

Health Consequences and Health Systems Response to the Pacific U.S. Nuclear Weapons Testing Program

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Abstract

Between 1946 to 1958 the U.S. detonated 67 thermonuclear devices in the Pacific as part of their U.S. Nuclear Weapons Testing Program (USNWTP). The aggregate explosive power was equal to 7,200 Hiroshima atomic bombs. Recent documents released by the U.S. government suggest that the deleterious effects of the nuclear testing were greater and extended further than previously known.

The Republic of the Marshall Islands (RMI) government and affected communities have sought redress through diplomatic routes with the U.S. government, however, existing medical programs and financial reparations have not adequately addressed many of the health consequences of the USNWTP. Since radiation induced cancers may have a long latency, a healthcare infrastructure is needed to address both cancer and related health issues. This article reviews the health consequences of the Pacific USNWTP and the current health systems ability to respond.

Background

In 1946 the U.S. began thermonuclear weapons testing in the RMI. During the 1946-1958 testing period 67 thermonuclear devices were detonated equivalent in power to 7,200 Hiroshima atomic bombs. The vast majority of the detonations were above ground and atmospheric explosions, accounting for almost 80% of the total atmospheric testing in the history of U.S. nuclear testing. In 1954, the Bravo hydrogen bomb test exposed approximately 250 Marshallese from the Rongelap, Utrok and Ailinginae atolls to high doses of direct radioactive fallout. Additionally, it has been argued that the 400 residents of Ailuk were exposed to radiation levels similar to the populations of Utrik and Rongelap. Radiation levels on Rongelap were so high that a majority of those exposed developed acute radiation sickness and one community suffered from exposure to doses in the lethal range.¹⁻³

Nuclear weapons were tested at sites where Marshallese people had lived for hundreds of years. Entire communities were moved from their homes so that the nuclear testing could commence. They were promised a quick return to their homeland. The Bikini and Rongelap communities who were moved off their atolls because of the Bravo test were returned to their atolls while the islands were still heavily contaminated with radioactive cesium. The Rongelap communities were returned to their atolls from 1957-1985. Some of the Bikini community returned from 1972-1978. These communities consumed a contaminated traditional diet during these years before they were relocated to safer locations.^{4,6} It is now more than 61 years after the USNWTP began and two communities still have not been returned to their ancestral lands.

A 2004 analysis by the U.S. National Cancer Institute (NCI) now suggests that people living on all atolls of the RMI were also directly affected by the testing.⁷ In addition, nearly 300 workers had exposures as part of the post-testing nuclear clean-up operations and the health effects on this group has never been evaluated.¹

Health Effects of the U.S. Nuclear Weapons Testing Program

Health, as defined by the World Health Organization, is a state of complete physical, mental and social well-being,

and not merely the absence of disease or infirmity. Health considerations in nuclear testing are often distilled to the effects of radiation and excess cancers. However, the true health consequences of nuclear weapons testing include the entire human experience of the bomb blast, the deleterious by-products of the bomb, and the impact on the culture and social fabric of the people who lived through the nuclear weapons testing program.

Because of the multiple levels of disruption, from an individual's DNA to the relocation of entire communities, a holistic approach must be part of any discussion of the health consequences of nuclear testing. Utilizing a holistic approach is crucial to developing healthcare systems that address the collective health consequences of nuclear testing in affected Pacific populations.

Radiation from the U.S. Nuclear Weapons Testing Program

Radiation is defined as energy propagating from electromagnetic waves, photons or subatomic particles. A by-product of nuclear reactions is radiation. Radiation released from nuclear testing can cause damage and death to living cells. Nuclear debris can remain in the environment from days to centuries and emit damaging energy to living organisms in close proximity. In the Marshall Islands, isotopes of cesium, strontium and plutonium remain in the environment and continuously release potentially harmful radiation.⁸⁻⁹

Illness from acute radiation exposure

Acute radiation illness results from sudden exposure to very high doses of radiation. The Rongelap community suffered acute radiation illness when they were dusted by the nuclear debris from the Bravo hydrogen bomb test. Hours to days after nuclear fallout covered Rongelap, the people suffered severe nausea, vomiting, burns, and hair loss from acute radiation sickness.⁵ Some of the Rongelapese suffered severe anemia, fetal death and malformation, severe hypothyroidism, and bone marrow shutdown.

Illness from chronic radiation exposure

Illness from chronic low levels of radiation may also occur. Chronic exposure to radiation results from living in a contaminated environment. Exposure to deleterious radiation may result from external radiation in the ground, inhalation of the radioactive particles from dust in the environment, or by ingestion of the concentrated radioactive particles in plants, animals, and fruit. The cell DNA can be damaged thereby initiating abnormal cell growth (cancer) and potential genetic mutations. Chronic exposure to low doses of ionizing radiation in the environment and food chain are responsible for at

least 20 types of cancer including leukemia, multiple myeloma, lung, intestine, stomach, kidney, liver, bone, thyroid, skin and brain cancers. These cancers may be latent (i.e., an individual exposed to chronic low doses as a child or adolescent may develop a radiation related cancer 50-70 years after the initial exposure).^{6-7,10-15}

In 1972, the U.S. National Academy of Sciences established a committee to study the biological effects of low dose ionizing radiation (BEIR). In 1990, the BEIR V Committee concluded that radiation is almost nine times more damaging than estimated by the 1972 BEIR I Committee.¹⁶ The latest scientific evidence from the 2005 BEIR VII report stated that exposure to even extremely low doses of ionizing radiation place individuals at a risk for cancer.¹⁷

A 2004 NCI report regarding the RMI estimated 530 excess cancers from the USNWTP, a 9% increase above the baseline prevalence of cancer for the period under study. In 2003, 56% of the 530 excess cancers had not yet manifested in the Marshall Islands population because of the latency period following the deleterious effects of ionizing radiation. Thyroid cancers prevalence was estimated to increase by 200 percent above the baseline.⁷

Notably, 85% of the stomach cancers and 75% of the colon cancers caused by the nuclear testing will manifest themselves in the next decades. Most of the excess cancers will occur in Marshallese exposed in the northern atolls. However, the NCI report notes that the ionizing radiation exposure from the testing extended throughout the Marshall Islands, including the southern atolls, and is expected to place populations previously considered not exposed at increased risk of cancer.⁷

Non-cancer radiogenic illness

BEIR VII also noted that intergenerational (hereditary) genetic effects, albeit small, may be possible in humans since intergenerational effects caused by ionizing radiation have been noted in mice, plants and fruit flies.¹⁶⁻¹⁷ BEIR VII further noted that a dose response relationship with mortality from non-neoplastic (non-cancer) disease mortality has been demonstrated with statistically significant associations with heart disease, stroke, digestive, respiratory, and hematopoiesis diseases. Ionizing radiation at high doses is now associated with illnesses other than cancer.

Although a great deal is known about the health effects of short and long term exposure to radiation, it is difficult to quantify the direct health impact of nuclear testing in the RMI, because of the limited resources

available for diagnosis and monitoring. There was no comprehensive cancer registry, thyroid tumor registry or health information system developed in the RMI before, during or after the testing period.

Cultural and social disruption

Cultural and social disruptions from the USNWTP are associated with adverse health outcomes and illness. Alienation from the land and critical natural resources through radioactive contamination or forced evacuation destroyed the physical and cultural means of sustaining and reproducing a self-sufficient way of life. It also destroyed community integrity, traditional health practices and sociopolitical relationships. Furthermore, community history and knowledge is destroyed when there is no lineage land from which to pass on knowledge about the local environment.^{1,18}

Food supplementation became necessary for those who were displaced from their land and for those whose lands and food sources were contaminated with radiation. For many years, the U.S. government provided U.S. Department of Agriculture (USDA) foods (mostly white rice and other processed foods) to the people of the four atolls. Some atoll communities are now using U.S. funding to purchase and ship their own foods rather than depending on USDA foods. Adverse health impacts following the introduction of a western diet are evident throughout the Pacific. However, the rate of change from traditional to Western diet caused by forced relocation was extreme in the recipient communities. Several of these adverse impacts are noted below.^{1,18}

The traditional diet has been altered. The available Western diet is high in fat and carbohydrates, low in fiber, and lacks vitamin A and iron. There has been a loss of the cultural activities and norms surrounding food gathering and preparation. The industriousness and work ethic required to prepare local foods from coral atolls with few natural resources has been stifled. The loss of the physical activities surrounding food preparation has resulted in a more sedentary lifestyle. Diseases such as diabetes, atherosclerotic diseases, and hypertension have been exacerbated by the Westernized diet and more sedentary lifestyle. Dependency on food supplementation has become the norm destroying the fabric of a once self-reliant community.

Land

Ancestral land was the basis of social structure and wealth in the traditional Marshallese society.¹⁸ There were specialized land zones for agriculture, living, burial sites, bird breeding grounds, turtle breeding grounds

and fishing grounds. The land where an individual lived often determined social status. The cultural, individual and social trauma suffered when home islands were vaporized or contaminated was devastating.

The lasting impact of the USNWTP can be understood through examination of the impact on the Marshallese land. The Bravo hydrogen detonation alone created a crater nearly a mile in diameter and 200 feet deep in the Bikini atoll. Two islands in the Bikini atoll were vaporized. A cement dome which houses nuclear waste, covers one island in Enewetak atoll. Parts of Rongelap, Bikini and Enewetak atolls remain contaminated with nuclear fallout and are unsafe living environments. In areas where testing was done the islands were scraped to remove contaminated debris, destroying all traditional landmarks. The contaminated soil was deposited in another section of the atoll.

The USNWTP destroyed homes. It was not safe to resettle for decades because of nuclear contamination. The Marshall Island communities from Bikini, Enewetak, and Rongelap were bounced between several locations while during the 12-year weapons testing period. Two communities are still waiting to be resettled 49 years after the testing ended.

The cleanup is still underway, but will likely remain incomplete as the cost to clean the contaminated areas has been determined to be cost prohibitive for the U.S. Within their home atolls only the main island is safe for inhabitation, the other adjoining islands remain contaminated.

The Bikinians and Rongelapese peoples were relocated to atolls which were not their ancestral lands and belonged to other Marshallese communities. Several of the locations were chosen because they were uninhabited and subsequently turned out to be hostile environments for living. The Bikinian community starved for a year in one instance before being relocated again. The post-traumatic stress, depression, anxiety, hopelessness, and the loss of ancestral identity is difficult to quantify.¹⁸

Healthcare environment, services, and funding in the RMI

Understanding the environment, structure and organization of the health systems which are available to address the healthcare needs associated with the USNWTP is important. The health systems must be able to provide comprehensive cancer care (prevention, screening, diagnosis, treatment, survivorship and palliative care) and healthcare for thyroid disease. Comprehensive healthcare must be provided for those

who cannot return to their homes, who lost access to their traditional foods and ways of life, and who have suffered post-traumatic anguish.

Who should be included in these health programs? The official Department of Energy (DOE) position is that only the peoples of the 4 atolls (Bikini, Enewetak, Rongelap and Utrok) that were most directly affected by the nuclear weapons testing program should have access to these health programs. A 1987 publication in the *Journal of the American Medical Association* concluded that the radiation from the testing extended to at least 14 atolls in the Marshall Islands.¹⁹ Most significantly, the 2004 NCI study stated that the radiation exposure was enough to increase the risk of cancer in all the people of the RMI who were living between 1946-1958, albeit radiogenic cancers were predicted to occur in a higher proportion in the northern than the southern atolls. Since the 2004 NCI report found that the entire RMI is at risk for cancer from the USNWTP, and because there is presently no method to differentiate cancers caused by radiation or other carcinogens, differential treatment for cancer care in the RMI is not reasonable or prudent.

Health Systems in the RMI

There are three tiers of healthcare in the RMI: the National Healthcare System; the 177 Health Care Program; and the DOE Program.^{1,20}

RMI Ministry of Health and Environment (National Healthcare System)

The present healthcare environment of the RMI is brittle.^{14,21} Many unnecessary illnesses and deaths occur because the healthcare system can not systematically respond to the needs of the people. The health situation will get worse as the population expands, as the proportion of elderly increases, as the burden of costly chronic illnesses grows and as the limited health dollars and finances wane. The infant mortality rate is 3 times that of the U.S. and the longevity of Marshallese is 12 years less than people in the U.S. Hansen's disease (leprosy) and tuberculosis are endemic.²¹⁻²³ In response to the heavy burden of cancer, the RMI completed a Comprehensive Cancer Plan in 2007. Cancer is the second leading cause of death in the RMI. The paucity of cancer care infrastructure is described in a later section.

The 15-year RMI Strategic Health Plan (2001-2015) describes a health system that is not financially sustainable with health resources of \$12 million annually. According to the RMI Strategic Health Plan, the Ministry of Health is projected to lose an equivalent of \$21 million dollars in services over the next 15 years. In 2000 and

2001 the RMI paid over \$4 million per year (a significant portion of all its annual health expenditures) to send patients out of the country for treatment. The monies spent in referral health centers abroad are not directed towards the RMI health infrastructure.²²⁻²³

The RMI, a former territory of the U.S. is now "Freely Associated" with the U.S. A legal document called the Compact of Free Association defines the political relationship between the RMI and the U.S., and was designed to provide enough economic support for this island nation to become economically self sufficient. The first Compact (1986-2001) failed to provide the necessary infrastructure to achieve economic self sufficiency for the RMI according to the U.S. Government Accountability Office (GAO) report.²⁴ The second Compact is now in place (2002-2021). The 2005 U.S. GAO report suggests that the funding of the second Compact will not allow the RMI to achieve the goal of self sufficiency. Notably the Compact is the primary source of healthcare dollars and resources.^{21,25} Funding from the Compact represents nearly half of the gross national product of the RMI and 40% of all healthcare funding (direct Compact funds, Section 177 funds, U.S. Federal Grants) in the RMI.

The total amount of all the sources of health revenue for fiscal year 2005 is now about \$14 million, an increase of \$2 million annually. Part of the \$2 million annual increase is derived from additional Compact II funding of \$1.5 million to the Ebeye hospital. This infusion of money is helpful, but will have a minimal impact in advancing population health in the RMI. As a comparison, the 2005 U.S. healthcare expenditure was about \$5,500 per capita annually. The RMI annual per capita healthcare expenditure is \$272.

Federally Funded Medical Programs for Marshallese affected by the USNWTP

There are two federally funded medical care programs for people affected by the USNWTP, the U.S. DOE Medical Program and the 177 Health Program.

The U.S. DOE Medical Program

Section 103(h) of the Compact "provide(s) special medical care and logistical support" to the populations present on Rongelap and Utrok during the Bravo hydrogen bomb test on March 1, 1954 (currently less than 120 patients). These individuals were exposed to direct fallout from the Bravo detonation. The DOE program also provides medical care to a comparison population, now with 80 patients remaining.²⁶ Members of the comparison group were not exposed to the Bravo fallout in 1954, however they lived in a nuclear contaminated environment with

the Rongelapese people from 1957-1985.¹

There is \$1.1 million annually to provide medical care to those exposed to the Bravo detonation and to the comparison group. An additional \$800,000 dollars annually is applied for logistic support for the medical mission. The funding for the program participants is adequate as it screens and cares for all radiogenic illnesses in this population, largely cancers and thyroid disease. The program is not designed or funded to take care of illnesses which the DOE defines as non-radiogenic (i.e., illness other than cancer and thyroid disease).

The 177 Health Care Program

The 177 Health Care Program provided in section 177 of the 1986 Compact is designed to provide primary, secondary and tertiary medical services to the people of Enewetak, Bikini, Rongelap and Utrok islands who were affected by the USNWTP. This includes most of the people enrolled in the U.S. DOE Medical Program. The design of the 177 Health Care Program was tasked to the U.S. Public Health Service (USPHS) in 1985. The structure proposed by the USPHS is laudable, having essential elements of primary, secondary and tertiary medical care. However, delivery of what was proposed by the USPHS has been impossible because of limitations in funding and the RMI healthcare infrastructure.

The 177 Health Care Program began in 1986 with \$4 million annually. In 1988 it was reduced to \$2 million annually and \$1 million annually from 2001-2007. The 1997 and 2006 per patient capita per month (PPPM) expenditure for the 177 Program was \$13.60 and \$5.95 respectively. In comparison, Medicare expenditures in 1997 were \$221 PPPM in the State of Nebraska. In 2006, Medicare expenditures were \$660 PPPM in Hawaii. U.S. standards of healthcare for cancer, thyroid illness, or other medical conditions that would be associated with the USNWTP can not be purchased or developed with these limited resources.

RMI ability to address the healthcare consequences of the USNWTP

The ability for health services in the RMI to systematically address the existing medical encounters is limited.²²⁻²³ When the 177 and DOE Programs cannot provide adequate services, patients turn to the RMI Health Care system. The RMI Health Care system, although improving, struggles to provide adequate routine healthcare for its citizens. The 177 Program is severely under-funded and contributes modestly to the overall healthcare needs of the 177 participants. The DOE Program is adequately funded for its patient base and

present mandates, however, the Program design lacks comprehensive care and is not improving the capacity of health services.

There is considerable evidence that the present RMI Health Services are unable to care for the current burden of cancer.^{23,27-28} From October 1, 2004 through June 6, 2005 there were 26 Marshallese patients with cancer who were presented to the medical referral committee to determine if they would benefit from off-island referral to a tertiary care center. Eleven of the 26 cases were denied referral because the cancers were too far advanced.²⁸ Far advanced cases suggest that the health system is unable to provide timely screening, early medical interventions, and indicates that the patients were not aware of their risks. The fact that 26 cancer patients were presented to the medical referral committee for out of country treatment substantiates that necessary medical care could not be provided in the RMI. Chemotherapy is not given in the RMI because of deficiencies in qualified laboratory, nursing and pharmacy staff. There is no oncologist and radiation therapy is not available.

Comprehensive cancer care requires local health systems to address prevention, screening (early detection), biopsies, pathology services, surgical expertise, intensive care unit, chemotherapy expertise, scanners, lab support, palliative care (reducing suffering) and attention to issues of survivorship. None of these systems are fully operational, and some are non-existent.²⁷ In 2003, only 9% of women in the age category to receive cervical PAP smears (to screen for cervical cancer) actually received a PAP smear. Almost 50 years after the nuclear testing program there is no cancer registry or oncologist in the RMI.^{14,27-28}

The status quo, inclusive of the RMI Health System, the 177 Program, and the DOE Program are unable to handle the cancer burden imposed by the USNWTP. The three tiers of health delivery cannot adequately address the other health effects of radiation and the health challenges brought about by nuclear testing. New systems of health delivery must be developed.

Building a healthcare system for cancer

The costs and design of a health system to care for cancer patients are dependent on the answers to several questions.¹

1. What is the standard of healthcare that the U.S. government owes to the victims of the USNWTP?
2. How much is the U.S. government willing to

- invest to support the designated standard?
3. What illnesses and health conditions will the healthcare system be able to treat?
 4. What population(s), how many people will have access to the system?
 5. Can all services/components be sustained in the RMI or will some services/components be provided at another center or site?
 6. How long must the system be sustained?
 7. Will the system design include the necessary primary, secondary, and tertiary health care components?
 8. Is the objective to build the capacity of the RMI to provide a higher level of healthcare or to merely to find a venue to get adequate care?
 9. Who will be responsible for running and maintaining the health system?

Comprehensive cancer care requires access to high functioning primary, secondary and tertiary health systems. A comprehensive cancer care system requires an intact primary care system, screening system, cancer registry (data tracking and surveillance), mammography, colonoscopy, medical laboratory, pharmacy, surgical capabilities, intensive medical care capabilities, supplies, prosthesis, pharmaceutical, a computed tomography scanner, x-ray unit, ultrasound, and the medical expertise to staff and run the system. A hospital with these capabilities is necessary. In the RMI, adequate screening should be available to the people of the outer islands. Inhabitants of the outer islands should be brought to the urban hospitals to get recommended cancer screening.^{27,28}

Other health conditions

The 2005 BEIR VII report suggested that other medical conditions are associated with ionizing radiation, such as heart disease, strokes, genetic effects, and hypothyroidism. There are also many indirect effects of nuclear testing including cultural, social and mental health trauma. The 2004 NCI report suggested that the ionizing radiation reached beyond the "four atolls" and even beyond the northern atolls of the RMI. The lack of a defined boundary of who was affected by nuclear fallout and the multiple health consequences of nuclear testing makes supporting a nation-wide comprehensive system of healthcare ideal for the RMI. Building such a system could provide comprehensive cancer care to all Marshallese while meeting their comprehensive healthcare needs.

A program which provides high standard comprehensive healthcare for all Marshallese would address the health consequences of the USNWTP in a cost effective,

capacity building manner. This system could also address the healthcare needs of over 200 Marshallese and other indigenous Pacific Islanders who participated in the clean-up of Bikini and Enewetak atolls. This subgroup has had little access to appropriate healthcare services.

Unanswered questions regarding the health consequences of nuclear testing

A number of unanswered questions regarding the effects of nuclear testing confound the health planning process. Were there excess cancers generated in the populations who lived and ate in contaminated environments after 1958? What is their risk of cancer from ionizing radiation exposure including low level exposure and is there a hereditary genetic effect? How should these health consequences be treated given the changing scientific understanding of the health circumstances of radiation exposure? Finally, how are health related problems that are not radiogenic such as the displacement of people, social and cultural disruption, and psychological trauma to be treated though these effects have yet to be fully quantified?

The 2004 NCI report quantified the risk of cancer for Marshallese who were alive between 1946-1958. However, there were Marshallese who lived and ate local foods from fallout contaminated environments after 1958. The people of Rongelap were evacuated from Rongelap in 1954, resettled on Rongelap in 1957, and again moved off in 1985 because of significant levels of cesium isotopes in the food supply. People of the northern atolls also lived in an environment that may not have been safe. In light of the BEIR VII report, even small amounts of ionizing radiation in the food chain may have affected the generations after 1958 in regards to cancer. In addition, there were nearly 300 Marshallese and other Micronesian workers who participated in the clean-up of the contaminated nuclear debris of Bikini and Enewetak in the 60's and 70's. The effect on their health remains unclear.

The NCI report addressed cancer issues but not other radiogenic illnesses. The BEIR VII report noted other non-neoplastic (non-cancer) effects of ionizing radiation including strokes, heart disease and genetic abnormalities. Some of these conditions are related to high dose radiation, some to low dose radiation and others to both.

Bodily harm is a tragedy that affects an individual for a finite period of time, whereas cultural destruction adversely affects the health of entire communities for generations. Cultural, mental and social impacts are

difficult to quantify and measure so it is easy to pretend they do not exist. The cancer burden that was generated from the nuclear testing program was quantified by the NCI 50 years after the insult, after much unnecessary suffering has taken place. Other health consequences will likely be quantified soon. These unanswered questions, *inter alia*, form an important focus for future research.

Discussion

Developing a healthcare system to address the health consequences of the USNWTP in the RMI is vitally important. Issues related to the burden of those health conditions, and the standard of care to be applied for each illness must be addressed. The present RMI Health Plan is a healthcare system that lacks infrastructure and funding. Both the 177 and the DOE Program fall short of providing the healthcare that is necessary for the affected peoples of the RMI. The 2007 RMI Comprehensive Cancer Plan details the current inability to manage the burden of cancer in the RMI. The 2004 NCI report and the 2005 BEIR VII report of the National Academy of Science provide new information about the extent and health consequences of the USNWTP. Given the new knowledge that is now available, and the ability of the existing health system to manage the effects of the USNWTP, a proactive stance and policy review is essential.

The evolution of scientific discovery and understanding has made the NCI and BEIR VII reports possible. Historically, direct measurements of ionizing radiation have been technically difficult due to geography, human movement, and the temporal sequence of testing. Newer methods now incorporate the previous data into new models of dose reconstruction to create a more accurate assessment of cancer risk. The BEIR VII report stated that the new science of ionizing radiation has been possible by "using new information from epidemiologic and experimental research that has accumulated during the 10 years since the 1990." The cancer burden has been clearly defined by the NCI for the cohort of people alive before 1958. The cancer burden of Marshallese who were not part of this cohort but who were exposed to other sources of ionizing radiation is still not known. Other health consequences of ionizing radiation (heart disease, strokes and genetic effects) and the indirect cultural impacts, though present, are more difficult to quantify.

The 12-year period of USNWTP in the RMI was initiated to advance the science of nuclear weaponry and to insure that the U.S. remained the world leader in its nuclear arsenal. The testing caused significant health

consequences to several Marshallese communities from ionizing radiation, effects that continue to this day. There was also disruption and destruction of the cultural, social, and nutritional fabric of the Marshall Islands that resulted as a consequence of the testing.

The U.S. government has the science, resources, and technology to address many of the consequences of its nuclear testing. The current medical programs for the radiation affected peoples and their families are limited in scope and are delivered with standards of healthcare far below that of the U.S. The U.S. government presently has a very conservative and outdated view of health risks from the USNWTP. This position is not in the interest of good healthcare for those affected by the USNWTP. The ethical, moral, and scientifically substantiated position would be to provide more comprehensive and higher standards of healthcare for the RMI.

Nuclear weapon testing in the RMI is a story about social injustice, disparate compensation and decades of substandard healthcare. The U.S. agencies have the resources to address these issues in light of the new scientific data regarding the health consequences of the nuclear testing program. This situation, in which a more economically and politically dominant nation causes or perpetuates inequity in a less powerful one has been termed "structural violence." This may result from direct action such as the nuclear testing program. Notably, it may also result from inaction, such as failure to fully address the health consequences of the testing program. U.S. policies in response to healthcare needs must be updated to include current knowledge from the 2004 NCI and the 2005 BEIR VII reports.

Unnecessary and unfair suffering has continued in the RMI for the past 50 years because the U.S. has not taken a proactive stance on healthcare issues. The radiogenic illnesses combined with the indirect health consequences of the Pacific USNWTP make health system improvements imperative. The health system improvements must consider the full range of health consequences from direct nuclear fallout to the disruption of culture from the loss of ancestral lands. While there are important scientific and clinical questions that remain to be answered, maintaining the status quo of healthcare in the Marshall Islands an unacceptable option. While a political debate ensues regarding responsibility and costs, Marshallese are developing and dying from illnesses associated with the USNWTP.

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