



U.S. DEPARTMENT OF  
**ENERGY**

# Impact of Climate Change on Runit Dome in the Marshall Islands

An Oktak in Mejatoto Jelōt Runit Dome ilo  
Marshall Islands.

Report to Congress (Ripoot ñan Congress)  
July 2024

United States Department of Energy  
Washington, DC 20585

# Message from the Secretary

## Enaan eo jen Secretary

The Department of Energy (DOE) is committed to fulfilling the United States' commitments to the health and safety of the people of the Marshall Islands from the effects of the nuclear weapons testing conducted in the past.

*Department of Energy ej dābdreb wōt ilo an kadedeiklok im kōmmani kallimur ko an United States ikijien ejmour im kōjparok ñan armij in Marshall Islands jen wāwein ko raar walok itok wōt jen kar kōmmālmel in kein tarinae ko rekajur (nuclear) raar kōmman jemaan.*

This is the DOE Report to Congress regarding the impacts of climate change to Runit Dome in the Marshall Islands, as outlined in Section 3140 of Public Law 117-81, *National Defense Authorization Act for Fiscal Year 2022*.

*Ripoot in ej an DOE ñan Congress ikijien ta ko remaroñ walok ñan Runit Dome itok wōt jen oktak in mejatoto ilo Marshall Islands, einwōt an elaajrak ilo Section 3140 Public Law 117-81, National Authorization Act for Fiscal Year 2022.*

Pursuant to statutory requirements, this report is being provided to the following members of Congress:

*Ekkar ñan wāwein ko emōj kemlet iumin kwōn bwe ren kōmman, ripoot in ej etal ñan rein uwaan Congress.*

- **The Honorable Jack Reed**  
Chairman, Senate Committee on Armed Services
- **The Honorable Roger Wicker**  
Ranking Member, Senate Committee on Armed Services
- **The Honorable Angus King**  
Chairman, Subcommittee on Strategic Forces  
Senate Committee on Armed Services
- **The Honorable Deb Fischer**  
Ranking Member, Subcommittee on Strategic Forces  
Senate Committee on Armed Services
- **The Honorable Mike Rogers**  
Chairman, House Committee on Armed Services
- **The Honorable Adam Smith**

Ranking Member, House Committee on Armed Services

- **The Honorable Doug Lamborn**  
Chairman, Subcommittee on Strategic Forces  
House Committee on Armed Services
- **The Honorable Seth Moulton**  
Ranking Member, Subcommittee on Strategic Forces  
House Committee on Armed Services

If you have any questions or need additional information, please contact me or Ms. Jennifer Bumgarner, Acting Assistant Secretary for Congressional and Intergovernmental Affairs, at (202) 586-2598.

*Ñe elon am Kajitōk ak aikuj ñan melele ko jet, jouj im kebaak ña ak Ms. Jennifer Bumgarner, Acting Assistant Secretary ñan Congressional im Intergovernmental Affairs, ilo (202) 586-2598.*

Sincerely,  
Ilo Kautiej,

Jennifer M. Granholm

## Executive Summary

This is the United States (U.S.) Department of Energy (Department or DOE) Report to Congress regarding the impacts of climate change to the Runit Dome in the Republic of the Marshall Islands (RMI) as outlined in Section 3140 of Public Law 117-81, *National Defense Authorization Act for Fiscal Year 2022*.

*Ripoot in ej an DOE ñan Congress ikijien ta ko remaroñ walok ilo Runit Dome itok wõt jen oktak in mejatoto ilo Marshall Islands, einwõt an alikar ilo Section 3140 Public Law 117-81, National Authorization Act for Fiscal Year 2022.*

The Runit Dome<sup>1</sup>, located in the Enewetak Atoll on Runit Island, contains radioactively contaminated soil and debris that was placed inside an unlined nuclear weapons test crater during cleanup operations performed by the U.S. in the 1970s and covered by a non-load bearing concrete cap. The RMI government maintains Runit Island as an indefinitely off-limits location due to the residual sub-surface levels of radioactive contamination. Access or visitation is restricted to official activities.

*Runit Dome eo, ej bed ilo aelōñ in Enewetak ion ene eo naetan Runit, eor budrej im kobej in radiation ko kar likit iloan juōn ron eo ear walok jen kein kōmālmel ko, ilo iien karreo eo United States ear kōmmāne ilo 1970 ko, im kar kiloke kin cement eo ej kalbubuki. Kien eo an Marshall Islands ej lolorjake ene eo Runit einwõt juōn jikin eo emo etal ñane jen wõt an wōr bwe (sub-surface level) in jorren ko jen radiation ie. Etal ñan ak deloñlok ene en ej ñan ro wõt ewōr aer melim jen kien.*

The study, independently conducted by the DOE Pacific Northwest National Laboratory (PNNL), assessed how climate change could affect the potential release or redistribution of radionuclides from the Enewetak lagoon, island land surfaces, and the Runit Dome site (including a hypothetical failure of the containment structure) and the subsequent impacts to Enewetak Atoll residents and environment. The study did not assess the effect of any other toxins nor determine reasons for the hypothetical failure of Runit Dome. Radionuclide data was derived from past studies; no new radiochemical sampling or analyses were performed. As mandated by Public Law 117-81, a draft of the report was published for public comment for 60 days resulting in 30 comments that were addressed by PNNL within the final report.

*Ekatak eo, ear bed iumin lolorjake eo jen DOE Pacific Northwest Laboratory (PNNL), etale wāwein an oktak in mejatoto maroñ jelet an naj driwojlok ak bar ajeded radiation*

<sup>1</sup> The Cactus Crater waste containment structure on Runit Island is located on Enewetak Atoll and is referred to colloquially as “Runit Dome.” In the appended report, the two terms are used interchangeably.

<sup>1</sup> Cactus Crater eo jikin kakwōn kwopej kar kalōke ion enen Runit ej pād ilo Aelōñ in Enewetak im rej naetan “Runit Dome”. Kobalok ibben ripoot in, melele kein ruo rej oktan doon.

*(radionuclides) ko jen lomalo eo, ion budrej in ene ko, im ijo Runit Dome ej bed ie (kobalok ne jenaj kotmene an jorren jikin kakkon in) im wāwein ko remaroñ walok im jelet armij in Enewetak im belaak ko. Ekkatok in ear jab etale ta ko jet remaroñ naj walok jen menin kojorāān (toxins) ko jet, ak bukot melele ko ñan kōlmenlokjen eo ke emaroñ wōr jorreen ñan Runit Dome. Data ikijien radionuclids raar buki jen ekatok ko ededelok kōmmani; ejelok sample in radiochemical kaal ko, ak jermal in etale ko kar bar kōmmani. Einwōt an kemlet ilo Public Law 117-81, joun draft in ripoot in ear driwojlok ñan an aolep armij kwalok ļōmñak ko aer ikijien ripoot in iumin 60 raan ko, im maroñ wōr 30 ļōmñak ko jen armij, ko im emōj an PNNL (atoreji) im likit ilo dredrelok in ripoot eo.*

PNNL determined that storm surge coupled with gradual sea level rise would have the most influence on the mobilization and transportation of radionuclides throughout the atoll. Storm scenarios were developed based on historical storms and accepted weather and global climate models. The study estimated radiation exposure for nine potential scenarios for current conditions and those postulated for 2090 including a hypothetical failure of Runit Dome.

*PNNL ej kotmene ke kajur in lañ ko kobalok ibben an laplok an ibwijleplep rej men ko remaroñ kōmman an makiutkut im itotak radionuclid ko ilo aelōñ eo. Makutkut in lan ko rej antoni ilo ripoot in raar kōmman bedbed wōt ikijien model ko jen lañ ko im mejatoto ko ededelok aer bok jikier. Jonan jedmatmat in radiation ko katak in ear kotmene lok ikijien ruatimjuōn wāwein ko remaroñ walok kio im ko antooni lok ilo iiō ne 2090, kobalok ļōmñak eo ñe enaj jorren Runit Dome eo.*

For storm scenarios where Runit Dome remains intact, changes in contaminant radiological doses are estimated to be below 0.1 mrem/year for all islands. With a hypothetical failure of Runit Dome, radiological doses are estimated to be below 0.2 mrem/year for all inhabited islands. Even smaller changes were estimated for lagoon biota. The overall low radiation exposure is due to storm redistribution of radionuclides to deeper waters providing increased distance, shielding, and dilution, and for future scenarios, radioactive decay.

*Ñan wāwein lañ ilo an Runit Dome eo jab jorren, oktak ko ikijien contaminant radiological doses ej kotmene renaj driklok jen 0.1 mrem/iiō ñan aolep ene ko. Ilo antoonelok an jorreen Runit Dome eo, dose in radiation ko rej kōtmeni ke renaj diklok jen 0.2 mrem/iiō ñan aolepen ene ko ewōr armej ie. Rej bar einwōt kotmene jonan oktak ko redriklok ilo menin eddōk ko im menin mour ko ilo lomalo eo. Wunleplep in an drik jedmatmat eo jen radiation ej kin an lan ko bar kajeded radionuclide ko lok ñan ijoko remulal lok ilo malo/lojet im kōmman bwe laplok kōta, libobo, im kabodān, im ñan waan joñak ko renaj walok tokelik, makunlok in radiation.*

An increase in radiological dose of approximately 20 mrem could accumulate in areas around the Runit Island in the first year following a hypothetical failure of the dome. Radiological doses to lagoon biota would temporarily increase but were estimated to be approximately 500-1000 times lower than the action levels recommended by U.S. and international agencies and organizations.

*Enaj laplok radiological dose kin drettan ne 20 mrem im loñlok ilo ijoko turin aelōñ in Runit ilo iiō ne jinoun ilo ad antoonelok elañe enaj jorāñ dome eo. Radiological dose ko ñan menin edded im menin mour ko ilo lomalo enaj laplok wōt ilo jidrik ien, ak bonbon ko raar kolmenlokjen kaki renaj tōbar joñane 500–1000 alen an driklok jen label ko U.S im ijoko jet lalin rej kuli.*

The results of the PNNL study, combined with data from ongoing DOE environmental monitoring programs, indicate no potential for increased health risks to residents of inhabited islands in the Enewetak Atoll from current or future conditions considering the impacts of climate change, including a hypothetical failure of the Runit Dome. Estimated changes in radiological dose for all postulated scenarios to aquatic biota in the lagoon are not anticipated to impact the health and diversity of the environment of the Enewetak Atoll. Additionally, the results indicate the Runit Dome does not represent a significant source of radiation exposure relative to other sources of residual radioactive contamination and naturally occurring radiological sources on the Enewetak Atoll.

*Jemlok ko ikijien ekatak in an PNNL, ekoba melele ko rej būki jen program in jermal ko ilo belaak im jermal in etale ko an DOE, ej kalikar ejelok bedbed (wūn) bwe en laplok kauwōtata ñan armij ro ilo ene ko ilo aelōñ in Enewetak jen wāwein ko ikijien oktak in mejatoto ran kein im bar ilo raan ko tokelik, im bareinwōt ilo kolmenlokjen eo ñe enaj bar jorren dome eo. Oktak ko raar antooneļok kin radiological dose ñan aolep wāwein ko kar waanjoñak kaki ñan menin mour ko ilo lomalo eo rejjab kōtmen an jelōt ejmour im oktakin meļan aelōñ in Enewetak. Kobaļok wōt, jemlok ko rej kwaļok ke Runit Dome eo ejjab represent e source eo elap ñan jedmatmat in radiation āinwōt joreen ko jen bwe in radioactive ko im radiological sources ko raar baj waļok wōt ilo aelōñ in Enewetak.*



# Impact of Climate Change on Runit Dome in the Marshall Islands

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# I. Legislative Language

Section 3140 of Public Law 117-81, *National Defense Authorization Act for Fiscal Year 2022*, states:

**“SEC. 3140. STUDY ON RUNIT DOME AND RELATED HAZARDS. KATAK  
“KIN RUNIT DOME IM MEN KO REKAUWŌTATA**

(a) *STUDY.*—Not later than 60 days after the date of enactment of this Act, the Secretary of Energy shall seek to enter into an agreement with a federally funded research and development center to conduct a study on the impacts of climate change on the “Runit Dome” nuclear waste disposal site in Enewetak Atoll, Marshall Islands, and on other environmental hazards due to nuclear weapons testing in the vicinity thereof. The report shall include a scientific analysis of threats to the environment and to the residents of Enewetak Atoll, including—

(a) *KATAK:* En jab rumwujlok jen 60 raan elkin an Act in bōk jikin, Secretary eo an Energy enaj bukōt kilen an dreloñe juōn bujen iben juōn jikin jermal eo ej bōk an jāān in makūtkūt jen kien eo kin jermal in etale, kabbok, im katak kake melele ko ikijien oktak in mejatoto im wāwein an jelet “Runit Dome” jikin kakkon kobej in radiation eo ilo aelōñ in Enewetak, Marshall Island, im jorāān ko jet ñan belaak eo turin wōt jen kar kōmālmel in kein tarinae rekajur. Ripoot eo enaj kobaik jermal in etale eo jen ro elap aer jelalokjen ikijien jorāān ko ñan belaak eo im armij in Enewetak, kobalok --

(1) the “Runit Dome” nuclear waste disposal site;

(1) Runit Dome eo, jikin kakon kobej in radiation;

(2) crypts used to contain nuclear waste and other toxins on Enewetak Atoll; and –

(2) jikin kakkon ko kar kōjermal ñan likit kobej in radiation ko im menin jorāān ko jet, im

(3) radionuclides and other toxins present in the lagoon of Enewetak Atoll.

(3) Tibdrik in radiation ko im menin jorāān ko jet ilo lomalo in aelōñ in Enewetak.



(b) *PUBLIC COMMENTS.*—*In conducting the study under subsection (a), the federally funded research and development center shall so-licit public comments.*

(b) *MELELE KO JEN LOBLEJ*—*Ilo kar kōmmāne katak in iumin subsection (a), jikin jermal eo ear lolorjake katak in aikuj kadiwojlok katak in ñan ro uaan loblej ñan aer kwalok aer melele.*

(c) *REPORT.*—*Not later than 18 months after the date of the enact-ment of this Act, the Secretary shall submit to the congressional de-fense committees a report containing the study conducted under sub-section (a).*

(c) *Ripoot - En jab rumujlok jen 18 allōñ elkin an Act in bōk jikin, Secretary eo enaj lelok ñan congressional defense committees juōn ripoot eo ebed katak in ie kōmman iumin section (a).*

## II. Introduction

This is the United States (U.S.) Department of Energy (Department or DOE) Report to Congress regarding the impacts of climate change to the Runit Dome in the Republic of the Marshall Islands (RMI) as outlined in Section 3140 of Public Law 117-81, *National Defense Authorization Act for Fiscal Year 2022*.

*Eñiin ej ripoot eo an United States (U.S.) Department eo an Energy (Department ak DOE) ñan Congress ikijeēn an oktak in mejatoto jelet Runit Dome ilo Republic eo an Marshall Islands (RMI) einwōt an kemlet ilo eon 3140 in Public Law 117-81, National Defense Authorization Act ilo iiō ne 2022.*

The RMI is located approximately 2,300 miles west of Hawaii in the northwest Pacific Ocean. Between 1946 and 1958, the U.S. conducted nuclear weapons testing in the Marshall Islands, many at the Enewetak Atoll in the northern and northeastern islands. In the late 1970s, the U.S. performed cleanup operations at Enewetak. The Runit Dome, situated on Runit Island in the northeast section of Enewetak Atoll, contains radioactively contaminated soil and debris that was placed inside an unlined nuclear weapons test crater and covered by a non-load bearing concrete cap during cleanup operations performed by the U.S. in the 1970s. The Runit Dome is approximately 114 meters (374 feet) in diameter and has an apex of 7.4 meters (24.3 feet). The RMI government maintains Runit Island as an indefinitely off-limits location due to the residual sub-surface levels of radioactive contamination. Access or visitation is restricted to official activities. Upon completion of the environmental cleanup program in 1980, the people of Enewetak Atoll were permitted access to the habitable islands of the Atoll. Only Enewetak

Island, which is about 13 miles from Runit Island, is currently inhabited by approximately 275 people.

*RMI ej pād ekepaaklok 2,300-mile turilikin wōt Hawaii tuiōñ turilikin wōt Lomalo in Pacific in. Ikōtaan iiō kane 1946 lok nan1958 eo, U.S. ear kōmman kōkemālmel in kein tarinae ko jen nuclear ilo aelōñ ko ilo Majōl, elōñ wōt iaer rekar kōmman ituiōñ im ituiōñ rear in Aelōñ in Enewetak. Ilo jemlokinlok 1970 eo, U.S. ear kōmman jermal in karreo ilo Enewetak. Dome eo Runit, kalōke ilo enen Runit ituōñ turear in Enewetak, ewōr būdej ko retoon kin radiation im kwopej ko rekar doori ilowan crater eo ejjelok earan kein kōmālmel in nuclear weapons ko im ej kalububu kin jimeen ilo ien karreo eo U.S ear kōmmane ilo kar 1970 eo. Runit Dome eo ej tarrin 114-meter (374 ne) drepakpak in im joñan utiej in 7.4 meters (24.3 ne). Kien eo an RMI ej lolorjake aelōñ in Runit einwōt juōn jikin eo emo etal ñane itok wōt jen menin jorren ko jen radiation ko iumin budrej. Enaj bellok etal ñan ro wōt eor aer melim jen kien. Ilo an kar dredrelok jermal-purokuraam in karreo eo ilo 1980 eo, armij in Enewetak ear bar melim aer rool ñan ene ko remaroñ bed ie. Ioon ene in Enewetak wōt ej ijo tarrin 275 armij rej jokwe ie, im ej jonan en 13 mile ko jen enen Runit.*

This report contains a description and summary of findings of the study independently performed by the Pacific Northwest National Laboratory (PNNL), a Federally Funded Research and Development Center under contract to DOE, to meet the requirements of Section 3140 of Public Law 117-81, *National Defense Authorization Act for Fiscal Year 2022*. The final report of the study, *Impacts of Climate Change on Human Health, and the Environment in the Enewetak Atoll*, is included as an appendix.

*Ripoot in ewōr kōmlele ko im tu kadu in jermal in rekar loi jen ekkatak ko rejenolok kōmman jen Pacific Northwest National Laboratory (PNNL), juōn doulul in ekkatak kien eo ej jibañlok kin jāān ñan an jermal iumwin DOE, ñan kake aikuij ko ilo Eon 3140 in Public Law 117-81, National Defense Authorization Act an iiō in jermal eo 2022. Jemlok in ripoot in ekkatak in, An Oktakin Mejatoto jelet ejmour an armej im pelaak eo pelaakin Aelōñ in Enewetak ej koba enwot juōn appendix.*

### III. Assessment

#### A. Study Scope and Description

The study conducted by PNNL assessed how climate change could affect the potential release or redistribution of radionuclides associated with nuclear weapons testing from the Enewetak lagoon, island land surfaces, and Runit Dome site (including a hypothetical failure of the containment structure) and the subsequent impacts to Enewetak Atoll residents and environment. The study did not assess the effects of any other toxins as records of any toxins present in Enewetak lagoon or Runit Island, other than radionuclides, were not available for inclusion in the study. Also, determining reasons for events leading up to a hypothetical failure of Runit Dome was not included in the scope of the study. Radionuclide data was derived from past studies completed by U.S. and RMI Government and independent researchers. The study did not include new radiochemical sampling and analyses because existing radiochemical data was sufficient to provide the required study analysis. The contribution of the radiological inventory

contained in “crypts” or “antechambers” outside the Runit Dome containment structure are included in the analyses of the study.

*Ekkatak eo kōmman jen PNNL ñan joñe aorōkin an ukotak in mejatoto jelōt radionuclides ko remaroñ diwōjlok ak ejeplōklōk im rej ailillōk ipen kōmālmel in nuclear weapons ko jen lomaļo eo ilo Enewetak, ioon āne, im Runit Dome eo (ekoba juōn ļōmnaċ elañne enaj joreen ļōm eo rekar kōkal e) im joreen ko ñan armej ro rej jukjuk im amnak ilo Enewetak Atoll im meļan eo. Ekkatak eo ear jab joñe aorōkin joreen ko jet jen toxins (men ko rej kakure) enwōt alikar in toxins ko im rewaļok ilo lomaļo in Enewetak ak ānen Runit, ijeļōkin radionuclides, raar jab pād ñan kobaik ipen ekatak in. Barainwōt, wūn ko rej kōmman bwe wāwein kein rej bōk jikier ren maroñ kōlaplok lōmnaċ eo kin an joreen Runit Dome eo ear jab bar deloñ ilo lajrak in ekkatak in. Meļeļe ko an radionuclides ko raar bōk jen katak ko raar kōmman moktaļok jen U.S. im RMI Government im rietale ro makeļok iaer. Melele (data) ko repād raar bwe, emōj ekkatak eo eaar jab kobaik radiochemical sampling ko rekāāl. Laajrakin radionuclide ko raar ae raar aini im droodi ilo nabōj in Runit Dome containment structure raar koba ilo etale ko an katak eo.*

The study determined that storm surge coupled with gradual sea level rise would have the most influence on how radionuclides could be mobilized and transported throughout the local environment and to human receptors. Storm scenarios for current and future events were developed based on data from three of the most historically severe storms observed in the region and currently accepted weather and global climate models. The study estimated radiation exposures for nine potential storm scenarios – six scenarios based on three different storm strengths using climate conditions for 2015 (the most recent observations available) and 2090 where Runit Dome remained intact; and three worst-case scenarios based on three different storm strengths using climate conditions for 2090 where the Runit Dome failed and release its entire contents to the surrounding area. Conditions for the postulated 2090 storms predicted a 62 cm (24.4 in.) rise in sea level from current levels. Human and biota radiation dose levels were estimated for each of the nine storm scenarios for receptors at 31 islands within the Enewetak Atoll and compared to current atoll radiation dose levels and U.S. and RMI radiation standards/guidance for the general public and environmental exposures, respectively.

*Ekkatak eo eaar kwaļok ke ļañ ko rekajoor kobaļok ipen gradual sea level rise emaroñ lap an jelet wāwein an radionuclides ko ejaak ipen doon im emmakut ipelaakin melaaj ko im ñan human receptors. Wawein ļañ ko kio im tokālik raar kōmman ekkar jen meļeļe ko jen jilu iaan ļañ ko rekajoorata im raar waļok ilo jikin eo im wawein mejatoto eo kio im eo an peļaaċin laļ in. Ekkatak eo eaar waate jedmatmat in radiation ñan ruatimjuōn (9) wāwein ļañ ko- jiljino (6) wāwein ko rej pedped ioon jilu (3) ļañ ko oktak kajoor ko aer ilo aer kojerbal wāwein mejatoto eo an 2015 (kōbbaal eo ekāāl tata) im 2090 ijo Runit Dome eo ej ped wōt ie; im jilu (3) wāwein ko renana pedped ioon jilu oktakin kajoor in ļan ko ilo aer kojerbal mejatoto eo an 2090 ijo Runit Dome enaj joreen im duwōjlok aolep men ko kobban ñan meļan ko reipaak. Wāwein ļañ eo ļōmnaċe an 2090 ear waate joñan ne 62 cm (24.4 in.) walōñlok in den eo lojet jen joñan eo kio. Radiation dose level eo nan armej im menin mour kab eddōk ko lojet (biota) raar antooneļok jen kajjo iaan ļañ ko ruatimjuōn ñan receptors ko ilo 31 āne ko ilowaan Enewetak Atoll im keidi ipen joñan radiation dose levels kio ilo aelōñ im joñan eo kar karoke (standards/guidance) ñan kajjojo armej im environmental exposure*

Upon completion, Marshallese and English versions of the draft study report were made available for public comment on the PNNL website. The comment period, initially set to 30 days, was extended to 60 days to ensure a maximum level of participation. Notices of the draft report and solicitation of comments were placed in the Marshall Islands Journal and U.S. news outlets where Marshallese citizens are known to reside as well as several social media outlets. Links to the draft report and public comment website were sent directly to the RMI National Nuclear Commission, the U.S. Embassy in RMI, Enewetak leadership, and the RMI Environmental Protection Authority. Additionally, DOE staff distributed flyers advertising the public comment period while visiting the Marshall Islands. A total of 30 comments were received and addressed.

*Alikin kadedeikļok, kajin Majol im Palle eo an katak eo ear peļļok ñan kajojo armej ñan likit aer ļomnak ilo website eo an PNNL. Joñan aetok eo ñan an armej likit aer ļomnak eaar kōmñmān ñan jilñuul raan, im eaar aetokļok ñan jiljinoñoul raan ñan kalikkar joñan level eo elap an armej bōk konaier. Kōjjeļļā eo an draft report eo im kajjitōk an armej kwaļok aer ļomnak raar likiti ilo newspaper eo an Marshall Island im U.S. ijoko ewōr rimajōl ie im barainwōt ilo social media outlets ko jet. Links nan draft report im public comment website eo raar jilikinļok ñan RMI National Nuclear Commission eo, U.S Embassy eo ilo RMI, rikweilok ro an Enewetak, im ñan RMI Environmental Protection Authority (EPA). Ipen men kein, rijerbal in DOE ro raar ajeej kōjjeļā ak flyer ñan kadeel kake ien public comment eo tōre eo raar lo ļok Marshall Islands. Ekar wōr 30 oran ļomnak ko ak comments ko raar būki im lali.*

## B. Study Findings

The primary radioactive contaminants that remain in the environment from nuclear weapons testing include the fission products cesium-137 ( $^{137}\text{Cs}$ ) and strontium-90 ( $^{90}\text{Sr}$ ), as well as plutonium (Pu) isotopes ( $^{239}\text{Pu}$  and  $^{240}\text{Pu}$ ), and americium-241 ( $^{241}\text{Am}$ ). These radionuclides are relatively immobile in the soil throughout the atoll. The study confirmed that radioactivity associated with lagoon sediments remains the largest long-term source of radioactive contamination at the Enewetak Atoll.

*Radioactive ko ekkā im rej ped wōt ilo aer kajoreen mejatoto eo jen kōmalmel in nuclear weapons ko ej koba in fission products kani cesium-137 ( $^{137}\text{Cs}$ ) im strontium-90 ( $^{90}\text{Sr}$ ), im bareinwōt plutonium (Pu) isotopes ( $^{239}\text{Pu}$  im  $^{240}\text{Pu}$ ), im americium-241 ( $^{241}\text{Am}$ ). Radionuclides kein rejjab kanoj emakit ilo bwidej ipeļaaikin aelōñ eo. Ekkatak eo ekar kalikkar ke radioactivity ko rej aililōk ipen lūm eo ilomalo rej ped enwōt source eo ekilep im aetok tata kitien an kajeeded joreen in radioactive ilo aelōñ in Enewetak.*

Radiation exposures attributable to residual contamination in Enewetak Atoll for 2015 were estimated to range from 2.7-1,386 mrem/year accounting for both terrestrial and aquatic exposure pathways. Radiation exposures attributable to residual contamination in Enewetak Atoll for 2090 were estimated to range from 1.4-194 mrem/year accounting for both terrestrial and aquatic exposure pathways. It is important to note that exposure estimates are in addition to exposure from natural radiation sources in the Marshall Islands, which is estimated to be approximately 730 mrem/year. The higher exposures are associated with the northeastern to

northern islands while the lower exposures are associated with the southeastern and southern islands. Estimated baseline radiation exposures for 2090 are less than 2015 exposures due to radioactive decay and redistribution of radionuclides to deeper parts of the lagoon and ocean resulting in increased distance, dilution, and shielding. For perspective, the current average radiation exposure from natural sources in the United States is estimated to be approximately 310 mrem/year but is highly dependent on location.

*Jedmatmat in radiation waļokjen joreen ak menin kakure ko rej ped wōt ilo Enewetak Atoll ñan 2015 raar waate ñan joñan ne 2.7-1,386 mrem/year ñan exposure pathways ko jimur ioon āne kab lojet eo. Jedmatmat in radiation waļokjen joreen ko ilo Enewetak Atoll ñan 2090 raar waate joñan ne 1.4-194 mrem/year jen ejja pathways kein wōt. E menin aurok ñan kalikar ke jedmatmat in radiation ko raar antooneļok rej koba ipen jedmatmat in natural radiation sources ko ilo aelōñ in Majol, im rej watwat ñan joñan ne 730 mrem/year. Jedmatmat ko rellapļok rej ailiļok ipen āne ko eñ-rear ñan tueañ ak ijoko eddik jedmatmat in radiation ko ie ej āne ko ilo rōk-rear im rōk. Joñan jedmatmat in radiation eo ediktata im raar antooneļok ñan 2090 reddik jen jedmatmat eo an 2015 kon wōt radioactive decay (an diklak kajoor in radioactive) im bar ajeded in radionuclides ñan ijoko remwilaļ ilo lomalo im lometo ekōmman an lapļok kōta, kabodān, im bobrae/libobo/kejparok (shielding). For prespective, joñan jedmatmat in radiation eo ekkā kio jen naustral sources eo an United State ej watwat ñan jejjot in 310 mrem/year bōtaab ej lukkun pedped ioon jikin eo.*

For the 2015 and 2090 storm scenarios where the Runit Dome remains intact, changes in radiological doses from contamination are estimated to be below 0.1 mrem/year and any additional risk to residents of inhabited islands is significantly less than that from naturally occurring environmental radionuclides. Furthermore, many of the islands are estimated to see a reduction in radiation exposure due to storm redistribution of radionuclides to deeper parts of the ocean and lagoon. Even smaller changes were estimated for lagoon biota.

*Ilo wāwein ļañ ko an 2015 im 2090 ijo Runit Dome ej ped ie, oktak in radiological doses ko walok jen joreen ko raar watwat ke rej ped ilo laļ in 0.1 mrem/year im jabdewōt kakobaba in kauwōtata ñan armej ro rej jokwe aelōñ ko elukun dikļok jen ko radionuclides ko rej make waļok jen pelaak ko (environment). Dedeen ke, elōñ iaan āne ko raar antoonelok ñan aer lale an diklok jedmatmat in radiation eo itok jen strom redistribution eo an radionuclides ñan ijoko remwilallok ilo lometo im lomalo eo. Meñe oktak ko reddik raar bar antooneļok ñan menin eddōk im mour ko ilo lomalo eo.*

For the 2090 storm scenarios where the Runit Dome fails, releasing the entire radiological inventory, incremental changes in radiological doses from contamination on islands other than Runit Island are estimated to be below 0.2 mrem/year compared to baseline conditions. Similar to scenarios without Runit Dome failure, many of the islands are estimated to see a reduction in radiation exposure due to storm redistribution of radionuclides and radiological doses are anticipated to decline as the remaining radiological inventory naturally decays and is further distributed by ocean currents and weather patterns.

*Ilo wāwein ļaņ ko an 2090 ijo Runit Dome eo enaj joreen, duwōjļok in aolepen radiological inventory, laplok in radiological doses ko jen joreen ko ioon āne ko ijellokin ānen Runit ekar watwat ñan lal in 0.2 mrem/iiō keidi ipen wāwein eo ilaltata. Ejjā enwōt wāwein ko ak ijenlokin an joreen Runit Dome eo, elon iaan āne ko raar antoņneļok aer loe an diklok jedmatmat in radiation itok jen storm redistribution in radionuclides (ļaņ ko bar ajeji radionuclides) im radiological doses ko raar katmān an dikļok enwōt an radiological inventory eo make makwūnļok im ej lapļok an ajeeded jen no ko lometo im weather patterns ko.*

An increase in radiological dose of approximately 20 mrem could accumulate in areas around the Runit Island in the first year following a hypothetical failure of the dome. Although the study hypothesized a scenario with a much higher radiological dose during the first year following a failure of the containment, the scenario is not realistic as it assumes there are inhabitants on Runit Island consuming locally grown or harvested foods. Following a hypothetical failure of Runit Dome, radiological doses to lagoon biota were estimated to be approximately 500-1,000 times lower than action levels recommended by DOE, the International Atomic Energy Agency, and United Nations Scientific Committee on the Effects of Atomic Radiation.

*Ilo an laplok radiological dose kon emaroņ turin lok 20 mrem emaroņ kobaik peļaaķ in ānen Runit ilo iiō eo jinoin ilo kar juōn elmakot ke enaj jorāān dome in. Mekarta ne ekkatak eo ej antoņneļok wāwein ko im elukkun eļļap dose in radiation ko ie ilo iiō eo jinoin ipenļok likjab ilo ekkal, wāwein eo ejjab mool enwōt ļōmņak ke ewōr armej ioon ānen Runit im rej mōñā kein ikkan ko ak bōķ leen kein ikkan ko. Kobaļok ipen juōn ļōmņak ke enaj joreen Runit Dome eo, dose in radiations ko ñan menin mour ko ilomalo raar watwat ñan emaroņ joņan kani 500-1,000 alen dikļok jen lukkun joņan eo kalikkar e jen DOE, International Atomic Energy Agency eo, im United Nations Scientific Committee on the Effects of Atomic Radiation.*

## IV. Conclusion

The results of the PNNL study, combined with data from ongoing DOE environmental monitoring programs, indicate no potential for increased health risks to residents of inhabited islands in the Enewetak Atoll from current or future conditions considering the impacts of climate change, and including a hypothetical failure of Runit Dome. Estimated changes in radiological dose for all postulated scenarios to aquatic biota in the lagoon are not anticipated to impact the health and diversity of the environment of Enewetak Atoll.

*Meļeļe ko raar waļok jen katak eo an PNNL, koba ipen meļeļe (data) ko jen environmental monitoring program eo an DOE im ej kōmņan wōt, rej kwaļok ke eben an naj lapļok kauwōtata ñan ejmour an armej ro rej jukjuk im amņak ioon āne ko ilo Enewetak Atoll jen tōrein ak ilo tōre ko tokālik ilo aer ļōmņak kōn joreen ko jen ukotak in mejatoto, ekoba ļōmņak eo kin an naaj joreen Runit Dome eo. Oktak ko raar antoņneļok ilo dose in radiation ñan wāwein ko remaroņ ak jab maroņ bōķ jikier ñan menin mour ko ilomalo rejjab kōtmāne aer jelōt ejmour im elōņ men ko ilo mejatoto eo an Enewetak Atoll.*

In addition, the results indicate that the Runit Dome does not represent a significant source of radiation exposure relative to other sources of residual radioactive contamination and naturally occurring radiological sources within the Enewetak Atoll.

*Kobaḷok wōt, meḷeḷe ko raar waḷok rej kalikkar ke Runit Dome eo ejjab juōn source in radiation (ijo ekajoortata/laptata radiation ie) exposure im ejab einwōt source (ijoko jet elaplok an kajoor radiation ie) ko jet me rej ped ilo aer radioactive contamination im bareinwōt men ko me ekar baj wōr wōt radioactive ie ilo Enewetak Atoll.*

## **V. Appendix**

Pacific Northwest National Laboratory study, *Impacts of Climate Change on Human Health, and the Environment in the Enewetak Atoll*, attached.