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BEFORE THE
UNITED STATES NUCLEAR REGULATORY COMMISSION
ATOMIC SAFETY AND LICENSING BOARD

82 AGO 16 P5:37

OFFICE OF SECRETARY
DOCKETING SERVICE

In The Matter Of

UNITED STATES DEPARTMENT OF ENERGY
PROJECT MANAGEMENT CORPORATION
TENNESSEE VALLEY AUTHORITY

(Clinch River Breeder Reactor Plant)

Docket No. 50-537

TESTIMONY OF DR. JOHN CANDLER COBB

My name is Dr. John Candler Cobb. I reside at 4824 East 6th Avenue, Denver, Colorado 80220. I am presently Professor of Community Health in the Department of Preventive Medicine and Biometrics at the University of Colorado School of Medicine in Denver, Colorado; from 1966 to 1973, I was Chairman of this Department. In 1974, I was appointed by Governor Lamm and Congressman Wirth of Colorado to be a member of the Lamm-Wirth Task Force on Rocky Flats Plutonium Weapons Facility near Denver, Colorado; from 1976 to 1979 I served as Commissioner representing the State Board of Health on the Air Pollution Control Commission of Colorado; and I have served on a number of other State and National advisory groups and task forces. From 1975 to 1982, my primary research activity has been as Principal Investigator on a U.S. Environmental Protection Agency (EPA) contract to study human plutonium burdens in people who had lived near the Rocky Flats Nuclear Weapons Facility. The final report of this research project was submitted to the EPA last December, under EPA contract #68-03-2217.

The purpose of this testimony is to offer evidence with regard to Intervenor's Contention 2. I am concerned that present and proposed standards or guidelines for plutonium and other alpha-emitting radionuclides like americium and uranium may be seriously inadequate to protect the public. Consequently calculations based on these standards or guidelines may be wrong in concluding that a maximum credible accident would not present a health risk to the nearby population.

I believe that where the health of the public is concerned, we should be conservatively cautious. We should not permit the development of a huge industry based on plutonium until the questions of safety for present and future generations have been more carefully evaluated.

My concern is based on the findings of recent research in four related areas:

1. The findings of our EPA-contracted study of plutonium burdens in the post-mortem tissues of people who had lived near the Rocky Flats plutonium weapons facility.
2. The findings of several epidemiological studies showing an excess of cancer mortality and incidence in the areas near to and downwind from Rocky Flats.
3. The findings of animal experiments suggesting that at very low dose rates, alpha-emitters like ^{239}Pu and ^{210}Po are very much more carcinogenic than had previously been suspected, perhaps by as much as a hundred times.
4. The findings of animal experiments showing that plutonium and other alpha-emitters cause mutations and genetic defects as well as cancers.

The public has a right and a need to know what the risks may be. Our EPA plutonium human burden study was undertaken in 1975 by Russell Train, then Administrator of EPA, at the request of Senator Floyd Haskell in response to the great concern about possible dangers from the Rocky Flats plutonium weapons facility among his constituents in Colorado. Citizens are now, more than ever, interested in knowing the

results of this tax-supported research project done on their behalf.

Let me emphasize that, at this stage, the data available do not prove that the EPA proposed guidelines are inadequate, but there are enough indications in the available data to cause a conservative person to be concerned. It would be unfortunate for the population of this country if promulgation of the proposed EPA guidelines for plutonium in the environment were to result in the relaxation of the present stricter Colorado State guidelines; and if then after some time, the more serious dangers to human populations became evident.

I have read the 20 September 1981 report by Stephen Chinn and the paper by Carl Johnson presented at the AAAS on 4 January, 1982 and also the review of an earlier draft of Chinn's report which was done by Richard G. Cuddihy and William C. Griffith under US Dept. of Energy Contract No. DE-AC04-76EV10103. This most recent report by Chinn addresses the criticisms raised by Cuddihy and Griffith. Considering Chinn's research together with similar studies by Dr. Carl Johnson and the findings of our EPA plutonium human burden study, I am left with the uneasy feeling that while the issue is far from settled, there is substantial reason for concern regarding the adequacy of the proposed guidelines. Before EPA promulgates these proposed guidelines, therefore, further investigation would be prudent.

Let me state briefly some of the findings which lead to my concern:

- A. Chinn's and Johnson's studies show an excess of more than ten percent in the cancer incidence (more than a hundred excess cases of cancer in three years) among people living in the areas known to be contaminated with weapons grade plutonium evidently released from Rocky Flats.

- B. Our study showed that some weapons grade plutonium (presumably from Rocky Flats) had gotten into the lungs of people living in this plutonium-contaminated area. The total amount of plutonium from all sources in the lungs of our study population was very small, the average being about 0.2 picocurie per person, which is very near the limit of detectability by the methods used at McClellan Airforce Base Laboratory where the plutonium measurements were done.
- C. Compared with lungs, the liver retains plutonium for a much longer time (mean residence time approximately 40 years for liver, 1.3 years for lung). The total amount of plutonium found in the livers of our study population was, thus, roughly an order of magnitude larger (average about 1.5 picocuries per person); and, in general, a smaller fraction of it was found to have been weapons grade plutonium (presumably because the plutonium from global atmospheric fallout was added to the weapons grade plutonium from Rocky Flats). However, our analysis did show that the people who had been living within 50 km east and south of the Rocky Flats plant at the time of the 1957 plutonium fire at Rocky Flats, had a slightly larger fraction of weapons grade plutonium in their livers than did those who had been living more than 50 km away from the plant at that time. We were quite surprised that this difference should still be detectable and statistically significant twenty years later, considering the continued deposition of plutonium from world-wide fallout over the twenty year period. This finding is, however, consistent with the hypothesis that there may have been a considerable exposure to

weapons grade plutonium (and possibly other mutagens also) for people living downwind and within 50 km of the plant at the time of the 1957 fire.

The reason for my concern is that if the exposure to plutonium resulting from the 1957 fire were indeed the cause of the 10% excess of cancers which showed up twelve to fifteen years later in the population of that area, then it would follow that the EPA proposed guidelines for alpha-emitting transuranium isotopes may be seriously too lenient. This conclusion follows logically from our EPA plutonium burden study finding that the total amount of plutonium in the tissues of our study population was exceedingly small and that people who had lived within 10 km of Rocky Flats could only have had at most about 50% more plutonium in their tissues, on the average, than did those living 50 km or more away. Let me emphasize again that plutonium is not proven to be causally related to these cancers, but it does seem to be a reasonable possibility. To settle this important question, we need to know the amount of plutonium released in 1957 and whether other carcinogens may also have been involved; and we need to find out whether, in recent years, the incidence of cancer and genetic defects has become progressively higher in long-term residents of the affected area, relative to unaffected areas, as would be expected if the cause were plutonium exposure which occurred 25 years ago.

Four studies should be done:

1. Measurement of plutonium, americium, uranium and other carcinogens and mutagens in sediments deposited during the years 1952-62 in Standley Lake.

2. Measurement of americium-241, uranium and other carcinogens and mutagens in the remaining aliquots and tissue samples from the EPA Plutonium Human Burden Study.
3. Repeat of the cancer incidence epidemiological studies for the period 1979-81.
4. Epidemiological study of the incidence of genetic defects in the affected area.

1. Sediment Examination

It is important to find out how much plutonium, other radionuclides and other carcinogens were dispersed into the environment during the 1957 fire and other events at Rocky Flats. Examining the sediment layers in a core sample from Standley Lake, which is a few miles southeast of Rocky Flats, would provide data on the relative importance of the 1957 releases compared with the already documented more recent releases of plutonium during the 1960's.

There was a study done by E.P. Hardy and others of the Environmental Measurements Laboratory of the Department of Energy which was reported in July 1978 in the Quarterly Report of US DOE, EML-342, I-123 under the title "Time Patterns of Offsite Plutonium Contamination from Rocky Flats Plant by Lake Sediment Analysis." Unfortunately they only reported their findings up to a depth of 50 cm in the Standley Lake sediment; so their analysis goes back only to 1962. That core sample did show the peak of plutonium contamination presumably coming from the oil-drum barrel spills at Rocky Flats during the late 1960's; but as pointed out above, it failed to go deep enough to provide information about the sediment deposited during the period of the 1957 fire. A new

study should be done on a deeper core sample, and it should look for other carcinogens and radionuclides, besides plutonium, which might be expected from that fire. There may, for example, have been some carcinogenic organic compounds in the smoke from that fire, as well as plutonium, americium, uranium and other radionuclides. Other events, like the disposal by burning at Rocky Flats of thousands of gallons of cutting oil containing uranium, could also be related to the excess cancers and could be evaluated by such a study of these sediments. In addition, sediment samples from the North Table Mountain Reservoir near Golden should be studied to evaluate the possible contribution from the Schwartzwald uranium mine which drained into that water system.

2. Analyses of remaining samples from our EPA Plutonium Human Burden Study

The bones, gonads and adrenals, which were collected from the 519 autopsies for the plutonium burden study, are still waiting in the freezers for someone to proceed with the planned analyses. Aliquots of the dissolved livers and lungs are also still being stored at EPA, Las Vegas, waiting for the planned analyses for americium and other elements. So far, they have only been analysed for plutonium. Completion of these planned analyses would provide important data for deciding whether plutonium, alone or together with other carcinogens, may have been the cause of the observed excess incidence of cancer in the area.

3. Cancer Incidence Study

Since many cancers caused by low level radiation have a latency period of up to 20 to 30 years, we would expect cancers caused by a low

level radiation exposure in 1957 to have their peak incidence in the 1980's. A repeat of the Johnson and Chinn studies for more recent years should be done as soon as possible. I understand that Dr. Johnson is doing this now under a grant from NCI.

4. An epidemiological study of genetic defects in the population downwind from Rocky Flats should be undertaken. If the exposure to plutonium and/or other radionuclides coming from the 1957 fire at Rocky Flats caused an increase in genetic defects in the population downwind, it might be revealed by a careful study of the incidence of such defects in children born during the years subsequent to 1957, comparing that population with the population living in upwind areas and with children born before 1957. Similar studies of domestic animals, cattle and horses, in these areas should also be done.

Until at least, these four studies can be completed, I think it would be foolhardy to permit the development of a huge new breeder reactor industry which would put into commercial circulation as much as 5 billion grams of plutonium per year.

Present guidelines, which may be far too lenient, allow only 8 billionths of a gram as the maximum permissible lung burden of plutonium. (If each of the four billion people in the world had this maximum permissible amount of lung burden, the total amount of plutonium would add up to only 32 grams, about one ounce). No other substance used by industry in such large quantities is anywhere near as toxic as plutonium. Can we be sure enough of our technology to handle as much as five billion grams of plutonium per year, when 8 billionths of a gram is dangerous to inhale?

My concern is that we may have underestimated the toxicity of plutonium by a large factor; and we have probably overestimated our ability to control it, as shown by our experience with the Rocky Flats plutonium weapons facility.

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Docket No. 50-537

UNITED STATES DEPARTMENT OF ENERGY
PROJECT MANAGEMENT CORPORATION
TENNESSEE VALLEY AUTHORITY

(Clinch River Breeder Reactor Plant)

AFFIDAVIT OF DR. JOHN CANDLER COBB

City of Denver

ss:

State of Colorado

I, Dr. John Candler Cobb, being duly sworn, depose and say that the foregoing testimony is true and correct to the best of my knowledge and belief.

John C. Cobb

Dr. John Candler Cobb

Subscribed and sworn to
before me this 12 day of
August 1982.

Frank J. [illegible]

Notary Public

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My Commission Expires 10/1/85*

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PERSONAL DATA:

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Date of Birth: 8 July 1919
Place: Boston, Massachusetts
Marital Status: Married (Holly Imlay-Franchot) 27 July 1946
Four children
Present Position: Professor of Preventive Medicine, Community Health
University of Colorado Health Sciences Center
4200 East Ninth Avenue, Denver, Colorado 80262
Phone: (303) 394-5177

EDUCATION-DEGREES:

1941 - Bachelor of Science (B.S.) Harvard University (Astronomy, cum laude)
1948 - Doctor of Medicine (M.D.) Harvard University
1954 - Master of Public Health (M.P.H.) Johns Hopkins University School of
Hygiene and Public Health, in Maternal and Child Health (MCH)

AWARDS AND HONORS:

1979 - Colorado Public Health Association, Florence Sabin Award (for outstanding
contributions to public health)
1980 - American Friends Service Committee, Colorado Area Committee
Jack Gore Memorial Peace Award (for contributions to the cause of
world peace)

CERTIFICATION AND LICENSURE:

Diplomate National Board of Medical Examiners 1948
Fellow American Public Health Association 1955
Diplomate American Board of Preventive Medicine and Public Health 1961
Licensed to Practice Medicine in Connecticut, Maryland, New Mexico

EMPLOYMENT EXPERIENCE:

- 1941-42 Friends Service Committee (malaria control work) Mexico
- 1942-44 American Field Service (ambulance driver) Syria, North Africa, Italy
- 1948-49 Intern in Pediatrics, Yale New Haven Hospital
- 1949-50 Fellow in Pediatrics, Yale New Haven Hospital
- 1950-51 Jr. Assistant Resident in Psychiatry, Yale Psychiatric Clinic
- 1951-54 Instructor, Maternal & Child Health, Johns Hopkins University, School of Hygiene and Public Health
- 1951-56 Instructor, Pediatrics, Johns Hopkins School of Medicine
- 1952-56 Instructor, Psychiatry, Johns Hopkins School of Medicine
- 1954-56 Assistant Professor MCH, Johns Hopkins School of Hygiene
- 1956-60 Area Consultant in MCH, U. S. Public Health Service, Division of Indian Health, Albuquerque Area Office
- 1960-64 Director, Medical Social Research Project, Lahore, Pakistan, with Johns Hopkins School of Hygiene and University of the Panjab, supported by Ford Foundation and Rockefeller Foundation through the Population Council
- 1965- Professor of Preventive Medicine, University of Colorado School of Medicine
- 1966-73 Chairman, Department of Preventive Medicine, University of Colorado School of Medicine
- 1969-70 Short-term consultant for WHO in Indonesia on Strengthening Health Services (M.C.H. and F.P.) (3 months)
- 1972-73 Short-term consultant for WHO in Western Pacific Region (Philippines, Korea, Vietnam, Fiji, etc.) on Family Health Education (6 months)
- 1977-78 Consultant to Project Hope, Rural Health Program in Tunisia (1 month)
- 1979 Consultant to Ministry of Health, Government of Togo (Family Health Training) (3 months)
- 1980-81 Acting Chairman, Department of Preventive Medicine, University of Colorado School of Medicine (4 months)
- 1975-82 Principal Investigator in U.S. Environmental Protection Agency. Contract to study human plutonium burdens in people who have lived near the Rocky Flats Nuclear Weapons Plant

JOHN CANDLER COBB, M.D., M.P.H.

EXTRA-CURRICULAR/HEALTH-RELATED ACTIVITIES - 1966-1982

Denver City and County:

- 1968-69 Board Member, Central Area Health Planning Association
- 1969 Chairman, Task Force for Preparing 314(b) Agency Grant Application
- 1969-72 Chairman, Commission on Public Health of Denver Medical Society
- 1981- Member, Ethics Committee, Denver Medical Society

State and Regional:

- 1966-68 Board Member, Planned Parenthood Association of Colorado
- 1966-69 Member, Regional Advisory Group, Colorado-Wyoming Regional Medical Program
- 1967-70 Board Member, Colorado Public Health Association
- 1968-69 Member and Chairman, Committee on Health Services for the Poor of Regional Medical Program
- 1969-71 Member, Task Force on Prevention for State Comprehensive Health Planning Council
- 1969-73 Executive Committee, Colorado Area Office of American Friends Service Committee
- 1970 Member, Program Committee for Colorado Interaction Conference on Medical Care, sponsored by Medical Society, UCHSC, Regional Medical Program and Denver Department of Health and Hospitals
- 1970 Member, President's Commission on Environmental Studies of the University of Colorado
- 1970-71 Member, Committee on Communicable Disease, Colorado Medical Society
- 1970-75 Member, University of Colorado Environmental Council
- 1970-75 Member, Environmental Council, University of Colorado
- 1973-80 Member, Governor's Scientific Advisory Council, Colorado
- 1974 Member, Eisenhower Tunnel Carbon Monoxide Standards Advisory Committee
- 1974-75 Member, Governor Lamm and Congressman Wirth's Task Force on Rocky Flats Plutonium Plant
- 1976 Member, Governor's Task Force on Uranium Enrichment Plant
- 1976-79 Commissioner, Air Pollution Control Commission of Colorado
- 1977 Member, Governor's Blue Ribbon Task Force on Transportation

Extra-Curricular/Health-Related Activities, Continued

- 1977-78 Member of AAAS Seminar Group on Air Pollution
- 1978- Member of Governor's Task Force on Health Effects of Air Pollution
- 1978- Member, Air Quality Policy Committee, Denver Regional Council of Governments
- 1978- Board Member, ROMCOE Center for Environmental Problem Solving
- 1978- Board Member, Mountain Bicyclists Association
- 1978- Board Member, Colorado Coalition for Full Employment
- 1979- Member, American Friends Service Committee Advisory Group on Rocky Flats/Nuclear Weapons Project
- 1980- Coordinator of Ethics Seminars at University Health Sciences Center

National:

- 1965-75 Member, National Committee on Indian Health of the Association on American Indian Affairs
- 1967-69 Member, Comprehensive Health Planning, Training and Studies Review Committee for U. S. Department of Health, Education and Welfare, Office of Comprehensive Health Planning
- 1971-73 Member, National Medical Committee, Planned Parenthood/World Population
- 1972-73 Executive Committee Member, American Association of Planned Parenthood Physicians
- 1972-73 President, American Association of Planned Parenthood Physicians
- 1972-73 Board Member, Planned Parenthood Federation of America
- 1978- Consultant, National Institute of Occupational Health and Safety on Naval Shipyards/Nuclear Submarine Studies
- 1981- Advisory Council of Coalition for Responsible Genetic Research
- 1982- Member, Advisory Group on Three-Mile-Island Nuclear Accident, Public Health Fund

International:

- 1968-70 American Friends Service Committee, Division of International Services, Family Planning Committee Member and Member of Working Party to prepare report, "Who Shall Live? Man's Control over Birth and Death."

Extra-Curricular/Health-Related Activities, Continued

- Member, International Solar Energy Society (since 1958)
- 1970 Member, WHO Scientific Group on Advances in Research (Clinical Experience with Methods of Fertility Regulation) Geneva
- 1979- Member, Physicians for Social Responsibility
- 1980 Medical Consultant to Executive Council on Foreign Diplomats Grand Canyon Conference (July 1980)

PUBLICATIONS BY: JOHN CANDLER COBB, M.D., M.P.H.

- "The Detection of Beta-Radiation by Photographic Film," with A. K. Solomon, Review of Scientific Instruments, Vol. 19, pp: 414-447, July, 1948
- "Radioautograph Technique With Carbon 14," with A. K. Solomon and A. M. MacDonald, Science, Vol. 107, pp: 550-552, May, 1948
- "Stripping Film Technic for Radioautographs," with A. M. MacDonald, A. K. Solomon and D. Steinberg, Proc. Soc. Exper. Biol. and Med., Vol. 72, pp: 117-121, October, 1949
- "Paroxysmal Fussing in Infancy, Sometimes Called 'Colic'," with Morris Wessel, Edith B. Jackson, George S. Harris, Jr., and Ann C. Detwiler, New Haven, Pediatrics, Vol. 14, No. 5, pp:421-435, 1954
- "Family Tension as a Cause of Colic in Infants," American Academy of Pediatrics Proceedings, Colic in Infants, Pediatrics Vol. 18, No. 5, pp: 835-836, November, 1956
- "Navajo Child Health Level Mirrors Tribe Future," Public Health Reports, Vol. 73, No. 3, March, 1958 (abstract)
- "Precocity of African Children," Pediatrics, Vol. 21, pp: 867, 1958 (letter)
- Emotional Problems of Indian Students in Boarding Schools, Report of Seminar Sponsored by U.S.P.H.S., Division of Indian Health, N.I.M.H., and New Mexico Department of Public Health, Published by New Mexico Department of Public Health, Albuquerque, N. M., 66 pages, 1960 (J.C. Cobb - editor)
- "Trachoma Among Southwestern Indians," with C. R. Dawson, J.A.M.A., Vol. 175, No. 5, Feb. 4, 1961
- "Aspectos de Salud Publica de la Mortalidad Infantil," with R. F. Goddard and S. J. Leland, Boletin de la Oficina Sanitaria Panamericana, Vol. 51, pp: 130-144, August, 1961
- "Our 'Vanishing Americans'," Harvard Medical Alumni Bulletin, Summer, 1961
- "Some Practical Considerations of Economy and Efficiency in Infant Feeding," Report of the Joint Committee on Economy and Efficiency in the Preparation of Infant Feeding, (J. C. Cobb - member), American Public Health Association, A.J.P.H., Vol. 52, pp:125-142, 1962
- "The Population Problem and Family Planning in Pakistan." with H. M. Raulet, Journal of the Pakistan Academy for Village Development, Comilla, Vol. 3, No. 1, pp: 1-11, July, 1962
- "A Preliminary Report on the Use of Oral Contraceptive Pills Synchronized With the Phases of the Moon," with N. A. Shah, published in Report of I.P.P.F. Conference, Singapore, 1963, Excerpta Medica, Amsterdam, International Congress Series No. 72, pp: 394-398, 1964

PUBLICATIONS BY: JOHN CANDLER COBB, M.D., M.P.H.

- "Some Problems of Demographic Measurement in Family Planning Research in the Punjab," with J.F. Kantner, Population Index, Vol. 29, p. 233
- "The Social Implications of Genetics with Special Reference to Pakistan," Mother and Child, Vol. 2, No. 1, pp:5-9, Jan. 1964
- Pakistan: "The Medical Social Research Project at Lulliani," Studies in Family Planning, No. 8, pp:11-16, October, 1965
- "Oral Contraceptive Program Synchronized With Moon Phase," Fertility and Sterility, Vol. 17, pp:559-567, July-August, 1966
- "Technology is Not Magic," Harvard Medical Alumni Bulletin, pp:8-9, Spring, 1967
- "Abortions in Colorado 1967-1969," Advances in Planned Parenthood, Vol. V, Excerpta Medica International Congress Series No. 207, pp:186-189, 1970
- Who Shall Live? Man's Control Over Birth and Death, A report (with others of the working party) to the American Friends Service Committee, Hill and Wang, 1970 - also translated into Spanish, "Quienes Viviran?" and published in Latin America, 1972
- Methods of Fertility Regulation: Advances in Research and Clinical Experience, WHO Technical Report Series No. 473, 1971 (with other members of scientific group convened in Geneva, December, 1970)
- Report on the Development of Education and Information Materials on Family Health, World Health Organization, WPRO, Manila, 1972
- "Non-procreative Sexuality as an Alternative to Contraception," Advances in Planned Parenthood, Vol. VIII, Excerpta Medica International Congress Series No. 271, pp:67-74, 1973
- Report on the Regional Seminar on the Role of Health Education in Family Planning, World Health Organization, WPRO, Manila, 1973
- "Standards for Air Pollutants for Denver" and "Health Effects of Carbon Monoxide and Photochemical Oxidant Air Pollution in Denver" - Chapters in monograph, Carbon Monoxide and the People of Denver, Miriam Orleans and Gilbert White, Eds. The University of Colorado IBS publication, 1974.
- Chapter on "Preventive Medicine and Public Health" (with Lee Kaiser) in Interdisciplinary Environmental Approaches, Utton and Henning Eds., Educational Media Press, California, 1974
- Report and Recommendations of the Eisenhower Tunnel Carbon Monoxide Standards Advisory Committee, Colorado Department of Health, August 28, 1974
- Medical Committee Report (with Arthur Robinson and Edward Gillette) of the Lamm-Wirth Task Force on Rocky Flats Plutonium Plant Preliminary Report, Colorado State Department of Health, February 10, 1975

PUBLICATIONS BY: JOHN CANDLER COBB, M.D., M.P.H.

Final Report - Lamm-Wirth Task Force on Rocky Flats, October 1, 1975

"Recruiting The Uncommitted Leader for Family Planning" with Moulding, T.S. & Cortese, C.F. The Mount Sinai Journal of Medicine 42, p. 308, 1975 (Alan Guttmacher Memorial Issue)

"Limits to Human Adaptability" published in The Future of Human Settlements in the Rocky Mountain West Vail Symposium/Six - T.J. Minger Ed., 1977.

"The Suntrap Insolator/Insulator" Proceedings of the Solar Cooling and Heating Forum, Univ. of Miami, 13 December 1976, T.N. Veciroglu, Ed., 1978.

Participation in Governor's Task Force on the Health Effects of Air Pollution in Colorado, R. Mitchell, Chairman - Report issued July 1978.
Modified version published by Mitchell et al, J.A.M.A. 242, p. 1163-8, 1979

- - -

Report to EPA, not yet cleared for publication, "Plutonium in Human Tissues Related to Smoking, Age, Residence near Rocky Flats and Eastern Colorado."
(This is the report of our research work 1975-1982.)

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CERTIFICATE OF SERVICE

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I hereby certify that copies of TESTIMONY OF DR. THOMAS B. COCHRAN, TESTIMONY OF DR. KARL Z. MORGAN, TESTIMONY OF DR. FRANK VON HIPPEL, AND TESTIMONY OF DR. JOHN CANDLER COBB were served this 16th day of August 1982 to:

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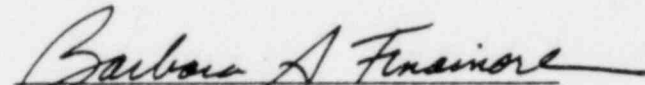
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