellow of the American Ceramic Society; Chairman, Basic Science Division, 1967-68
Materials Research Society, Founding member, 1973; Vice President, 1974-75; President 1976-
Member of the American Chemical Society; American Physical Society; American Association for the Advancement of Science
Co-Chairman, "International Conference on the Characterization of Materials," November 1966
Chairman, U.S. delegation to "Japan-American International Cooperation Seminar on Ceramic Materials," Tokyo, Japan, 1969
Chairman, "National Colloquy on the Field of Materials," 1969
Chairman, Steering Committee, NAS-NAE Conference on "Materials and the Development of Nations," 1976
Co-Chairman, International Summer School on Crystal Growth, 1977
Founder and Joint Editor-in-Chief, "Materials Research Bulletin," published by Pergamon Press
Joint Editor, "Minerals, Rocks and Inorganic Materials," Springer Verlag, 1968-
Editorial Boards of "Journal of Materials Science," 1966-69; "Journal of Crystal Growth," 1967-69; "Chemical and Engineering News," 1970-73, and 1976-; "Annual Reviews of Materials Science," 1970-74
Foreign Counselor, Société Francaise de Minéralogie, 1973-
Founder and Editor, "Journal of Education Modules for Materials Science and Engineering," 1979-

Professional Recognition and Awards

Member of the National Academy of Engineering
Foreign Member, Royal Swedish Academy of Engineering Sciences
Hibbert Lecturer (Centenary year), London University, England, 1979
Mineralogical Society of America Award, 1957 (chief national award in the Geological Sciences for the most significant research by a younger man)
Welch lecturer, Texas Universities, 1974; Fairchild Lecturer, Lehigh University, 1976
Mineral named after him, "Rustumite," by Cambridge University colleagues

Research Activities

Materials Preparation and Characterization; Crystal Chemistry, Synthesis, Stability, Phase Equilibria and Crystal Growth in Non-Metallic Systems; Ultrahigh Pressure Reactions in Solids; Chemistry and Physics of Non-Crystalline Solids
Innovative education, via new materials and new delivery systems
Science, Technology and Human Values
Author of some 350 scientific papers and chapters in books

Industrial Experience

Founder and Director, Tem-Pres Research, Inc., 1957-69
Consultant retained by:
- The Xerox Company (1963-)
- Standard Oil Company of Indiana (1968-70)
- General Telephone and Electronics Company (1964-67)
- The Carborundum Company (1965-)
- Bausch and Lomb, Inc. (1962-)

Initiator of University-Industry Consortia:
- Industrial Coupling Program at The Pennsylvania State University
- Materials Advisory Panel for the State of Pennsylvania

Committee Activities (National and State)

National Academy of Sciences:
- Mineral Science and Technology Committee, Member, 1966-69. Chairman, Panel on Non-metallic Materials, 1966-69.
- Committee on the Survey of Materials, 1970-74. Chairman, Panel on Universities, 1970-74.

National Academy of Sciences-National Academy of Engineering-National Research Council:
- National Materials Advisory Board, Member 1970-76; Chairman, Council of Materials Science/Technology interface, 1970-76.
- Committee on Radioactive Waste Management 1972-75; 1976-. Chairman, Panel on Waste Solidification, 1976-79.
- Committee on USSR and Eastern Europe, 1974-79; Chairman 1976-79.
- National Research Council, Member, 1962-72; Executive Committee of Chemistry Division, Member, 1967-72.
- Materials Advisory Board: Committee on Ceramic Materials, Member, 1963-64.
  - Committee on Materials Characterization, 1964-66.
  - Chairman, Panel on Structural Characterization, 1964-66.
  - Committee on Ceramic Processing, 1966-68.

National Science Foundation:
- Advisory Committee on Ethical and Human Value Implications of Science and Technology, 1973-76.
- Engineering Advisory Committee, 1968-72.
- Advisory Committee to Division of Materials Research, Metallurgy and Materials Section, 1973-77.

Governor's Science Advisory Committee, Member under Govs. Scranton, Shafer and Shapp, 1965-1978.
- Chairman, Materials Advisory Panel of Pennsylvania GSAC, 1965-78.

Non-Professional Activities (National and State)

National Council of Churches
- Planning and Strategy Committee, 1964-70
- Chairman, Committee on Science, Technology and the Church, 1966-68

Dag Hammarskjold College, Columbia, MD: Member, Board of Governors, 1968-75. Chairman, 1970-72; 1974-75.
Kirkridge, Retreat center, Bangor, PA: Member, Board of Directors, 1956-. Chairman, 1970-72.
Lecturer on, and author of magazine articles and books on interaction of religion and philosophy with contemporary society.

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

IN THE MATTER OF:	)	
	)	
PROPOSED RULEMAKING ON	)	
THE STORAGE AND DISPOSAL	)	
OF NUCLEAR WASTE	)	PR - 50,51 (FR 61372)
	)	
(Waste Confidence Rulemaking)	)	

PROOF OF SERVICE

I, Jessie Gibson, state that on July 7, 1980, I deposited copies of this Statement of Position in the United States Mail, postage prepaid to the persons listed below:

Samuel J. Chilk, Esq.
Secretary of the Commission
U.S. Nuclear Regulatory Commission
Washington, D.C., 20555

Marshall E. Miller, Esq.
U.S. Nuclear Reulatory Commission
Washington, D.C. 20555

Jessie Gibson

SUBSCRIBED AND SWORN TO BEFORE ME THIS
7th DAY OF JULY, 1980

Phyllis Dunbar
NOTARY PUBLIC