STATEMENT OF
ROBERT ALVAREZ
SENIOR SCHOLAR
INSTITUTE FOR POLICY STUDIES
BEFORE
THE
SUBCOMMITEE ON ASIA, THE PACIFIC AND THE GLOBAL ENVIRONMENT
U.S. HOUSE OF REPRESENTATIVES

May 20, 2010

Summary

The radiological legacy of U.S. nuclear weapons testing in the Marshall Islands remains to this day and will persist for many years to come. The most severe impacts were visited upon the people of the Rongelap Atoll in 1954 following a very large thermonuclear explosion which deposited life-threatening quantities of radioactive fallout on their homeland. The Rongelap people were exposed to more than three times the estimated external dose to the most heavily exposed people living near the Chernobyl nuclear accident in 1986.

It took more than two days before the people of Rongelap were evacuated after the explosion. Many of the exposed Rongelap people suffered from tissue destructive effects of radiation and subsequently from latent radiation-induced diseases.

In 1957, they were returned to their homeland even though officials and scientists working for the U.S. Atomic Energy Commission determined that radiation doses would significantly exceed those allowed for citizens of the United States. The desire to study humans living in a radiation-contaminated environment appeared to be a major element of this decision.

By 1985, the people of Rongelap fled their atoll, after determining that the levels of contamination were comparable to the Bikini atoll where people were re-settled in 1969 and evacuated by the early 1970's after radiation exposures were found to be excessive. A few years before the evacuation of the Rongelap people in 1985, a policy was secretly established by the Energy department during the closing phase of the Compact of Free Association to eliminate radiation protection standards, so as to not interfere with the potential resumption of weapons testing.

These circumstances were subsequently uncovered in 1991 by the U.S. Senate Committee on Governmental Affairs. As a result, in 1992 the U.S. Departments of Energy and Interior entered into an agreement with the Republic of the Marshall Islands and the Local Rongelap Government that re-established radiation protection standards as a major element for the re-settlement of Rongelap. This agreement was reviewed by the U.S. National Academy of Sciences in 1994 and found to be viable. According to the Academy: "A crucial provision of the MOU is that resettlement will occur only if *no person* returning to Rongelap and subsisting on a native-foods-

only diet will receive a calculated annual whole-body radiation dose equivalent of more than 100 mrem above background."

In 2006, a radiological expert for the people of the Rongelap Atoll reported that the 100 millirem limit would be exceeded based on a local food only diet, if potassium fertilizer were not repeatedly applied. Apparently, this was not done for the southern islands of the atoll where local food is obtained.

Despite this warning, the Departments of Energy and Interior did not take steps to ensure this would be done, in accordance with the 1992 agreement. Give the long and unfortunate legacy of nuclear testing it appears that this critical element of safety was lost in the shuffle.

Until the U. S. Government can assure that steps to mitigate doses below 100 millrem are demonstrated by applying potassium fertilizer, efforts to force the Rongelap people back to the home is unjustified and unfairly places the burden of protection on the Rongelap people. It appears that DOE and Interior have quietly crept away from the 1992 agreement, without verifying that its terms and conditions to allow for safe habitability will be met.

Moreover, the 100 millirem limit stipulated in the agreement, should have a safety margin, in which the doses fall beneath this limit to encompass uncertainties. Keep in mind that the limit set for the general public in the U.S. by the EPA is 15 millirems. DOE is self-regulating and has a public exposure limit four times greater. However, DOE is required under the Superfund program to meet the 15 millirem limit as it proceeds with cleanup of weapons sites.

Background

Between 1946 and 1958, the United States exploded 66 nuclear weapons into the atmosphere and underwater in the Marshall Islands. The tests were conducted on the northwestern atolls of Bikini and Enewetak. Twenty-three of the tests were conducted at Bikini and the remaining 43 were conducted at Enewetak. Although the period of testing spans 12 years, the tests were done in series that occurred mostly during even years and lasted two to three months. (One other test was conducted during Operation Hardtack I. This test, named Yucca, occurred in April 1958 was detonated northeast of Enewetak from a balloon at a height of approximately 86,000 feet.)

These tests have created significant damage to the environment, natural resources and health of the Marshall Islands people. For instance by 1954, the U.S. was compelled to detonate nuclear weapons from barges because, *"high yield thermonuclear tests were blowing vast holes in the reefs at Bikini and Enewetak… otherwise the U.S. test program would soon run out of islands."* [1]

The Bravo Explosion

Between 1946 and 1958, as a result of nuclear weapons testing, the Marshall Islands sustained significant damage and radiological contamination. The people of Bikini and Enewetak were placed into exile by the U.S. Government so that their atolls could be used to explode nuclear weapons. The tests were conducted joint Department of Defense (DOD)/Atomic Energy Commission (AEC) Task Forces (JTF). The commander of the JTF was a military officer who was given authority to act for the AEC. AEC staff plus staff from its weapons laboratories in Los Alamos New Mexico, and Livermore California served as technical and safety advisors to the JTF commander. Final decisions were made by the JTF commander on behalf of the DOD and AEC.

Other Marshallese were occasionally evacuated temporarily but, for the most part were left on their atolls. On March 1, 1954, the detonation of an estimated 15 megaton thermonuclear weapon, known as "Bravo" took place – as part of the "Castle" test series. According to the U.S. Radiochemistry Society, "***the Bravo test created the worst radiological disaster in US history*** [Emphasis added]….*the yield of Bravo dramatically exceeded predictions, being about 2.5 times higher than the best guess and almost double the estimated maximum possible yield (6 Mt predicted, estimated yield range 4-8 Mt).*"[2] The bomb was over 1000 times more powerful than those exploded over Hiroshima and Nagasaki in 1945. The Bravo crater in the atoll reef had a diameter of 6,510 ft, with a depth of 250 ft.[3] The cloud top rose and peaked at 130,000 feet (almost 40 km) after only six minutes. Eight minutes after the test the cloud had reached its full dimensions

[1] Radiochemistry Society, U.S. Nuclear Tests, Operation Castle, Pacific Proving Ground, http://www.radiochemistry.org/history/nuke_tests/castle/index.html

[2] Ibid.
[3] Ibid.

with a diameter of 100 km, a stem 7 km thick, and a cloud *bottom* rising above 55,000 feet (16.5 km), and after 10 minutes had a diameter of more than 60 miles. [4] See Figure 1.

Figure 1. Bravo Test March 1, 1954
Source: U.S. Department of Energy

Intense radioactive fallout from the cloud was carried eastward and severely contaminated a Japanese commercial fishing boat and the atolls of Rongelap, Alinginea, Rongerik, and Utirik, some 200 miles away. About five hours after detonation, fallout began to deposit on the Rongelap Atoll. The fallout was so heavy that the Rongelap people, who had never seen snow, thought it was snowing. Children played in the radioactive powder, and no warning was issued by the JTF. *"We saw a flash of lightening in the west like a second sun rising,* "Anjain said in 1980. *"we heard a loud explosion and within minutes the ground began to shake. A few hours later radioactive fallout began to drop on the people, into drinking water, and on the food. The children played in the colorful ash. They did not know what it was and many erupted on their arms and faces."*[5]

About 50 hours after the explosion, the Navy evacuated the Rongelap people. About 24 hours later residents of Uterik were evacuated. Within the first 48 hours following evacuation two Rongelap people began to experience symptoms of vomiting. [6]With two to three weeks the exposed people began to exhibit a wider range of symptoms from radiation injury, including hair loss, skin and mucous membrane lesions, and significant blood changes.[7] At the time of the evacuation, the external penetrating radiation exposure (gamma) rate, one hour after the fallout on Rongelap, was

[4] Ibid.
[5] National Committee for Radiation Victims, ed. Invisible Violence, Proceedings of the National Citizen's Hearings for Radiation Victims, April 10-14, 1980, p. 19.
[6] Naval Station, Kwajalein, to AEC, Washington, 15 March 1954, Joint Committee on Atomic Energy , General Subject Files, Box 80, Weapons Tests Pacific Proving Ground (Castle) 1954, p. 51, RG 128, NARA.

[7] Memorandum by Ed Heller, 23 Mar 54, JCAE General Correspondence, Box 712, "Weapons Tests (Eniwetok) 19541955," RG 128, NARA

~3.51to 35 roentgen (R) per hour. [8] Total-body exposures were large enough to cause tissue destruction. *"Our people began to be very sick,* "John Anjain remembered. *"They vomited, burns showed on their skin, and people's hair began to fall out."*[9] (See figures 2.)

The people on Rongelap sustained the highest average external doses. In 1956 the AEC researcher estimated the total body external penetrating dose to Rongelap residents was 175 rad (radiation absorbed dose).[10] In 1985, the estimated dose increased to 190 rads, [11] and by 2000 the research done for the U.S. Centers for Disease Control estimated that the total-body dose to the Rongelap people from the Bravo test and other subsequent tests in the Castle series in 1954 was 202 rads. [12] (See Table 1.) This is more than three times the estimated external dose to the most heavily exposed people living near the Chernobyl nuclear accident in 1986. [13] According current risks derived by the National Research Council's. Advisory Committee on the Biological Effects of Ionizing Radiation (BEIR VII) the external dose received by the people of Rongelap would result in a 100 percent probability of contracting a radiogenic cancer. [14] Internal doses particularly to radioiodine were quite high. Dose estimates were derived from a single pooled urine sample taken in 1954. In 1964, AEC scientists estimated that a child 3-4 years old received a thyroid dose in the range of 1,200 to 5,200 rad.[15] By comparison the highest doses from radioiodine to children living near the Chernobyl reactor in a heavily contaminated area were estimated at 430 rads.[16]

Figure 2 Fallout dose contours originating from the Bikini Atoll in the Marshall Islands from the Castle-Bravo test on March 1st, 1954.

[8] U.S. Atomic Energy Commission, University of Washington, Laboratory of Radiation Biology, Gamma Dose Rates at the Rongelap Atoll, 1954-63, May 1965, http://worf.eh.doe.gov/data/ihp1d/67528e.pdf

[9] Ibid.

[10] U.S. Atomic Energy Commission, Ionizing Radiation on Human Beings, a report on the Marshallese and Americans accidentally exposed to radiation from fallout and a discussion of radiation injury in the human being, July 1956. http://worf.eh.doe.gov/data/ihp2/7548_.pdf

[11] Edward Lessard et al, Thyroid-absorbed dose for people of Rongelap, Utrik, and Sifo on March 1, 1954, Brookhaven National Laboratory, U.S. Department of Energy, BNL-51882, 1985.

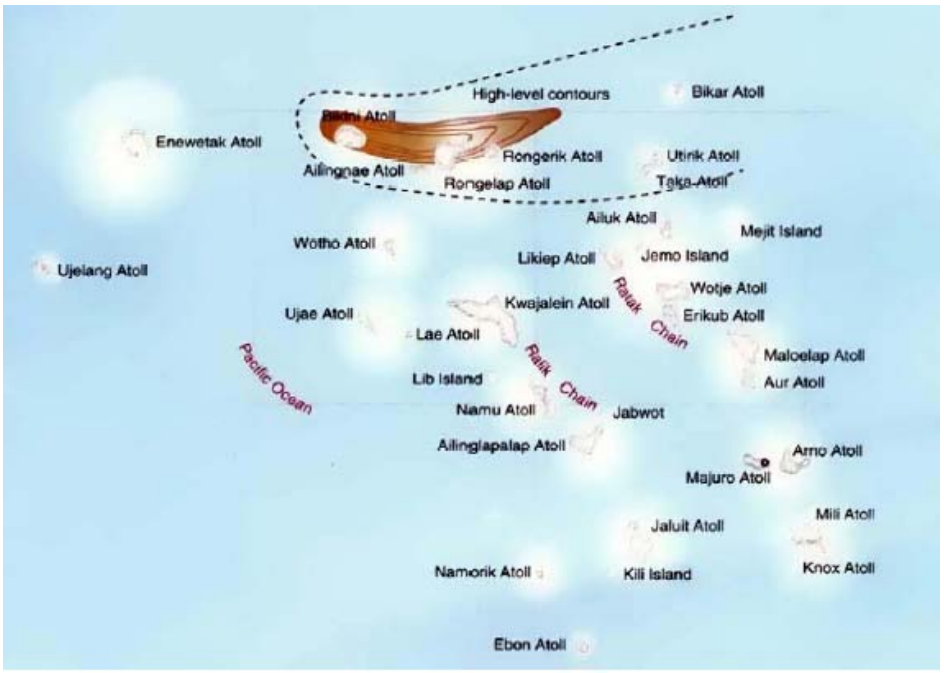
[12] Robert C. Whitcomb, Reconstruction and Analysis of Cesium-137 Fallout Deposition Patterns in the Marshall Islands, University of Florida, U.S. Centers for Disease Control, 2000 (Hereafter known as CDC 2000)

[13] The Health Physics Society, University of Michigan, http://home.comcast.net/~john.kimball1/BiologyPages/R/Radiation.html

[14] Evan Douple, Rick Jostes, Summary of BEIR VII, National Research Council, Presentation to CRCPD Annual Meeting 2006, "On Average, assuming a sex and age distribution similar to that of the entire U.S. population, the BEIR VII lifetime risk model predicts that approximately 1 person in 100 would be expected to develop cancer (solid cancer or leukemia) from a dose of 100 mSv above background.." http://www.crcpd.org/AnnualMeeting-06/Manuscripts/SUMMARY_OF_BEIR_VII.pdf#search=%22doubling%20dose%20BEIR%20VII%22

[15] Ralph H. James, Estimate of Radiation Dose to Thyroids of the Rongelap Children Following the Bravo, Event. Lawrence Livermore National Laboratory, December 16, 1964. http://worf.eh.doe.gov/data/ihp1a/1299_.pdf

[16] Gavrilin, Y. et al. Individual thyroid dose estimation for a case-control study of Chernobyl-related thyroid cancer among children of Belarus-part I: 131I, short-lived radioiodines (132I, 133I, 135I), and short-lived radiotelluriums (131MTe and 132Te). Health Physics, 2004 Jun; 86(6):565-85.



Source: U.S. Department of Energy

Table 1 Cumulative External Radiation Doses from the Castle Test Series

Atoll&land	Bravo	Romeo	Koon	Union	Yankee	Nectar	Total
Ailinginae	60000	3400	3300	8	600	70	67000
Ailinglaplap	7.2	140	100	8	0	0	255
Ailuk	5000	410	110	100	500	20	6140
Amo	60	200	300	8	25	1.3	594
Aur	40	200	50	8	40	2.6	341
Bikar	60000	3000	1200	650	1700	150	67000
Ebon	20	250	50	8	25	0	353
Erikub	390	200	50	0	0	6.5	647
Jaluit	20	300	70	8	0	2.6	401
Jemo	1200	410	130	18	200	20	1978
Kili	20	200	70	0	0	1.3	291
Kwajalein	150	480	250	12	320	17	1235
Lae	5.5	12	12	7.5	78	95	125
Likiep	1700	170	80	30	200	16	2196
Maj uro	200	200	50	20	0	1.3	471
Maloelap	350	120	50	0	25	4	549
Mili	60	160	200	20	0	1.3	441
Namorik	20	160	70	2	0	0	252
Namu	1.8	90	100	0	25	0	216
Rongelap	180000	11000	6000	3400	1700	300	202000
Rongerik	190000	9000	5000	550	1400	280	206000
Taka	15000	800	1000	120	380	50	17000
Taongi	280	60	9.5	10	10	--[a]	370
Ujae	6	32	17	9.5	48	1.4	114
Ujelang	85.4	--[a]	176	52	142	--[a]	455
Utirik	22000	1200	700	100	330	50	24000
Wotho	250	270	110	55	95	4	784
Wotje	1800	300	200	13	220	10	2543

Source: CDC 2000

The outside world first learned of Bravo's disastrous effects two weeks after the blast when a Japanese tuna trawler, Fukuru Maru (the Lucky Dragon) arrived home. The ship was 90 miles east of the explosion. By the time the shipped returned, the entire crew was suffering from radiation sickness. Seven months after the blast they remained in the hospital receiving blood transfusions. The tuna aboard the "Lucky Dragon" were extremely contaminated. This, as it turned out, was not unusual. In 1954 Japanese monitoring programs showed that 683 boats had contaminated fish in their holds. About one out of every eight inspected boats had contaminated fish aboard. The Japanese government was forced to destroy over one million pounds of contaminated fish. By the end of September a crew member of the "Lucky Dragon" died from acute radiation syndrome.

Since that time, the U.S. Government officially maintains that the "Bravo" fallout tragedy was an unfortunate accident, due to an unexpected in the winds. It was planned that the bomb cloud would be blown to the west and north. However, for unexpected reasons, the wind blew east.

The official U.S. position on the "Bravo" test fallout has been challenged by the Air Force weathermen stationed in the fallout path, who claim they warned about a wind shift, several hours before detonation. On April 1, 1982, the DOD's Defense Nuclear Agency (DNA) released an official history of the "Castle" series which revealed that test planner knew during test countdown that the winds were blowing towards Rongelap. [17]Additionally, Dr. Merrill Eisenbud, the Director of the of the AEC's Health and Safety Laboratory, who also served as a scientific member of the "Bravo" Joint Task Force, wrote;

"There are many unanswered questions about the circumstances of the 1954 fallout. It is strange that no formal investigation was ever conducted. There have been reports that the device was exploded despite an adverse meteorological forecast. It has not been explained why an evacuation capability was not standing by, as had been recommended, or why there was not immediate action to evaluate the matter when the Task Force learned (seven hours after the explosion) that the AEC Health and Safety Laboratory recording instrument on Rongerik was off scale. There was also an unexplained interval of many days before the fallout was announced to the public."[18]

Gordon Dunning, an AEC radiation safety official noted months before the Castle tests, that the *"main objection to evacuation is the high costs and the logistic problems presented in supporting such an operation."* [19] In a press release, when the U.S. Government did finally announce the aftermath of the "Bravo" test, the Atomic Energy Commission stated that: *"United States personnel and 236 residents were transported from neighboring atolls…according to plan as a precautionary measure. These individuals were unexpectedly exposed to some radioactivity. There were no burns. All were reported well. After completion of the tests, the natives will be returned to their homes."* [20] Other than the fact that the people were evacuated, all other the claims in the press release were false.

---

[17] Edward Martin, Richard H. Rowland, Castle Series, 1954, U.S. Department of Defense, Defense Nuclear Agency, Technical Report, P. 202. http://worf.eh.doe.gov/data/ihp1c/0858_a.pdf

[18] Merrill Eisenbud,, An Environmental Odyssey: People, pollution and the politics in the life of a practical scientist, Seattle, WA; (University of Washington Press: `1990)

[19] Marshall Island Chronology p. 7

[20] *Marshall Islands: A Chronology--1944-1978* (Honolulu: Micronesia Support Committee, 1212 University Ave., Honolulu, HI 96826), p. 4.

The Legacy of Fallout

The "Bravo," test was one of six large nuclear weapons tests conducted between February 28 and May 14, 1954, which released about 4.2 billion curies of Iodine-131, and 4.9 million curies of cesium-137.[21] The Castle series produced more than half of the total amount of these radionuclides from all tests in the Marshall Islands. [22] See Table 2. By comparison, the amount of Iodine 131 and Cesium-137 released by the Castle test series was 475 times greater and 2.5 times greater, respectively, than from the 1986 Chernobyl accident.[23] The amount of Iodine-131 released from the Castle test series was nearly half of all released from Marshal Island tests[24] and more than 28 times greater than released from all nuclear weapons tests conducted at the Nevada Test Site in the United States. [25] See Table 2) Although the primary focus of the effects of radioactive fallout has been on the Bravo test, a 2000 review done for the U.S. Centers for Disease Control indicates that radioactive fallout from tests in the Castle, Redwing, and Hardtack series deposited Cesium-137 on Rongelap.[26] (See Tables 3 and 4) In 1958 the highest air concentration for Iodine-131 (125.5 pCi/m3) outside of the test areas, for the Hardtack I test series, was measured on Rongelap [27]– 25 percent above the EPA's current exposure standards for the U.S. public. [28]

Table 2 Production of Radioactivity from the Castle Series (Fission Yield of 62 percent)*

Test	Yield	Iodine 131**	Cesium-137***
Bravo (March 1, 1954)	15 megatons (Fission Yield 9.3 mt)	1,395,000,000 Ci**	1,488,000 Ci
Romeo (March 27, 1954)	11 megatons (Fission yield 6.82 mt)	1,023,000,000 Ci	1,091,000 Ci
Koon (April 7, 1954)	0.110 megatons (fission yield 0.682 mt)	102,300,000 Ci	109,120 Ci
Union (April 26, 1954)	6.9 megatons (Fission yield 4.23 mt)	654,000,000 Ci	676,800 Ci

[21] CDC 2000
[22] Ibid.

[23] National Research Council, Radiation Dose Reconstruction for Epidemiologic Uses, National Academy of Sciences Press. P. 105.
[24] CDC 2000. (Pacific Proving Ground tests were estimated to release 9 billion Ci of I-131 based on 60,246 kilotons of fission yield.)
[25] CDC 2000
[26] CDC 2000
[27] U.S. Atomic Energy Commission, Memorandum to: John L. Dunning, Director, Division of Biology and medicine, From: Gordon Dunning, Health Physics Branch, and October 15, 1958. http://worf.eh.doe.gov/data/ihp1b/5638_.pdf
[28] U.S. Agency for Toxic Substances and Disease Registry, Case Studies in Environmental Medicine, November 2002, P. 31. http://www.atsdr.cdc.gov/HEC/CSEM/iodine/docs/iodine131.pdf#search=%22The%20federal%20standard%20for%20Iodine-131%20in%20air%20is%20100%20pCi%2Fm3.%22

Yankee (May 5, 1954)	13.5 megatons (Fission yield 8.37)	1,255,500,000 Ci	1,339,200 Ci
Nectar (May 14, 1954)	1.69 megatons (Fission yield 1.05 mt)	157,500,000 Ci	168,000 C
TOTAL	48.2 megatons (Fission yield 29.8 mt)	4,229,800,000 Ci	4,872,120 Ci

* Source: CDC 2000

** NCI 1997 (150,000 Ci 1-131 per kiloton)*** CDC 2000 (160,000 Ci Cs-137 per megaton)

Table 3. Estimated Cesium-137 Deposition On Rongelap From 1954-58

	Distribution Percentiles				
Operation	5'''	25'''	50'''	75'''	95'''
Ivy	0.0	0.0	0.0	0.0	0.0
Castle	123835.1	137568.2	146685.4	155818.9	169408.4
Redwing	49.6	55.4	59.5	63.6	69.2
Hardtack I	210.9	223.7	233.2	242.9	256.9

Source CDC 2000

Table 4 Estimates of Cs-137 Deposition at Rongelap from the Castle Series

Test	$X_{(H+12)}$ µCi m^{-2}		Bq m^{-2}	Decay to 1982	Bq kg-'
Bravo	8369.6	6.5785	243404	127923	581.3
Romeo	814.8	0.6152	22761	11962	54.4
Koon	246.1	0.1858	6875	3613	16.4
Union	131.1	0.0989	3661	1924	8.7
Yankee	91.6	0.0692	2559	1345	6.1
Nectar	0.0	0.0	0.0	0.0	0.0
Σ =			279760	146768	667

CDC 2000

The Bravo test sparked world-wide protect against atmospheric nuclear weapons testing By the late

summer of 1956 the issue of fallout was being covered on nation-wide television at the Democratic National Convention. The Democratic Party was campaigning to halt H-bomb tests. Presidential candidate Adlai Stevenson, relying on the information of AEC critics, cited the genetic and strontium 90 hazards from tests.

Nuclear testing advocates Edward Teller and Ernest O. Lawrence responded with a joint statement depicting radioactive fallout as *"insignificant."*[29] Institutional differences over dangers of fallout became quite clear during the election. On one side were the AEC and its scientists, such as Commissioner Willard Libby, Shields Warren, John Bugher, Teller, and Lawrence. The other side included several prominent scientists from the California Institute of Technology--Linus Pauling, E. B. Lewis, A. H. Sturtevant, and George Beadle. Although Stevenson lost the election, his campaign provided a national forum for the fallout debate.

The Marshall Islands were in the category of a protective "trust territory" arrangement engineered by the United States Government. The U.S. had signed a United Nations trusteeship agreement under which the American government had pledged to *"promote the social advancement of the inhabitants, and to this end shall protect the rights and fundamental freedoms of all elements of the population without discrimination; protect the health of the inhabitants. "*[30]

Following the exposure and evacuation of the Rongelap people the U.S. AEC and Defense department initiated several radiation-related research efforts, which were aimed at understanding the immediate aftermath of the fallout from Bravo, and subsequent radiological contamination, human health effects, dose estimation, and radioecological implications, particularly with respect to consumption of contaminated foods.

In May 1954, Urine samples were taken from the Rongelap people and flown to the Los Alamos Scientific Laboratory for analysis -- revealing that plutonium levels for three people were found to exceed the permissible limit for workers.[31]

Comprehensive information taken from all exposed Rongelap people was analyzed. A study known as “Project 4.1,”of the Castle test series, stated:

“the exposure of these individuals afforded a unique opportunity to study the effects of radiation in man and it was considered desirable to supplement the clinical studies with as much information as possible concerning the period of exposure. [This research] *detailed information concerning the clinical observations and therapy, the external lesions, the hematological studies and the internal radioactive contamination of the 82 native inhabitants of Rongelap and Alinginea Atolls…*[including]*: (1) a detailed sketch of Rongelap Village (2) a brief description of the islanders’ homes and their food and water supplies; (3) the various family groups and the location of their dwellings; (4) events during fallout (5) the evacuation and decontamination procedures;*

---

[29] *New York Times*, June 21, 1956.

[30] "United Nations Trusteeship Agreement for the United States Trust Territory of the Pacific Islands," Article 6; reprinted in Greg Dever, M.D., *Ebeye, Marshall Islands A Public Health Hazard* (Honolulu: Micronesia Support Committee), p. 25.

[31] U.S. Atomic Energy Commission ,Gordon Dunning to John C. Bugher, 21 May 54, Rongelap twxs, 1954 re: Fallout following Bravo, RG 326, DOE Archives, Germantown Maryland

and (6) readings of the external radioactive contamination of these individuals.[32]

In the after math of the Bravo test, by November 1954, the AEC drafted new "Policies Regarding Radiological Safety of the Public During Weapons Testing at the Nevada Proving Grounds," in which a dose of 30 roentgens, more than three times less than received by the Rongelap people, would trigger evacuation. [33] By November 1956, dose limits to the public near the Nevada test site were reduced to 3.9 roentgens for any year, [34] – 48 times less than received on Rongelap.

Studies of the distribution and concentration of radiological contamination and the uptake of radionuclides in biota commenced within less than a month after the 1954 Bravo test.[35] A year after the test researchers from the Naval Radiological Defense Laboratory (NRDL) found, "significant amounts of radioactive contamination." The highest concentrations were in marine foods taken from the Northern Rongelap Lagoon, particularly with respect to radioreuthenium, and rhodium, Zirconium-95, niobium. In terms of terrestrial contamination the dominant radionuclide was Cesium-137. [36]

In this context, the U.S. government decided to return the Rongelap people to their homeland in 1957. But, humanitarian concerns were not necessarily behind the government's desire to return them to the atoll. According to the minutes and transcripts of the meetings of the AEC's Advisory Committee on Biology and Medicine (ACBM)in 1956 the people of Utrik and Rongelap were returned despite the fact that food contamination in particular was significantly higher than acceptable for U.S. citizens, and that the risks of congenital malformations from fallout could be significant. But, the Committee recognized that the Rongelap people might still incur substantial radiation doses if they returned.

In his presentation to the Committee in January 1956, Dr. Merill Eisenbud, then head of the AEC's Health and Safety Laboratory, commented that the people in the Northern Marshall Islands provided unique opportunity for human research.

"They had been living on that island [Utrik]… is by far the most contaminated place in the world and it would very interesting to go back and get good environmental data, how many per square mile, what isotopes are involved and a sample of food changes in many humans through their urines, so as to get a measure of the human uptake, when people live in a

---

[32] Robert Sharp and William Chapman, Report to the Scientific Director, Exposure of Marshall Islanders and Military Personnel to Fallout, Operation Castle, Project 4.1 Addendum, March 1957

[33] U.S. Atomic Energy Commission, Memorandum to: Joe Sanders, Assistant Manager Los Vegas Field Office, From: Gordon Dunning, Division of Biology and Medicine, Subject: Review of Policies for NVP [Nevada Proving Ground], November 5, 1954. http://worf.eh.doe.gov/data/ihp1d/77883e.pdf

[34] U.S. Atomic Energy Commission, Radiological Safety Criteria for the Nevada Test Site, November 13, 1956. http://worf.eh.doe.gov/data/ihp1c/8757_.PDF

[35] Applied Fisheries Laboratory, University of Washington, 'A Radiological Study of Rongelap Atoll, Marshall Islands, during 1954-1955," UWFL-42. http://worf.eh.doe.gov/data/ihp1c/7955_.PDF

[36] Residual Contamination of plankton, Animals, Soil, and Water of the Marshall Islands One Year following Operation Castle Flaw USNRDL-454, p. iii, McCraw, Box 9, Radiological Sumy, RG 326, DOE Archives

contaminated environment… Now, data of this type has never been available. ***While it is true that these people do not live, I would say, the way Westerners so, civilized people, it is nevertheless also true that they are more like us than the mice."*** *[Emphasis added.]*[37]

At the ACBM's 56th Meeting In May 1956, there was further discussion about Rongelap people serving as research subjects. According to minutes of the meeting Committee member Bentley Glass stated.

"This is an ideal situation to make your genetic study. It is far more significant than anything you could ever get out of Hiroshima and Nagasaki."[38]

In November 1956 the Committee issued a formal statement, which made it clear that the moving people off Rongelap, once they were resettled would adversely impact nuclear weapons testing:

"It has been suggested by Dr. Conard that they be permitted to return in April or May 1958. …It was agreed that because of the already relatively high exposure to which these natives had already been subjected, limiting their exposures in terms of now on was unrealistic; but on the other hand, the psychological effect of permitting them to receive more radiation than our own people, could be subject to criticism. A further discussion resulted in the decision to prepare a statement expressing the Committee's opinion. Statement was subsequently prepared as follows:

It is moved that the ACBM approve the Division of Biology and Medicine's proposal to return the Rongalpese to their native atoll. However, it is the opinion of the ACBM that if it should become necessary to re-evacuate because of further tests, there would result world opinion unfavorable to the continuation of weapons testing."[39]

The AEC's own reports later conceded severe health damage. Out of twenty-two Rongelap children exposed to the fallout from the Bravo test, nineteen have had thyroid nodules surgically removed.[40]

Very soon after the Rongelap and Utirk people were evacuated, the U.S. Military and the Atomic Energy Commission performed regular radiological monitoring and surveillance of the contaminated areas. From 1954 to 1963, external gamma dose rates were continuously measured using aerial radiological and hand held instruments. These data indicate that while background levels of external penetrating radiation continued to decline as a result of radioactive decay of short-lived fission products, such as Reuthenium 106, levels were high enough to deliver annual doses on Rongelap Island during this period, that were hundreds to hundreds to thousands of time greater than current public radiation protection standards permit. [41] [42] [43] The year the Rongelap

---

[37] U.S. Atomic Energy Commission, Advisory Committee on Biology and Medicine, Transcript, January 13, 14, 1956.

[38] U.S. Atomic Energy Commission, Advisory Committee on Biology and Medicine, Minutes, May 26, 27, 2006.

[39] U.S. Atomic Energy Commission, Advisory Committee on Biology and Medicine, Minutes of the 58th Meeting, November 16, 17, 1956.

[40] Gaff Johnson, "Paradise Lost," *Bulletin of the Atomic Scientists*, December 1980, p. 28. The article quotes a 1977 federally funded study by Brookhaven National Laboratory, stating: "Recently about 50 percent of the exposed Rongelap people showed hypothyroidism without clinical evidence of thyroid disease, a finding that probably portends trouble ahead."

[41] Arthur D. Welander, Radiobiological Studies of the Fish Collected at Rongelap and Allinginea Atolls, July 1957, University of Washington Applied Fisheries Laboratory, March 5, 1958. http://worf.eh.doe.gov/data/ihp1c/7850_.PDF

people were returned to their Atoll, internal assimilation of Cesium-137 from the uptake of contaminated food rose by 60 times to 680 nanocuries, [44]more than twice the level permitted for workers at Atomic Energy Commission nuclear weapons sites at the time. [45]

Moreover, the "Hardtack" test series in 1958 resulted in more fallout on Rongelap, which added to the external doses and measurable increases in radioactive assimilations, from contaminated food. [46]

Beginning in 1962, the people of Rongelap began experienced thyroid nodules. Over the years, nineteen out of twenty-two exposed Rongelap children had nodules removed surgically. By the late 1970's concern began to mount over an increase in thyroid cancer among the people of Utrik who were exposed to less radiation that the people of Rongelap. This concern was noted in 1977 by Dr. Konrad Kotrady, DOE's resident physician in the Marshall Islands. According to Kotrady:

"The theory put forth that Utrik received low radiation, so a detailed follow up was not necessary. Now the facts of thyroid cancer at Utirk have strongly shown the theory is wrong, it also further emphasizes to the people [of the Marshall Islands] that the United States really does not know what the effects of radiation are."[47]

By 1997 DOE-sponsored researcher reported:

The most significant complication of the exposure bas been found to be thyroid disease due to the ingestion of radioactive iodides from the fallout. In 1963 the first thyroid nodules were found in Rongelap subjects and in 1969 in Utirik. Non-neoplastic adenomatous nodules were associated with higher doses of radiation and neoplastic nodules developed in individuals receiving lower doses of radiation. Women were more susceptible to the development of palpable thyroid nodules than men.[48]

That same year DOE researchers concluded that external radiation doses to the people of Rongelap would exceed the 30-year dose of 5 rem recommended for protection of the U.S. public.[49]

In 2005, the National Cancer Institute reported to the U.S. Senate Committee on Energy and

---

[42] Op Cit Ref. 2. Figure 2. Dose rates between 1957 when the Rongelap people returned to 1963 were between 0.5 milliroentgens per hour to 0.02 miliroengtens per hour.
[43] 10 CFR 40
[44] Robert A. Conard, et al, Medical Survey of Rongelap People Five and Six years After Exposure to Fallout, Brookhaven National Laboratory, U.S. Atomic Energy Commission, September 1960. http://worf.eh.doe.gov/data/ihp1a/3221_.pdf
Ibid.
[45] National Bureau of Standards, Maximum Permissible Body Burdens and Concentrations of Radionuclides in Air and Water for Occupational Exposure, NBS Handbook No. 69
[46] Ibid.
[47] Kotrady, Konrad, M.D. "The Brookhaven Medical Program to Detect Radiation Effects in Marshallese People: A Comparison of the Peoples' vs. the Program's
Attitudes." Jan.1,1977

[48] Jean E. Howard et al, Thyroid Disease Among the Rongelap and Utrik Population – A Update, Health Physics, 73(1):190-198; 1997

[49] N.A. Greenhouse and R.P. Miltonberger, External Radiation Survey and Dose Predictions for Rongelap, Utirik, Rongerik, Ailuk, and Wotje Atolls, Brookhaven National Laboratory, BNL 50797, December 13, 1977, P. 9

Natural Resources that, among the 14,000 inhabitants who live in the Marshall Islands, an estimated 500 cancers would result from radioactive fallout. The risk of contracting cancer for those exposed to fallout was greater than one in three.

"About 400 of the 500 estimated radiation-related excess cases of all cancers may be expected to develop in the roughly 35 percent of the exposed population that was under 10 years of age at exposure. Since this age group is mainly between 50 and 60 years of age at present, most of their baseline and excess cancers are projected to occur in the next few decades as they reach ages at which baseline cancer rates are normally highest… ***Disproportionately higher excess cancer rates are expected to occur in the relatively small proportion of the population with the highest doses, particularly those exposed on the atolls of Rongelap and Ailinginae."*** *[Emphasis added.]*[50]

Safeguard C and the Takeover the Marshall Islands Health and Environmental Programs by the Nuclear Weapons Program

In the fall of 1982, during the final stages of negotiations over the Compact of Free Association, the U.S. Department of Energy (DOE) placed the Marshall Islands (RMI) health and environmental research program under the direct control of the DOE nuclear weapons program. At the time, the United States nuclear arsenal was undergoing a steep build up. As part of this effort, the readiness capability established in 1963, known as Safeguard C, to resume atmospheric nuclear weapons testing in the Pacific region was given a high priority. In this regard, the Marshall Islands medical and environmental programs became part of the Safeguard C readiness program. And the head of the Safeguard C program was named as the primary DOE representative to the Compact negotiations.

Once under the control of the Safeguard C program in the DOE's Office of Defense programs, key policies and practices were quietly terminated – most notably the adherence to previously adopted radiation exposure standards for the cleanup of the Atolls and restrictions on the consumption of contaminated foods. Instead, the DOE advised Compact negotiators that radiation protection should be based on choices made by the people of the Marshall Islands about the risks and benefits – as explained by the DOE.

DOE, and the Compact negotiators had now regressed back to a 1950's-era policy adopted to allow their return the people of Rongelap to their home land in 1958 – namely that radiation protection standards for the American public were inappropriate for the Marshall Island population and that such use *"could establish an undesirable precedent for other situations of environmental contamination from nuclear explosives."*[51]

[50] Letter to from; Andrew C. von Eschenbach, M.D. Director National Cancer Institute, To: Senators Pete Dominici, Chairman U.S. Senate Committee on Energy, April 24, 2005.

[51] Notes of Robert Alvarez, Professional Staff, U.S. Senate Committee Governmental Affairs, March 1991. (Hereafter known as Alvarez 1991)

This shift in policy by the U.S. Government in the early 1980's, was not made known to the RMI during the Compact negotiations. In 1979, a general policy banning nuclear tests in the Marshall Islands was agreed to by the United States representatives to the Compact negotiations. A year later, specific language was agreed to and was adopted as Section 314 of the Compact. The Safeguard C program was to initiate testing at the Johnston Atoll, but also included sea-launched nuclear missile tests in the Pacific, which could be near the RMI. Moreover, the logistical and diagnostic support to resume testing, including the deployment of nuclear warheads, would be carried by the same entity responsible for administering the medical and environmental programs in the RMI.

Upon lifting restrictions from eating contaminated foods, in 1982, DOE researchers found significant increases in internal radiation doses to Rongelap people – which reversed a decreased dose trend beginning in 1965. This was not brought to the attention f the Rongelap people, their elected representatives, the RMI, Compact negotiators or the U.S. Congress.

Nor were these changes not made known as part of the hearing record to the U.S. Congress, which held some 20 hearings about the Compact. It was only in 1991, that this information only came to light after an investigation was conducted by the U.S. Senate Committee on Governmental Affairs. As a result, the DOE removed the RMI medical and environmental programs from the control of the nuclear weapons program and entered into an agreement with the RMI, the elected leadership of Rongelap and the Interior Department in 1992, which re-established a standard-based context to define the terms and conditions of habitability on the Rongelap Atoll. In 1993, the U.S. Congress abolished the Safeguard C program.

On March 23, 1982, an Action Memorandum was submitted to the US. Secretary of Energy (DOE) requesting that the health and environmental research program of the Marshall islands be moved to the DOE's Office of Defense Programs – the nuclear weapons production and testing program. The rationale for this transfer was to integrate the health and environmental research into a readiness program to resume atmospheric nuclear weapons testing involving the Marshall Islands.

Known as "Safeguard C," this was one of four contingencies stipulated by the Joint Chiefs of Staff in 1963 as a condition of approval for the Limited Test Ban Treaty. The specific C details of Safeguard C were remained secret for several years. They included:

"The maintenance of the facilities and resources necessary to institute promptly nuclear tests in the atmosphere should, they be deemed essential to our national security or should the treaty or any of its terms be abrogated by the Soviet Union."[52]

In June 1964, an agreement was made between the AEC and the Defense department to establish a Joint Nuclear Test Planning Group to implement this contingency. The group was replaced in 1968 by the 1968 revised National Nuclear Test Readiness Program (NNTRP). Since that time the

---

[52] U.S. Atomic Energy Commission. Memorandum for McGeorge Bundy, Special Assistant to the President, Subject: Maintenance of Condition of Readiness Under a Test Ban Treaty, February 13, 1963 http://www.gwu.edu/~nsarchiv/NSAEBB/NSAEBB94/tb46.pdf

NNTRP served as the institutional basis for maintenance of Safeguard C. According to previous secret testimony before the Congressional Joint Committee on Atomic Energy in October 1971 by AEC official, Herman Roser, "the proposed tests once authorized, would be carried out essentially as in the last atmospheric series, primarily in the Pacific Area."[53]

The basic requirements for Safeguard C were to be able to detonate nuclear weapons in the atmosphere with three months and to have a sustained program ready within a year. Since Safeguard C was designed to replicate the last Pacific test series in 1962, the resumption of testing would include a missile-launched high altitude detonation from the Johnston Atoll and an open-sea missile launch. Between 1965 and 1972, some 12 "Thor" missiles were launched at the Johnston Atoll without nuclear tips as part of maintaining the Safeguard C program.

The DOE delegated operational responsibilities to the Nevada Operations Office for management of Safeguard C. In Turn the Nevada Operations Office was responsible for assuring that the DOE's Pacific Area Support Office (PASO) in Hawaii carried out logistical and support responsibilities for Safeguard C. DOE and DOD used the same contractor to maintain this program, which was Holmes and Narver, which also operated cleanup and logistics for DOE in the Marshall Islands.

In 1982, Mr. Roser, in a March 23rd Memo, again invoked this contingency, now as Assistant Secretary for Defense Programs in the DOE to justify the transfer of the Marshall Islands health and environmental research program. Negotiations on the Compact of Free Association, then in their 13th year were nearing completion. The memo indicated urgency in affecting the transfer so that DOE's Marshall Islands *"programs will continue uninterrupted during status negotiations."*

The two page memo describes a "common" relationship between the Marshall Islands medical and environmental programs with Safeguard C. According to Roser:

"DP [Defense Programs] should assume policy direction and control of the DOE's Marshall Islands activities as a single coherent program…the technical resources that are in use in the Marshall Islands are largely weapons-program related, and most of DOE's logistic and support is common to the Safeguard C readiness program. Safeguard C… requires the U.S. to maintain the capability to resume atmospheric weapons testing."[54]

In an undated memo written sometime before the program was transferred in the fall of 1982, Dr. Charles Edington of the DOE's Office of Health and Environmental Research denounced this move:

"It is ludicrous to claim that the Marshall Islands program is an exercise in the expeditionary capability of the Safeguard C program and is related to U.S. capabilities to resume atmospheric testing… Such statements, if available to the press or the government of the Marshall Islands, would destroy whatever credibility the U.S. enjoys in the Marshalls and probably force the termination of the program… Such statements also lend credence to the claim that the U.S. is studying the Marshallese as 'guinea pigs'…Linkage of the medical and environmental

[53] Alvarez 1991

[54] U.S. Department of Energy, Memorandum, To; The Secretary, From: Herman Roser, Assistant Secretary for Defense Programs, March 23, 1982

programs to possible resumption of atmospheric testing (implied to occur in the Marshalls) would lead to extreme political embarrassment in the status negotiations, the U.N. and the national and world press… Association of the health care and radiological monitoring programs to the weapons program and readiness capability destroys any pretense of objectivity and credibility."[55]

The 1978 Radiological Survey of the Northern Marshall Islands

In August 1978, the Department of Energy initiated its Radiological Survey of the Northern Marshall Islands. According to DOE:

"*the purpose of the Northern Marshall Islands survey program is to provide documentation of the remaining radioactivity from nuclear testing and provide support data for an assessment of the radiation dose to people before the termination of the United States Trust Agreement.*[56]

A primary motivation for this study stemmed from litigation brought by the people of Bikini (THE PEOPLE OF BIKINI ET AL VS. SEAMANS ET AL, CIVIL NO.75 -348, U.S.D.C., D Hawaii), who asserted that the U.S. government had not properly assessed the radiological conditions at Bikini comparable to that done for Enewetak in 1972-73.[57] According to DOE:

"During negotiations with the Department of Justice, the plaintiffs' legal counsel recognized that the surveys and evaluation of radiological conditions at BikiniAtoll were not as comprehensive as more recent work at Enewetak Atoll, and sought an aerial radiological survey of Bikini and other northern Marshall Islands…The proposed aerial survey uses the same equipment and procedures which were successfully employed at Enewetak Atoll in 1972-73. The people of Bikini feel they have been shortchanged because the U.S. conducted a highly visible, exhaustive survey, coupled with previous and planned ground surveys... If the aerial survey of the Northern Marshalls, including Bikini, is not conducted, the U.S. Government would be terminating the Trust Territory agreement without taking all prudent steps to evaluate the residual radiological contamination on the islands affected by the U.S. nuclear weapons tests.[58]

The survey was completed by the end of 1978, but only provided partial picture of the contamination problems facing the Rongelap people. This survey, by its very nature, was only a "snap-shot" in time and was, but the most recent of numerous aerial surveys performed over the Marshall Islands. Between 1946 and 1958 several aerial radiological surveys and extensive ground and biota monitoring were performed to measure and track radioactive clouds and fallout. [59] [60] [61] [62]

---

[55] Alvarez 1991.
[56] U.S. Department of Energy, Radiological Survey Plan for the Northern Marshal Islands, August 22, 1978.
[57] Ibid.
[58] Ibid.
[59] U.S. Department of Defense, Joint Task Force 132, Fallout and Cloud Particle Studies, Operation Ivy, November 1952
[60] U.S. Atomic Energy Commission, Fallout Location and Delineation by Aerial Surveys, Operation Redwing, Project 2.64, 1956

[61] U.S. Department of Defense, Joint Task Force 194. Radiological survey of downwind atolls contaminated by BRAVO. JTF7. March 12, 1954.

[6364] These studies should have been utilized and provided to the Rongelap people so as to fill important gaps in the 1978 survey such as short-lived radionucildes, “hot spots,” soil and biota concentrations.

However, several aerial radiological surveys and related ground measurements during and shortly after the tests remained classified until after the Marshall Islands plebiscite approving the Compact on September 7, 1983. [65] [66] [67] [68] [69] In particular, a 1955 report, declassified on August 310, 1984, provided daily fallout maps with isoactivity contours, which clearly show that the Rongelap Atoll was in the direct path of radioactive fallout for all tests in the 1954 Castle test series. (See Figure 3)

Figure 3 Total Fallout from Castle Series July 1, 1954

---

[62] US Weather Bureau, 1955. World-Wide Fallout from Operation Castle. U.S. Weather Bureau. NYO-4645 (Extracted Version) Washington, D.C. May 17,
1955.

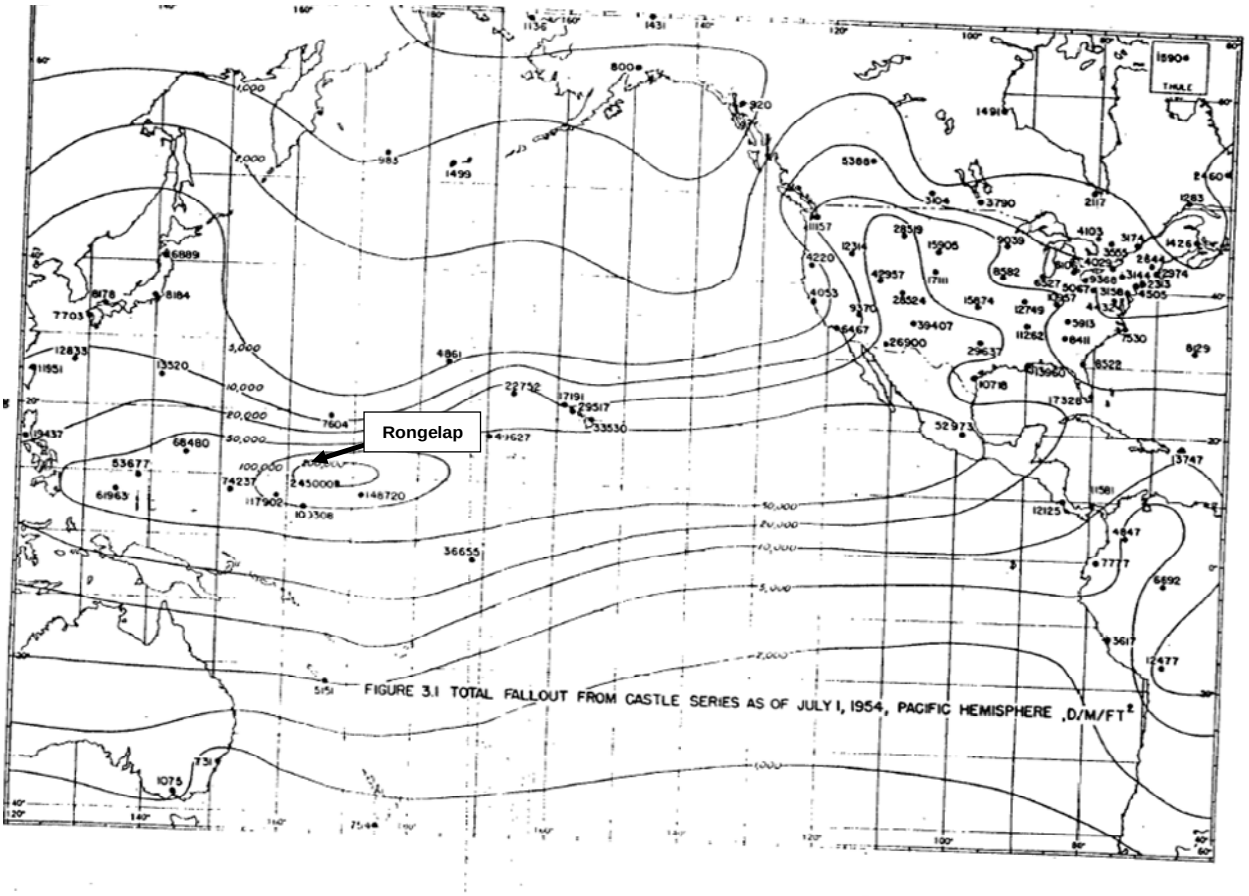
[63] U.S. Department of Defense, Operation HARDTACK I, 1958. United States Atomic Nuclear Weapons Tests, Nuclear Test Personnel Review. DNA-6038F. Wash., DC. ,1982.

[64] Dunning, G.M. fed). Radioactive Contamination of Certain Areas in the Pacific Ocean from Nuclear Tests, U.S. AEC Report. 1957

[65] U.S. Department of Defense, Joint Task Force 132, Fallout and Cloud Particle Studies, Operation Ivy, November 1952 – declassified December 6, 1985.

[66] U.S. Department of Defense, Operation Greenhouse, Annex 9.3 Radiological Safety, 1951 – Declassified August 23, 1984.

[67] U.S. Department of Defense, Hardtack, Final Report, Task Group 7.4, 1958. Declassified August 20, 1986.
[68] U.S. Atomic Energy Commission, Fallout Location and Delineation by Aerial Surveys, Operation Redwing, Project 2.54, 1957 – Declassified April 10, 1988.
[69] US Weather Bureau, 1955. World-Wide Fallout from Operation Castle. U.S. Weather Bureau. NYO-4645 (Extracted Version) Washington, D.C. May 17, 1955. Declassified –August 31, 1984.



Source: NYO-4645

Additional data that would allow for estimations of radioactive releases from the explosions was not made part of the public record until after the 1978 survey was completed and as late as 1994. [70] [71] [72] Moreover, a comprehensive assessment of radiation dose would also have required a reconstruction of the quantities of radionuclides released from the tests, to validate aerial, terrestrial and biota measurements, most notably those from the 1954 Castle test series.

This is considered a basic criterion for radiation risk assessment along with several others, which the 1978 aerial radiological survey did not possess. From the late 1970's to the present, several radiation dose reconstruction studies have been done relative to public exposures from U.S. nuclear weapons test and production facilities. In each instance the scientifically credible estimate of the

[70] Hicks, H. G. Calculation of the concentration of any radionuclide deposited on the ground by offsite fallout from a nuclear detonation. Health Physics 42:585-600. 1982.

[71] Hicks, H. G. Results of calculations of external gamma radiation exposure rates from local fallout and the related radionuclide compositions of selected U.S. Pacific events. Lawrence Livermore National Laboratory, Report UCRL-5505. Livermore. CX. 1984.

[72] England, T. R. and Rider, B. F. Evaluation and Compilation of Fission Product Yields. Los Alamos National Laboratory Report LA-UR-94-3 106. October 1994.

amount of radiation released, also known as the "Source Term," was considered essential.

In 1995, the National Academy of Sciences identified several criteria for dose reconstruction of populations exposed to radiation from nuclear weapons activities. They include:

- *"All pertinent data relating to the source term and environmental pathways should be collected and evaluated. Insofar as possible, the original source data, rather than derived or summary information, should be used.*
- *Quality control should be required at all stages of data collection and evaluation. Where possible, alternative approaches should be used to estimate the components of the dosimetry (source term, environmental transport, metabolic disposition, behavioral variation).*
- *Best estimates of doses should be used rather than maximal doses; uncertainties in doses (defined by confidence intervals) also should be estimated.*
- *Biologic markers of dose, effect, and susceptibility should be considered."* [73]

None of these criteria were met by the DOE prior to or following the implementation of the Compact of Free Association.

In 2000 these data collected from previous aerial radiological surveys were analyzed in a study sponsored by the Centers for Disease Control, which provided a more through and comprehensive assessment of radiation doses, than that contained in the 1978 aerial survey.

For instance, the 1978 survey merely reported the dose-rates measured from the 13 islands surveyed. By contrast the 2000 CDC dose assessment reviewed aerial radiological surveys taken from 1954 to 1958, in addition to external and internal dose assessments, medical data, and detailed ground, and food contamination data, principally for Cs-137, collected through 1997. According to the CDC, the cumulative deposition of Cesium-137 was the highest on Rongelap than any other Marshall Islands Atoll – 210 times higher than from global fallout alone. [74]

No such comprehensive information was provided by DOE.

The DOE funding proposal prepared in May 1978 for the aerial survey clearly stated its utility was limited to assessing external penetrating radiation:

The surveys will provide "ground truth" data on ambient external gamma radiation levels on-island. This data will be used as the basis for calibration and normalization of aerial radiological monitoring by the E.G&G Corporation. The program will include detailed external radiation measurements with pressurization chamber and scintillation survey instruments and in situ gamma spectrometry on all islands of interest. Surface soil samples will be collected and analyzed for significant gamma emitters in order so make decay corrections for long term dose predictions

[73] National Research Council, Commission on Life Sciences, Radiation Dose Reconstruction for Epidemiologic Uses, National Academy Press, (1995), Washington, D.C.
[74] CDC 2000, p. 113.

via the external radiation exposure pathway. [75]

Around the same time that DOE initiated the1978 aerial survey, Energy researchers also acknowledged that this effort was not adequate or sufficient.

"Environmental and personnel monitoring programs for the Marshallese people living at Bikini, Rongelap and Utrik Atolls must continue indefinitely in order to assess dose contributions to these people from residual radioactivity originally produced by U.S. nuclear weapons tests in the Pacific. ***Detailed assessments of the contributions of external gamma radiation have been made over the past two years, but identification of internal exposure pathways and determination of their radiological significance are subject to many variables which will require environmental and diet monitoring and bioassay programs for many years."*** [Emphasis added. [76]

DOE and the Compact of Free Association

Edington notes that Roger Ray, the person designated in the March 1982 from Roser to assume control of the Marshall Islands Health and environmental program as part of the Safeguard C program had already been named as the DOE representative to the Compact negotiations. Mr Ray was the Deputy for Pacific Operations (DPO) at the DOE's Nevada Operations Office. His duties included management of the logistic capability for DOE's activities in the Marshall Islands and the Safeguard C program. Mr Ray also served as coordinator for the evaluation and cleanup effort at the Enewetak Atoll. He was also involved in managing and assessing underground nuclear weapons tests in the United States during the early 1970's.[77]

Mr. Ray's involvement in nuclear weapons testing was quite extensive. In 1954, while on detail from the Defense Department to the AEC, Mr. Ray took part in the "Bravo" test in terms of providing diagnostic analysis of the weapon's performance. He also tool part in subsequent tests series in the Marshall Islands, Johnston Atoll and elsewhere in the Pacific. Immediately prior to joining the AEC in 1972, Mr. Ray served in the Office of the Assistant Secretary for Atomic Energy in the Defense Department. In this capacity, Mr. Ray was responsible for the implementation of Safeguard C activities including 12 missile tests at Johnston atoll (without nuclear tips) to assure test readiness capabilities.

According to Edington in April 1982, *"Roger Ray is the only person advising the Ambassador in these negotiations re: radiological issues… There has been essentially no briefing of or coordination with senior DOE management regarding future DOE interests in the Marshalls, or lack thereof, of which I am aware by Mr. Ray."*[78]

On April 30, 1982, Ray sought approval for a formal statement which he had already made on the record to the plenary negotiating session in which he claimed, *"none of the above mentioned activities* [DOE's heath and environmental programs] *has any defense, national security or*

[75] U.S. Department of Energy, Marshal Islands Radiological Safety Program Review, May 21, 21, 1981. http://worf.eh.doe.gov/data/ihp1a/2810_.pdf

[76] Ibid.
[77] Alvarez 1991.
[78] Avarez 1991

intelligence function or significance." [79] This was not true.

Radiation Safety Policies in the Marshall Islands

Upon assuming control over the RMI heath and environmental programs, Mr. Ray relaxed radiological protection standards and practices that had been in place for several years. They included the elimination of exposure limits used for the cleanup of the atolls, lifting of food restrictions, and coordination of radiation protection with the U.S. Department of Interior and the Environmental Protection Agency – which is responsible for overall radiation protection of the America public. These policies and practices were mostly embodied in the environmental restoration program for the Enwetak Atoll and were also based on several years of experience in the cleanup and rehabilitation of the Bikini Atoll, which led to the aborted resettlement of the Bikini people.

In 1974, the U.S. adopted an exposure limit that was half the allowable dose to the American public at the time. The rationale for this was based on a lack of confidence in dose modeling and in exposure estimates containing numerous assumptions with little or no validation. Moreover, there was particular concern that the dietary practices of the resettled Marshallese were poorly known.

"The recommendations on radiological cleanup of weapons test debris are to be consistent with AEC radiological protection practices which rely on basic radiation protection standards and emphasizes the current requirement for maintaining radiation exposure as low as practicable." [80]

In particular the AEC Task Group specifically recommended that the annual exposure limit then in effect for the U.S. of 500 millirems be reduced to 250 millirem. In addition the group recommended that the 30-year dose be reduced from 5 rems to 4 rems – a 20 percent reduction.

This recommendation was adopted by the AEC on August 6, 1974 despite opposition by the Defense Department, and Roger Ray in the Office of Defense Programs. The DOD echoed the position taken in the 1950's by the AEC to return the Rongelap people to their atoll, despite excessive radiation levels, not acceptable in the United States;

"[the Defense Department] believes that radiation standards applicable to the general public are not appropriate for the small Enewetak population and that such use could establish an undesirable precedent for other situations of environmental contamination from nuclear explosives." [81]

Radiation protection standards were not used for the cleanup of the Bikini Atoll initiated in 1969. It was clear that the Bikini cleanup was not to interfere with military prerogatives. According to the Memorandum of Understanding between the AEC and DOD entered into on February 11, 1969:

"*The Bikini cleanup will not interfere significantly with the maintenance of the test readiness posture."*

[79] Alvarez 1991.
[80] U.S. Atomic Energy Commission, Outline of Staff Paper on Enewetak Cleanup, April 16, 1974.
[81] Ibid.

When the people of Bikini were returned in 1972, it was understood that consumption of locally grown food would likely increase radiation doses, but it was believed that advice on food restrictions and use of imported foods would make Bikini habitable. Unfortunately these assumptions proved wrong. By 1978 the U.S. Department of Interior was forced to reevacuate the atoll, after exposure data collected by the DOE showed that residents were absorbing doses were exceeding annual limits for the U.S. public from the consumption of contaminated food. By June of 1982, Dr. Henry Kohn, the scientist hired to oversee the Bikini cleanup indicated that the 250 millirem limit first set for Enewetak be applied to Bikini.

When the RMI health and environmental program was transferred to the DOE nuclear weapons program in 1982, DOE subsequently bypassed and otherwise excluded the Department of Interior and the High Commissioner by dealing directly with the RMI government. Prior to this time, DOE served in an advisory capacity to Interior and the High Commissioner, and communicated through them. This change occurred during a critical period of negotiations over the Compact. [82]

Instead, Mr. Ray substituted a standard-based radiation protection policy with a policy based on *"risk acceptance."* The concept behind this change was that the people of the Marshall Islands should only be told what their risk is, and on that basis they would make their own decisions.

Since the 1954 "Bravo" fallout tragedy, major portions of the northern Marshall Islands, particularly the northern islands of the Rongelap Atoll sustained persistently high levels of radioactivity. For several years, the DOE's Brookhaven National Laboratory (BNL) was performing *in-vivo* of radiation on Bikini and Rongelap using "whole body counters." Beginning in the early 1960's, the AEC and subsequently the DOE advised Trust Territory officials on the importance of restrictions on eating food collected from the northern Rongelap islands in order to limit radiation exposures. For almost 25 years the restrictions on food from the northern Rongelap islands was honored and exposures to the people steadily declined.

While the Rongelap people have had the benefit of receiving imported foods from the U.S. as part of the U.S. Trust responsibility, some individuals would occasionally go to the northern Islands for local food. Coconut crabs, in particular, have been a favorite food collected in the north. This was easily detected by the use of whole-body counting done by BNL.

By July 1982, BNL was detecting sharp increases in internal radiation levels among Rongelap people, deviating from the historical trend. It was assumed by BNL researchers that greater quantities of local food from the northern islands were being consumed.

On November 8, 1982, BNL reported to Roger Ray, who had assumed control over their research that the average adult Rongelap male body burden of radioactivity for Cesium-137 increased by 56 percent. Adult female dose levels went up by eleven percent and children doses increased by 82 percent.[83]

These increases in internal exposures represented a reversal of the trend in doses measured by BNL

[82] Alvarez 191.
[83] Alvarez 1991.

beginning in 1965. Moreover, this phenomena had already been discovered in the Bikini people after they were resettled in 1972 and then reevacuated. Dr. Edward Lessard, then head of the Marshall Islands radiation dose studies, reported to Ray, *"this recent increase may have resulted from the relaxing of restrictions to the northern islands of Rongelap Atoll as a source of coconut crabs."*

Also in November 1982, DOE published its results from the 1978 radiation survey – known as the 1982 Bilingual Radiation Report. Mr. Ray subsequently arranged through the RMI government for public presentations of the report at various atolls.

On December 9, 1982, A DOE team consisting of Roger Ray, Dr. William Bair of Battelle's Pacific Northwest National Laboratory, and William Robison of Lawrence Livermore National Laboratory presented the bilingual report to elected leaders of the RMI. Contrary to usual policy, there were no representatives of the High Commissioner of the Trust Territory, Department of Interior, BNL or other medical staff in attendance.[84]

According to the transcript of the meeting a great deal of discussion focused on the risks of eating contaminated foods in the northern islands. During the presentation Mr. Ray indicated that consumption of food from the contaminated northern islands was optional and dependant on the circumstance. When asked by Senator Ataji Balos about the degree of safety associated with eating contaminated food from the northern islands, Mr, Ray responded:

There is I think not a yes or no answer to the question of the portion of the diet that comes from the northern islands as that portion increases the radiation dose to the person increases. If al of the diet comes from the northern islands that still is not a great catastrophe but things can be better if none of it comes from the northern islands... There is a choice that the individual must make or the community must make.…The amount of radiation that all of us received just coming here for this visit is not very different from the increase in radiation that your Rongelap person would have had by your daily increase in diet from the northern islands over six weeks. Our one trip here might equate to six weeks of this increased diet from Rongelap. (P 64 of the transcript)

According to a report of the meeting a DOE official who accompanied Ray, stated:

"Roger Ray's statements were not compatible with past policy. Advice was given directly to the Marshallese... that changed and in the perception of some, voided past restrictions." [85]

Rongelap People Flee their Homeland

Unlike the people of Bikini and Enwetak who were removed from the homes prior to testing, all of the Rongelap people are an "exposed" population, not just those living on Rongelap in 1954. DOE has persisted in the application of its "maximum permissible levels" dose standards to a population with both an acute exposure (1954) and a chronic exposure (1957- 1985).

A crisis point for the Rongelap people was reached in November 1982, when DOE reached, when

[84] Alvarez 1991.
[85] Alvarez 1991.

the U.S. Department of Energy (the successor agency to the AEC), when DOE released a bilingual report on radiation contamination derived from a radiological survey of the 13 islands and atolls in the Northern Marshalls. In particular, a map in the report comparing the radiological conditions of the atolls caused major concern. It indicated that the Rongelap Atoll appears to be just as contaminated with radioactivity as the areas in the Marshall Islands where nuclear weapons were detonated and where no people were permitted to live.

In a briefing on the bilingual report for leaders of the fallout impacted atolls in December 1982, Roger Ray, a DOE official stated that the Marshallese should make their own decisions on radiation exposures and cancer risk they would accept, and declined to provide advice or recommendations on radiation protection, or to say whether or not Rongelap was a safe place to live.

According to a DOE official with long-standing involvement in the Marshal Islands, *"The evacuation of Rongelap Atoll appears to be a totally senseless action unless the role of the Department of Energy in this decision is understood. DOE's involvement could subject this agency to severe criticism both nationally and internationally."*

In an internal Memo dated July 22, 1985, Thomas McCraw, a DOE radiation protection official, reported that:

The Rongelap people were told that they should make their own judgments on radiation protection. They were also told that they could eat food that had been restricted for many years Whole body exposures on Rongelap atoll measured by Brookhaven National Laboratory (BNL) increased significantly during 1982 and were still elevated in 1983. The relaxing of a restriction on U3I certain food from more contaminated islands at Rongelap appears to be a contributing factor. In the past, this restriction was stated clearly as a prohibition… Questions about past radiation exposures on Rongelap have remained unanswered for more than 2 years.

I have argued that exposures not found acceptable for the U.S. population are also not acceptable in the Marshalls and that radiological criteria should be the same from atoll to atoll. This, of course, is not compatible with the idea that the population of each atoll should make its own judgment. Short of acting against Federal policies, or having the Department of Interior (DOI) mount a successful effort to get an exemption from these policies, the DOE appears to have no valid alternative but to continue to apply current radiation standards in the Marshalls.

The new advice that was obviously intended to give freedom of choice has backfired. The Rongelap people followed-the advice they were given, made the judgment not to accept the risk, and left their atoll. [86]

By August 1983, the Congress of the Republic of the Marshall Islands, known as the Nitijela, unanimously passed a resolution asking the United States to relocate the Rongelap people. In the following two years, representatives of Rongelap testified before the U.S. Congress asking to be relocated. Where they had not been wiling to assert before, DOE now claimed that Rongelap was

[86] U.S. Department of Energy, Memorandum to: Edward J.. Vallario, From: Thomas McCraw, July 22, 1985. http://worf.eh.doe.gov/data/ihp1d/400171e.pdf

safe, but avoided discussing the bilingual report or the radiological map. By May 1985, a vessel operated by Greenpeace, an international environmental organization transported some 300 people from Rongelap to an island in the Kwajalain Atoll.

In response to their plight, the U.S. Congress added a provision to the Compact of Free Association, which called for an independent assessment of the radiological conditions on Rongelap. The assessment was completed in 1988. It found that the northern part of the atoll should be considered "forbidden territory." Only a year later, when questioned by Members of the U.S. Congress, was it revealed by Dr. Henry Kohn, the study's author that it was safe to return only if they could rely on imported food for the next 30 to 50 years. Kohn was following the lead provided by the DOE at the time, which had in the early 1980's ended its prior policies relative to radiation protection in the Marshall Islands.

The 1992 Agreement

In February 1992, the U.S. Departments of Energy and Interior entered into an agreement with the Republic of the Marshall Islands and the Rongelap Local Atoll Government that addressed the terms and conditions for resettlement of the Rongelap Atoll. In particular, the agreement overturned the policy of the U.S. during the 1980's of discarding radiation protection standards and established limits for exposure. Specifically, the agreement states:

"*The primary condition of a determination to initiate resettlement…is that the calculated maximum whole-body radiation dosed equivalent to the maximally exposed resident shall not exceed 100 millirem (mrem) year above natural background, based on a local food only diet."*

The U.S. National Academy of Sciences subsequently reviewed this agreement and found it to be viable.[87] The Panel recommended, among other things:

- *"Because of the substantial uncertainties in this complex and unprecedented situation, the committee recommends that no categorical assurances be given concerning the MOU requirement that no individual receive a calculated annual radiation dose equivalent of more than 100 mrem above background. Some people returning to Rongelap and subsisting on a local-food-only diet might receiv*e *an annual dose in excess of 100 mrem above background if there is no remedial action."*

In 2006, a radiological expert for the people of the Rongelap Atoll reported that the 100 millirem limit would be exceeded based on a local food only diet, if potassium fertilizer were not repeatedly

[87] Committee on Radiological Safety in the Marshall Islands, Board on Radiation Effects Research, Commission on Life Sciences, National Research Council, Radiological Assessments for the Resettlement of Rongelap in the Republic of the Marshall Islands, National Academy Press, Washington, D.C. 1994.

applied. [88]Apparently, this was not done for the southern islands of the atoll where local food is obtained.

Despite this warning, the Department's of Energy and Interior did not take steps to ensure this would be done, in accordance with the 1992 agreement.

Give the long and unfortunate legacy of nuclear testing it appears that this critical element of safety was lost in the shuffle.

[88] B. Franke, Institute for Energy and Environmental Research, Radiation Doses That People May Receive If They Return To Rongelap Island In 2006, March 4,2006.