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MARSHALL ISLANDS DOSE ASSESSMENT AND RADIOLOGICAL PROGRAM

BIKINI · ENEWETAK · RONGELAP · UTRŌK

Individual Radiation Protection Monitoring in the Marshall Islands: Utrōk Atoll (2003-2004)

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This work was performed under the auspices of the U.S. Department of Energy by University of California, Lawrence Livermore National Laboratory under Contract W-7405-Eng-48.

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As a hard copy supplement to the Marshall Islands Program website (http://eed.llnl.gov/mi/), this document provides an overview of the individual radiological surveillance monitoring program established for the Utrōk Atoll population group along with a full disclosure of all verified measurement data (2003-2004). The Utrōk whole body counting facility has been temporarily stationed on Majuro Atoll and, in cooperation with the Utrōk Atoll Local Government, serves as a national facility open to the general public.

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INTRODUCTION

The United States Department of Energy (U.S. DOE) has recently implemented a series of strategic initiatives to address long-term radiological surveillance needs at former U.S. nuclear test sites in the Marshall Islands. The plan is to engage local atoll communities in developing shared responsibilities for implementing radiation protection monitoring programs for resettled and resettling populations in the northern Marshall Islands. Using the pooled resources of the U.S. DOE and local atoll governments, individual radiological surveillance programs have been developed in whole body counting and plutonium urinalysis in order to accurately assess radiation doses resulting from the ingestion and uptake of fallout radionuclides contained in locally grown foods.

Permanent whole body counting facilities have been established at three separate locations in the Marshall Islands (Figure 1). These facilities are operated and maintained by Marshallese technicians with scientists from the Lawrence Livermore National Laboratory (LLNL) providing on-going technical support services. Bioassay samples are collected under controlled conditions and analyzed for plutonium isotopes at the Center for Accelerator Mass Spectrometry at LLNL using state-of-the art measurement technologies. We also conduct an on-going environmental monitoring and characterization program at selected sites in the northern Marshall Islands. The aim of the environmental program is to determine the level and distribution of important fallout radionuclides in soil, water and local foods with a view towards providing more accurate and updated dose assessments, incorporating knowledge of the unique behaviors and exposure pathways of fallout radionuclides in coral atoll ecosystems. These scientific studies have also been essential in helping guide the development of remedial options used in support of island resettlement.

Together, the individual and environmental radiological surveillance programs are helping meet the informational needs of the U.S. DOE and the Republic of the Marshall Islands. Our updated environmental assessments provide a strong scientific basis for predicting future change in exposure conditions especially in relation to changes in life-style, diet and/or land-use patterns. This information has important implications in addressing questions about existing (and future) radiological conditions on the islands, in determining the cost and the effectiveness of potential remedial measures, and in general policy support considerations. Perhaps most importantly, the recently established individual radiological surveillance programs provide affected atoll communities with an unprecedented level of radiation protection monitoring where, for the first time, local resources are being made available to monitor resettled and resettling populations on a continuous basis.

As a hard copy supplement to Marshall Islands Program website (http://eed.llnl.gov/mi/), this document provides an overview of the individual radiation surveillance monitoring program established for the Utrōk Atoll population group along with a full disclosure of all verified measurement data (2003-2004). The Utrōk whole body counting facility has been temporarily stationed on Majuro Atoll and, in cooperation with the Utrōk Atoll Local Government, serves as a national facility open to the general public. Readers are advised that an additional feature of the associated website is a provision whereby users are able to calculate and track radiation doses delivered to volunteers (de-identified information only) participating in the Marshall Islands Radiological Surveillance Program.

Figure 1. President Note of the Republic of the Marshall Islands seated in the whole body counting chair on Majuro (Dedication Ceremony for the opening of the Utrōk Atoll Whole Body Counting Facility, January 2004).

BRIEF HISTORY OF NUCLEAR TESTING IN THE MARSHALL ISLANDS

Immediately after WWII, the United States created a Joint Task Force to develop a nuclear weapons testing program. Planners examined a number of possible locations in the Atlantic Ocean, the Caribbean, and the Central Pacific but decided that coral atolls in the northern Marshall Islands offered the best advantages of stable weather conditions, fewest inhabitants to relocate and isolation with hundreds of miles of open-ocean to the west where trade winds were likely to disperse radioactive fallout. During the period between 1945 and 1958, a total of 67 nuclear tests were conducted on Bikini and Enewetak Atolls and adjacent regions within the Republic of the Marshall Islands. The most significant contaminating event was the Castle Bravo test conducted on March 1, 1954 (Figure 2). Bravo was an experimental thermonuclear device with an estimated explosive yield of 15 MT (USDOE, 2000), and led to widespread fallout contamination over inhabited islands of Rongelap and Utrōk Atolls, as well as other atolls to the east of Bikini. Today, the United States Department of Energy (U.S. DOE) through the Office of Health Studies continues to provide environmental monitoring, healthcare and medical services on the affected atolls.

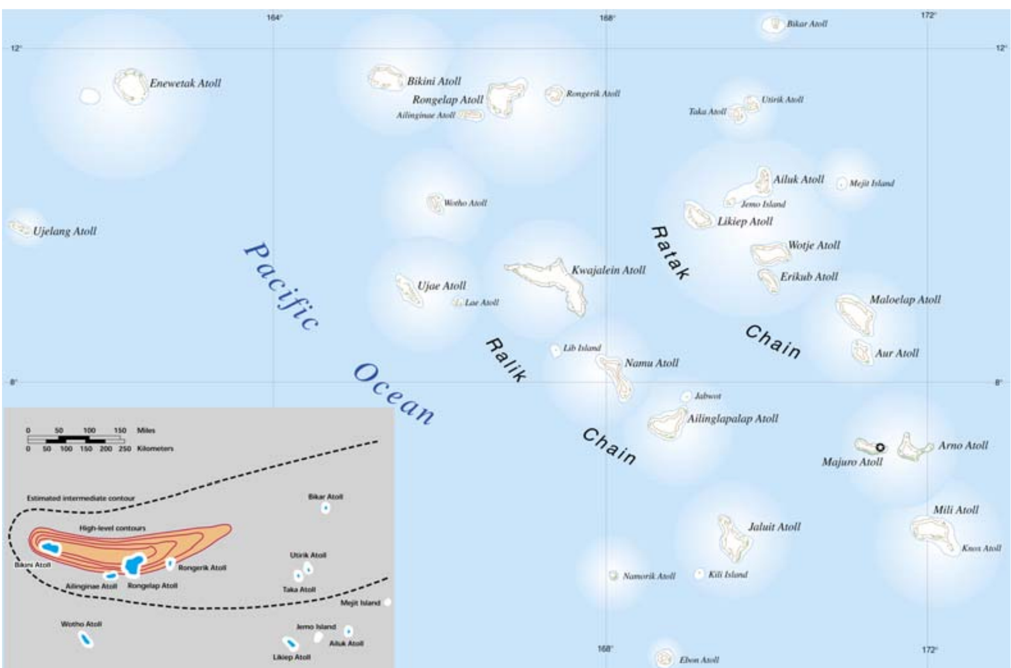
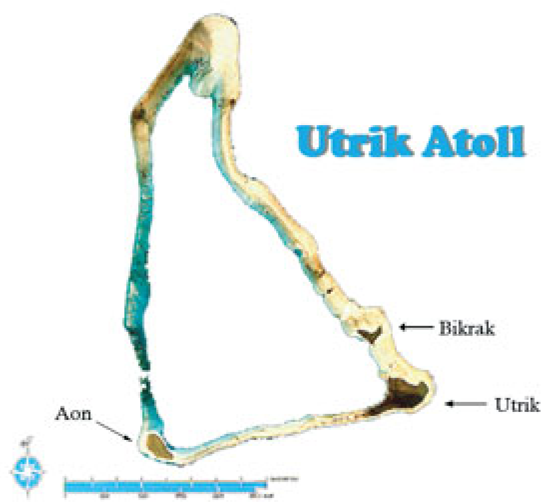


Figure 2. Map of the Republic of Marshall Islands showing the fallout pattern from the Bravo nuclear test conducted on March 1 of 1954.

Key directives of the Marshall Islands Dose Assessment and Radioecology Program conducted at the Lawrence Livermore National Laboratory are (1) to provide technical support services and oversight in establishing radiological surveillance monitoring programs for resettled and resettling populations in the northern Marshall Islands; (2) to develop comprehensive assessments of current (and potential changing) radiological conditions on the islands; and (3) provide recommendations for remediation of contaminated sites and verify the effects of any actions taken.

UTRŌK ATOLL

People & Events | Historical Data|



People and Events on Utrōk Atoll

Utrōk Atoll is located about 500 kilometers east of Bikini Atoll. The atoll experienced significant radioactive fallout deposition from atmospheric nuclear weapons tests conducted in the Northern Marshall Islands during the 1950s. The most significant contaminating event on Utrōk Atoll was the Bravo test conducted at Bikini Atoll on March 1, 1954. The 167 residents (including 8 *in utero*) living on Utrōk Atoll at the time of the blast received significant external and internal exposures to *fresh* fallout contamination before being evacuated to Kwajalein Atoll on March 3, 1954. The Utrōk community returned to their home atoll 3 months later but continues to seek assurances from the United States Government that the atoll is safe for habitation.

The U.S. Department of Energy originally assigned responsibility for the internal dosimetry program on Utrōk Atoll to the Brookhaven National Laboratory. Through the 1990s scientists from Brookhaven conducted periodic whole body counting missions to the Marshall Islands to determine the body burdens of gamma-emitting radionuclides such as cesium-137, cobolt-60 and potassium-40 in Marshallese from Bikini, Enewetak, Rongelap and Utrōk Atolls (Sun *et al.*, 1997). More recently, the U.S. Department of Energy has developed a series of initiatives to address long-term radiological surveillance needs in the Marshall Islands. Under a working agreement between the Utrōk Atoll Local Government, the Republic of the Marshall Islands and the U.S. Department of Energy (MOU, 2002), a permanent whole body counting system was established on Majuro Island (Majuro Atoll)[#] during May 2003. With the cooperation of the Utrōk Atoll Local Government this facility also serves the general public, especially those residents and visitors who return from the northern Marshall Islands and have concerns about being exposed to elevated levels of fallout contamination in the environment. Under supervision from scientists from the Lawrence Livermore National Laboratory, the Utrōk Whole Body Counting Facility on Majuro is maintained and operated by Marshallese technicians. It is expected that Utrōk Atoll residents will be able to receive whole body counts during scheduled visits to Majuro Atoll under the routine medical surveillance program or on occasional outings to the capital.

Historical Data

Today, exposure to residual fallout contamination on Utrōk Atoll represents only a small fraction of the dose that people receive from natural sources of background radiation in the Marshall Islands. The radiological dose delivered to inhabitants living on Utrōk Atoll from residual fallout contamination in the environment is dominated by the external exposure and ingestion of cesium-137 (and to a lesser extent, strontium-90) contained in locally grown food crop products such as coconut, breadfruit and *Pandanus*. According to (Robison *et al.*, 1999), the estimated population average maximum annual effective dose on Utrōk Atoll, based on a mixed diet containing imported foods, is less than 0.04 mSv (4 mrem) per year and has no consequence on the health of the population. Moreover, the predictive dose assessments based on environmental data and dietary models developed by the Lawrence Livermore National Laboratory appear to be in excellent agreement with estimates based on whole body counting (Robison and Sun, 1997).

Justification for establishing a permanent whole body counting system on Majuro Atoll for use by the Utrōk community comes from renewed concerns about *high end* doses to maximal exposed individuals on Utrōk Atoll and that the associated health risk may exceed current guidelines adopted by the Marshall Islands Nuclear Claims Tribunal for cleanup of radioactively contaminated sites. Such *high-end* individual doses in the Utrōk population have not been clearly demonstrated but the potential does exist for members of the population to *binge* on a local foods only diet or eat more foods containing higher than average radionuclide concentrations, e.g., coconut crab. In addition, a permanent whole body counting program will be able to answer other questions including concerns about seasonality effects on cesium-137 uptake and dose. Justification for intervention could then be made on the presumption that *high-end* doses are reasonably achievable

and that the risks from radiation exposures can be reduced by means of remedial actions taking into account the relative benefits including social and economic factors.

Figure 3. Whole Body Counting technicians in charge of the Utrōk Whole Body Counting Facility (Majuro Atoll, Republic of the Marshal Islands). Mr. Sherwood Tibon (standing) and Ms. Lolieta Chee (seated).

Majuro is the capital city of the Republic of the Marshall Islands and the main hub for the local airline

WHOLE BODY COUNTING

What is Whole Body Counting? | What Will the Whole Body Counting Show? | Estimating Doses from Cesium-137 Based on Whole Body Counting | Doses Delivered to the Utrōk Population Group as well as other Marshall Islanders from Internally Deposited Cesium-137

What is Whole Body Counting?

The whole body counting systems installed in the Marshall Islands contain large volume sodium iodide radiation detectors that measure gamma rays coming from radionuclides deposited in the body. The detector systems are modeled after the 'Masse-Bolton Chair' design (Figure 4) and can be used to detect high-energy gamma-emitting radionuclides from the decay of cesium-137, cobalt-60 and potassium-40 in most of the body and all of the internal organs. Using established protocols the whole body counting measurement data are converted into an annual effective dose using specially designed computer software (Canberra, 1998a; 1998b).

There are currently three operational whole body counting facilities in the Republic of the Marshall Islands. These facilities are located on Enewetak, Rongelap and Majuro Atolls. The whole body counting systems are calibrated using a mixed-gamma point source. The point source calibration procedure was developed by cross-reference to a Bottle Man-akin Absorption (BOMAB) phantom (or human surrogate) calibration source containing a standard mix of gamma-emitting radionuclides traceable to the U.S. National Institute of Standards and Technology (NIST).

Wherever possible, the whole body counting program in the Marshall Islands is conducted using the same quality requirements as established under the U.S. Department of Energy Laboratory Accreditation Program (DOELAP) for internal dosimetry. Background and other quality control check counts are performed on a daily basis to ensure that the measurement system conforms to all applicable quality requirements. Also, each whole body counting facility participates in external performance testing exercises with the Hazards Control Department at the Lawrence Livermore National Laboratory using '5 bottle phantoms' prepared under contract by the Oak Ridge National Laboratory. These performance test samples are distributed around each of the facilities including a *mirror* whole body counting system located at Livermore. The performance of the facilities is then evaluated by comparing results with those obtained by the Hazards Control Department at the Lawrence Livermore National Laboratory–a DOELAP accredited facility–and with the reference values supplied by the

Oak Ridge National Laboratory. Under this quality assurance program, the data returned by these remote facilities in the Marshall Islands has consistently exceeded the ANSI 13.30 criteria for accuracy and measurement precision.

Local Marshallese technicians are responsible for all daily operations within the facilities including scheduling of personal counts, performing systems performance checks, data reduction, and reporting to program volunteers. The technicians receive an initial six weeks of intensive training at the Lawrence Livermore National Laboratory and are employed to run the facilities for up to 40 hours per week. Scientists from the Lawrence Livermore National Laboratory provide on-going technical support services, advanced training in whole body counting and basic health physics, and perform a more detailed data quality assurance appraisal before the data are released in reports or posted to the world-wide web.

What Will the Whole Body Counting Show?

The main pathway for exposure to residual fallout contamination in the northern Marshall Islands is through ingestion of cesium-137 contained in locally grown foods such as coconut, *Pandanus* fruit and breadfruit. The strategic objective of the Marshall Islands Whole Body Counting Program in the Marshall Islands is to offer island residents an unprecedented level of radiation protection monitoring until such time that it is clearly demonstrated that radiation surveillance measures can be relaxed. The value of this type of radiation protection monitoring program lies in the fact that whole body count data provides a direct measure of the full range of radionuclide uptakes into the local population. Information about potential *high-end* health risks and seasonal fluctuations in the body burden of cesium-137 within exposed Marshallese can be assessed from measurement data rather than relying on a range of assumptions from different dietary scenarios.

In combination with environmental monitoring data, residents who receive a whole body count showing the presence of cesium-137 can now make an informed decision about their eating habits or life-style based on what is considered a “safe” or acceptable health risk. The Republic of the Marshall Islands Nuclear Claims Tribunal has adopted a standard for cleanup of radioactively contaminated sites of 0.15 millisievert (mSv) per year (or 15 mrem per year) [EDE, Effective Dose Equivalent] using a lifetime cancer risk criterion recommended by the U.S. Environmental Protection Agency (EPA).

Figure 4. A whole body counter with a volunteer seated in the chair.

As displaced communities return to their ancestral homelands, the Marshall Islands Whole Body Counting Program will allow the U.S. Department of Energy to monitor the return of the people and help ensure that the radiation related health risks remain at or below these established standards.

Estimating Doses from Cesium-137 based Whole Body Counting

People living in the Marshall Islands may be exposed to cesium-137 contained in their diets from eating locally grown food crop products such as coconut. Whole body counting provides a direct measure of the amount of cesium-137 inside the body of people. The biokinectic behavior of cesium-137 inside the human body is well known and allows information from the whole body counter to be converted to a radiation dose. The radiation dose is what is used to quantify the potential human health risk associated with radiation exposure. The dosimetric data displayed in graphics presented in this report and the associated web site are based on the calendar year committed effective dose equivalent (CEDE) from intakes of radionuclides in the year of measurement projected over 70 years (details of methodologies can be found in Appendix 3, Daniels *et al.*, 2006). Dose equivalent is given in units of rem, the conventional units used by federal and state agencies in the United States. The SI unit of dose equivalent is the joule per kilogram or sievert (Sv). Doses from exposure to environmental radioactivity (natural or manmade) are normally expressed as 1/1000th of the base unit, i.e., in millirem (mrem) or millisievert (mSv). 1 mSv is equal to 100 mrem.

INFORMATION NOTE

We have recently updated our methodologies for computing doses from the whole body counting and plutonium urinalysis programs (refer to the Technical Basis Document, Daniels *et al.*, 2006). This new methodology uses a 50 y dose commitment and complies more fully with ICRP methodology. The algorithms developed to allow users to compute doses directly from the measurement data made available on the web site are also consistent with this new methodology.

Doses Delivered to the Utrōk Population Group and Other Marshall Islanders from Internally Deposited Cesium-137

The individual (de-identified) measurement data developed under the whole body counting program for the Utrōk Atoll population group as well as for other Marshall Islanders (excludes residents living on Enewetak Atoll and the Rongelap Atoll resettlement workers) are tabulated in Appendix I, TABLE 1 & 2, respectively.

The frequency distribution of the committed effective dose equivalent received by program volunteers (2003-2004) from exposure to dietary cesium-137, annualized to the year of measurement, is shown in Figure 5.

The Utrōk Atoll population group has been divided into those program volunteers who reside on Utrōk Atoll and those who live elsewhere in the Marshall Islands, largely on Majuro Atoll. Similarly, the Marshall Islands population group has been divided into those program volunteers who reside on the southern atolls (including Majuro) and those who live in the northern Marshall Islands.

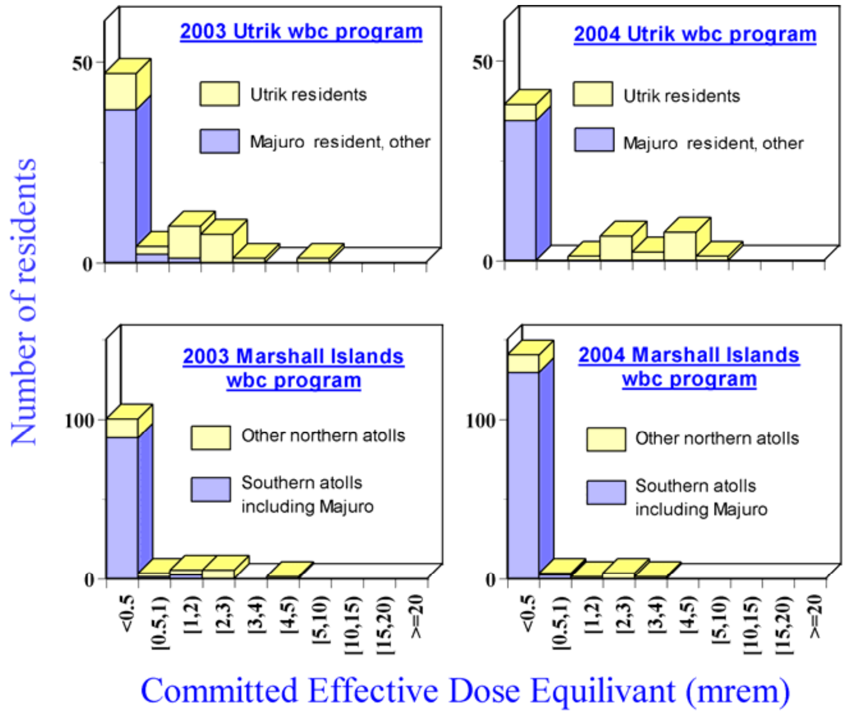


Figure 5. Frequency distribution of the committed effective dose equivalent for the Utrōk population group (upper graphics) in comparison to other program volunteers residing on Majuro Atoll or elsewhere in the Marshall Island (lower graphics) annualized to the year of measurement (2003-2004). Summary graphics for each measurement year are based on the committed dose received over 70 year; refer supporting documentation (Daniels *et al.*, 2006, Appendix 3).

The population average committed effective dose equivalent for program volunteers living on Utrōk Atoll was 1.6±1.4 mrem (N = 25) and 3.0±1.8 mrem (N = 21) during 2003 and 2004, respectively. Over the same period most people from the Utrōk population group who lived on Majuro Atoll (or elsewhere in the Marshall Islands) did not acquire a measurable body burden of cesium-137 (N= 74) (Figure 5).

Similarly, the population average committed effective dose equivalent for program volunteers living elsewhere in the northern Marshall Islands was 1.0±1.3 mrem (N = 23) and 0.8±1.2 mrem (N = 17) during 2003 and 2004, respectively. It should be noted that the vast majority of these program volunteers (other than Utrōk residents) lived on Ailuk Atoll. Again, very few people who lived on the southern atolls (including Majuro) acquired a measurable whole body burden of cesium-137 (N = 220) (Figure 5). No additional treatment of the data according to gender and age group was deemed necessary because the total number of volunteers in the program is still relatively few.

Although the whole body burdens of cesium-137 are generally low and equate to annualized dose contributions of less than 5 mrem, these data do show that people living on Utrōk Atoll and elsewhere in the northern Marshall Islands are exposed to higher intakes of cesium-137 in their diets. These results are also consistent with previous measurements performed by the Brookhaven National Laboratory (Sun *et al.*, 1997).

The committed effective dose equivalent from internally deposited cesium-137 within the Utrōk Atoll population group as well as for other program volunteers can be compared with natural background doses of 140 mrem per year in the Marshall Islands and 300 mrem per year in the United States. All program volunteers received a dose from cesium-137 ingestion that is significantly below the annual dose criteria of 100 mrem per year, excluding medical irradiation, imposed in 10CFR Part 20 (NRC, 2004) for protection of the public. The Republic of the Marshall Islands Nuclear Claims Tribunal has adopted a standard for cleanup of radioactively contaminated sites in the Marshall Islands of 15 mrem per year (EDE, Effective Dose Equivalent). With the knowledge that cesium-137 ingestion is a major contributor to dose from exposure to residual fallout contamination in the Marshall Islands, data derived from the whole body counting program provides an direct measure of the internal doses experienced by program volunteers in comparison with applicable cleanup standards or guidelines. Consequently, the whole body counting program appears to demonstrate that residents living on Utrōk Atoll are not being exposed to significantly elevated levels of cesium-137 in their diets. It is, however, recommended that the monitoring program be continued in order to acquire data across all age groups and to more accurately assess potential *high-end* doses, especially for permanent residents living on Utrōk Atoll and other northern atolls including Ailuk, Mejit, Wotje and Likiep.

MEASUREMENT DATA FROM THE INDIVIDUAL RADIOLOGICAL SURVEILLANCE PROGRAM

Introduction | Individual Measurement Database

Introduction

The individual (de-identified) measurements database developed for the Utrōk Atoll population group as well as for other Marshall Islanders (excludes residents living on Enewetak Atoll and the Rongelap Atoll resettlement workers) is accessible over the world-wide web (Figure 6, http://eed.llnl.gov/mi/);

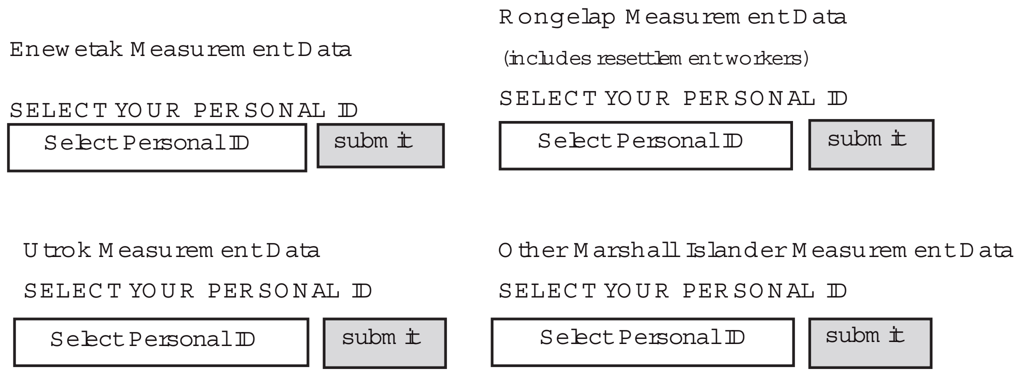


Figure 6. Layout of the menu to access measurement data from our whole body counting over the world-wide web (http://eed.llnl.gov/mi/).

Whole-body counting provides a direct measure of the total amount of cesium-137 present in the human body at the time of measurement. The amount of cesium-137 detected is usually reported in activity units of kilo-Becequerel (kBq), where 1 kBq equals 1000 Bq and 1 Bq = 1 nuclear transformation per second ($t\ s^{-1}$).

Individual Measurement Database

The website provides electronic access to verified whole body counting data developed under the Marshall Islands Radiological Surveillance Program at the Lawrence Livermore National Laboratory (1998-present). Please note that measurement data developed for the Utrōk and other Marshall Islander population groups (2003-present) incorporates counts from all three of our whole body counting facilities and may include people from other affiliations with the exception of permanent residents and resettlement workers from Enewetak and Rongelap Atolls.

DOSIMETRIC DATA AND METHODOLOGY

Introduction | Dosimetric Methodology

Introduction

The individual (de-identified) dosimetric database developed for the Utrōk Atoll population group as well as for other Marshall Islanders (excludes residents living on Enewetak Atoll and the Rongelap Atoll resettlement workers) is accessible over the world-wide web (Figure 7, http://eed.llnl.gov/mi/);

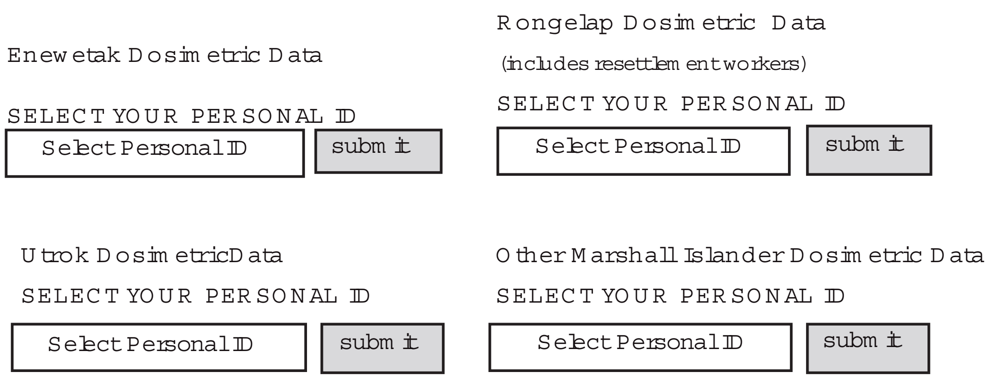


Figure 7. Layout of the menu to access dosimetric data from our whole body counting over the world-wide web (http://eed.llnl.gov/mi/).

In general, nuclear transformations emit energy and/or particles in the form of gamma rays, beta particles and alpha particles. Tissues in the human body may adsorb these emissions with the potential for any deposited energy to cause damage and disrupt biological function of cells. The general term used to quantify the extent of any health risk from radiation exposure is referred to as the dose. The equivalent dose is defined by the average absorbed dose in an organ or tissue weighed by the average quality factor for the type and energy of the radiation causing the dose. The effective dose equivalent (as applied to the whole body) is the sum of the average dose equivalent for each tissue weighted by tissue weighing factors. The SI unit of effective dose equivalent is the joule per kilogram (J kg^{-1}), named the sievert (Sv). The conventional unit often used by federal and state agencies in the United States is called a rem; 1 rem = 0.01 Sv.

Based on measurements of the internally deposited ^{137}Cs and/or the urinary excretion of plutonium, an estimate can be derived for either or both radionuclides of the annual number of nuclear transformations (t y^{-1}) that occurred in the body during the measurement year. For both radionuclides, this result is the time integral of activity in the body of an individual normalized over a one-year measurement period. In addition to nuclear transformations occurring during the year of measurement, additional transformations may occur in the future due to the presence of residual activity in the body at the end of the measurement year. The number of transformations derived from the residual radioactivity is usually evaluated up to 50 y in the future (a conservative maximum as defined by the United States (U.S.) Environmental Protection Agency (EPA) for members of the public) resulting in a committed dose. Accordingly, these future transformations will commit additional dose to the individual according to the biological half-life of the radioactive element of concern. For this reason, it is considered appropriate and conforming with the national and international recommendations of the United States Environment Protection Agency (EPA) and the International Commission on Radiological Protection (ICRP) that this additional dose commitment be assigned to the year of measurement. Consequently, dose reports issued under the Marshall Islands Radiological Surveillance Program are based on the Committed Effective Dose Equivalent (CEDE).

Dosimetric Methodology

The calendar year dose represents the sum of radionuclide-specific, age-dependent, committed effective dose equivalent for each monitored radionuclide. The total calendar years dose is calculated over a calendar year but only applies to the sum of the committed dose from cesium-137 and the 50-y integrated dose from plutonium (based on a time integral of any whole body counting and any available plutonium bioassay measurements performed during that year). When only one radionuclide is measured, the total dose assigned in a year and the CEDE for a specific radionuclide are identical. When more than one radionuclide is measured, the total annual ‘calendar year’ dose is the sum on the CEDE for each measured radionuclide. The calendar year dose estimates based on whole body counting and plutonium bioassay are conservative in nature, especially in relation to plutonium, and is only be comparable to the internal dose component of the EDE standard of 15 mrem per year as adopted by the Marshall Islands Nuclear Claims Tribunal for cleanup and rehabilitation of radioactively contaminated sites (to view the full report on the dose methodology, see Daniels *et al.*, 2006).

PROVIDING FOLLOWUP ON RESULTS

All volunteers participating in the Marshall Islands Radiological Surveillance Program are issued a preliminary copy of their dose report immediately after they receive a whole body count. Scientists from the Lawrence Livermore National Laboratory verify the measurement data and, if required, issue a revised dose report. Annualized doses of 10 mrem or above will normally evoke a pre-determined action or investigation for the particular radionuclide concerned. These actions may include follow-up verification measurements, a dietary evaluation and/or a work history review. Below this level, default assumptions for assigning doses (Daniels *et al.*, 2006) are assumed to be valid and no further action is taken. Data may be withheld from the website or hard copy reports while these investigations are on-going. Our action level is one-tenth of the investigation level used throughout the U.S. Department of Energy and is well below the 15 mrem per year standard adopted by the Republic of the Marshall Islands Nuclear Claims Tribunal for cleanup of radioactively contaminated sites. In addition, at the end of each calendar year, all program volunteers receive a final written report containing an estimate of their "*calendar year* dose" based on available data for the measurements year.

ACKNOWLEDGMENTS

This work was performed under the auspices of the U.S. Department of Energy by the University of California, Lawrence Livermore National Laboratory under contract No. W-7405-Eng-48. We gratefully acknowledge the cooperation effects of the Utrōk Atoll Local Government in helping develop and implement this radiological surveillance monitoring program. We acknowledge the excellent work and dedication of our Marshallese technicians (Mr. Sherwood Tibon and Mr. Lolieta) in overseeing the daily operation of the Utrōk Whole Body Counting Program on Majuro Atoll, and thank Ms. Jennifer Luna and Ms. Pat Fontes for administrative support in helping produce this report.

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GLOSSARY OF TERMS

Absorbed Dose

The absorbed dose is the energy deposited in an organ or tissue per unit mass of irradiated material. The common unit for absorbed dose is the rad, which is equivalent to 100 egs per gram of material. The international scientific community has adopted the use of different terms. The SI unit of absorbed dose is the joule per kilogram (J kg^{-1}) and its special name is the gray (Gy). One Gy is the same as 100 rad.

Activity

Activity is the rate of transformation or decay of a radioactive material. The SI unit of activity is the reciprocal second (s^{-1}) and its special name is the Becquerel. Federal and state agencies in the United States use conventional units where activity is given in curies (Ci); 1 Ci = 3.7 x 10^{10} Bq.

Alpha Particles

Alpha particles are one of the primary types of radiation associated with radioactivity and exist as energetic nuclei of helium atoms, consisting of two protons and two neutrons. Alpha rays are heavy, slow moving, charged particles that travel only one or two inches in air, and can be stopped by a piece of paper or the outer dead layer of human skin.

Background Radiation

The average person in the United States receives about 3.6 mSv (360 mrem) of ionizing radiation every year. About 3.0 mSv (300 mrem) per year comes from natural background radiation including cosmic radiation, radiation emitted by naturally occurring radionuclides in air, water, soil and rock, and radiation emitted by natural radionuclides deposited in tissues of organs; and about (0.6 mSv) 60 mrem from man-made sources such as exposures to diagnostic X-rays and consumer products (e.g., from smoking tobacco). The general worldwide contribution from radioactive fallout contamination is <0.3% of the average total annual dose. Exposures to natural background radiation vary depending on the geographic area, diet and other factors such as the composition of materials used in the construction of homes. The natural background radiation dose in the Marshall Islands is around 1.4 mSv (140 mrem) per year and is significantly less than what most people receive around the world.

Baseline

We have all been exposed to some level of worldwide fallout contamination. In the United States, the general population receives up to 0.015 mSv (1.5 mrem) or about 0.3% of the average total annual dose from exposure to worldwide fallout contamination from atmospheric nuclear weapons testing and about 0.005 (0.5 mrem) or about 0.1% of the average total annual dose from operations related nuclear power generation. Similarly, people living in the Marshall Islands will have very small quantities of internally deposited fallout radionuclides such as cesium-137, strontium-90 and plutonium in their bodies from worldwide contamination of food, air, water and soil. Assessments of possible increases in radiation exposure from elevated levels of fallout contamination in the northern Marshall Islands can only be made on the basis of comparisons with residual systematic burdens of radionuclides acquired from previous exposures to global fallout contamination. Under the Marshall Islands Radiological Surveillance Program, efforts are being made to improve on the reliability of measurements of background urinary excretion rates of plutonium from Marshallese populations against which the results of future bioassay measurements can be compared to accurately assess the impacts of resettlement on radiation exposure and dose.

Becquerel (Bq)

A Becquerel (abbreviated as Bq) is the International System (SI) unit for activity of radioactive material. One Bq of radioactive material is that amount of material in which one atom is transformed or undergoes 1 disintegration every second. Whole body counting and plutonium bioassay measurements are usually reported in activity units of kBq (kiloBecquerel) (1000 x 1 Bq) and μBq (microBecquerel) (1×10^{-6} x 1 Bq), respectively.

Biokinectic

The word ‘biokinectic’ is used here to describe the adsorption (uptake), distribution and retention of elements in humans.

Calibration

Calibration is the process of adjusting or determining the response or reading of an instrument to a standard.

Committed Dose Equivalent

Committed dose equivalent is the time integral of the dose-equivalent rate in a particular tissue that will be received by an individual following an intake of radioactive material into the body by inhalation, ingestion or dermal absorption. For adults the committed dose is usually the dose received over 50 years. For children, the committed dose is usually calculated from the age of intake to age 70 years. For these age groups the term ‘integrated dose equivalent’ is used.

Committed Effective Dose Equivalent (CEDE)

The committed effective dose equivalent is the committed dose equivalents to various tissues or organ in the body each multiplied by an appropriate tissue-weighing factor and then summed. The conventional unit for committed effective dose equivalence (CEDE) used by federal and state agencies within the United States is the rem. The international scientific (SI) unit of committed effective dose equivalent is called a sievert (Sv). One Sv is the same as 100 rem.

Critical Level (L_C)

The critical level is the amount of a count or final measurement of a quantity of an analyte at or above which a decision is made that the analyte is definitely present ($L_C \approx$ MDA/2).

Default Assumptions (used in assignment of dose)

The largest dose contributions attributable to exposure to residual nuclear fallout contamination in the Marshall Islands result from either internal exposure from intakes of radionuclides through ingestion, inhalation and/or absorption through the skin or external exposure from radionuclides distributed in the soil. External exposure rates can be measured directly using instrument surveys of the radiation field. The assignment of dose to internally deposited radionuclides is much more complicated. Biokinectic and dosimetric models developed by the International Commission on Radiological Protection (ICRP) are used to convert whole body burdens (from whole body counting or from *in vitro* bioassay tests such as urinalysis) into dose. In the case of a chronic exposure, organ and body burdens continue to build up over time until a steady state is reached where losses due to decay and excretion are balanced by intake and absorption.

Cesium-137 has an effective half-life in an adult of about 110 days, and under chronic exposure conditions reaches a maximal dose contribution after about 2 years. By contrast, plutonium absorbed from the gastrointestinal or respiratory tract enters the blood stream and deposits in liver and bone with an effective half-life of 20 to 50 years. Only a small fraction of plutonium entering the blood stream is excreted in urine with the long-term excretion rate approaching 2×10^{-5} of the systemic body burden per day. Knowledge of excretion rates and time of exposure are important when interpreting urinalysis data. A more detailed discussion of the dose calculation methodology is given elsewhere (see under Daniels *et al.*, 2006).

Direct bioassay

The measurements of radioactive material in the human body utilizing instrumentation that detects radiation emitted from radioactive material in the body (synonymous with *in vivo* measurements).

Dose Assessment

The scientific process used to determine radiation dose and uncertainty in the dose.

Dose Equivalent

The dose equivalent is the adsorbed dose at a point in tissue multiplied by a biological effectiveness factor or quality factor for the particular types of radiation to cause biological damage. The conventional unit of dose equivalents used by federal and state agencies in the United States is the rem. A dose of 100 rem to an adult normally produces some clinical signs of radiation sickness and requires hospitalization. The international scientific unit for dose equivalent is the joule per kilogram ($J\ kg^{-1}$) and is called the sievert (Sv). One Sv is the same as 100 rem.

Effective Dose Equivalent

The effective dose equivalent for the whole body is the sum of dose-equivalents for various organs in the body weighted to account for different sensitivities of the organs to radiation. It includes the dose from radiation sources internal and/or external to the body. The effective dose equivalent is usually expressed in units of millirem (mrem). The international scientific unit for dose equivalent is the joule per kilogram ($J\ kg^{-1}$) and is called the sievert (Sv). One Sv is the same as 100 rem.

External Dose or Exposure

That portion of the dose equivalent received from radiation sources outside the human body.

Fission Track Analysis

During neutron irradiation heavy nuclei such as uranium and plutonium undergo nuclear fission with release of large fission fragments. This property has led to the development of a number of measurement techniques such as delayed neutron activation analysis and fission track analysis. Fission track analysis is a measurement technique commonly employed in plutonium urinalysis (bioassay) monitoring programs. Urine samples are chemically treated to remove plutonium. The plutonium is then mounted in contact with a special plastic or quartz slide known as solid-state nuclear track detector (SSNTD). The slide along with the sample is then irradiated in a reactor where neutron-induced fission of plutonium-239 (or uranium-235) causes emission of energetic fission fragments. Some of the fragments penetrate into the SSNTD damaging the integrity of the material before coming to rest. The SSNTD is separated from the sample and chemically etched to expose the damaged areas (known as fission tracks) on the detector surface. The fission tracks are then counted under an optical microscope. The amount of plutonium (and/or uranium) present in the sample is a function of the total number of tracks and the neutron flux.

Gamma-rays

Gamma-rays are electromagnetic waves produced by spontaneous decay of radioactive elements during de-excitation of an atomic nucleus. Sunlight also consists of electromagnetic waves but gamma-rays have a shorter wavelength and much higher energy. High-energy gamma-rays such as those produced by decay of cesium-137 may penetrate deeply into the body and affect cells. Gamma-rays from a cobalt-60 source are often used for cancer radiotherapy.

High-End Health Risk

High-end health risk is used here under the context that it refers to the maximally exposed individuals in a population.

In Vito

In vitro measurements are synonymous with indirect bioassay techniques, such as plutonium urinalysis.

In Vivo

In vivo measurements are synonymous with bioassay techniques, such as whole body counting.

Indirect bioassay

In direct bioassay are measurements used to determine the presence of and/or the amount of a radioactive material in the excreta, urine or in other biological materials removed from the body (synonymous with *in vitro* measurements).

Individual

An individual is any human being.

Internal Dose or Exposure

The internal dose is that portion of the dose equivalent received from radiation sources inside the human body.

Isotope

Atoms with the same number of protons but different numbers of neutrons are called isotopes of that element. We identify different isotopes by appending the total number of nucleons (the total number of proton plus neutrons in the nucleus of an atom) to the name of the element, e.g., cesium-137. Isotopes are usually written in an abbreviated form using the chemical symbol of the element. Two examples include ^{137}Cs for cesium-137 and ^{239}Pu for plutonium-239.

Minimum Detectable Amount (MDA)

The minimum detectable amount (MDA) is the smallest activity or mass of an analyte in a sample or person that can be detected with an acceptable level of uncertainty.

Quality Assurance

All those planned and systematic actions necessary to provide adequate confidence that an analysis, measurement or surveillance program will perform satisfactorily.

Quality Control

Quality Control is defined as those actions taken to control the attributes of a analytical process, system or facility according to predetermined quality requirements.

Radiation Dose (or mrem)

A generic term to describe the amount of radiation a person receives. Dose is measured in units of thousands of a roentegen equivalent man (rem) (called the millirem). The conventional unit used by federal and state agencies in the United States is the millirem (mrem). Dose is a general term used to assist in the management of exposure to radiation. The common international scientific (SI) unit for dose is the millisievert (mSv). One mSv is the same as 100 mrem.

Radioactivity

A natural and spontaneous process by which unstable atoms of an element emit energy and/or particles from their nuclei and, thus change (or decay) to atoms of a different element or a different state of the same element.

Radiological Monitoring

Radiological monitoring is the process of measuring radiation levels or individual doses, and the use of the results to assess radiological hazards or potential and actual doses resulting from exposures to ionizing radiation.

Remediation

Remediation is the actions taken to reduce risks to human health or the environment posed by the presence of radioactive or hazardous materials.

Risk

The probability of harm from the presence of radionuclides or hazardous materials taking into account (1) the probability of occurrences or events that could lead to an exposure, (2) probability that individual or populations would be exposed to radioactive or hazardous materials and the magnitude of such exposures, and (3) the probability that an exposure would produce a response.

Validation

Validation refers to the process of defining the method capability and determining whether it can be properly applied as intended.

Whole Body

For the purposes of external exposure includes the head, trunk, the arms above and including the elbow, and legs above and including the knee.

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Appendix I

Individual Radiological Surveillance Monitoring Data Based on Whole Body Counting
(2003-2004)

UTRŌK ATOLL POPULATION GROUP
(AND OTHER MARSHALL ISLANDERS)

Table 1. Whole body count data for the Utrōk Atoll population group (2003-2004).

Personal ID #	Age Type	Gender	Collection Date	^{137}Cs (kBq) Value	MDA
UT00002	Adult	Male	2003-07-21	0.00 ± 0.00	0.11
UT00002	Adult	Male	2004-02-28	0.00 ± 0.00	0.07
UT00003	Adult	Female	2003-07-21	0.00 ± 0.00	0.11
UT00004	Adult	Male	2003-07-21	0.00 ± 0.00	0.11
UT00005	Adult	Female	2003-07-21	0.00 ± 0.00	0.10
UT00006	Adult	Female	2003-07-22	0.00 ± 0.00	0.11
UT00006	Adult	Female	2004-10-21	0.00 ± 0.00	0.11
UT00007	Adult	Male	2003-07-23	0.00 ± 0.00	0.11
UT00007	Adult	Male	2004-08-31	0.00 ± 0.00	3.28
UT00008	Adult	Male	2003-07-23	0.61 ± 0.03	0.18
UT00009	Adult	Female	2003-07-23	0.38 ± 0.02	0.18
UT00009	Adult	Female	2004-05-14	0.00 ± 0.00	0.12
UT00010	Pre-Teen	Female	2003-07-23	0.00 ± 0.00	0.10
UT00011	Adult	Female	2003-07-24	0.00 ± 0.00	0.10
UT00012	Adult	Male	2003-07-24	0.00 ± 0.00	0.10
UT00013	Teenager	Female	2003-07-28	0.00 ± 0.00	0.10
UT00014	Adult	Male	2003-07-28	0.00 ± 0.00	0.11
UT00015	Adult	Female	2003-07-28	0.00 ± 0.00	0.10
UT00016	Adult	Male	2003-07-29	0.00 ± 0.00	0.10
UT00017	Adult	Female	2003-07-29	0.00 ± 0.00	0.10
UT00018	Adult	Male	2003-07-30	0.00 ± 0.00	0.10
UT00019	Adult	Female	2003-07-30	0.00 ± 0.00	0.10
UT00019	Adult	Female	2004-08-30	0.00 ± 0.00	3.23
UT00020	Adult	Female	2003-07-30	0.00 ± 0.00	0.10
UT00020	Adult	Female	2004-10-21	0.00 ± 0.00	3.05
UT00021	Adult	Female	2003-08-04	0.00 ± 0.00	0.10
UT00022	Adult	Female	2003-08-04	0.00 ± 0.00	0.10
UT00023	Adult	Male	2003-08-06	0.00 ± 0.00	0.10
UT00023	Adult	Male	2004-10-22	0.00 ± 0.00	0.11
UT00024	Adult	Female	2003-08-01	0.00 ± 0.00	0.10
UT00025	Adult	Male	2003-08-01	0.00 ± 0.00	0.10
UT00026	Adult	Female	2003-08-01	0.00 ± 0.00	0.10
UT00027	Adult	Female	2003-08-07	0.00 ± 0.00	0.10
UT00027	Adult	Female	2003-11-26	0.00 ± 0.00	0.10
UT00028	Adult	Female	2003-08-08	0.00 ± 0.00	0.11
UT00029	Adult	Male	2003-08-08	1.20 ± 0.04	0.19
UT00030	Adult	Female	2003-08-13	0.00 ± 0.00	0.11
UT00031	Adult	Male	2003-08-13	0.17 ± 0.02	0.18
UT00031	Adult	Male	2004-04-20	0.00 ± 0.00	3.51
UT00032	Adult	Male	2003-08-13	0.00 ± 0.00	0.10
UT00033	Adult	Male	2003-08-13	0.00 ± 0.00	0.11
UT00034	Adult	Male	2003-08-13	0.56 ± 0.03	0.17
UT00035	Adult	Female	2003-08-14	0.00 ± 0.00	0.10
UT00036	Adult	Male	2003-08-14	0.00 ± 0.00	0.10
UT00037	Adult	Female	2003-08-14	0.00 ± 0.00	0.10
UT00038	Adult	Female	2003-08-14	0.00 ± 0.00	0.10

Table 1. Continued.

Personal ID #	Age Type	Gender	Collection Date	^{137}Cs (kBq) Value	MDA
UT00039	Adult	Female	2003-08-14	0.30 ± 0.02	0.17
UT00040	Adult	Female	2003-08-14	0.00 ± 0.00	0.10
UT00041	Adult	Female	2003-08-15	0.00 ± 0.00	0.10
UT00041	Adult	Female	2004-10-21	0.00 ± 0.00	0.11
UT00042	Adult	Female	2003-08-15	0.00 ± 0.00	0.11
UT00043	Adult	Male	2003-08-15	0.28 ± 0.02	0.17
UT00044	Adult	Female	2003-08-18	0.32 ± 0.02	0.17
UT00045	Adult	Male	2003-08-18	0.42 ± 0.02	0.17
UT00046	Adult	Female	2003-08-19	0.00 ± 0.00	0.10
UT00047	Pre-Teen	Female	2003-08-20	0.00 ± 0.00	0.11
UT00048	Pre-Teen	Male	2003-08-20	0.00 ± 0.00	0.10
UT00049	Adult	Female	2003-08-22	0.00 ± 0.00	0.10
UT00050	Adult	Female	2003-09-02	0.00 ± 0.00	0.10
UT00051	Adult	Male	2003-09-02	0.00 ± 0.00	0.10
UT00052	Teenager	Female	2003-10-09	0.18 ± 0.02	0.14
UT00053	Adult	Female	2003-10-14	0.21 ± 0.02	0.15
UT00054	Adult	Female	2003-10-14	0.46 ± 0.03	0.19
UT00055	Adult	Male	2003-10-16	0.15 ± 0.02	0.15
UT00056	Adult	Female	2003-11-03	0.00 ± 0.00	0.11
UT00056	Adult	Female	2004-10-21	0.00 ± 0.00	0.11
UT00057	Adult	Male	2003-11-07	0.41 ± 0.03	0.18
UT00058	Adult	Male	2003-11-07	0.34 ± 0.03	0.18
UT00058	Adult	Male	2004-11-03	0.77 ± 0.08	0.33
UT00059	Adult	Male	2003-11-07	0.44 ± 0.03	0.19
UT00060	Adult	Male	2003-11-07	0.63 ± 0.03	0.18
UT00060	Adult	Male	2004-12-13	1.06 ± 0.07	0.29
UT00061	Adult	Male	2003-11-07	0.24 ± 0.02	0.18
UT00061	Adult	Male	2004-12-01	0.20 ± 0.07	0.33
UT00062	Adult	Male	2003-11-07	0.29 ± 0.02	0.18
UT00063	Adult	Male	2003-11-11	0.15 ± 0.02	0.14
UT00064	Adult	Male	2003-11-11	0.00 ± 0.00	0.11
UT00065	Adult	Female	2003-11-13	0.47 ± 0.03	0.18
UT00066	Adult	Female	2003-11-13	0.33 ± 0.03	0.18
UT00066	Adult	Female	2004-11-03	0.60 ± 0.07	0.32
UT00067	Adult	Female	2003-11-26	0.12 ± 0.02	0.17
UT00067	Adult	Female	2004-01-23	0.00 ± 0.00	0.11
UT00068	Adult	Male	2003-12-09	0.00 ± 0.00	0.11
UT00068	Adult	Male	2004-09-16	0.00 ± 0.00	0.11
UT00069	Adult	Male	2004-01-22	0.17 ± 0.02	0.13
UT00069	Adult	Male	2004-04-28	0.09 ± 0.04	0.19
UT00070	Adult	Male	2004-02-04	0.40 ± 0.03	0.18
UT00071	Adult	Female	2004-02-26	0.07 ± 0.04	0.19
UT00072	Adult	Female	2004-02-26	0.00 ± 0.00	0.10
UT00072	Adult	Female	2004-10-29	0.00 ± 0.00	0.11
UT00073	Adult	Female	2004-02-27	0.00 ± 0.00	0.09
UT00074	Adult	Male	2004-04-28	0.35 ± 0.07	0.32

Table 1. Continued.

Personal ID #	Age Type	Gender	Collection Date	^{137}Cs (kBq) Value	MDA
UT00075	Adult	Male	2004-04-28	0.00 ± 0.00	0.11
UT00076	Adult	Female	2004-05-14	0.72 ± 0.07	0.30
UT00077	Adult	Female	2004-05-14	0.41 ± 0.07	0.33
UT00078	Adult	Female	2004-07-20	0.00 ± 0.00	0.11
UT00079	Adult	Male	2004-07-08	0.89 ± 0.08	0.35
UT00080	Adult	Male	2004-07-22	0.97 ± 0.08	0.34
UT00081	Adult	Male	2004-07-22	0.98 ± 0.08	0.32
UT00082	Adult	Male	2004-07-23	0.12 ± 0.05	0.21
UT00083	Teenager	Male	2004-07-23	0.70 ± 0.08	0.33
UT00084	Teenager	Male	2004-07-24	0.40 ± 0.07	0.33
UT00085	Teenager	Male	2004-07-24	0.00 ± 0.00	0.12
UT00086	Teenager	Female	2004-08-06	0.48 ± 0.08	0.34
UT00087	Adult	Male	2004-08-10	0.00 ± 0.00	0.11
UT00088	Adult	Male	2004-08-10	0.53 ± 0.08	0.35
UT00089	Adult	Male	2004-08-10	0.41 ± 0.08	0.34
UT00090	Adult	Male	2004-08-10	0.18 ± 0.05	0.25
UT00091	Adult	Male	2004-08-10	0.00 ± 0.00	0.11
UT00092	Adult	Male	2004-08-31	0.57 ± 0.07	0.33
UT00093	Adult	Female	2004-09-02	0.00 ± 0.00	0.11
UT00094	Adult	Male	2004-09-02	0.00 ± 0.00	0.11
UT00095	Adult	Female	2004-09-08	0.00 ± 0.00	0.11
UT00096	Adult	Female	2004-09-08	0.00 ± 0.00	0.11
UT00097	Adult	Female	2004-09-13	0.00 ± 0.00	0.11
UT00098	Adult	Female	2004-09-13	0.00 ± 0.00	0.11
UT00099	Adult	Male	2004-09-16	0.00 ± 0.00	0.11
UT00100	Adult	Female	2004-10-05	0.00 ± 0.00	0.11
UT00101	Adult	Male	2004-10-11	0.00 ± 0.00	0.11
UT00102	Adult	Female	2004-10-21	0.00 ± 0.00	0.12
UT00103	Adult	Female	2004-10-21	0.00 ± 0.00	0.11
UT00104	Adult	Male	2004-10-22	0.00 ± 0.00	0.11
UT00105	Adult	Male	2004-10-22	0.00 ± 0.00	0.11
UT00106	Adult	Female	2004-10-23	0.00 ± 0.00	0.11
UT00107	Adult	Female	2004-10-23	0.00 ± 0.00	0.11
UT00108	Adult	Female	2004-10-23	0.00 ± 0.00	0.11
UT00109	Adult	Female	2004-10-23	0.00 ± 0.00	0.11
UT00110	Adult	Female	2004-10-23	0.00 ± 0.00	0.11
UT00111	Adult	Female	2004-10-23	0.00 ± 0.00	0.11
UT00112	Adult	Female	2004-10-23	0.00 ± 0.00	0.11
UT00113	Adult	Male	2004-10-26	0.83 ± 0.08	0.34
UT00114	Adult	Male	2004-10-26	0.87 ± 0.08	0.35
UT00115	Adult	Male	2004-10-26	1.39 ± 0.10	0.38
UT00116	Adult	Female	2004-11-29	0.76 ± 0.07	0.31
UT00117	Adult	Female	2004-12-01	0.00 ± 0.00	0.11
UT00118	Adult	Male	2004-12-01	0.00 ± 0.00	0.11
UT00119	Adult	Male	2004-12-01	0.00 ± 0.00	0.11
UT00120	Adult	Female	2004-12-01	0.00 ± 0.00	0.11

Table 1. Continued.

Personal ID #	Age Type	Gender	Collection Date	^{137}Cs (kBq) Value	MDA
UT00121	Adult	Female	2004-12-02	0.00 ± 0.00	0.11
UT00122	Adult	Female	2004-12-23	0.00 ± 0.00	0.11
UT00126	Adult	Female	2004-12-09	0.25 ± 0.07	0.33

Table 2. Whole body count data for other Marshall Islanders (excludes residents living on Enewetak Atoll and the Rongelap Atoll resettlement workers) (2003-2004).

Personal ID #	Age Type	Gender	Collection Date	^{137}Cs (kBq) Value	MDA
MI00003	Adult	Male	2003-07-21	0.00 ± 0.00	0.09
MI00003	Adult	Male	2003-11-04	0.00 ± 0.00	0.11
MI00003	Adult	Male	2003-12-30	0.00 ± 0.00	0.11
MI00003	Adult	Male	2004-02-10	0.00 ± 0.00	0.11
MI00003	Adult	Male	2004-02-25	0.00 ± 0.00	0.10
MI00003	Adult	Male	2004-04-13	0.00 ± 0.00	0.11
MI00003	Adult	Male	2004-12-09	0.00 ± 0.00	0.11
MI00006	Adult	Male	2003-07-21	0.00 ± 0.00	0.11
MI00007	Adult	Female	2003-07-19	0.00 ± 0.00	0.11
MI00008	Adult	Female	2003-07-22	0.00 ± 0.00	0.10
MI00009	Adult	Female	2003-07-22	0.00 ± 0.00	0.11
MI00010	Adult	Male	2003-07-22	0.00 ± 0.00	0.11
MI00011	Adult	Female	2003-07-22	0.00 ± 0.00	0.11
MI00012	Adult	Female	2003-07-22	0.00 ± 0.00	0.11
MI00013	Adult	Female	2003-07-22	0.00 ± 0.00	0.11
MI00014	Adult	Male	2003-07-22	0.00 ± 0.00	0.11
MI00015	Adult	Male	2003-07-22	0.00 ± 0.00	0.11
MI00016	Adult	Male	2003-07-23	0.00 ± 0.00	0.11
MI00017	Adult	Male	2003-07-23	0.00 ± 0.00	0.10
MI00018	Adult	Male	2003-07-23	0.00 ± 0.00	0.10
MI00019	Adult	Male	2003-07-23	0.00 ± 0.00	0.10
MI00020	Adult	Male	2004-05-10	0.00 ± 0.00	0.11
MI00021	Adult	Male	2003-07-24	0.00 ± 0.00	0.10
MI00022	Adult	Male	2003-07-24	0.00 ± 0.00	0.10
MI00023	Adult	Male	2003-07-24	0.00 ± 0.00	0.11
MI00024	Adult	Female	2003-07-24	0.00 ± 0.00	0.10
MI00025	Adult	Female	2003-07-24	0.00 ± 0.00	0.11
MI00026	Teenager	Female	2003-07-25	0.00 ± 0.00	0.11
MI00027	Adult	Female	2003-07-25	0.00 ± 0.00	0.10
MI00028	Adult	Female	2003-07-25	0.00 ± 0.00	0.11
MI00029	Adult	Male	2003-07-25	0.00 ± 0.00	0.10
MI00030	Adult	Female	2003-07-25	0.00 ± 0.00	0.10
MI00031	Adult	Male	2003-07-25	0.00 ± 0.00	0.10
MI00032	Adult	Male	2003-08-05	0.00 ± 0.00	0.11
MI00033	Adult	Female	2003-08-05	0.00 ± 0.00	0.10
MI00034	Adult	Male	2003-08-06	0.00 ± 0.00	0.11
MI00035	Adult	Male	2003-08-06	0.38 ± 0.02	0.18
MI00036	Adult	Female	2003-08-06	0.00 ± 0.00	0.12
MI00037	Adult	Male	2003-08-06	0.48 ± 0.03	0.18
MI00038	Adult	Female	2003-08-06	0.00 ± 0.00	0.10
MI00039	Adult	Male	2003-08-06	0.00 ± 0.00	0.11
MI00040	Adult	Male	2003-08-06	0.00 ± 0.00	0.10
MI00041	Adult	Male	2003-08-06	0.11 ± 0.02	0.17
MI00042	Adult	Male	2003-08-06	0.00 ± 0.00	0.10
MI00043	Adult	Male	2003-08-07	0.92 ± 0.03	0.18
MI00044	Adult	Male	2003-08-07	0.34 ± 0.02	0.17

Table 2. Continued.

Personal ID #	Age Type	Gender	Collection Date	^{137}Cs (kBq) Value	MDA
MI00045	Adult	Male	2003-08-07	0.00 ± 0.00	0.10
MI00046	Adult	Female	2003-08-07	0.00 ± 0.00	0.10
MI00047	Adult	Male	2003-08-07	0.00 ± 0.00	0.10
MI00048	Adult	Female	2003-08-07	0.00 ± 0.00	0.10
MI00049	Adult	Female	2003-08-07	0.00 ± 0.00	0.11
MI00050	Adult	Female	2003-08-07	0.00 ± 0.00	0.11
MI00051	Adult	Female	2003-08-07	0.00 ± 0.00	0.10
MI00052	Adult	Female	2003-08-07	0.00 ± 0.00	0.10
MI00053	Adult	Male	2003-08-07	0.00 ± 0.00	0.10
MI00054	Adult	Female	2003-08-07	0.00 ± 0.00	0.10
MI00055	Adult	Male	2003-08-07	0.00 ± 0.00	0.10
MI00056	Adult	Male	2003-08-07	0.00 ± 0.00	0.10
MI00057	Adult	Male	2003-08-08	0.00 ± 0.00	0.10
MI00058	Adult	Female	2003-08-08	0.23 ± 0.02	0.18
MI00059	Adult	Female	2003-08-08	0.00 ± 0.00	0.10
MI00060	Adult	Male	2003-08-08	0.00 ± 0.00	0.10
MI00061	Adult	Male	2003-08-11	0.00 ± 0.00	0.10
MI00062	Adult	Male	2003-08-11	0.00 ± 0.00	0.10
MI00063	Adult	Female	2003-08-11	0.00 ± 0.00	0.10
MI00064	Adult	Female	2003-08-11	0.00 ± 0.00	0.10
MI00065	Adult	Male	2003-08-11	0.00 ± 0.00	0.10
MI00066	Adult	Female	2003-08-11	0.00 ± 0.00	0.10
MI00067	Adult	Female	2003-08-11	0.00 ± 0.00	0.10
MI00068	Adult	Male	2003-08-13	0.00 ± 0.00	0.10
MI00069	Adult	Male	2003-08-13	0.00 ± 0.00	0.10
MI00070	Adult	Male	2003-08-13	0.00 ± 0.00	0.10
MI00071	Adult	Male	2003-08-14	0.00 ± 0.00	0.11
MI00072	Adult	Female	2003-08-14	0.00 ± 0.00	0.11
MI00073	Adult	Female	2003-08-18	0.00 ± 0.00	0.10
MI00074	Adult	Male	2003-08-18	0.00 ± 0.00	0.10
MI00075	Adult	Female	2003-08-18	0.00 ± 0.00	0.10
MI00076	Adult	Female	2003-08-18	0.00 ± 0.00	0.10
MI00076	Adult	Female	2004-10-11	0.00 ± 0.00	0.11
MI00077	Adult	Female	2003-08-18	0.00 ± 0.00	0.10
MI00078	Adult	Male	2003-08-18	0.00 ± 0.00	0.10
MI00079	Adult	Male	2003-08-19	0.00 ± 0.00	0.10
MI00080	Adult	Male	2003-08-19	0.00 ± 0.00	0.11
MI00081	Adult	Female	2003-08-19	0.00 ± 0.00	0.10
MI00082	Adult	Female	2003-08-19	0.43 ± 0.02	0.17
MI00083	Adult	Female	2003-08-22	0.00 ± 0.00	0.10
MI00084	Adult	Male	2003-08-28	0.00 ± 0.00	0.11
MI00085	Adult	Male	2003-09-01	0.00 ± 0.00	0.10
MI00086	Adult	Male	2003-09-01	0.00 ± 0.00	0.10
MI00087	Adult	Female	2003-09-01	0.00 ± 0.00	0.10
MI00088	Adult	Female	2003-09-01	0.00 ± 0.00	0.10
MI00089	Adult	Male	2003-09-01	0.00 ± 0.00	0.10

Table 2. Continued.

Personal ID #	Age Type	Gender	Collection Date	^{137}Cs (kBq) Value	MDA
MI00090	Adult	Male	2003-09-01	0.00 ± 0.00	0.10
MI00091	Adult	Male	2003-09-03	0.00 ± 0.00	0.10
MI00092	Adult	Female	2003-10-06	0.00 ± 0.00	0.11
MI00093	Adult	Female	2003-10-06	0.00 ± 0.00	0.12
MI00093	Adult	Female	2004-10-23	0.00 ± 0.00	0.11
MI00094	Adult	Female	2003-10-09	0.00 ± 0.00	0.09
MI00095	Adult	Female	2003-10-31	0.00 ± 0.00	0.11
MI00096	Adult	Female	2003-10-31	0.11 ± 0.02	0.18
MI00097	Adult	Male	2003-10-31	0.35 ± 0.02	0.18
MI00098	Adult	Female	2003-10-31	0.17 ± 0.02	0.18
MI00099	Adult	Female	2003-10-31	0.00 ± 0.00	0.11
MI00100	Adult	Male	2003-10-31	0.00 ± 0.00	0.11
MI00101	Adult	Female	2003-11-03	0.00 ± 0.00	0.11
MI00102	Adult	Male	2003-11-04	0.00 ± 0.00	0.11
MI00102	Adult	Male	2003-11-25	0.52 ± 0.03	0.18
MI00103	Adult	Male	2003-11-04	0.00 ± 0.00	0.10
MI00105	Adult	Male	2003-11-05	0.00 ± 0.00	0.10
MI00106	Adult	Female	2003-11-06	0.36 ± 0.03	0.18
MI00107	Adult	Male	2003-11-06	0.00 ± 0.00	0.11
MI00108	Adult	Female	2003-11-07	0.00 ± 0.00	0.11
MI00109	Adult	Male	2003-11-07	0.22 ± 0.02	0.18
MI00109	Adult	Male	2003-11-24	0.20 ± 0.02	0.18
MI00110	Adult	Male	2003-11-12	0.00 ± 0.00	0.11
MI00111	Adult	Male	2003-11-12	0.00 ± 0.00	0.11
MI00112	Adult	Female	2003-11-19	0.00 ± 0.00	0.10
MI00115	Adult	Male	2003-11-21	0.00 ± 0.00	0.11
MI00116	Adult	Male	2003-11-21	0.17 ± 0.03	0.18
MI00117	Adult	Male	2003-11-21	0.00 ± 0.00	0.11
MI00119	Adult	Female	2003-11-25	0.40 ± 0.03	0.18
MI00120	Adult	Female	2003-11-25	0.00 ± 0.00	0.11
MI00121	Adult	Male	2003-11-26	0.00 ± 0.00	0.11
MI00122	Adult	Female	2003-11-26	0.00 ± 0.00	0.11
MI00123	Adult	Male	2004-11-26	0.00 ± 0.00	0.11
MI00124	Adult	Male	2003-12-01	0.00 ± 0.00	0.11
MI00125	Adult	Male	2003-11-28	0.00 ± 0.00	0.11
MI00126	Adult	Male	2003-12-01	0.00 ± 0.00	0.11
MI00127	Adult	Male	2003-12-01	0.00 ± 0.00	0.11
MI00129	Adult	Male	2003-12-02	0.00 ± 0.00	0.11
MI00130	Adult	Male	2003-12-02	0.23 ± 0.02	0.18
MI00131	Adult	Female	2003-12-04	0.00 ± 0.00	0.11
MI00132	Teenager	Female	2003-12-04	0.00 ± 0.00	0.10
MI00133	Adult	Female	2003-12-04	0.00 ± 0.00	0.11
MI00134	Adult	Male	2003-12-17	0.00 ± 0.00	0.11
MI00135	Adult	Male	2003-12-30	0.00 ± 0.00	0.11
MI00136	Adult	Male	2003-12-30	0.00 ± 0.00	0.11
MI00138	Adult	Male	2003-12-30	0.00 ± 0.00	0.11

Table 2. Continued.

Personal ID #	Age Type	Gender	Collection Date	^{137}Cs (kBq) Value	MDA
MI00139	Adult	Male	2003-12-30	0.00 ± 0.00	0.11
MI00140	Adult	Male	2003-12-30	0.00 ± 0.00	0.11
MI00141	Adult	Male	2003-12-30	0.00 ± 0.00	0.11
MI00142	Adult	Male	2004-01-07	0.00 ± 0.00	0.11
MI00143	Adult	Male	2004-01-08	0.00 ± 0.00	0.11
MI00144	Adult	Female	2004-01-09	0.00 ± 0.00	0.11
MI00145	Adult	Male	2004-01-09	0.00 ± 0.00	0.11
MI00146	Adult	Male	2004-01-09	0.00 ± 0.00	0.11
MI00147	Adult	Male	2004-01-09	0.00 ± 0.00	0.11
MI00149	Adult	Male	2004-01-20	0.00 ± 0.00	0.11
MI00150	Adult	Male	2004-01-20	0.00 ± 0.00	0.11
MI00151	Adult	Male	2004-01-20	0.00 ± 0.00	0.11
MI00152	Adult	Male	2004-01-20	0.00 ± 0.00	0.11
MI00153	Adult	Male	2004-01-20	0.00 ± 0.00	0.11
MI00154	Adult	Male	2004-01-20	0.00 ± 0.00	0.11
MI00155	Adult	Female	2004-01-20	0.00 ± 0.00	0.11
MI00156	Adult	Male	2004-01-21	0.00 ± 0.00	0.11
MI00157	Adult	Male	2004-01-21	0.00 ± 0.00	0.11
MI00158	Adult	Male	2004-01-21	0.00 ± 0.00	0.11
MI00159	Adult	Male	2004-01-21	0.00 ± 0.00	0.11
MI00160	Adult	Male	2004-01-21	0.00 ± 0.00	0.20
MI00160	Adult	Male	2004-01-21	0.00 ± 0.00	0.11
MI00161	Adult	Male	2004-01-21	0.00 ± 0.00	0.11
MI00162	Adult	Male	2004-01-21	0.00 ± 0.00	0.11
MI00163	Adult	Male	2004-01-21	0.00 ± 0.00	0.11
MI00164	Adult	Male	2004-01-21	0.00 ± 0.00	0.11
MI00165	Adult	Male	2004-01-21	0.00 ± 0.00	0.11
MI00166	Adult	Male	2004-01-21	0.00 ± 0.00	0.11
MI00167	Adult	Male	2004-01-21	0.00 ± 0.00	0.11
MI00168	Adult	Male	2004-01-21	0.00 ± 0.00	0.11
MI00169	Adult	Male	2004-01-21	0.00 ± 0.00	0.11
MI00170	Adult	Male	2004-01-21	0.00 ± 0.00	0.11
MI00171	Adult	Male	2004-01-21	0.00 ± 0.00	0.11
MI00172	Adult	Male	2004-01-21	0.00 ± 0.00	0.11
MI00173	Adult	Male	2004-01-21	0.00 ± 0.00	0.11
MI00174	Adult	Male	2004-01-21	0.00 ± 0.00	0.11
MI00175	Adult	Male	2004-01-21	0.00 ± 0.00	0.11
MI00176	Adult	Male	2004-01-21	0.00 ± 0.00	0.11
MI00177	Adult	Male	2004-01-21	0.00 ± 0.00	0.11
MI00178	Adult	Male	2004-01-22	0.00 ± 0.00	0.11
MI00179	Adult	Male	2004-01-22	0.00 ± 0.00	0.11
MI00180	Adult	Male	2004-01-22	0.00 ± 0.00	0.11
MI00181	Adult	Male	2004-01-22	0.00 ± 0.00	0.11
MI00182	Adult	Male	2004-01-22	0.00 ± 0.00	0.11
MI00183	Adult	Male	2004-01-22	0.00 ± 0.00	0.11
MI00184	Adult	Male	2004-01-22	0.00 ± 0.00	0.11

Table 2. Continued.

Personal ID #	Age Type	Gender	Collection Date	^{137}Cs (kBq)	
				Value	MDA
MI00185	Adult	Male	2004-01-22	0.00 ± 0.00	0.11
MI00186	Adult	Male	2004-01-22	0.00 ± 0.00	0.11
MI00187	Adult	Male	2004-01-22	0.00 ± 0.00	0.11
MI00188	Adult	Male	2004-01-22	0.00 ± 0.00	0.11
MI00189	Adult	Male	2004-01-23	0.00 ± 0.00	0.11
MI00190	Adult	Male	2004-01-23	0.00 ± 0.00	0.11
MI00191	Adult	Male	2004-01-23	0.00 ± 0.00	0.11
MI00192	Adult	Male	2004-01-23	0.00 ± 0.00	0.11
MI00193	Adult	Male	2004-01-23	0.00 ± 0.00	0.11
MI00194	Adult	Male	2004-01-23	0.00 ± 0.00	0.11
MI00195	Adult	Male	2004-01-23	0.00 ± 0.00	0.11
MI00196	Adult	Male	2004-01-23	0.00 ± 0.00	0.11
MI00197	Adult	Male	2004-01-27	0.00 ± 0.00	0.11
MI00198	Adult	Male	2004-01-27	0.00 ± 0.00	0.10
MI00199	Adult	Male	2004-01-27	0.00 ± 0.00	0.10
MI00200	Adult	Male	2004-01-27	0.00 ± 0.00	0.11
MI00201	Adult	Male	2004-02-10	0.00 ± 0.00	0.11
MI00202	Adult	Female	2004-02-12	0.00 ± 0.00	0.11
MI00203	Adult	Male	2004-02-12	0.00 ± 0.00	0.11
MI00204	Adult	Male	2004-02-18	0.00 ± 0.00	0.11
MI00205	Adult	Male	2004-02-18	0.10 ± 0.02	0.17
MI00206	Adult	Male	2004-04-19	0.27 ± 0.07	0.32
MI00208	Adult	Male	2004-05-07	0.00 ± 0.00	0.11
MI00209	Adult	Male	2004-05-21	0.00 ± 0.00	0.11
MI00210	Adult	Female	2004-07-13	0.00 ± 0.00	0.11
MI00211	Adult	Female	2004-07-13	0.00 ± 0.00	0.11
MI00212	Adult	Male	2004-07-13	0.00 ± 0.00	0.11
MI00212	Adult	Male	2004-08-10	0.00 ± 0.00	0.11
MI00213	Adult	Male	2004-07-15	0.00 ± 0.00	0.11
MI00215	Adult	Male	2004-07-15	0.00 ± 0.00	0.11
MI00216	Adult	Male	2004-07-15	0.00 ± 0.00	0.11
MI00217	Adult	Male	2004-07-15	0.00 ± 0.00	0.11
MI00218	Adult	Male	2004-07-15	0.00 ± 0.00	0.11
MI00220	Adult	Female	2004-08-05	0.00 ± 0.00	0.11
MI00221	Teenager	Female	2004-07-20	0.00 ± 0.00	0.11
MI00222	Adult	Male	2004-07-21	0.00 ± 0.00	0.11
MI00223	Adult	Male	2004-07-21	0.00 ± 0.00	0.11
MI00224	Adult	Male	2004-07-21	0.00 ± 0.00	0.11
MI00226	Adult	Female	2004-07-22	0.00 ± 0.00	0.11
MI00227	Adult	Male	2004-07-23	0.00 ± 0.00	0.11
MI00228	Teenager	Female	2004-07-26	0.00 ± 0.00	0.11
MI00229	Adult	Female	2004-07-26	0.00 ± 0.00	0.11
MI00230	Adult	Female	2004-07-26	0.00 ± 0.00	0.11
MI00231	Adult	Male	2004-07-26	0.00 ± 0.00	0.11
MI00232	Adult	Male	2004-07-27	0.00 ± 0.00	0.12
MI00233	Adult	Male	2004-07-28	0.00 ± 0.00	0.11

Table 2. Continued.

Personal ID #	Age Type	Gender	Collection Date	^{137}Cs (kBq) Value	MDA
MI00234	Adult	Male	2004-07-29	0.00 ± 0.00	0.11
MI00235	Adult	Male	2004-08-05	0.00 ± 0.00	0.11
MI00236	Adult	Female	2004-08-06	0.00 ± 0.00	0.11
MI00237	Adult	Male	2004-08-09	0.00 ± 0.00	0.11
MI00238	Adult	Male	2004-08-13	0.10 ± 0.05	0.21
MI00239	Adult	Female	2004-08-16	0.00 ± 0.00	0.11
MI00240	Adult	Female	2004-08-17	0.09 ± 0.05	0.22
MI00240	Adult	Female	2004-12-30	0.00 ± 0.00	0.12
MI00241	Adult	Male	2004-08-24	0.00 ± 0.00	0.12
MI00242	Adult	Male	2004-08-24	0.13 ± 0.05	0.23
MI00243	Adult	Male	2004-08-26	0.00 ± 0.00	0.11
MI00244	Adult	Male	2004-09-04	0.00 ± 0.00	0.11
MI00245	Adult	Female	2004-09-07	0.00 ± 0.00	0.11
MI00246	Adult	Male	2004-09-07	0.00 ± 0.00	0.11
MI00247	Teenager	Male	2004-09-07	0.50 ± 0.07	0.31
MI00248	Teenager	Male	2004-09-07	0.00 ± 0.00	0.11
MI00249	Pre-Teen	Female	2004-09-08	0.00 ± 0.00	0.11
MI00250	Child	Female	2004-09-08	0.00 ± 0.00	0.11
MI00251	Adult	Male	2004-09-08	0.00 ± 0.00	0.11
MI00252	Adult	Female	2004-09-08	0.00 ± 0.00	0.11
MI00253	Adult	Male	2004-09-08	0.00 ± 0.00	0.12
MI00254	Adult	Male	2004-09-08	0.14 ± 0.05	0.22
MI00255	Adult	Male	2004-09-09	0.00 ± 0.00	0.11
MI00256	Adult	Male	2004-09-09	0.00 ± 0.00	0.11
MI00257	Teenager	Male	2004-09-09	0.00 ± 0.00	0.11
MI00258	Adult	Male	2004-09-09	0.00 ± 0.00	0.11
MI00259	Adult	Male	2004-09-09	0.00 ± 0.00	0.11
MI00260	Adult	Male	2004-09-13	0.43 ± 0.07	0.32
MI00261	Adult	Male	2004-09-13	0.13 ± 0.05	0.24
MI00262	Adult	Male	2004-09-14	0.00 ± 0.00	0.11
MI00263	Adult	Male	2004-09-15	0.00 ± 0.00	0.12
MI00264	Teenager	Male	2004-09-15	0.00 ± 0.00	0.11
MI00265	Teenager	Male	2004-09-15	0.00 ± 0.00	0.11
MI00266	Teenager	Male	2004-09-15	0.00 ± 0.00	0.11
MI00267	Adult	Female	2004-09-16	0.51 ± 0.08	0.34
MI00268	Adult	Male	2004-09-17	0.00 ± 0.00	0.11
MI00269	Adult	Male	2004-09-17	0.00 ± 0.00	0.12
MI00270	Adult	Female	2004-09-23	0.00 ± 0.00	0.11
MI00271	Adult	Female	2004-09-23	0.00 ± 0.00	0.11
MI00272	Adult	Male	2004-10-06	0.00 ± 0.00	0.11
MI00273	Adult	Male	2004-10-11	0.00 ± 0.00	0.11
MI00274	Adult	Female	2004-10-21	0.00 ± 0.00	0.11
MI00275	Adult	Female	2004-10-21	0.00 ± 0.00	0.11
MI00276	Adult	Female	2004-10-21	0.00 ± 0.00	0.11
MI00277	Adult	Female	2004-10-21	0.00 ± 0.00	0.11
MI00278	Adult	Female	2004-10-21	0.00 ± 0.00	0.11

Table 2. Continued.

Personal ID #	Age Type	Gender	Collection Date	^{137}Cs (kBq) Value	MDA
MI00279	Adult	Female	2004-10-21	0.00 ± 0.00	0.11
MI00280	Adult	Female	2004-10-21	0.00 ± 0.00	0.11
MI00281	Adult	Female	2004-10-21	0.00 ± 0.00	0.11
MI00282	Adult	Female	2004-10-21	0.00 ± 0.00	0.11
MI00283	Adult	Female	2004-10-21	0.00 ± 0.00	0.11
MI00284	Adult	Male	2004-10-22	0.00 ± 0.00	0.11
MI00285	Adult	Male	2004-10-22	0.00 ± 0.00	0.11
MI00286	Adult	Male	2004-10-22	0.00 ± 0.00	0.11
MI00287	Adult	Male	2004-10-22	0.00 ± 0.00	0.11
MI00288	Adult	Male	2004-10-22	0.00 ± 0.00	0.11
MI00289	Adult	Male	2004-10-22	0.00 ± 0.00	0.11
MI00290	Adult	Male	2004-10-22	0.00 ± 0.00	0.11
MI00291	Adult	Male	2004-10-22	0.00 ± 0.00	0.11
MI00292	Adult	Male	2004-10-22	0.00 ± 0.00	0.11
MI00293	Adult	Male	2004-10-22	0.00 ± 0.00	0.11
MI00294	Adult	Male	2004-10-22	0.00 ± 0.00	0.11
MI00295	Adult	Female	2004-10-22	0.00 ± 0.00	0.11
MI00296	Adult	Female	2004-10-23	0.00 ± 0.00	0.11
MI00297	Adult	Female	2004-10-23	0.00 ± 0.00	0.11
MI00298	Adult	Female	2004-10-23	0.00 ± 0.00	0.11
MI00299	Adult	Female	2004-10-25	0.47 ± 0.07	0.33
MI00300	Adult	Female	2004-10-29	0.00 ± 0.00	0.11
MI00301	Adult	Female	2004-10-29	0.00 ± 0.00	0.11
MI00302	Adult	Female	2004-10-29	0.00 ± 0.00	0.11
MI00303	Adult	Female	2004-11-02	0.00 ± 0.00	0.11
MI00304	Adult	Male	2004-11-04	0.00 ± 0.00	0.11
MI00305	Adult	Male	2004-11-04	0.00 ± 0.00	0.11
MI00306	Adult	Male	2004-11-04	0.00 ± 0.00	0.11
MI00307	Adult	Male	2004-11-04	0.00 ± 0.00	0.11
MI00308	Adult	Male	2004-11-15	0.00 ± 0.00	0.11
MI00309	Adult	Female	2004-11-30	0.00 ± 0.00	0.12
MI00310	Adult	Female	2004-12-01	0.00 ± 0.00	0.12
MI00311	Adult	Male	2004-12-01	0.00 ± 0.00	0.11
MI00312	Adult	Male	2004-12-02	0.00 ± 0.00	0.11
MI00313	Adult	Female	2004-12-02	0.00 ± 0.00	0.11
MI00314	Adult	Female	2004-12-02	0.00 ± 0.00	0.11
MI00315	Adult	Male	2004-12-21	0.00 ± 0.00	0.11
MI00316	Adult	Male	2004-12-23	0.00 ± 0.00	0.11
MI00317	Adult	Female	2004-12-23	0.00 ± 0.00	0.11
MI00318	Adult	Female	2004-12-28	0.00 ± 0.00	0.11
MI00319	Adult	Male	2004-12-30	0.00 ± 0.00	0.12