DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
PUBLIC HEALTH SERVICE
FOOD AND DRUG ADMINISTRATION
ROCKVILLE, MARYLAND 20852

OCT 24 1972

Senator Olympio T. Borja
Chairman, Special Joint Committee
Concerning Rongelap and Utirik Atolls
Congress of Micronesia
Saipan, Mariana Islands 96950

Dear Senator Borja:

It is my pleasure to submit my report (Attachment No. 1) as a Consultant to your Committee in accordance with the Memorandum of Understanding of September 21, 1972, (Attachment No. 2).

I have combined portions of my response to the multiple questions in an attempt to more concisely state my observations on the methods of examination of the exposed persons of Rongelap and Utirik, as well as on the delivery of health care to the entire population of those atolls. The latter observation is made in response to the verbal request of Mr. Hans Wiliander, Vice Chairman of the Special Joint Committee.

I trust my report will be of assistance to your Committee in its continuing deliberations concerning Rongelap and Utirik Atolls.

As requested by you, I have attached a resume of my professional background.

With best personal regards, I remain

Sincerely yours,

William S. Cole, M.D.
Associate Director
Bureau of Radiological Health

3 Enclosures

Attachment No. 1

REPORT OF WILLIAM S. COLE, M.D., MEDICAL CONSULTANT TO THE SPECIAL JOINT COMMITTEE CONCERNING RONGELAP AND UTIRIK ATOLLS, CONGRESS OF MICRONESIA, FROM THE U.S. PUBLIC HEALTH SERVICE, BUREAU OF RADIOLOGICAL HEALTH, FOOD AND DRUG ADMINISTRATION, DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE

In accordance with the Memorandum of Understanding, dated September 21, 1972, I submit this report. The observations and opinions expressed are the result of my visits to Ebeye Island, Rongelap Atoll, Utirik Atoll, and Majuro Island, Marshall Islands, Trust Territory of the Pacific Islands, from September 5, 1972, to September 23, 1972, with the Brookhaven National Laboratory Medical Team. During this interval the following Marshallese were examined:

Exposed persons	- Rongelapese	32
	- Utirikese	76
Unexposed Rongelapese Control Group		16
Children of exposed Rongelapese		30
Children of unexposed Rongelapese		10

In addition, approximately 100 men, women, and children were examined and treated for diseases not related to radiation exposure. For example, more than 60 pairs of charity-donated eyeglasses were dispensed to the people of Rongelap and Utirik.

The visit of the Medical Team coincided with a serious outbreak of upper respiratory diseases and an acute gastro-enteritis infection on both Rongelap and Utirik. In addition, a localized epidemic of influenza occurred among those people and the personnel of the Medical Team, resulting in a quarantine of the involved islands. This proved to be an additional handicap in the conduct of the examinations by the Medical Team when it arrived at the Majuro Memorial Hospital, Majuro Atoll.

1. METHOD OF EXAMINATION OF THE PEOPLE OF RONGELAP AND UTIRIK ATOLLS BY THE BROOKHAVEN NATIONAL LABORATORY MEDICAL TEAM

The annual examination of the exposed people of Rongelap and Utirik Atolls is considered adequate for the detection of radiation-induced diseases, the result of fallout exposure in March 1954. This method of examination has detected serious thyroid abnormalities in 21 Marshallese in the past and resulted in the discovery of two additional cases at this most recent examination. The first case of acute myelogenous leukemia was discovered at this examination and the patient taken to the Hospital of the Medical Research Center at Brookhaven National Laboratory, Upton, New York, and subsequently transferred to the National Institutes of Health, Department of Health, Education, and Welfare, for observation and treatment.

Examinations performed by the Brookhaven National Laboratory Medical Team are considered technically adequate for its purpose. The history and physical examinations are performed under difficult circumstances on the islands with the lack of any facilities on Utirik compounding the problem. The permanent facilities available in the trailers on Rongelap are much more adequate for the examinations. The blood and urine tests performed by the American and Marshallese technicians are adequate and accurate. Additional examinations not related to radiation-induced disease could be added as clinically indicated. In regard to the treatment of radiation-induced disease and, in particular, the thyroid abnormalities occurring in exposed persons who were under the age of 10 at exposure, all available records indicate the treatment to have been excellent. The surgical care rendered to these individuals in Guam, Hawaii, and the United States is comparable to the best afforded in this country.

An annual medical examination with diagnosis and treatment of diseases endemic to the Marshall Islands not related to radiation is inadequate to protect the health of the people. Much more medical training of the Trust Territory Health Aides with standardization of the facility, surgical supplies, and medications is necessary before much improvement is to be expected. Frequent visits by Medical Officers of the District Headquarters are imperative.

There is difficulty in communication with the people on the purpose of the annual examination for the detection of radiation-induced disease. The facilities available on both Rongelap and Utirik do not afford the opportunity for a good physician-patient relationship and, until this situation is improved, misunderstanding and mistrust by the people will continue. This was more evident when I visited the Marshall Islands with members of the Special Joint Committee in July 1972. The language barrier increases the difficulty for both patient and examining physician as the physical examination is conducted.

2. OBSERVATIONS RELATIVE TO THE TREATMENT OF PAST AND PRESENT DISEASES

In regard to the diagnosis and treatment of disease endemic to the Marshall Islands visited and not related to radiation, the methods for delivery of good health care are totally inadequate. The difficulty in transporting heavy diagnostic medical equipment ashore at Rongelap and Utirik precludes examination using, for example, modern x-ray machines. In view of this, consideration should be given to the procurement of a "hospital" ship with such equipment permanently installed. This method would also allow additional clinical examinations to be performed as well as treatment of surgical problems. Such a facility would afford visiting medical personnel clean living accomodations not now available. This method of delivery of good health care has been adopted and proven highly successful in other developing countries.

The medical record system observed is totally unsatisfactory. A medical record should be established for all persons, both exposed and non-exposed. That information pertinent to the exposed population should be part of such a record and available for the visiting Medical Officers of the Trust Territory. An upgraded record of immunizations should be maintained to prevent outbreaks of diseases which could be prevented by early childhood immunizations. The tragic poliomyelitis epidemic of 1963-64 is an example of the necessity of such a program.

Consideration should be given to the preparation of a document in Marshallese on the purpose of the annual examination by the Brookhaven National Laboratory Medical

Team for distribution to the people prior to the visit of the physicians. I am not aware that such written information is presently available. Such a document may alleviate misunderstandings now in existence.

The dispensaries on Rongelap and Utirik should be upgraded with standardization of surgical supplies and medications. The hospital on Ebeye is inadequate to deliver good health care to the 5,000 residents of that island. The construction of the new hospital should be expedited as rapidly as possible. Additional medical training of the Health Aides on Rongelap and Utirik is a necessity. In my opinion, without it, even the scheduled visits by the Medical Officers from the District Headquarters will not prevent possible serious or fatal illnesses in the outer islands.

3. OPINION ON THE REPORTED ACUTE AND LATE RADIATION EFFECTS ON THE PEOPLE OF RONGELAP AND UTIRIK ATOLLS

The Bravo thermonuclear device of the Operation Castle test series was detonated on a coral reef on Bikini Atoll on March 1, 1954. This produced a yield of 15 megatons TNT equivalent and contaminated an area approximately 330 miles by 60 miles with radioactive debris. This large area included Rongelap and Utirik Atolls. The reported exposures to the people on those islands released by the U.S. Atomic Energy Commission in July 1956 were as follows:

Rongelap	175 rads whole body gamma	
Ailingnae	69 rads " " "	
Rongerik	78 rads " " "	(USAF Personnel)
Utirik	14 rads " " "	

The people of Rongelap received a skin exposure to such a degree to produce burns and partial epilation of the scalp, the result of a significant beta dose. The external beta dose was the result of direct skin contamination by fallout material. The presence of clothing and partial shielding by trees or houses resulted in spotty skin contamination.

In addition to the whole body gamma exposure and beta burns of the skin, a significant amount of radionuclides was absorbed by ingestion and inhalation. The dose calculations were begun at Kwajalein about two weeks after the detonation by determination of radioactivity within pooled urine samples. Such samples were returned to the United States for radiochemical analysis. Such analyses were continued and, at six months following the exposure, only minute amounts of radioactivity were detectable in the urine. Radioactive iodine was the most hazardous of the absorbed isotopes and, by extrapolation, a dose of 160 rads to the thyroid gland of the exposed adult and a range of 700-1400 rads to the exposed child's thyroid gland was received. In addition, both groups received 175 rads from external gamma irradiation.

Articles on this subject, published by the U.S. Atomic Energy Commission, the Brookhaven National Laboratory, the Department of Defense, and testimony before the Special Subcommittee on Radiation of the Joint Committee on Atomic Energy, Congress of the United States, were carefully reviewed with particular attention to methods used in dose calculations. Granted that much of the data were determined by post-detonation calculations and extrapolations, one must conclude that the published figures are reasonably accurate. It may be possible to reevaluate the data but this would be a formidable procedure.

By the Spring of 1957, ten surveys of Rongelap Atoll had been made by the Applied Fisheries Laboratory of the University of Washington and U.S. Naval Radiological Defense Laboratory. A decision was made to allow the people to return to their island on June 29, 1957, with the belief that permanent residence would not be detrimental to their health. The last nuclear device of the Operation Hardtack Tests was detonated on Eniwetok on July 26, 1958. Published data indicates that only a small and insignificant increase in background levels occurred on Rongelap as a result of this test.

In early 1958, a joint field trip was made by the Laboratory of Radiation Biology of the University of Washington and the Brookhaven National Laboratory Medical Team. Subsequently, three additional radiation surveys were conducted by the Laboratory of Radiation Biology prior to 1960. The maximum gamma dose level in September of 1959 was recorded as 0.04 mrads per hour, or approximately 350 mrads per year, well within the accepted maximum permissible dose of 500 mrads

per year to an individual. It was recommended to the people that land and coconut crabs not be consumed because of their selective absorption of strontium-90 and cesium-137.

It is accepted that the radioisotopes of iodine I-131, I-132, I-133, and I-135 contributed to the total dose to the thyroid gland, resulting in the development of nodules in the thyroid gland in 19 of 82 exposed people on Rongelap, with the preponderance in individuals who were less than 10 years of age at the time of exposure. The first thyroid abnormality was discovered nine years after exposure. Subsequent surgical exploration was carried out in Guam, Hawaii, and the United States on 18 of the victims, revealing three to have cancer of the thyroid gland. In addition, two boys were found to have developed total atrophy of the gland resulting in hypothyroidism. In an effort to prevent the development of thyroid nodules, the exposed people were administered thyroxine on a continuing basis. In my opinion, the surgical and medical treatment of the thyroid abnormalities afforded was comparable to the best available in the United States.

The long term or delayed effects of radiation are in the main the result of the radioactive isotopes strontium-90 and cesium-137. These two isotopes were plentiful in the fission products and have relatively long half-lives. Body burdens for cesium-137 and strontium-90 by radiochemical assay of the exposed Rongelapese in 1969 indicated no increase since similar evaluations in 1965. In addition, there was no significant difference in the body burdens of the exposed and unexposed persons living on Rongelap, indicating an equilibrium had been reached. It is difficult if not impossible to predict the ultimate result of this increased body burden of potentially carcinogenic substances. It is generally considered that the biological hazard from cesium-137 is not as great as strontium-90, a beta emitter that is selectively deposited in bone. There are animal experiments which indicate that strontium-90 in sufficient quantities may produce bone cancer and possibly leukemia. Pathological effects of cesium-137 in the muscle mass of the body are not definitely known at the present time.

At this examination, a nodular thyroid gland was detected in a Rongelapese girl who was 12 years of age at exposure and the first nodular thyroid in a woman exposed on Ailingnae when she was less than 10 years of age. Unfortunately, the first case of acute myelogenous leukemia among the exposed

Rongelapese was discovered at this examination. This case of leukemia occurred well beyond the peak incidence expected as the result of radiation exposure but radiation cannot be dismissed as the causative agent. In my opinion, the discovery of this disease in an exposed person on Rongelap is an extremely disturbing event at this late date following the acute radiation exposure. One of the most difficult problems at the moment is determining the effect of continued low dose irradiation of a given population. It is prudent to assume that there is no level below which some damage may be produced. Although I am not able to conclude with certainty that this case of leukemia resulted from radiation, it would appear that this is the case. Certainly it demands the continued annual examination of all exposed Marshallese for the forseeable future.

William S. Cole, M.D.

Submitted: October 18, 1972

CURRICULUM VITAE PRIVACY ACT MATERIAL REMOVED

WILLIAM S. COLE, M.D.

BIRTHDATE:

MEDICAL EDUCATION:

University of Virginia Medical School - Doctor of Medicine, 1937

INTERNSHIP AND RESIDENCIES:

Virginia Mason Hospital, Seattle, Washington, 1937-1938
Resident on Internal Medicine, The Mason Clinic, Seattle, Washington, 1938-1939
Fellowship in Radiology, Mayo Clinic, Rochester, Minnesota, 1947-1948-1949

CIVILIAN PRACTICE OF MEDICINE:

General Practice: Taylor-Richardson Clinic, Ellensburg, Washington, 1939-1942
Chief of Radiology, Washington Clinic, Washington, D.C., 1954-1968
Assistant Professor of Radiology, Johns Hopkins University, Baltimore, Maryland, 1968-1973
Staff Radiologist, Johns Hopkins Hospital, Baltimore, Maryland, 1969-1973

MILITARY SERVICE:

U.S. Navy Medical Corps, 1942-1954
Rank: Commander, MC-USN (ret.), 1954
Last duty station: Chief of Radiology, U.S. Naval Hospital, Bethesda, Maryland, 1953-1954
Retired from the U.S. Navy as a result of injuries received in combat in the South Pacific Theater.

SCHOLARSHIPS AND HONORARY MEDICAL SOCIETIES:

E. I. DuPont Scholarship, 1932-1933-1934, University of Virginia
Richard Henry Whitehead Scholarship, 1935-1936-1937, University of Virginia Medical School
Alpha Omega Alpha Honor Medical Society, 1937

ALUMNI ASSOCIATIONS AND SOCIAL CLUBS:

Mayo Foundation Alumni Association
University of Virginia Medical Alumni Association
President, Manor Country Club Community Association, 1966
Board of Governors, Manor Country Club, 1967-1968
Executive Committee, Manor Country Club Board of Governors, 1968
Advisory Committee, Manor Country Club Board of Governors, 1969-1972

SEMINARS AND LECTURES:

Radiology Representative, Tumor Board Seminars, U.S. National Naval Medical Center, Bethesda, Maryland, 1950-1954
American Cancer Society Speakers Bureau, Washington, D.C. Chapter, 1964-1965-1966

PROFESSIONAL AND SCIENTIFIC SOCIETIES:

American Medical Association - 1941-1972
American College of Radiology - 1949-1972
  Executive Committee of the Council ACR, 1968
  Councilor from the Washington Chapter of ACR, 1965-1968
  Committee on Radiological Units. Standards and Protection. 1970-1972
  Councilor from U.S. Public Health Service - 1970-1972
  Member, Task Force on Pneumoconiosis of ACR - 1970-1972
  Member, American College of Radiology Residents Workshop, Washington, D.C. - 1965
  Chairman, American College of Radiology Residents Workshop, Johns Hopkins Hospital, 1970
  Fellow, ACR, 1969
Diplomate of the American Board of Radiology, 1949
District of Columbia Medical Society
  Chairman, Committee on Licensure, 1967-1968
  Vice-Chairman, Committee on Credentials, 1967-1968
  Chairman, Annual Scientific Assembly, 1966
  Chairman, Committee on Hospital Utilization, 1966
New York Academy of Sciences, 1968
Eastern Radiological Society, 1968-1972
Louis MacKall Medical Society, Washington, D.C., President, 1967-1968
Advisory Committee Chairman, Mid-Eastern Conference of X-ray Technicians, 1967-1968
Honorary Member, District of Columbia Society of Radiological Technicians, 1968
Radiological Society of North America - 1949-1972
  Committee on Audio-visual Aids, 1970
American Roentgen Ray Society - 1971

PRESENT POSITION:

Associate Director
Bureau of Radiological Health, USPHS

Executive Secretary, Medical Radiation Advisory Committee
Bureau of Radiological Health, USPHS

ARTICLES, BOOKS, REPORTS:

"Macrocytic Anemia in Association with Esophagitis"; William S. Cole, M.D.; Clinics of the Virginia Mason Hospital; 16:2:1937.

"Tabes Dorsalis Simulating Disease of the Gastro-Intestinal Tract"; William S. Cole, M.D.; Clinics of the Virginia Mason Hospital; 16:3:1937.

"The Plasma Proteins Following Partial Hepatectomy"; Alfred Chanutin, J. C. Hortenstine, and William S. Cole - J. Biol. Chem., p. 123-247, 1938.

"Massive Hemorrhage from Peptic Ulcer"; John M. Blackford, M.D., and William S. Cole, M.D.; Am. J. Dig. Dis.; 6:637:1939.

"Peptic Ulcer: A Review of 1,033 Cases"; John M. Blackford, M.D., M. F. Dwyer, M.D., Robert H. Williams, M.D., and William S. Cole, M.D.; Radiology; 36:217:1941.

"A Manual of Radiation Therapy"; William S. Cole, M.D.; Mayo Clinic Press, Rochester, Minnesota, 1949.

"Carcinoma of the Larynx Occurring in a Patient Receiving Therapeutic Doses of I-131"; E. R. King, M.D., William S. Cole, M.D., Alec Horwitz, M.D., Calvin T. Klopp, M.D.; Archives of Otolaryngology; 59:333; March 1954.

"Opportunities and Problems in the Clinic Practice of Radiology"; American College of Radiology Workshop, Washington, D.C., Nov. 13, 1965.

"Aggressive Approach to Metastatic Testicular Teratocarcinoma"; Theodore H. Wilson, Capt. MC-USN; David P. Osborne, Capt. MC-USN, William S. Cole, M.D.; The Journal of Urology, Vol. 96, August 1966.

"The Judicious Use of Radiation in the Healing Arts"; William S. Cole, M.D.; (Presentation at APHA, November 1968). American Journal of Public Health, Vol. 59, No. 7, July 1969.